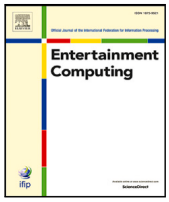
Entertainment Computing 52 (2025) 100883

Contents lists available at ScienceDirect

Entertainment Computing

journal homepage: www.elsevier.com/locate/entcom



Exploring music-based attachment to video games through affect expressions in written memories

Kai Tuuri [a,b,*], Oskari Koskela [b], Heli Tissari [c,d], Jukka Vahlo [e,b]

[a] Faculty of Education and Psychology, University of Jyväskylä, FI-40014, Finland
[b] Department of Music, Art and Culture Studies, University of Jyväskylä, FI-40014, Finland
[c] Department of Language Studies, Umeå University, Umeå 901 87, Sweden
[d] Department of Languages, University of Helsinki, FI-00014, Finland
[e] Centre for Collaborative Research CCR, Turku School of Economics, University of Turku, FI-20014, Finland

ARTICLE INFO

Dataset link: https://urn.fi/urn:nbn:fi:fsd:T-FSD3473

Keywords:
Game music
Attachment
Memories
Affect expressions
Music psychology
Cognitive linguistics

ABSTRACT

This paper presents an exploratory research on music-based attachment to video games, studied through personally valued game music memories. It focuses on people's engagement with game music and game technologies, expanding previous research on the role of game music in people's lives. We gathered 183 written game music memories and analyzed their contents and language. We focused on expressions of affect and sentiment, which we assumed would indicate affective involvement. However, we also explored the constitution of attachment by investigating how expressions of affect and sentiment were associated with other aspects in the stories that reflect personal valuation, focusing specifically on factors of autobiographical remembrance, conceptualizations of game music, and gaming technology related to memories. These investigations employed a mixed-methods approach that combined qualitative and statistical analyses. A major finding was that especially personal remembrances that involved an awareness of the self or related to the game music experience significantly predicted the use of expressions of affect and sentiment in the stories. In sum, the study outlines a framework for investigating people's long-term engagement with technology as being intimately related to the context of everyday life and the constitution of self-understanding.

1. Introduction

Video games are cultural and commercial media products that offer their players a wide range of recreational activities and experiences. For many people, games and their music may also become objects of affection. Emotional attachment to certain products or brands in general relates to their perceived value, that is, how strongly people want to hold on to them rather than discarding them easily [e.g.,1]. As the concept of attachment originally stems from the context of interpersonal bonding [2,3], it has also been defined as a "strength of the bond" between the person and attachment targets, such as people, places, as well as technological products like social media [4, p. 71]. The interpersonal framework is relevant for understanding attachment to media, as there is evidence that people's engagement with music listening, watching TV, and reading fiction do function as social surrogates [5]. In sum, the concept of attachment is essentially about long-term commitment to an object of affection that a person considers valuable and meaningful. In regard to video games, such attribution of value and affection to a game may develop upon appreciating the game either as a cultural expression/artifact [6,7] or as a first-hand experience of the playful activity (i.e., meaningful play) it affords [8–10]. Attachment to games has been studied mainly through the lenses of need satisfaction, as well as from the perspectives of preferences, gratifications, and addiction for playing [11–16], or as an attachment to specific elements in games, such as characters [17], places [18] or virtual commodities and possessions [19,20]. To this date, however, no studies on attachment to game music has been published.

Sounds and music have been prominent aspects of engaging with games since the dawn of video games. While the awareness and appreciation of game music as a significant part of gameplay experience has increased over the past years, studies on the long-term implications of game music are still scarce. Most of the existing research on game music has focused on the immediate effects of game music, that is, the role and function of music and audio on the gameplay experience during playing [e.g., 21–23]. A recent anthology on game music research [24] acknowledges perspectives that extend beyond gameplay (e.g., synergies with commercial popular music, remix communities, and game music concerts), but these accounts do not try to broadly approach

* Corresponding author at: Faculty of Education and Psychology, University of Jyväskylä, FI-40014, Finland.
E-mail address: kai.tuuri@jyu.fi (K. Tuuri).

https://doi.org/10.1016/j.entcom.2024.100883
Received 16 April 2024; Received in revised form 14 August 2024; Accepted 22 August 2024
Available online 28 August 2024

everyday practices with game music, nor do they explore the potential factors being involved in attachment to game music. In terms of broader game music studies, we want to emphasize Diaz-Gasca's [25] study on motivators in the consumption of video game soundtracks. Relevantly to the present study, Diaz-Gasca explored the experiential and socio-cultural reasons for engaging with game soundtracks, highlighting the role of personal memory connections in the development of interest in game music. However, his study does not attempt to comprehensively investigate the constituents of personal game music attachment.

Music is strongly interconnected with memories, especially the ones including biographical self-remembrance [26]. This linkage between music and memory has motivated us to investigate the long-term valuation of game music through written memories. Music has an ability to take the listener back in time, and vivid feelings and sensations, like the ones involving nostalgia [27], can accompany memories of a specific event remembered. Some memories may even relate to intensely strong experiences with music [28], which can partly explain why people also attach to and willingly carry and cherish memories of specific pieces of music in their mind [29].

In this paper we investigate people's meaningful relationships and lasting engagement with game music and gaming technologies, extending the scrutiny on the role of music in the person's life in the longer term. This is done through focusing on personally valued memories and, in particular, the expressions of affect in them. Our focus is on Game Music Memories (GMMs), that is, *memorable experiences of game music* that are spontaneously self-selected by the research participants as meaningful and valued. The GMMs analyzed in this study were personal game music stories collected from 183 people though an open writing invitation.

Our study belongs methodologically in a continuum of music research, in which experiences with a personally important piece of music is explored through retrospective, written self-narratives. Gabrielsson [28], for example, asked people to write about the strongest experience with music they have ever had. His seminal study presented a very wide spectrum of ways in which music can be personally important, demonstrating that the phenomenon of musical attachment is multifaceted in nature. As another example, Saarikallio et al. [30] collected descriptions of how people use their favorite piece of music to evoke emotions in daily life, pointing out the relevance of psychological functions of music in developing an everyday relationship with music. Finally, in an ethnomusicological study, Kilpiö [31] investigated people's personal memories about their C-cassette use in Finland. This research highlighted the social and cultural historical role of technology as part of intimately memorable experiences with music.

On the basis of existing research on music and memory [26,27] and previous studies involving retrospective recollection of experiences with music [28,30,31], we assume that writing about fond memories of game music experiences provides the participants with an access to personally important events and contexts being associated to games and their music. We expect that such memories open up the diverse ways how games and their music are connected with people's lives, self-understanding, and social relationships. In this way, stories of memorable and valued experiences of game music disclose aspects of the music's personal meaningfulness that not only relate to video games but also extend beyond the actual gameplay. Such a retrospective approach based on memories is expected to reveal perspectives of everyday life in varying time-spans, which inherently emphasize a long-term engagement with music. Through analyzing various indicators that reflect personal fondness, affection and cherishing being incorporated in GMMs, the overarching aim is to explore people's personal attachment to game music, as well as people's musical attachment to games.

Our investigation is initially done by analyzing affect expressions (AEs) in written memories of fond (i.e., personally valued) game music experiences. With affect expressions we mean words and multi-word expressions that refer to affect [32]. Our rationale for this approach is that the amount of expressed affect in the written stories is deemed as a key indicator of an emotional involvement in writing a GMM, presumably signifying personal valuation and attachment towards the memory. Earlier studies on product attachment have distinguished emotional involvement as a factor of attachment and demonstrated its ability to predict, for example, brand loyalty and longevity behavior [33,34]. After outlining how expressions of affect are distributed across the GMMs, we perform further analyses on the language and the content of the stories. These are done with a particular aim to identify domains of story contents that would provide meaningful frameworks in relation to AEs that would explain how the memories with game music are valued by their owners. These analyses in relation to the affect expression indicators comprise the main element of the study.

Next, through reviewing theoretical approaches in the upcoming sections, we will outline three domains as hypothetical frameworks for the purpose of relational analyses. Through these domains, we will find out how AEs are displayed in association with (1) personal remembrance, (2) metaphorical conceptualizing of game music, and (3) gaming-technologies associated with the stories. These story-related domains provide thematic lenses for complementing the investigation of AEs, by explaining how game music memories are valued by their owners — also providing us with a human-centric framework in gaining understanding of people's relationship with games and ways people are attached to their music.

2. Research framework and questions

2.1. Meaningfulness of autobiographical memories

Music has been found to be an effective trigger of autobiographical memories [35]. A recollection of game music arguably provides a way for a person to get in touch with the meaningful events of the past. In other words, fond GMMs not only concern involvement with the music itself, but they should also incorporate various elements of gameplay experience as well as broader everyday meanings that extend beyond the actual situations of play. According to Diaz-Gasca's [25] study, people value experiences of game music because of the memories they evoke. The study revealed that many of those evoked memories related to the gameworld, its events, feelings and aesthetics. But similarly to musically evoked memories in general [26,27], they also included broader remembrances and associations of past times: nostalgic memories of family, friends, places and other autobiographically and socially significant experiences. In general, it has been hypothesized that the sense-making of the self (i.e., what kind of person we are) and the others (how we relate to other people) are among the most prominent functions of autobiographical recollection in humans [36–38].

The retrieval of autobiographical memories can be either spontaneous or strategic in nature [37]. The former type is also called involuntary recall as it refers to becoming aware of a past experience without a conscious attempt to retrieve it [39]. Spontaneous and strategic retrieval also differ from each other in regard to the type of memory content. For example, spontaneous recall more often provides access to specific episodes of a personal past and the associated emotions [40]. On the other hand, strategic/voluntary retrieval is more often associated with problem solving and social sharing of memories, rather than daydreaming, thinking about a person, or identity, which were more frequently disclosed purposes in involuntary memories [37]. The way in which memories are sampled thus matters in studying GMMs. Specific and detailed episodic memories, characteristic of spontaneous retrieval, together with emotional associations [including connections to embodied memories, see 41] fit the purposes of this research better than more abstract and disembodied generalizations of past experiences. Our method for gathering the memories intentionally aimed at providing support for spontaneity in recalling personally meaningful game music experiences.

2.2. Purposes of engaging with music memories

DeNora [42,43] has emphasized the role of music as a personal and social resource that people use reflexively for constructing meanings and constituting themselves as certain types of individuals and social agents. The idea of "music as a resource" raises the question: in what ways do people, either consciously or unconsciously, use music in their everyday lives? In the field of music psychology, there has been a lot of research especially on functions related to the regulation of emotions and moods, social bonding, and evoking memories as well as developing one's self and identity through music [44–48]. A recent study by Tuuri et al. [49] corroborates the relevance of this approach also in the context of game music.

Because the number of different functions of music identified in music psychology studies is large and the functions relate to different research approaches, there have been efforts to synthesize and find the themes underlying the functions and connecting them. Schäfer et al. [50], for example, carried out a survey that included 129 descriptions of the functions identified in the literature. By using principal component analysis, three functional dimensions of listening to music were outlined from the responses. According to the results, people in general listen to music (1) to achieve self-awareness, (2) as an expression of social relatedness, and (3) to regulate arousal and mood. Arguably, these findings also promote a more general understanding of how the dimensions of music's everyday meaningfulness and valuation could be structured.

Considering that Shäfer et al.'s [50] functions relate to the context of listening to music, we expect to see some differences between them and the functions relating to reminiscing on musical experiences, which is the focus of the current study. While the former relate to utilizing musical sounds in everyday circumstances, the functions in reminiscing are about utilizing the past experiences to perceive and make sense of the present.

In the context of reminiscing, the self-awareness function clearly relates to perception of the self through reminiscing and reflecting the experiences with music. Due to the private nature of reminiscing, the relatedness function apparently focuses on reflecting social relations through the past experiences with music, instead of expressing and displaying them through music in the present. These two dimensions of self-awareness and social relatedness align well with the similarly prominent functions of autobiographical recollection in general [36–38].

In regard to the third music listening function, arousal and mood regulation, our focus will be on the needs to re-experience the music through reminiscing — that is, the purposes of re-enacting the emotional and aesthetic past experiences of the music. From this viewpoint, relying on either spontaneous or strategic retrieval, reminiscing music arguably is closely related to the memory-related phenomenon of musical imagining. This refers to recalling and experiencing a familiar piece of music through the "mind's ear" [29,51–53].

In the manner described above, the tripartite model of self-, social- and experience oriented purposes of engaging with music can be applied as *dimensions of personal remembrance* for analyzing the autobiographical and game music related experiential contents in the GMMs.

