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The Effect of Music and Musical Elements on Elderly People - A Scoped Systematic Literature Review

S. Schmidt
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Supervisors:
Dr. L.M.A. Braakman- Jansen
Christian Wrede, MSc

University of Twente
P.O. Box 217
7500 AE Enschede
The Netherlands

Abstract

Background: Normal ageing leads elderly people progressively to experience problems like declining cognition, lower mental and physical health and a loss in their capabilities. Music was found to counteract those problems and has also shown to have a positive effect on the elderly's life. Some studies reported especially an impact of music and musical elements on the arousal and relaxation level, the quality of life and well-being, social behaviour and cognition which was also the core of this review. The aim of the review was to summarize existing findings in the field of music and its impact on elderly people, with special regard to the following five research questions:

1. What kind of music and which musical elements are currently applied in the care of the elderly?
2. What are the effects of music on the arousal and relaxation of the elderly?
3. What are the effects of music on social behaviour like communication/participation in the elderly?
4. What are the effects of music on well-being and the quality of life?
5. What are the effects of music on the elderly's cognition or performance?

Method: The design of the study comprised a scoped systematic literature review. To find relevant articles aimed at answering the research questions, the database Scopus was used. The found documents were screened for its relevance by using eligibility criteria that were developed based on the PICO criterion.

Results: The screening process narrowed the initially found articles down to a total of ten studies. The quality of the studies was assessed by its measurement and its level of evidence; a good study comprising a good study design and a comprehensible measurement with adequate reliability (α>.80). It turned out that the studies had varying qualities, most having good quality. Also, they included different musical interventions and tested the effect of some musical elements in particular on the elderly. The vast majority of the studies have shown positive effects of music on the arousal, emotions, social behaviour, quality of life, well-being and cognition of elderly people while only two studies did not report significant findings of a tested intervention. No study found statistically relevant effects of music on the elderly's relaxation but still, the studies concluded from interviews that music can relax the elderly.

Conclusion: The review summarized the existing literature of one database and offered a first insight into the topic. Music was found to have throughout positive effects as no study reported any negative effect of music on elderly people. With regard to the review's limitations, namely the small quantity of included studies, studies of varying quality and diverse study designs, the findings could not always be compared and should generally be treated with caution. Except for the first research question and the concept of relaxation, all research questions could be validated with statistical significance meaning that music has a positive effect on the elderly in most domains. The review presented findings and trends of current research and showed the relevance for future research. In particular, musical elements showed promising positive impacts, among them rhythm, volume, tempo and mode. Also, happy, classical and self-selected music, binaural beats and live performances have influenced the elderly positively and can be taken as reference points for future research. Concluding, it can be said that the use of music has an added value to the life of elderly people and one should not hesitate using it more frequently in the care of elderly people as it did not show any negative impacts.

<u>Introduction</u>

Music surrounds us on a daily basis and is considered a fundamental human ability (Peretz, 2008). Therefore, music has always been a topic of interest and people were eagerly interested in researching music and its impact on us (Trehub, 2003). Within this research, a considerable positive effect of music on dementia patients was found. The case of patient Henry illustrates this. Henry is suffering from symptoms of severe dementia. He is among others cognitively declined and unresponsive to his environment. When he was exposed to music, his state seemed to change which could be observed by his bodily responses of moving along the music and having wide opened eyes. Music brought back memories that were inaccessible to him before and enabled him to communicate with his caregivers (Matthews, 2015).

This potential positive impact is not limited to dementia patients alone, especially for elderly people music was found to be of therapeutic relevance as it promotes their physical and mental health (Kramer, 2001). Elderly people often suffer due to their ageing from cognitive decline and capability loss. They often encounter problems in vision, hearing, memory and motor coordination, mobility and might develop chronic pain or other health problems (Viña, Borrás, & Miquel, 2007; WHO, 2017). Also, they are likely to report sleep disturbances and depressions which are the most frequently experienced mental disorders in the elderly (Chan, Chan, & Mok, 2010). As a result of the pre-mentioned and other circumstances, many elderly are lonely and live isolated which further amplifies their psychological distress. This creates a vicious circle due to the interaction of mental and physical health as they both influence each other. It can be seen that people with physical health problems report lower levels of mental health and low mental health affects physical outcomes negatively (WHO, 2017). Consequently, it is important to counter those negative health outcomes and try to improve the elderly's health.

In particular, music was reported to be effective in counteracting those problems and promote the elderly's health by, among others, increasing their well-being and cognitive functioning while decreasing depressive symptoms. In terms of social behaviour, research has shown that the social activity, quality of life and the well-being increased in older adults while listening or engaging to music (Coffman, 2002; Lehmberg & Fung, 2010; Kramer, 2001). Music also facilitated the creation of social connections that lasted longer than the musical intervention itself, leading to a larger social network. This research also showed that a desire for social interaction

was a reason to engage in a musical intervention in the first place (Lehmberg & Fung, 2010). Concerning the elderly's cognition, music was found to improve language functioning and the attention span (Kramer, 2001). A study researching the effect of music on elderly with dementia found that music influenced cognition in mild and moderate dementia patients by prolonging the cognitive decay. In particular, their cognition did not further decline over the time of the intervention for all measured dimensions of the MMSE (Mini-Mental State Examination) for example in orientation in place and time, attention, recall and language functioning. A notable increase of cognitive functioning was found in the short term recall of dementia patients (Chu et al., 2014). With regard to the elderly's mental health, it was seen that musical interventions improve the sleep quality and also decrease depression in elderly with and without dementia (Chan, Chan, & Mok, 2010; Chu et al., 2014). One possible explanation is the distraction from negative feelings towards pleasurable emotions while listening to or engaging with music. So, music was observed to alleviate the mood of dementia patients and, therefore, reduced depression (Chu et al, 2014).

Studies show that music-induced emotions go along with listening to music (cf. Vuoskoski & Eerola, 2011). It was