2.3. Conceptualizations of intimate relationship with game music

The way DeNora [42,43] has framed music as a resource is already an example of metaphorical language, that is, a way of describing some abstract thing, a target domain, in terms of a more concrete conceptual source domain. In general, such metaphorical mappings relate to conceptualizing a given target domain through the characteristics of a chosen conceptual source, consequently constituting one's understanding of the target domain [54]. Talking about music as a "resource" thus is about understanding music as a valuable commodity, while also bringing the focus on what it provides to a person when interacting with it.

Rather than suggesting that metaphors are merely a rhetorical device, the theory of conceptual metaphors [54,55] highlights the cognitive-linguistic mappings incorporated in the processes of human sensemaking. It is well known that people tend to use metaphoric language when describing what they hear in music and what their musical experience is like [56,57]. Besides conceptualizing specific moments in music, metaphors can also operate on a larger scale, as is evident in the way whole musical works are treated as "stories" or "narratives" [58]. Moreover, it has been suggested that even the most fundamental aspects of our understanding of music, such as the pervasive idea of music as "movement", are largely metaphorical in nature [59].

According to the theory of conceptual metaphor [54], human thought is largely structured by different conceptual metaphors. For example, the metaphor MUSIC IS RESOURCE can be identified in metaphoric expressions, such as "I use music to relieve my stress", which employ the conceptual metaphor in question. With respect to the aims of this study, we consider this kind of cognitive-linguistic perspective insightful for describing how attachment manifests in language. Particularly, we investigate how the perspective of conceptual metaphors can be applied to discovering *"ways of attaching"*, that is, what kind of conceptual metaphors people use in conceiving their intimate or fond relationship to game music.

2.4. Role of gaming technologies in music-based attachment

Gaming technologies, different platforms and their interfaces are essential aspects of everyday gaming experiences. By investigating attachment to video games with a long-term perspective through written memories, aspects of an enduring attraction of the games and devices from different eras are likely to be revealed. It is easy to assume that fond memories of engaging with game music also disclose affection towards games and game devices of different time periods that relate to the music. Despite being rendered obsolete by newer ones, some games, gaming devices [e.g., 60], and even specific types of audio hardware [e.g., 61] attain a status as classics — or as objects of a certain "retro chic" fascination because of being outdated [62].

Besides cultural valuations of gaming technologies, seen, for example, in the discourses about the past "golden era" of video games and video game music, valuations also relate to a personal level of meaningfulness that entangle with people's autobiographical histories involving gaming artifacts. This is in line with studies addressing how games and the related hardware from certain periods may serve as vehicles for nostalgia [63], venerated artifacts of retro sensibilities and different fan communities [64], loci for constructing one's identity [65] or sources of appreciation for aesthetic features related to bygone technologies [61,66]. These notions imply how an affection to game music could relate to certain technologies or time periods. More generally, we can hypothesize that there are linkages between video games, gaming technologies and game music that potentially have implications on attachment. A person may have developed, for example, a particular fondness for the sounds, graphics, or physical interfaces of certain devices or specific technology brands.

2.5. Research questions

The study is organized into research questions (RQs), which are formulated as follows. Affect expressed in written reminiscing of personal game music experiences is here deemed as a fundamental indicator of personal affection towards the memory. Therefore, the initial aim of the investigation is to detect how much affect is expressed across the game music memories (coined as RQ #0). The subsequent RQs (#1–3) relate to further investigations on the GMM contents that, in relation to the affect-component, provide complementary takes on how the valuation

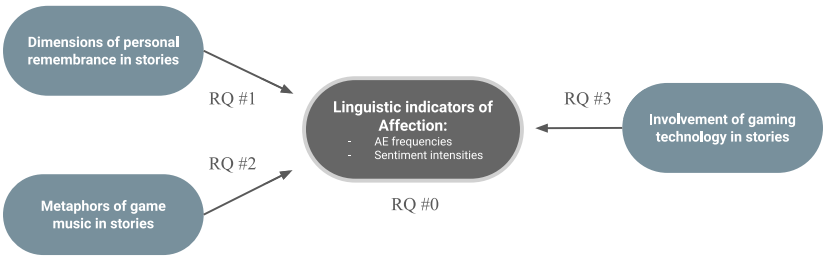


Fig. 1. Research model for exploring music-based attachment to video games through affect expressed in written memories about personally valued game music.

of the game music is displayed in these personal narratives. These RQs address how AEs are displayed in association with the thematic domains discussed in the previous sections.

As a methodological premise, we expected stories about fondly reminisced game music experiences to reflect personal valuation of the memories, incorporating expressions and content relevant to music-based attachment to video games. The overarching objective of this study is to find out which of the variables, outlined in investigations of RQs #1–3, are statistically the most important in predicting the use of AEs and positive/negative sentiment in the stories. By identifying the main precedents for expressing affect in reminiscing game music experiences, it is consequently possible to better understand their potential roles in constituting attachment to game music. The research model, as a whole, is illustrated in Fig. 1.

RQ #0: What is the amount and valence of expressed affect across the GMMs?

The first aim of the study is to get an initial grasp of an overall "affective landscape" of the stories in order to understand people's attachment to games and their music. The target of the investigation here is in detecting how much affect is expressed across the personal narratives. We take explicit AEs as general indicators of affective involvement in recalling and writing GMMs, and therefore also as an indicator of importance of a memory and its experiential contents. An accompanying strategy here is to investigate the overall valence of the memories by measuring the amount of positive and negative sentiment in the stories [67]. While one would expect the fond memories to be mostly positive, previous research suggests [68] that affective experiences often consist of a mix of positive and negative valence. Both the measures of AE frequencies and the sentiment intensities across the stories comprise the dependent variables representing game-music based affection in the GMMs for the rest of the investigation.

RQ #1: How do the dimensions of personal remembrance structure GMMs and how are these dimensions associated with AEs?

Our investigation regarding this RQ is formed in accordance with the three dimensions of personal remembrance outlined above. Firstly, the dimension of *Self-awareness* captures cognitive reflection involving a person's self and identity through reminiscing experiences with game music. The second dimension, *Social relatedness*, is about the social environment around musical engagement. In these two dimensions, the element of affection is hypothesized to involve the valuation of autobiographical remembrances and the associated reflections of the self and the others. The dimension of *Game music experience* focuses on the reminisced experiences of being involved with game music. Our take on this dimension not only includes game music, but it also extends to capture the lived-through experiences of the gameplay as a whole. Here, the affective element is expected to relate to the aesthetic enjoyment of the experience and the related practices [see 10,69].

RQ #2: How do metaphors of game music structure GMMs and how are these metaphors associated with AEs?

This RQ relates to explaining attachment to game music trough metaphorical conceptualizations of game music in the stories. We first identify metaphoric expressions of game music and then explore the employment of different cognitive-linguistic source domains in them. The utilized source domains provide information on how the story writers conceive their relationship with the game music (e.g. by conceptualizing music as a "buddy" or a means of "traveling").

RQ #3: How does involvement of gaming technology structure GMMs and how are technology relations associated with AEs?

The reminisced experiences in stories relate to games and game devices from different historical periods, as well as different types of technological platforms (i.e., home computers and gaming consoles). Regarding this RQ, we explore these variations in technology types (i.e., the game titles and devices) across GMMs, and possible technology-related dependencies that may indicate the existence of technology-specific attachment and nostalgia.

3. Data and methods

3.1. Data gathering

Stories about fondly reminisced game music were collected from Finnish participants via a publicly available writing invitation for GMMs, arranged in collaboration with the Finnish Social Science Data Archive. In the online form for story collection we asked: "Do you have memories related to game music that you feel are important to you – or even loved? We want to hear your story about just such memorable game music experiences". After the initial question, the topic of memorable game music experience was briefly described in an open and non-definitive manner. Adapting the idea of elicited writing [see 70], the intention of the call was to get spontaneous and freely formed personal narratives on the given topic from the people. In addition to the stories, background information of participants was asked. The form included questions about gender, age, gamer identity (options: "I'm an active gamer", "I've been an active gamer at an earlier stage of life", "I don't consider myself an active gamer"), and questions about the time a person uses daily for playing games.

The writing invitation, together with the link to the online questionnaire form, was dispatched through various channels, including social media groups and emailing lists. A Facebook marketing campaign was also used for spreading the writing invitation to ensure that it would reach people from different demographic groups. There are indications that similar memory triggers about random topics, received during everyday activities, have provided support for spontaneous reminiscing [71]. Initially, 184 people responded to the writing invitation, of whom one had to be left out because of being under-aged.[1]

[1] The Finnish national board on research integrity states that the person's own consent to participate is sufficient when the participant is 15 years old or older.

Table 1
Cross-tabulations of gamer identity with daily average gameplay, and gender.

	Active gamer	Has been active gamer	Not a gamer	Total (n)
Less than 15 min	5.4%	73.0%	21.6%	100% (37)
15–30 min	41.2%	41.8%	17.2%	100% (29)
30–60 min	82.1%	15.4%	2.6%	100% (39)
1–2 h	85.4%	14.6%	0.0%	100% (41)
Over 2 h	100.0%	0.0%	0.0%	100% (37)
Total	64.5%	27.9%	7.7%	100% (183)
Female	51.5%	24.2%	24.2%	100% (33)
Male	67.8%	28.0%	4.2%	100% (143)
Total	64.8%	27.3%	8.0%	100% (176)

3.2. Participants

The participants consisted of 183 people (Age $M = 34.6$ years, $SD = 7.81$, $Min = 17$, $Max = 59$). Two individuals did not disclose their ages, and these are treated as missing values in the coming analyses. Of the participants 78% ($n = 143$) were male and 18% ($n = 33$) were female. It should be noted that the smaller portion of female respondents does not represent the Finnish population of game players, which should consist of more or less equal distribution of the male and female genders [72]. Five participants reported their gender as "other", and two participants did not want to tell their gender. Due to the small size of the latter two groups, these cases are excluded from further statistical analyses involving gender comparisons.

Most of the participants ($64.5\%, n = 118$) reported that they are active gamers. The second largest group ($27.9\%, n = 51$) reported that they have been playing actively at an earlier stage of life. The rest of the participants ($7.7\%, n = 14$) did not consider themselves as being active gamers. This self-classification is consistent with the reported amount of daily gameplay in a statistically significant manner $\chi^2(8, 183) = 98.50, p < .001$ (see Table 1). Participants that have been active gamers also appear to be moderately active game players in the present. The Chi-squared test reveals a significant dependence between gamer identity and gender $\chi^2(2, 176) = 14.79, p < .001$. Compared to males, a bigger percentage of the female participants do not identify themselves as gamers.

3.3. Methodological approach on analyzing the data

The analyses performed on the stories followed a mixed-methods approach combining both qualitative and quantitative elements. The qualitative elements essentially comprised the means of identifying and understanding the verbal expressions and thematic contents of the stories in relation to each research question. The rationale for the quantitative elements was to investigate the prevalence of the given qualitative dimensions in numerical form and outline them as variables to perform statistical analysis.

The strategy was to first perform linguistic analysis of the stories for detecting the instances of displayed affect (RQ #0), as well as identifying the use of metaphoric expressions and their ways of conceptualizing a person's relationship with the game music across the stories (RQ #2). Next, shifting the qualitative focus on story contents, we identified instances of the thematic dimensions of Self-awareness, Social relatedness, and Game music experience (RQ #1). From the stories, we also collected information about the mentioned games and gaming technologies (RQ #3).

In qualitative analysis, coding generally refers to attaching labels to segments of data that describe their content and provide analytical handles for making comparisons with other coded data segments [73]. Through exploratory qualitative coding, we first identified specific key expressions and thematic contents from the textual data, and then investigated how affect expressed across the stories associates with the other elements identified in the stories. All of the coding was carried out manually, with the third author being primarily responsible for linguistic identification of affect expressions and conceptual metaphors, while the first and the second authors being responsible for thematic content analysis and additional parsing and grouping of metaphors.

The qualitative codings were quantified for performing comparative between-participants statistical analyses. In addition to the quantification of qualitative analyses, numerical data about the expression of sentiment (RQ #0) was computationally extracted from the stories by the method of automated sentiment analysis.

The ultimate aim was to explore how the affect expressed in the stories associates with the linguistic and content-related elements, also coded into the stories, and finally to model which of the elements are the most important predictors of affect expressions and sentiment intensities. Statistically this was achieved through a linear regression model, using the frequency of affect expressions as a target, and the other story related elements as independent variables.

3.4. Qualitative analysis

The qualitative analyses were done with *Atlas.ti* software for indicating the presence of specific expressions, mentions, themes or concepts in the textual data. Quotations from the text data were coded in terms of each aspect of interest. Quotation length was freely determined by a researcher responsible for a given code, thus the unit of analysis was not fixed (e.g., to words or paragraphs). The validity of codes and coding was constantly controlled by evaluative discussions between the researchers during the process of content analysis.

Our starting point of text analysis was to outline affect expressions (RQ #0). As a principle, we concentrated on wordings that were used to describe affective or emotional experience, thus not necessarily direct expressions or bursts of emotions [see 32]. In this manner, 853 quotations were identified as AEs.

In order to illustrate the content of these identified AEs, their most frequent words were examined. Table 2 shows English translations of the original Finnish words[2] that were counted at least three times across all AE-coded quotations. Note that the words in the quotations that were deemed to be irrelevant noise in terms of the affect content (such as equivalents of "and", "which" or "that") were not included in the word count but were filtered out by using the stop-list function of Atlas.ti. Moreover, frequent words "music" and "game" as well as words that translate redundantly to the same English word were excluded from Table 2. The resulting list (see Table 2) includes a range of verbal means for either denoting emotions, moods and feelings, or describing the ways of being affectively engaged.

In a similar manner to detecting AEs, another linguistically oriented analysis was carried out to outline metaphoric expressions of game music in the stories (RQ #2)[3]. The researcher responsible for the initial detection phase gave them preliminary names as conceptual metaphors, thus identified their conceptual source domains. A similar naming process is described by Stefanowitsch [75], which he calls metaphorical pattern analysis. In the next phase, the metaphors and the naming of their source domains were scrutinized together with the other authors. As a result of the discussion, the categorization of metaphors became both more precise and more diverse. Also, some of the expressions originally marked as metaphorical were excluded from the analysis, which resulted in the final number of game music metaphors across the stories being 555. In the final stage of the analysis, all metaphoric expressions of game music were parsed and

[2] An inflected Finnish word often needs to be translated into more than one English word. Whereas Finnish operates with endings, English operates with prepositions.

[3] This analysis of conceptual metaphors has been previously published. For a more detailed report, see [74].

Table 2
A list of the most frequently used words across the 853 AEs (Finnish words translated into English).

Emotions	Emotion	I liked	Nostalgic	It felt (like)	To me	I like
Heart	I got enthusiastic	Excitement	Mind	Nostalgy	Peaceful	Feeling
Melancholic	Came	To cause	I got enthralled	Happiness	With eagerness	Attached
Rather	Memories	I enjoy	Enjoyed	Get	Good	Excited
Exciting	Experience	Cold	I remember	Up	Dear	I love
Dearest	Dear ones	Soothing	To the heart	My heart	Feel	Into a mood
Shivers	Anxiety	Annoy	Particularly	Longing	Evoked	To my delight
With some	Grateful	Towards	Touch	Tears	Warm	With warmth
To my mind	Gladly	Pleasure	Me	In me	Fear	Sadness
Sad	Greatly	Atmosphere				

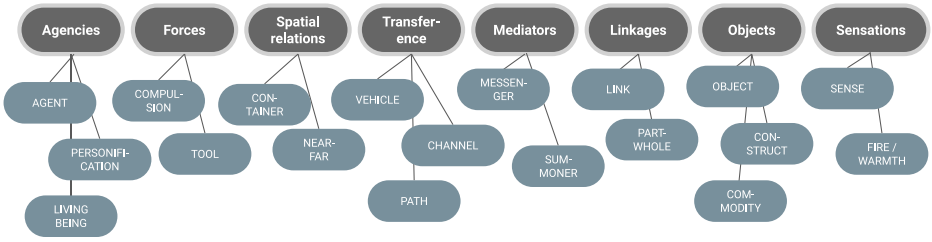


Fig. 2. The main categories of metaphorical source domains, together with examples of the related image-schematic structures, in the conceptualization of game music.

grouped into a more coherent model of metaphor types. The purpose was to clarify metaphorical similarities and differences by examining their image-schematic structures [76]. Through this process, 8 main thematic categories of metaphorical source domains were identified (see Fig. 2), in which game music is conceptually described in terms of *Agencies, Forces, Spatial relations, Transference, Mediators, Linkages, Tangible objects,* and *Sensations*. Fig. 2 also illustrate how each of the main categories incorporated varying image-schematic structures for manifesting the source domain.

Regarding the content analysis on the three dimensions of personal remembrance (RQ #1), another set of coding was carried out for each thematic dimension (the number of quotations attributed to each theme is presented in brackets). For this we utilized combinations of previously done content-driven sub-codings that matched the theory-based dimensions. The theme of *Self-awareness* combined two separate sub-codings: "autobiographical expressions" and "expressions reflecting or describing the self" (in all 586 quotations). The theme of *Social relatedness* consisted of a coding category "other people", which includes either explicit mentions or implicit indications of other people being involved in the experience (in all 559 quotations). And finally, the theme of *Game music experience* combined three sub-codes containing descriptions of "episodic experiences of activity", "experienced immersion, adventure and flow", and "qualities of music" (in all 1139 quotations).

All mentions of gaming devices and game titles were detected and coded across the stories (RQ #3). These codings were used as the basis for categorizing GMMs according to a gaming device type (home *computer* memories, game *console* memories, or *mixed/undisclosed*), and for determining a median publication year of the game titles mentioned in the story. In addition, references to specific game music technologies were coded. Such type of explicit references mostly pointed at specific sound-producing technologies that were common in devices from the early 1980s to the mid 1990s [see 77]. By utilizing these codes in combination with the codes involving specific gaming devices and game titles, we were able to categorize all GMMs after the game music technologies they incorporate (*vintage* audio, *modern* digital audio, or *both* technologies). The vintage audio class here includes "chiptune" technologies (i.e., programmable sound chips and beepers), "tracker" or "MOD" format music technologies (based on short sound samples), and "Adlib" or "General MIDI" technologies (i.e., FM or wavetable synthesizers on sound cards) [see 78, pp. 7–61]. In contrast to the vintage game music, which is based on a sequenced playback of synthesized sounds, the modern digital audio class is characterized by a pre-recorded form of music playback.

3.5. Quantitative measures and analysis

The frequencies of code occurrences and co-occurrences were obtained from the Atlas.ti software. Because the quotations of both AEs and Social relatedness were relatively short (often just a few words or even a single word), relational co-occurrences between the two were detected by using a five-word-long window of neighboring words both preceding and following the quotations.

In this study, sentiment analysis functions as an indication of the general intensity of positive and negative valence in texts (RQ #0). Therefore, we do not expect that only explicitly expressed affect would have an effect on the sentiment intensity measures. Stories also contain, for example, opinions and evaluative expressions, as well as episodic descriptions of gameplay. The two example quotations[4] below demonstrate parts of stories that were not identified as explicit AEs but nevertheless get a high intensity score of sentiment. The latter example also illustrates how the reporting of gameplay experiences (of, e.g., fighting the aliens in a game) can denote negative sentiment, although the overall point of the writer seems to be in describing the positively impressive nature of the game music.

> . . . In the 80s, game music was awesome! The C64 game "Forbidden Forest" by Paul Norman and the music he composed for the same game were really great. (+4 *positive sentiment*)

> . . . However, the most impressive song always played when x-com soldiers attacked to destroy an alien base. The background music playing during the mission brought to the surface all the same sensations as during any horror film. (−4 *negative sentiment*)

We used the *SentiStrength* [67] software to perform the analysis. It is a lexicon-based analysis program that also provides word lists for the Finnish language. SentiStrength has been designed to evaluate the intensity of sentiment in short informal texts (e.g., in social media) and has been used for analyzing texts in Finnish [79]. The software provides two scores to the texts: the intensity of *positive sentiment* (a score ranging from 1 to 5) and the intensity of *negative sentiment* (a score ranging from −1 to −5). The dual scoring method is appropriate since texts often contain a mix of positive and negative sentiments.

[4] All quotation examples in this paper are translations of the original Finnish texts. However, all measures refer to the original texts.

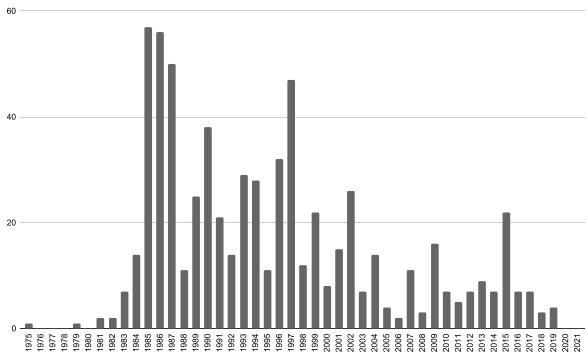


Fig. 3. Frequencies of mentions of games and game series (n = 664) ordered by publication year.

For the sake of clarity in the further analyses, the scores of negative sentiment was converted to positive values. We also used the program's ability to perfom a trinary classification of *overall sentiment* (a score of −1, 0 or 1, respectively denoting negative, neutral and positive overall sentiments).

Statistical analysis was performed with *SPSS 29* software. The number of affect expressions and the word count in stories were tested with a Kolmogorov–Smirnov test of normality, which indicates that the AE frequencies and story lengths do not follow a normal distribution, $D(183) = .226, p < .001$ and $D(183) = .205, p < .001$ respectively. For this reason, and due to the ordinal nature of some measures of this study, statistical analyses preferably utilize non-parametric tests appropriate for given variables, including Kruskal–Wallis analysis of variance and Spearman's correlations.

3.6. Story data descriptions

All but one of the stories were written in Finnish (one was in English). The length of the stories varied strongly from very short ($Min = 8$ words) to relatively long ($Max = 2144$ words), the mean and median lengths being 235.8 and 158.0 words, respectively. Gender seems to have an effect on the length of the stories, as the Kruskal–Wallis test indicates $H(1, 176) = 5.68, p < .05$). The median word count for female respondents ($Mdn = 192.0$) was higher than the same figure for male respondents ($Mdn = 137.0$).

In all, 322 different games or game series were mentioned across the stories. The publication years of the titles were retrieved from a videogame database hosted by Kinrate Analytics.[5] Broad references to game series were common in the stories, which did not necessarily specify the exact titles of the series. In these cases, the specific sub-titles of the series were ignored in the analysis. The publication year of the most frequently mentioned specific game title (e.g., Final Fantasy VII) was selected to represent the whole game series (e.g., Final Fantasy). As we can see from Fig. 3, the overall emphasis in GMMs was on older games: games published in 1985–1987 received the greatest number of mentions across the stories. In further analysis we use the *Median publication year* of all the game titles mentioned within a story. Thus, in terms of games mentioned in GMMs, this figure represents the average time period that the story has its focus on. In terms of a Median publication year, the biggest number of stories were attributed to the years 1997 (12%, n = 22) and 1986 (8.2%, n = 15). For six stories, publication years could not be determined.

There was a strong negative correlation with the median publication years and the age of the participants ($r = -.548, p < .001$), meaning that older participants tended to reminisce about older games. Also, the median publication years are associated with gender $H(1, 170) = 6.65, p < .05$. However, the average values for men (Mdn = 1995) and women (Mdn = 1997) differed only a little.

In regard to gaming devices, the GMM stories were divided into *home computer* memories (42.6%, n = 78), *game console* memories (31.1%, n = 57), and memories of *mixed or undisclosed* device types (25.7%, n = 47). One of the stories was not based on digital game technology and it was excluded from the categorization. Yet another technology-related classification concerned how the stories related to either *vintage* (31.7%, n = 58) or *modern* (36.6%, n = 67) game music technology, or *both* of the technologies (30.1%, n = 55). Three of the stories (1.6%) did not provide particular enough references to technologies and were excluded from these classes. The Chi-squared test reveals a significant dependence between these groupings ($\chi^2(4, 179) = 60.76, p < .001$). In particular, it seems that computer-based memories are associated more with vintage music technologies (61.5% overlap), and console-based memories are more affiliated with modern digital audio technology (59.6% overlap).

Table 3
Comparison of average median publication years (MPY) and ages across gaming device and game music technology groups.

		MPY (Mdn)	Age (Mdn)
Gaming device:	Computer	1990	40
	Console	1997	29
	Mixed	1997	33
Music technology:	Vintage	1987	41
	Modern	2002	29
	Both	1996	35

From Table 3 we can observe how both of the technology-based categorizations differ in terms of a story's Median publication year and a participants' age. On average, computer-based memories were centered on older games and were written by older participants when compared to the other types of GMMs. The association between Gaming device and Median publication year is significant ($H(2, 176) = 24.221, p < .001$). A post-hoc pairwise comparisons test (Dunn-Bonferroni) further indicated that, in particular, the scores of the Computer group were observed to be significantly different from those of group Console ($p < .001$) and group Mixed ($p < .001$). The Music technology groups also differed in terms of the Median publication years of the stories. The score differences were significant ($H(2, 177) = 108.416, p < .001$). But unlike the Game device groups, in which only computer-based stories differed, post-hoc comparisons indicated that all three Music technology groups were significantly different from each other ($p < .001$).

4. Results

4.1. Indicators of affect (RQ #0)

4.1.1. Affect expressions

Across the stories, 853 excerpts of text were identified as AEs. The mean frequency of AEs within a story was 4.66 ($SD = 6.17$). Their distribution was uneven, however, and not all stories even contained them: of the 183 stories, 24.6% ($n_{none} = 45$) had no AEs, 35% ($n_{few} = 64$) had 1–3 AEs, and 40.4% ($n_{many} = 74$) contained more than three AEs. The maximum number of AEs per story was 39. This is not to say that almost one quarter of the stories were without affect, but it was just not explicitly expressed in the text.

Regarding gender related differences in the distribution of AEs, there is a statistically significant effect of gender, according to the Kruskal–Wallis test, $H(1, 176) = 12.31, p < .001$. Fig. 4 indicates that women ($Mdn = 6$) used AEs more frequently than men ($Mdn = 2$). As many as 72.7% of women used more than three AEs in their stories, compared to 32.2% of men in the same category.

[5] Kinrate Analytics (https://kinrateanalytics.com) is an academic startup company that provides services in player analytics, and they hold a game database of some 100,000 entries.

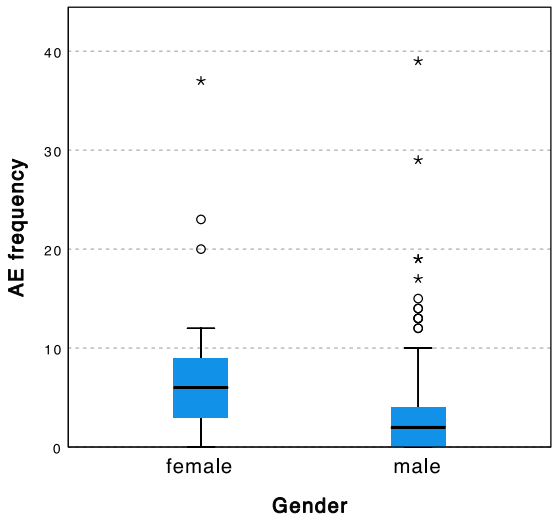


Fig. 4. Boxplot showing distributions of AE frequencies for females (Mdn = 6) and males (Mdn = 2).

We also found significant correlations both between Age and AE fq ($r = -.270, p < .001$) and between Word Count and AE fq ($r = .786, p < .001$). So there is a slight negative correlation with respondent's age, and a strong positive correlation with the word count of the stories, both of which are observable in Fig. 5. The latter correlation seems obvious in a sense that longer stories afford more frequent use of AEs.

4.1.2. Sentiment intensities

Across the stories, the values for positive sentiment ($M = 2.53$, $Mdn = 3$, $Min = 1$, $Max = 4$) were generally higher than the negative counterparts ($M = -2.07$, $Mdn = 1$, $Min = 1$, $Max = 5$). As the median values imply, the most frequent score for positive sentiment was 3 (54.6% of the stories) while the respective score for negative sentiment was 1 (53.0% of the stories). In other words, more than half of the stories attested no negative sentiment, as the score of 1 denotes no intensity. The portion of stories with no detected positive sentiment was much smaller, only 19.1% of the stories. The classifications of overall sentiment polarity provided further indication of a general bias towards positive valence in GMMs. As much as 121 stories (66%) were evaluated as positive, 33 (18%) as neutral, and 29 (16%) as negative.

The Kruskal–Wallis test showed no significant differences of gender in positive sentiment scores, $H(1, 176) = 2.48, p = n.s.$ Both women ($Mdn = 3, M = 2.76, SD = .87$) and men ($Mdn = 3, M = 2.48, SD = .91$) produced positive sentiment with almost an equal intensity, although the mean value is slightly higher for females. However, there is a statistically significant effect of gender in negative sentiment, $H(1, 176) = 3.885, p < .05$. It appears that women ($Mdn = -2$, $M = -2.48$, $SD = 1.5$) generally produced slightly higher intensities for negative sentiment than men ($Mdn = -1$, $M = -1.92$, $SD = 1.19$).

No significant correlations were found between sentiment intensities and age. However, the word count of the stories had statistically significant correlations with both positive ($r = .487, p < .001$) and negative ($r = .532, p < .001$) sentiment. We also found a significant dependency between gamer identity classes and overall sentiment polarity classifications, $\chi^2(4, 183) = 12.17, p < .05$. The most salient observation from the distributions is as follows: Of the 29 stories classified as negative, even 26 (89.7%) were written by active gamers. The negative sentiment stories were, however, only 22% of the active gamers' stories in total ($n = 118$), the percentages for neutral and positive stories being 13.6% and 64.4% respectively. Although most of the negative stories were written by active gamers, 62.8% ($n_{pos} = 121$) of the positive and 48.5% ($n_{neut} = 33$) of the neutral sentiment stories were also written by this largest group of participants.

Finally we tested if there are correlations between sentiment intensities and AE frequencies. The results yielded significant correlations, moderate for positive ($r = .444, p < .001$) and strong for negative ($r = .600, p < .001$) sentiment scores. The results imply that both types of sentiment intensities go hand-in-hand with AE occurrences across stories.

4.2. Dimensions of personal remembrance (RQ #1)

Across the stories, contents relating to the dimensions of *Self-awareness* (586 instances in 88.5% of the stories), *Social relatedness* (559 instances in 63.9% of the stories), and *Game music experience* (1139 instances in 88.0% of the stories) were identified. The frequencies of each remembrance dimension per story were distributed as follows: Self-awareness ($M = 3.20$, $SD = 3.16 Min = 0, Max = 19$), Social relatedness ($M = 3.05$, $SD = 4.53$ $Min = 0$, $Max = 32$), and Game music experience ($M = 6.22$, $SD = 8.69$ $Min = 0$, $Max = 73$). Remembrances about game music experiences were about two times more common in comparison to the other dimensions. No associations with age or gamer identity with the distribution of remembrance types were found. There was, however, significant effect of gender on the story contents concerning Self-awareness ($H(1, 176) = 11.517, p < .001$) and Social relatedness ($H(1, 176) = 18.557, p < .001$), being observable in higher respective frequencies in the stories of women ($M_{self} = 4.48$, $M_{social} = 5.85$) than men ($M_{self} = 2.91$, $M_{social} = 2.34$).

4.2.1. Thematic sub-types of affect expressions

For explicating the associations between the thematic dimensions and the AEs (RQ #1), we carried out a relational analysis of how AEs were thematically displayed in the stories. This was done through detecting three sub-types of AEs that represent co-occurrences of AEs with the story contents relating to dimensions of *Self-awareness*, *Social relatedness*, or *Game music experience*. For each sub-type, we provided some examples in the form of text quotations that illustrate how AEs were connected to each dimension of personal remembrance.

In all, 404 Self-awareness related AEs (i.e., SELF-AE) were detected, hence this was clearly the largest of the three subclasses. The mean frequency of SELF-AEs within a story was 2.21 ($SD = 3.64$), which is almost a half of the overall frequency of AEs. The distribution across the 183 stories was as follows: 40.4% ($n_{none} = 74$) had no SELF-AEs, exactly same amount of stories ($n_{few} = 74$) had 1–3 of them, and 19.1% ($n_{many} = 35$) contained more than three. The maximum number of SELF-AEs in a story was 26.

The following examples show AEs within their thematic contexts including self-reflective remembrances of past times. These typically dealt with themes of personal growth, coming of an age, overcoming obstacles of life, as well as other kinds of relationships with the game music that reflect a person's identity. In the quotations, AEs are highlighted with bold text, and emphasis is added to the game title.

> ...I began to think that this game [*Child of Light*], and also its music, taps into a **feeling of how I took some key steps towards adulthood during that time**. Many things are somehow associated with that **feeling that the years of youth are over**: Playing the title song yourself (just as was customary with Amelie's theme back then); a return to video games after years of adolescence, and the difficult stages and losses in my close relationships that forced me to look at life in a new way... (male, 31)

> ...*Sonic*'s music is **happy** and helps me cope with everyday life. It **cheered me** up as a child when I was bullied at school... (female, 30)

> ...With that game [*Legend of Zelda: Ocarina of Time*], I learned to play, read, and learned a new language, because of course the game was in English. At the same time, I also went through **a wide variety of emotions**. You could say I kind of grew up with that game... (male, 26)

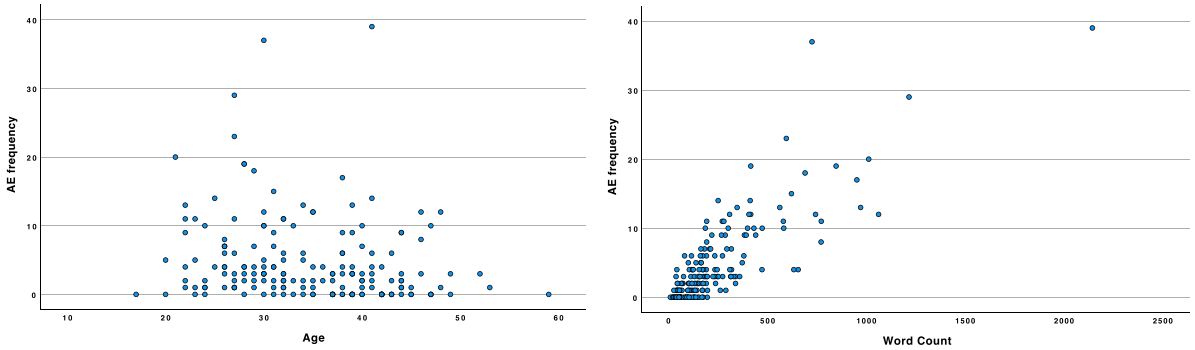


Fig. 5. Scatterplots of story-cases within *Age* and *AE frequency* (figure on left) and within *Word Count* and A*E Frequency* (figure on right).

. . . One **very dear** and **almost always uplifting** example of game music is the soundtrack of the original game *The Sims* and its add-ons. Somewhat elevator-like music, but at the same time skillfully composed and somehow timeless songs take me back to an 11 year-old's carefree life where playing that game was **a great pleasure**, and **nostalgia for this time evokes positive feelings in me**. Before graduating from the university, I was often able to use that soundtrack in the background when I needed the energy to study and focus, and the soundtrack even played in the background many times while writing my thesis. . . (female, 30)

The number of socially linked AEs (i.e., SOCIAL-AE) was surprisingly low, as only 47 items were detected. This seems odd when considering that the numbers of text quotations for the Social relatedness and Self-awareness codes were almost the same. One possible explanation for this result is the short nature of the text quotations for the Social relatedness code, which technically made code co-occurrences less likely to happen (even with the extended detection window). The mean frequency of SOCIAL-AEs within a story was 0.26 ($SD = .68$). As much as 82.5% ($n_{none} = 151$) of the stories did not contain SOCIAL-AEs, and 16.4% ($n_{few} = 30$) had 1–3 of them. Only two stories contained more than three SOCIAL-AEs.

The AEs within social thematic contents were typically about particular moments or stages of life where gameplay experiences were shared with friends or family. As is illustrated in the following examples, the bonding with other people usually was local, but sometimes involved online multiplayer environments.

. . . I cherish game memories because they are moments when I spend time with people **I love**. . . (female, 29)

. . . There are **emotions involved** in the game [*Trollie Wallie*]: I got to do something great! I got to be with my big brother and his friends! I crossed the gender barrier? Primary school boys **hated** girls! I knew how to play!. . . (female, 44)

. . . **We totally got kicks out of it** [*The Last Ninja*] **– really exciting!** We made it through the level and the music became lighter, more positive! I guess I was playing, and my friend stood by. But then he had to go home, and (later) I finally got through the game in one session. For the first time. . . (male, 43)

. . . The game [*Final Fantasy XIV*] soon began to feel like home. It is been 6 years now. Yet even to this day, when I stop to listen to the music of these starting areas, **I am overwhelmed by a warm nostalgia and gratitude** for this game world being like a second home to me, where I have experienced **both laughter and tears**, met new friends and **enjoyed** life. . . (female, 23)

. . . *Ocean's loading music* always **evokes a very warm feeling** of being primary school aged, waiting for the newly received **favorite game** to load. As it loaded from the tape drive, **I had time to enjoy** the music for a long time. I even **pitied my friends** whose games were on floppies because they could not hear that music. . . (male, 43)

Game music experience is the third dimension of interest here. In all, 265 AEs relating to experiences of being engaged with games and their music (i.e., EXPERIENCE-AE) were detected. The mean frequency of EXPERIENCE-AEs was 1.45 ($SD = 2.34$). Their distribution across stories was as follows: 51.9% ($n_{none} = 95$) of the 183 stories had no detections, 34.4% ($n_{few} = 63$) had 1–3 of them, and 13.7% ($n_{many} = 25$) contained more than three. The maximum number of detections in one story was 14.

The AEs within experiential story contents were typically memories with a focus on the experience of the game and its music. As the following examples indicate, their contents often describe arousing experiences situated in the gameplay, or moods being evoked by engaging with the gameworld.

. . . [*UFO: Enemy Unknown*] The background music playing during the mission brought to the surface all the same sensations as during any horror film. **Anxiety, tension and fearful horror.** Couldn't be sure what was behind the next corner, or behind which door in the next enemy turn the alien would enter. **An immense concern** for your own warriors. Quite a **hair-raising experience** every time. . . (male, 40)

. . . [*Mass Effect 2*] I can't explain it properly, but when you watch those shocking events on the screen and hear the pompous music, **something inside me moves and touches deeply**. Really, I often **run into tears** when this **touching music** or the **desperate** task starts. . . (female, 29)

. . . [*Bubble Bobble*] Its music has been ingrained in my heart more precisely than perhaps any other single childhood memory. Just thinking about it makes your heart rate pick up. Its 8-bit, manic riot is full of the promise of a state of flow: a complete immersion into the game's often insanely difficult challenges, which, however, were sometimes overcome with the help of my playmate. The loop of music was short, simple, and actually **just really annoying**, but for some reason in my childhood-brain it **aroused sheer love**. . . (other, 38)

. . . [*Final Fantasy VII*] The music perfectly described the atmosphere of each area or situation and I thought it was very essential in bringing the graphically relatively modest game-world to life. Battle music in particular **always raised the neck hair** when they started playing, even before you knew against what enemy the fight would be. . . (male, 35)

> ...One element in the game [*Legend of Zelda: Ocarina of Time*] that **comforted** and helped me, and that didn't need to be learned, which I always understood, was the music of the game. It brought the whole adventure and **emotional spectrum** of the game into life, the **sense of freedom and adventure** as well as the **anxiety and sadness**. With the music, I understood the game-world and its characters even when I didn't understand what they were saying... (male, 26)

Similarly to the AE frequencies in general, we found significant effects of gender for SELF-AEs ($H(1,176) = 16.004, p < .001$), SOCIAL-AEs ($H(1,176) = 14.201, p < .001$), and EXPERIENCE-AEs ($H(1,176) = 5.326, p < .05$). Thus, regarding to the AE sub-types, women seem to have a relatively stronger tendency to utilize them in their GMMs, according to the mean frequency comparisons (SELF-AE, $M_{female} = 3.61$, $M_{male} = 1.87$; SOCIAL-AE, $M_{female} = 0.61$, $M_{male} = 0.17$; EXPERIENCE-AE, $M_{female} = 2.27$, $M_{male} = 1.16$). This difference is particularly noticeable in SOCIAL-AEs, where the mean value for women was over three times higher (albeit still very low). Despite the fact that women are strongly underrepresented in the sample of this study, as many as 41% ($n = 13$) of the 32 stories having SOCIAL-AEs were written by them. In regard with the gender-related differences of EXPERIENCE-AEs, it is worth noting that the effect of gender was not detected in distributions of the contents relating to the Game music experience dimension ($H(1,176) = 1.267, p = .260$). For the other two dimensions, the effect of gender was statistically significant similarly to SELF-AEs and SOCIAL-AEs.

4.2.2. Dependencies between remembrance dimensions and affect indicators

Besides outlining and investigating AE sub-types in relation to the dimensions of personal remembrance, answering RQ #1 would benefit from an general overview on how the three dimensions are coupled with all types of AEs and sentiment measures. We therefore performed correlation tests between these variables, that are shown in the upper part of Table 4. According to the results, Game music experience yielded the strongest correlation ($r = .646$) with the AE frequencies, while Self-awareness and Social relatedness respectively delivered almost equally strong and moderate level correlations. The results indicate that all three dimensions of remembrance firmly associate with the use of AEs in the stories, although this applies slightly less to the social dimension. Regarding the AE sub-types, the strongest correlation coefficients clearly show the dependence between each dimension and the corresponding AE sub-type. Interestingly though, in case of SELF-AE frequencies, all three dimensions scored correlations above the level of $r = .500$. Although the contents of Self-awareness had the highest association, SELF-AEs thus also strongly correlated with socially and game music experience related contents. And finally, in terms of sentiment intensities, only the dimension of Game music experience showed a strong correlation (with negative sentiment, $r = .556$). All other correlations between the dimensions and the sentiment intensities were at a moderate level.

4.3. Conceptual metaphors of game music (RQ #2)

Across the stories, 555 quotations of text were coded as metaphoric expressions about game music. Their mean frequency of occurrence per story was 3.03 ($Mdn = 2$, $SD = 3.55$). In all, 78.1% of the stories contained at least one metaphoric expression, meaning that 21.9% ($n_{none} = 40$) of GMMs did not employ metaphors of game music. The maximum number of metaphors in a single story was 19. Frequencies of metaphoric expressions correlated with AEs ($r = .582, p < .001$) as well as the positive ($r = .324, p < .001$) and negative ($r = .329, p < .001$) sentiment measures, thus giving an indication of an existing association between the metaphorical conceptualization of game music and the expression of affect. No significant effects of gender, age or gamer identity on the distribution of metaphoric expressions were found.

4.3.1. Metaphorical source domains

Instead of just looking at the use of game music metaphors in general, a more detailed scrutiny on the employment of the thematic metaphor categories in GMMs is needed for getting a grasp of their meanings and for unveiling the nature of the association between the metaphors and the usage of AEs (RQ #2). The eight identified categories (see Table 5) tell us how the participants described the game music they are fond of by using particular conceptual source domains. These domains thus offer specific cognitive-linguistic indicators of how a person conceptualizes the game music and/or the relationship with it. Through the eight source domains, *the game music is*: an agent, a living or person-like entity, like a close friend (*Agencies*; 131 cases across stories, $M = 0.72$ per story), force that has the ability to influence, compel and make things happen (*Forces*; 135 cases across stories, $M = 0.74$ per story), something positioned in relation to the space, inside or outside, near or far (*Spatial relations*; 217 cases across stories, $M = 1.19$ per story), a means of transportation that carries or moves things from one place to another (*Transference*; 75 cases across stories, $M = 0.41$ per story), a mediator that brings something or summon something to the place (*Mediators*; 40 cases across stories, $M = 0.40$ per story), a linkage with something, or a part of a whole (*Linkages*; 90 cases across stories, $M = 0.49$ per story), a physical, tangible thing, construct, or object (*Objects*; 74 cases across stories, $M = 0.40$ per story), or a sensory feeling or bodily sensation (*Sensations*; 50 cases across stories, $M = 0.27$ per story). In all, the identified 555 metaphoric expressions incorporated different source domains in 812 cases, thus, each expression employed one or more of the source domain types ($M = 1.46$). The categories of different source domains are used in the further analyses concerning their associations with the AE frequencies.

4.3.2. Dependencies between metaphors and affect indicators

In order to find out how different kind of metaphors of game music associate with affect indicators, we tested how the frequencies of the eight metaphorical domains correlated with the AE distributions and sentiment measures (see the middle part of Table 4). All categories yielded statistically significant correlations with AE frequencies, ranging from weak (*Mediators*, $r = .259$) to moderate level (*Forces*, $r = .444$) coefficients. Of the AE sub-types, SELF-AEs and EXPERIENCE-AEs had significant moderate-to-weak correlations with all of the metaphor types, with the highest coefficients being scored by *Agencies* ($r = .376$, and $r = .300$, respectively), denoting conceptualizations of game music as a person-like entity, and *Forces* ($r = .371$, and $r = .355$, respectively), pointing at the ways of understanding game music as forces that have the ability to compel and make things happen. In comparison, the SOCIAL-AEs only had weak correlations with four of the eight metaphor types: *Agencies, Transference, Sensations,* and *Spatial relations*. Finally, regarding sentiment intensities, all but one type of metaphor (i.e., *Mediators*) had significant moderate-to-weak correlations with both of the sentiment measures, *Forces, Sensations,* and *Agencies* having the highest coefficients. Of the metaphor types, *Mediators*, denoting ways of conceptualizing game music as bringing or summoning something, was the least associated with the affect indicators, according to the correlation tests.

4.4. Gaming-technology (RQ #3)

We first investigated the potential association of Median publication years with the frequencies of expressed affect and the sentiment intensities. Significant, albeit small correlations were only found in relation to the general amount of AEs and the EXPERIENCE-AE frequencies (Table 4). More recent game titles mentioned in the stories are therefore associated with a slight increase of AEs that coincide with experiential descriptions in GMMs, but not with self-involvement or social relatedness. Next, technology-related group comparisons are performed with the two variables: Gaming Device and Music Technology, which classify

Table 4
Correlation coefficients between the affect indicators the remembrance dimensions, metaphorical domains, and median game publication years.

	Affect Expression (AE) freq.	Self-AE freq.	Social-AE freq.	Exp.-AE freq.	Pos. sentiment	Neg. sentiment
Self-awareness	.621**	.678**	.417**	.381**	.412**	.380**
Social relatedness	.485**	.533**	.549**	.291**	.309**	.310**
Game music experience	.646**	.521**	.265**	.664**	.421**	.556**
Agencies	.439**	.376**	.210*	.300**	.283**	.249**
Forces	.444**	.371**	.130	.355**	.314**	.314**
Spatial relations	.392**	.327**	.163*	.254**	.166*	.213*
Transference	.407**	.348**	.185*	.288**	.213*	.240**
Mediators	.259**	.234*	−.007	.270**	.077	.093
Linkages	.414**	.317**	.050	.315**	.173*	.274**
Objects	.379**	.247**	.023	.265**	.273**	.232*
Sensations	.312**	.244**	.165*	.252**	.269**	.271**
Mdn game publication year	.241**	.124	−.096	.218*	.070	.137

* $p < .05$,
** $p < .001$

Table 5
Eight types of game music metaphors employing different source domains (Finnish expressions translated into English).

Source domain	Example quotations
Agencies	This game and its soundtrack **have walked along with me** on to this day. (male, 26) …the music **seemed to understand me, as if it were my friend who comforted and encouraged me** to endure a stressful time. (male, 41)
Forces	Somehow, the beginning music of the level **charged positive energy**, built hope that there are opportunities to survive on the level. (male, 46) The game **regulates the feeling** desired/wanted using music **as a tool**. (male, 25)
Spatial relations	…the theme songs of childhood games are nostalgic and I may never have even **gotten over** those games (female, 26) Its music **has agglomerated in me** deeper than perhaps any other single childhood memory. (other, 38)
Transference	A small piece of music makes you **transport into** the game world and leave the grayness of everyday life. (male, 24) …a few minutes of devotional time with the game's theme music before **moving into** the game world is an exhilarating experience. It calms down, **descends from** the middle of everyday life **into** a new atmosphere and another world. (other, 35)
Mediators	It brought the whole adventure and emotional spectrum of the game into life, the sense of freedom and adventure as well as the anxiety and sadness. (male, 26) …**bring to the surface** the warmest memories of gaming moments. (male, 24)
Linkages	The story and the game's music were **tied together** …(male, 46) That song (and the game) has become **a part of me** …(male, 22)
Tangible objects	Nostalgia is hard to avoid. At least if you haven't listened to the song in a while or **haven't worn it out**. (male, 33) …it is **composed to support** these different emotions and the story of the characters. (female, 26)
Sensations	…they **color my everyday life** constantly, sometimes as background music at work and sometimes while jogging …(female, 32) Longing and **warmth awakes** when hearing these tunes …(male, 22)

GMMs in accordance with the respective types of technology being disclosed as an object of a story.

Kruskall-Wallis analysis of variance was used for testing out group differences within Game device and Music technology. Comparisons of groups together with the associated mean values are reported in Table 6. Significant effects on AE frequency were found for both variables, $H(2, 182) = 15.123, p < .001$ and $H(2, 180) = 20.474, p < .001$ respectively. Table 6 shows that the mean frequencies of AEs are distinctively lower in computer game and vintage music technology based memories. Post-hoc pairwise tests (Dunn-Bonferroni) confirmed that indeed the Computer group (out of the Game device groups) and the Vintage group (out of the Music technology groups) in particular were the significantly different ones in this respect.

In regard to self-awareness related AEs, Gaming device had a significant effect on the amount of SELF-AEs, $H(2, 182) = 8.899, p < .05$. Pairwise comparison further revealed that the significant differences were specifically found between the Computer and Console groups, implying that AEs with self-aware elements might characterize two distinct ways of expressing one's affective identity that associate with either computer or console based memories. Hence, stories of gaming console memories ($M = 3.09$) had over twice the amount of SELF-AEs, compared to computer based memories ($M = 1.32$). No statistically significant effects of Gaming device were detected on the other two AE sub-types.

Music technology also had a significant effect on the SELF-AE frequencies, $H(2, 180) = 8.683, p < .05$. According to the pairwise comparisons, significant differences exist between the vintage group and the group disclosing both vintage and modern types of technologies. Interestingly, the latter group scored the highest number of the self-aware AEs ($M = 2.89$) while the vintage group had the lowest ($M = 1.14$). Stories referring to both types of technology thus utilized the highest amount of self-involving AEs in the reminiscing. No effect of Music technology was detected on socially related AEs, but there was a significant effect on EXPERIENCE-AEs, $H(2, 180) = 8.345, p < .05$. The involvement of more recent music technologies in GMMs in general seems to result in an increase of AEs relating to game music experiences, and this view is also supported by the exclusive, albeit also small, correlation between game publication years and EXPERIENCE-AEs (see Table 4). Post-hoc tests confirm that the Vintage group, in which EXPERIENCE-AEs were utilized almost three-times less than in the Modern group, differed significantly from the other two groups.

In sum, the Computer and Vintage groups provided differences within their respective technology-based groupings. The amounts of AEs were significantly lower in both of the groups, meaning that GMMs that were based on computer gaming and GMMs that involved vintage music technologies in general contained explicit expressions of affect less frequently. Neither Gaming device or Music technology had any significant effect on sentiment intensities, according to Kruskal–Wallis

Table 6
AE mean frequencies across technology-related groupings and AE sub-types. Pairwise significance column denotes Dunn-Bonferroni post-hoc group comparisons of significant Kruskall-Wallis tests.

	AE freq.		Self-AE freq.		Social-AE freq.		Exp.-AE freq.	
	Mean freq.	Pairwise sig.	Mean freq.	Pairwise sig.	Mean freq.	Pairwise sig.	Mean freq.	Pairwise sig.
Gaming device								
Computer (a)	2.69	a–b*, a–c*	1.32	a–b*, a–c	.17	n/a	.95	n/a
Console (b)	6.23	b–a*, b–c	3.09	b–a*, b–c	.35	n/a	1.74	n/a
Mixed (c)	6.06	c–a*, c–b	2.60	c–a, c–b	.26	n/a	1.96	n/a
Music technology								
Vintage (a)	2.19	a–b*, a–c*	1.14	a–b, a–c*	.24	n/a	.69	a–b*, a–c*
Modern (b)	5.67	b–a*, b–c	2.63	b–a, b–c	.21	n/a	1.94	b–a*, b–c
Both (c)	6.15	c–a*, c–b	2.89	c–a*, c–b	.35	n/a	1.73	c–a*, c–b

* Significant at the $p < .05$ level (Bonferroni-adjusted)

Table 7
Multiple regressions between predictor variables that were included in stepwise linear regression models and the target variables of affect expression, positive sentiment, and negative sentiment.

	Affect expressions	Posit. sentiment	Negat. sentiment
	β	β	β
Self-Awareness	.45***	.40***	n/a
Game music experience	.35***	n/a	.41***
Agencies	.11*	n/a	n/a
Mediators	.13**	n/a	n/a
Sensations	−.13*	n/a	n/a
Linkages	n/a	n/a	.15*
Mdn game publication year	.19***	n/a	n/a
Gender	n/a	n/a	−.16*
Adjusted R^2	.66	.16	.26

* $p < .05$,
** $p < .01$,
*** $p < .001$

tests. However, in regard to negative sentiment, both Gaming device ($M_{computer} = -1.91$, $M_{console} = -2.26$, and $M_{mixed} = -2.13$) and Music Technology ($M_{vintage} = -1.86$, $M_{modern} = -2.27$, and $M_{both} = -2.11$) yielded (non significant) differences between the groups. In particular, the intensities for negative sentiment were noticeably lower in computer and vintage groups.

4.5. Predictive models of affective involvement

After performing analyses separately in regard to RQs #1–3, we finally conducted an integrative investigation to identify the set of most important variables in predicting each of the affect indicators. Forward stepwise linear regressions were used to explore the influence of potential predictors of the outcome variables (*AE freq., Pos. sentiment* and *Neg. sentiment*) out of the 17 candidate variables. Predictor candidates included Self-awareness, Social relatedness, and Game music experience (variables relating to RQ #1), Agencies, Forces, Spatial relations, Transference, Mediators, Linkages, Objects, and Sensations (variables relating to RQ #2), Median game publication year, Gaming device, and Music technology (variables relating to RQ #3), and finally, Gender, Age, and Gamer identity (variables relating to the participants). In the stepwise procedure, at each step, variables were added to the model based on probabilities of F (p-values < 0.05). The procedure stops when there are no variables left that satisfy the entry criterion. The rationale for using stepwise regression is in doing exploratory data analysis by reducing the number of possible predictors. After the selection phase, to avoid potential output biases of the stepwise regression, the final output of the linear models was tested by conducting separate regression analyses that used the variables selected for each of the three target variables.

A total of six variables out of 17 candidates were identified by the forward stepwise procedure to potentially have a statistically significant effect on affective expression frequency outcome. These variables were Self-awareness and Game music experience (relating to RQ #1), Mediators, Agencies, and Sensations (relating to RQ #2), and Median game publication year (relating to RQ #3). Next, the same procedure was repeated first for identifying predictors for positive sentiment and then for negative sentiment. For the positive sentiment outcome, only one variable, namely self-awareness, was identified as potential significant predictor. And for negative sentiment, the three variables of Game music experience (relating to RQ #1), Linkages (relating to RQ #2), and Gender were identified as its potential predictors. Next, multiple regressions for AE frequency, positive sentiment, and negative sentiment were calculated by including in each of these three models the variables identified in the stepwise procedure as potential predictors of the outcome variable. The results of these regressions are reported in Table 7.

Contents relating to Self-Awareness and Game music experience were identified as the main predictors for affect expression frequency in the stories. Both of these variables had a moderate positive effect on the outcome variable, but in addition to them, also Mediators and Agencies and Median game publication year (referring to newer publication years of the games mentioned in the story) were found to be positively associated with affect expression frequency. Furthermore, Sensations was found to be negatively associated with affect expressions. The model explained 66% of the variance of the affect expression frequency variable. In the second regression model, Self-awareness had a moderate effect on positive sentiment, explaining 16% of the variance of this outcome. In the third model, Game music experience was the main predictor for negative sentiment with moderate effect. Both Linkages and Gender also demonstrated small effects on the outcome variable. The negative effect of Gender here refers to a slight influence of female gender on higher intensities of negative sentiment (i.e., female gender is represented by a lower number in the binary categorical variable). The third model explained 26% of the variance of the outcome variable.

5. Discussion

The present sample of stories written about game music memories contained a substantial number of affect expressions scattered across the writings. This is not surprising, as it can be assumed that the authors of these writings have spontaneously selected and shared their game music memories based on an existing affective bond. The emotional affection and personal valuation of the memory was highlighted both by the prevalence of AEs in stories, and by their contents. Sentiment analyses in this study complemented the investigation of affect expressions in terms of the overall emotional valence of the stories, which seemed to lean fairly strongly towards positive sentiment. Such a positive emphasis supports the idea that the stories concern personally valuable and fondly reminisced experiences.

The relationship between the AEs and the sentiment intensities appeared to be quite aligned, as both positive and negative sentiment correlated with the prevalence of explicitly expressed affect. However, this is not to say that AEs and sentiment measures were too overlapping or redundant. On the contrary, the analyses in this study showed that AE frequencies and both positive and negative sentiment measures served as distinctive indicators of affective involvement by revealing notable differences in their associations with the key variables outlined in the investigations of RQs #1–3. Through linear regression models, we explored how the affect indicators were predicted by these variables, and which of them were the most effective in predicting the given affect indicator.

Regarding RQ#1, the content dimensions of personal remembrance, *Self-awareness* and *Game music experience* appeared to have the most significant connections with the affect indicators. According to regression analyses, both variables were among the strongest predictors of explicit AEs in the stories. The contents of Self-awareness dimension outlined a heterogeneity of ways how games and their musics are self-reflected, and how they are involved in people's everyday experiencing. This dimension most frequently co-occurred with AEs in the analysis of AE sub-types. The game music experience dimension contained episodic descriptions of actual gameplay and music related experiences. Different mood-evoking and experiential aspects of music within gameplay were relatively often displayed together with AEs, although these co-occurrences were clearly less frequent compared to the self-related dimension.

The dimension of *Social relatedness* was not included in the model of significant predictors of AEs, and these contents only rarely co-occurred with the AEs. This is surprising, since the involvement of other people in the described gaming situations and personal reflections was not rare at all. Memories often included mentions of friends, siblings, boy- and girlfriends, or parents. The result might imply that in many of those cases of social bonding, the affective meaning was left implicit (i.e., without an explicit emphasis of affect). But in terms of affect indicators, social functions of reminiscing game music were posited as less important in comparison to self-reflective and experience-related functions.

Self-aware and experiential dimensions of remembrance were also significant precedents of sentiment intensities, although they differed in their associations to the positive–negative polarities: In the regression models, the Self-awareness dimension was identified as a sole predictor of positive sentiment, while the Game music experience significantly predicted the use of negative sentiment in the language of the stories. It was to be expected that self-related autobiographical reminiscing would involve personal nostalgia that would explain the connection with the positive sentiment [e.g., 80]. In regard with the link between the negative sentiment and experiential content, as discussed earlier, a possible explanation can relate to the lively episodic descriptions of gameplay situations.

The language used in the stories frequently included a range of verbal means for depicting intimate relationship with game music. Through RQ#2 we investigated how different metaphors of game music were employed by the participants and how the metaphors related to the affect indicators. Interestingly, the initial correlation tests and the integrative regressions gave rather different pictures of which of the metaphor types had the most important associations. In the integrative analysis, only three of the metaphors, *Mediators*, *Agencies* and *Sensations*, were included in the model predicting AE frequencies. According to the model, the expressions of affect thus appear to be especially associated with the conceptualizations of game music in terms of *how it brings something*, *how it is personified or conceived as a living entity*, and negatively associated with *how it is conceived as a sensory feeling*. However, of these metaphor types, mediators and sensations demonstrated the lowest correlations with the AE frequencies, and only agencies was among the better correlating metaphor types. Our interpretation of this discrepancy is as follows: Although game music metaphors are widely linked to AEs, many of them (e.g., forces and spatial relations) might show overlap with the self-aware and experiential content dimensions that have proven to be strong predictors in the model. Metaphors of game music as mediators, agencies and sensations thus proved to possess more independence as statistical predictors of AEs.

Regarding the regression models concerning sentiment intensities as a target, only one metaphor type, *Linkages*, was identified as a significant predictor of negative sentiment (alongside with Game music experience and Gender). This metaphor type also had the second highest correlation to the negative sentiment, further underlining the connection between negative sentiment and a tendency to conceptualize game music as a linkage with or a part of something. Future studies are needed for more detailed investigations on the nature of this connection.

In our technology-focused investigation (RQ#3), we found clear gaming device related differences in relation to the frequencies of AEs. Memories based on computer gaming formed the most distinctive group in this sense. The average utilization of AEs in the computer based GMMs was surprisingly low: more than two times lower than the amount of AEs in the gaming console based stories. Despite this, the *Gaming device* variable was excluded from the predictive regression model of AE frequencies. Instead, the *Median publication year* of the games was included as the only gaming technology related variable significantly predicting the distribution of AEs (i.e., newer games predict higher amount of AEs). Due to the found significant association between Gaming device and Median publication year, the publication years of the games reflect the gaming device types. The computer-based memories more often involved older games and vintage music technologies, including a lot of mentions of 8-bit and 16-bit computers, such as Commodore 64 and Amiga. The found emphasis on older games in computer-based memories might be an anomaly of the present sample, as both types of gaming platforms, computers and consoles, have been equally available during both the older and the modern periods of the history of gaming. Such an emphasis could at least partly explained by the immense popularity of computer gaming in Finland during the 1980s [81].

Because the technology-related effect on the number of AEs was also reflected on the frequencies of self-aware sub-type of AEs, it would be tempting to interpret the results as referring to identity-based differences between computer and console users. As there is no drop of AE frequencies in stories that include both the console and computer based memories, mere technologies themselves do not count as an explanation. Rather, we interpret that the stories based on computer gaming memories exemplify a distinct type of a device-specific nostalgia enthusiastically directed to older home computers, which also manifests differently in the written stories (e.g., with more implicit involvement of affect). Demographic differences could also offer some explanation, because, on the average, the authors of computer-based memories were older men that identify themselves as formerly active gamers. Further (qualitative) investigation on this subsample is, however, needed for making further conclusions.

None of the gaming technology variables had any significant associations with either sentiment measure. In line with this observation, the computer-based memories were equally positively reminisced as console-based memories and even contained noticeably less negative sentiment, despite the lower amount of explicit AEs. This exemplifies how sentiment analysis complemented the investigation of AEs by accounting for the more implicit emotional attributions (i.e., positive and negative valence) in texts.

Of the variables related to individual differences between participants, only *Gender* was included in one of the predictive models. It was initially found that women used AEs in their stories much more frequently than the men did. However, gender was not selected into the group of statistically important predictors of AE frequencies. Instead, gender was among the predictors of negative sentiment, thus strengthening the other initial finding, according to which women also produced slightly higher intensities of negative sentiment in their texts. Overall, these kind of gender-related effects were to be expected, as previous research has shown that women indeed may be more expressive of their emotions [82].

Like other strong experiences with music [28, pp. 129–144], personally valued GMMs can also connect with negative or mixed feelings. In some cases, the game music memory was associated with overcoming obstacles in a person's life, which would inevitably result in negative sentiment expressed in a story. However, acknowledging the emotional complexity with gameplay experiences [83], it is also possible that much of the negative sentiment in the stories would relate to episodes of gameplay recalled in the GMMs. Interestingly, almost all authors of the negative sentiment stories were active players. It has been found that players who are interested or very interested in playing digital games, and who report that they play digital games more than 15 h in a week are also more likely to enjoy aggressive elements such as killing, shooting, and warfare more than the average player [15,84]. It is thus likely that the GMMs of active players would contain episodic descriptions and reflections of aggressive gameplay activities, thus ending up including words with negative sentiment in the story. Of course it should also be recognized that active gamers were a very large, and potentially heterogeneous group of participants in this study, and the negative sentiment stories represented only about one fifth of their stories in general. In future investigations, additional qualitative analysis on negative sentiment texts is required to clarify actual differences, for example, in terms of an evaluative writing style, or in ways of how vividly and episodically rich manner gameplay experiences were described [see e.g., 85].

Finally, we would argue that the GMMs gathered in this study epitomize a strong nostalgic stance on past experiences and therefore nostalgia should be accounted as a motivating factor for reminiscing about game music and video games. Many of the stories characterized a desire to re-live and cherish memories of the more carefree days of one's youth or childhood. But personal nostalgia is more than just childhood memories. Wildschut et al.'s [80] study establishes nostalgia as a happiness-related emotion and argues "that, like love, nostalgia bolsters social bonds; that, like pride, nostalgia increases positive self-regard; and that, like joy, nostalgia generates positive affect" (p. 989). Using these functions of nostalgia as criteria, our study indeed confirms that GMMs in general included a significant amount of reminiscing about social relatedness, reflections of the self, explicit expressions of affect, while the stories yielded an overall positive emotional valence.

5.1. Implications

This study spans across several disciplines and as such we consider its potential contributions to be interdisciplinary in nature, that is, endorsing a human-centered approach to videogame music that encompasses perspectives and methods from diverse fields of research. Nevertheless, we may highlight research on video games, music psychology research, and linguistic studies as three domains for which this paper provides particular implications.

This research importantly sheds light on how memories can be utilized for gaining a long-term perspective for studying attachment to video games. This is essentially about steering the attention from games to various ways in which gameplay intersects and entangles with the daily life. Particularly, in respect to the nascent field of video game music research, we have presented a comprehensive approach for investigating game music beyond the game. The experience of game and its music, after all, does not end when the gaming ceases but is carried on in discussions, reminiscences as well as other diverse forms of metagame activities [86], of which the collected stories attest. Likewise, the meanings of games are not restricted to games but mesh with diverse personal, social, and cultural meanings, eventually lading the game with personal significance and developing a bonding with the game.

In terms of music psychology, this paper contributes to the existing discussions [43,87] on psychological functions of music as well as musical tastes and preferences by providing a complimentary approach, which focuses on long-term engagement with music and is based on freely written first-person accounts of the use of music in everyday life. We have wished to demonstrate the rich and often complex relationship people have established with their favorite music, and illustrate how the meaningfulness of this music is realized and articulated as a part of one's life. This kind of nuanced in-depth view on the genealogies and practices of personal importance of music should prove to be valuable in understanding how music is and has grown dear to someone. The emphasis in music psychology research has traditionally been set on measurable emotional reactions to musical stimuli [88]. We believe that the concept of attachment is useful in enriching research on long-term affective engagement with music. Therefore, the presented method of analyzing affective qualities in the spontaneous stories on self-selected favorite music provides a potentially fruitful perspective for future research on music and emotion.

This paper also has implications for linguistic studies. It shows that it is possible to combine analyses of affect and sentiment with a metaphor analysis in a new way, as well as to combine linguistic analyses of affect, sentiment, and metaphor with analyses representing music psychology and game research. To put it differently, instead of coding metaphors of emotion into the textual data, we have coded metaphors of game music and analyzed how they correlate with expressions of affect and sentiment. This is new; there is plenty of previous research on metaphors of emotion [32] and metaphors of music [56,59], but we do not know of any research that would mix an analysis of metaphors of music with an analysis of affect or sentiment. Moreover, we have integrated linguistic analyses with analyses that rather relate to music psychology and game studies, thus bridging the gap between different disciplines. To explain what we did in one more way, perhaps we could call our research psycholinguistic research of the everyday experience of music.

5.2. Conclusions

The results of our mixed-methods research provide new grounds for understanding the constituents of music-based attachment to games that signify different domains of personal valuation in people's lives. Overall, it was discovered that self-aware and game music experience related personal remembrances were the main precedents for expressing affect in the stories. Furthermore, each of the investigated domains of valuation, personal remembrance dimensions, metaphors of conceptualizing game music, and the involvement of game technologies, contributed to the prevalence of affect expressions. However, this did not apply to the sentiment intensities, which could only be predicted by a few of the key variables in the study. Future studies could further explore the factors that influence the use of positive and negative sentiment.

As our investigation pointed out, both the memories about gameplay (i.e., experiential descriptions of the music in a gameplay) and

beyond gameplay (i.e., autobiographical memories of the game music) associate with video game music affection. This underlines the importance of game music, not only within games, but generally in how we engage with music for constructing our everyday experiences, and even our identity as the persons who we are. We thus consider this research as a step towards considering game music within a wider context of everyday musical activities and different dimensions of social and personal life. In more general terms, we hope to contribute to generating new discussion that lies in the intersection of player experience and the broader view of music psychology. We believe that studying game music through memories highlights how daily experiences of music are often meshed with and even obscured by the mundane contexts and activities they entangle with. Yet, upon a reflection – such as the participants have provided in their stories – the "unheard melodies" [cf. 89] that accompany video games may incorporate important and memorable experiences in our lives.

CRediT authorship contribution statement

Kai Tuuri: Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Oskari Koskela:** Writing – review & editing, Data curation, Conceptualization. **Heli Tissari:** Writing – review & editing, Methodology, Data curation. **Jukka Vahlo:** Writing – review & editing, Formal analysis.

Declaration of competing interest

The authors of this manuscript certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Data availability

The codes and data that support the findings of this study are available upon reasonable request from the corresponding author. The full data is not publicly available due to consent restrictions by some of the participants. A slightly limited version (177 respondents) of the story data is available as an electronic dataset: Finnish Social Science Data Archive [distributor] https://urn.fi/urn:nbn:fi:fsd:T-FSD3473.

Acknowledgments

This work was funded by Kone Foundation, Finland (Game Music Everyday Memories, 201908388) and Academy of Finland (Centre of Excellence in Game Culture Studies, decision 353267; PROFI 7 JYU.LearnDigi, decision 353325).

References

[1] H.N. Schifferstein, E.P. Zwartkruis-Pelgrim, Consumer-product attachment: Measurement and design implications, Int. J. Des. 2 (3) (2008).
[2] J. Bowlby, Attachment and Loss, no. 79, Random House, 1969.
[3] S.J. Trinke, K. Bartholomew, Hierarchies of attachment relationships in young adulthood, J. Soc. Pers. Relatsh. 14 (5) (1997) 603–625.
[4] R.A. VanMeter, D.B. Grisaffe, L.B. Chonko, Of "likes" and "pins": The effects of consumers' attachment to social media, J. Interact. Mark. 32 (1) (2015) 70–88.
[5] K. Schäfer, T. Eerola, How listening to music and engagement with other media provide a sense of belonging: An exploratory study of social surrogacy, Psychol. Music 48 (2) (2020) 232–251.
[6] S.E. Jones, The Meaning of Video Games: Gaming and Textual Strategies, Routledge, 2008.
[7] S. Niedenthal, What we talk about when we talk about game aesthetics, in: Digital Games Research Association (DiGRA), London, UK (2009), DiGRA Online Library, 2009.
[8] K. Salen, E. Zimmerman, Rules of Play: Game Design Fundamentals, MIT Press, 2003.
[9] M.B. Oliver, N.D. Bowman, J.K. Woolley, R. Rogers, B.I. Sherrick, M.-Y. Chung, Video games as meaningful entertainment experiences, Psychol. Pop. Media Cult. 5 (4) (2016) 390–405.
[10] C.T. Nguyen, Games: Agency as Art, Oxford University Press, USA, 2020.
[11] A.K. Przybylski, C.S. Rigby, R.M. Ryan, A motivational model of video game engagement, Rev. Gen. Psychol. 14 (2) (2010) 154–166.
[12] G.W. Selnow, Playing videogames: The electronic friend, J. Commun. 34 (2) (1984) 148–156.
[13] T. Wulf, J.S. Breuer, J.B. Schmitt, Escaping the pandemic present: The relationship between nostalgic media use, escapism, and well-being during the COVID-19 pandemic, Psychol. Pop. Media 11 (3) (2022) 258.
[14] J.-H. Wu, S.-C. Wang, H.-H. Tsai, Falling in love with online games: The uses and gratifications perspective, Comput. Hum. Behav. 26 (6) (2010) 1862–1871.
[15] J. Vahlo, J.K. Kaakinen, S.K. Holm, A. Koponen, Digital game dynamics preferences and player types, J. Comput.-Mediat. Commun. 22 (2) (2017) 88–103.
[16] Y. Sung, T.-H. Nam, M.H. Hwang, Attachment style, stressful events, and Internet gaming addiction in Korean university students, Personal. Individ. Differ. 154 (2020) 109724.
[17] J.A. Bopp, L.J. Müller, L.F. Aeschbach, K. Opwis, E.D. Mekler, Exploring emotional attachment to game characters, in: Proceedings of the Annual Symposium on Computer-Human Interaction in Play, 2019, pp. 313–324.
[18] T. Oleksy, A. Wnuk, Catch them all and increase your place attachment! the role of location-based augmented reality games in changing people-place relations, Comput. Hum. Behav. 76 (2017) 3–8.
[19] R. Watkins, M. Molesworth, Attachment to digital virtual possessions in videogames, in: Research in Consumer Behavior, Vol. 14, Emerald Group Publishing Limited, 2012, pp. 153–170.
[20] P. Nagy, B. Koles, "My avatar and her beloved possession": Characteristics of attachment to virtual objects, Psychol. Mark. 31 (12) (2014) 1122–1135.
[21] T. Summers, Understanding Video Game Music, Cambridge University Press, 2016.
[22] S.M. Zehnder, S.D. Lipscomb, The role of music in video games, in: P. Vorderer, J. Bryant (Eds.), Playing Video Games: Motives, Responses, and Consequences, Lawrence Erlbaum Associates Publishers, 2006, pp. 241–258.
[23] J. Zhang, X. Fu, The influence of background music of video games on immersion, J. Psychol. Psychother. 5 (4) (2015) 191.
[24] M. Fritsch, T. Summers, The Cambridge Companion to Video Game Music, Cambridge University Press, 2021.
[25] S. Diaz-Gasca, Music beyond Gameplay: Motivators in the Consumption of Videogame Soundtracks (Ph.D. thesis), Griffith University, 2013.
[26] A.M. Belfi, B. Karlan, D. Tranel, Music evokes vivid autobiographical memories, Memory 24 (7) (2016) 979–989.
[27] F.S. Barrett, K.J. Grimm, R.W. Robins, T. Wildschut, C. Sedikides, P. Janata, Music-evoked nostalgia: Affect, memory, and personality, Emotion 10 (3) (2010) 390.
[28] A. Gabrielsson, Strong Experiences with Music, Oxford University Press, 2010.
[29] E. Huovinen, K. Tuuri, Pleasant musical imagery: Eliciting cherished music in the second person, Music Percept.: Interdiscip. J. 36 (3) (2019) 314–330.
[30] S. Saarikallio, V. Alluri, J. Maksimainen, P. Toiviainen, Emotions of music listening in Finland and in India: Comparison of an individualistic and a collectivistic culture, Psychol. Music 49 (4) (2021) 989–1005.
[31] K. Kilpiö, "We listened to our mix-tapes of love songs, talking about boys": Young finns as a target group for cassette technology, in: Situating Popular Musics: IASPM 16th International Conference Proceedings, 2011, pp. 153–162.
[32] Z. Kövecses, Metaphor and Emotion: Language, Culture, and Body in Human Feeling, Cambridge University Press, 2003.
[33] M. Thomson, D.J. MacInnis, C. Whan Park, The ties that bind: Measuring the strength of consumers' emotional attachments to brands, J. Consum. Psychol. 15 (1) (2005) 77–91.
[34] J. Shaver, R.-N. Yan, Examining sustainable consumption behaviors through the mass customization context: Emotional product attachment and environmental attitude perspectives, J. Sustain. Res. 4 (3) (2022).
[35] P. Janata, The neural architecture of music-evoked autobiographical memories, Cerebral Cortex 19 (11) (2009) 2579–2594.
[36] S. Bluck, Autobiographical memory: Exploring its functions in everyday life, Memory 11 (2) (2003) 113–123.
[37] A.S. Rasmussen, D. Berntsen, The unpredictable past: Spontaneous autobiographical memories outnumber autobiographical memories retrieved strategically, Conscious. Cogn. 20 (4) (2011) 1842–1846.
[38] J.H. Mace, E. Atkinson, Can we determine the functions of everyday involuntary autobiographical memories, Appl. Mem. (2009) 199–212.
[39] D. Berntsen, Voluntary and involuntary access to autobiographical memory, Memory 6 (2) (1998) 113–141.

[40] D. Berntsen, N.M. Hall, The episodic nature of involuntary autobiographical memories, Mem. Cogn. 32 (5) (2004) 789–803.
[41] T. Fuchs, Embodied knowledge–embodied memory, in: Analytic and Continental Philosophy: Methods and Perspectives. Proceedings of the 37th International Wittgenstein Symposium, 2016, pp. 215–229.
[42] T. DeNora, Music as a technology of the self, Poetics 27 (1) (1999) 31–56.
[43] T. DeNora, Music in Everyday Life, Cambridge University Press, 2000.
[44] J.A. Sloboda, S.A. O'Neill, A. Ivaldi, Functions of music in everyday life: An exploratory study using the experience sampling method, Music. Sci. 5 (1) (2001) 9–32.
[45] S. Saarikallio, J. Erkkilä, The role of music in adolescents' mood regulation, Psychol. Music 35 (1) (2007) 88–109.
[46] A.J. Lonsdale, A.C. North, Why do we listen to music? A uses and gratifications analysis, Br. J. Psychol. 102 (1) (2011) 108–134.
[47] T. Schäfer, P. Sedlmeier, From the functions of music to music preference, Psychol. Music 37 (3) (2009) 279–300.
[48] M.V. Thoma, S. Ryf, C. Mohiyeddini, U. Ehlert, U.M. Nater, Emotion regulation through listening to music in everyday situations, Cogn. Emot. 26 (3) (2012) 550–560.
[49] K. Tuuri, O. Koskela, J. Vahlo, Pelimusiikin käyttötavat ja funktiot suomalaisten arjessa [the uses and functions of game music in everyday life], Musiikki 52 (4) (2022) 8–45.
[50] T. Schäfer, P. Sedlmeier, C. Städtler, D. Huron, The psychological functions of music listening, Front. Psychol. 4 (2013) 511.
[51] R.J. Zatorre, A.R. Halpern, Mental concerts: Musical imagery and auditory cortex, Neuron 47 (1) (2005) 9–12.
[52] F. Bailes, Empirical musical imagery beyond the "mind's ear", in: The Oxford Handbook of Sound and Imagination, Volume 2, Oxford University Press, 2019, pp. 445–463.
[53] V.J. Williamson, S.R. Jilka, J. Fry, S. Finkel, D. Müllensiefen, L. Stewart, How do "earworms" start? Classifying the everyday circumstances of involuntary musical imagery, Psychol. Music 40 (3) (2012) 259–284.
[54] G. Lakoff, M. Johnson, Metaphors We Live By, University of Chicago Press, 2008.
[55] M. Johnson, The Meaning of the Body: Aesthetics of Human Understanding, University of Chicago Press, 2007.
[56] S. Schaerlaeken, D. Glowinski, M.-A. Rappaz, D. Grandjean, "Hearing music as…": Metaphors evoked by the sound of classical music, Psychomusicology: Music Mind Brain 29 (2–3) (2019) 100.
[57] M. Antović, M.B. Küssner, A. Kempf, D. Omigie, S. Hashim, A. Schiavio, 'A huge man is bursting out of a rock'. Bodies, motion, and creativity in verbal reports of musical connotation, J. New Music Res. (2024) 1–14.
[58] J. Robinson, Can music function as a metaphor of emotional life? Rev. Fr. d'études Am. (2000) 77–89.
[59] M.L. Johnson, S. Larson, "Something in the way she moves"-metaphors of musical motion, Metaphor Symb. 18 (2) (2003) 63–84.
[60] J. Švelch, Keeping the spectrum alive: Platform fandom in a time of transition, in: Fans and Videogames, Routledge, 2017, pp. 57–74.
[61] L.J. Paul, For the love of chiptune, in: K. Collins, B. Kapralos, H. Tessler (Eds.), The Oxford Handbook of Interactive Audio, Oxford University Press, USA, 2014, pp. 507–528.
[62] S. Reynolds, Retromania: Pop Culture's Addiction to Its Own Past, Macmillan, 2011.
[63] M. d'Errico, How to reformat the planet: Technostalgia and the "live" performance of chipmusic, J. Art Rec. Prod. 6 (2012).
[64] I. Marquez, Playing new music with old games: The chiptune subculture, GAME Games Art Media Entertain. 1 (3) (2014).
[65] G. Reid, Chiptune: The ludomusical shaping of identity, Compute. Games J. 7 (4) (2018) 279–290.
[66] V. Zappi, From 8-bit punk to 8-bit avant-garde: Designing an embedded platform to control vintage sound chips, in: Proceedings of the 15th International Audio Mostly Conference, 2020, pp. 269–272.
[67] M. Thelwall, K. Buckley, G. Paltoglou, D. Cai, A. Kappas, Sentiment strength detection in short informal text, J. Am. Soc. Inf. Sci. Technol. 61 (12) (2010) 2544–2558.
[68] R. Berrios, P. Totterdell, S. Kellett, Eliciting mixed emotions: A meta-analysis comparing models, types, and measures, Front. Psychol. 6 (2015) 428.
[69] K. Collins, Playing with Sound: A Theory of Interacting with Sound and Music in Video Games, MIT Press, 2013.
[70] B. Johnstone, et al., Qualitative Methods in Sociolinguistics, Vol. 50, Oxford University Press, USA, 2000.
[71] S.T. Peesapati, V. Schwanda, J. Schultz, M. Lepage, S.-y. Jeong, D. Cosley, Pensieve: Supporting everyday reminiscence, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2010, pp. 2027–2036.
[72] J. Kinnunen, K. Taskinen, F. Mäyrä, Pelaajabarometri 2020: Pelaamista Koronan Aikaan, TRIM Research Reports 29, Tampere University Press, 2020.
[73] K. Charmaz, Constructing Grounded Theory, SAGE publications Ltd, 2014.
[74] O. Koskela, H. Tissari, K. Tuuri, Käsitemetaforan näkökulma pelimusiikin henkilökohtaiseen merkityksellisyyteen [the perspective of conceptual metaphor on personal meaningfulness of game music], Musiikki 52 (4) (2022) 46–84.
[75] A. Stefanowitsch, Words and their metaphors: A corpus-based approach, in: W. Bisang, H.H. Hock, W. Winter, A. Stefanowitsch, S. Gries (Eds.), Corpus-Based Approaches to Metaphor and Metonymy, Mouton de Gruyter, 2006, pp. 63–105.
[76] M. Johnson, The philosophical significance of image schemas, in: From Perception to Meaning: Image Schemas in Cognitive Linguistics, Mouton de Gruyter Berlin, 2005, pp. 15–33.
[77] M. Fritsch, T. Summers, Chiptunes: Introduction, in: M. Fritsch, T. Summers (Eds.), The Cambridge Companion to Video Game Music, in: Cambridge Companions to Music, Cambridge University Press, 2021, pp. 5–58.
[78] K. Collins, Game Sound: An Introduction to the History, Theory, and Practice of Video Game Music and Sound Design, MIT Press, 2008.
[79] J. Jussila, V. Vuori, J. Okkonen, N. Helander, Reliability and perceived value of sentiment analysis for Twitter data, in: A. Kavoura, D. Sakas, P. Tomaras (Eds.), Strategic Innovative Marketing, Springer, 2017, pp. 43–48.
[80] T. Wildschut, C. Sedikides, J. Arndt, C. Routledge, Nostalgia: Content, triggers, functions, J. Pers. Soc. Psychol. 91 (5) (2006) 975.
[81] J. Suominen, Popular history: Historical awareness of digital gaming in Finland from the 1980s to the 2010s, Proc. DiGRA (2020) 14–17.
[82] T.M. Chaplin, Gender and emotion expression: A developmental contextual perspective, Emot. Rev. 7 (1) (2015) 14–21.
[83] E.D. Mekler, S. Rank, S.T. Steinemann, M.V. Birk, I. Iacovides, Designing for emotional complexity in games: The interplay of positive and negative affect, in: Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts, 2016, pp. 367–371.
[84] J. Vahlo, J. Smed, A. Koponen, Validating gameplay activity inventory (GAIN) for modeling player profiles, User Model. User-Adapt. Interact. 28 (4) (2018) 425–453.
[85] B. Levine, E. Svoboda, J.F. Hay, G. Winocur, M. Moscovitch, Aging and autobiographical memory: Dissociating episodic from semantic retrieval, Psychol. Aging 17 (4) (2002) 677.
[86] J. Kahila, T. Valtonen, S. López-Pernas, M. Saqr, H. Vartiainen, S. Kahila, M. Tedre, A typology of metagamers: Identifying player types based on beyond the game activities, Games Cult. (2023) 15554120231187758.
[87] A. North, D. Hargreaves, The Social and Applied Psychology of Music, OUP Oxford, 2008.
[88] T. Eerola, J.K. Vuoskoski, A review of music and emotion studies: Approaches, emotion models, and stimuli, Music Percept. Interdiscip. J. 30 (3) (2012) 307–340.
[89] C. Gorbman, Unheard Melodies: Narrative Film Music, Indiana University Press, 1987.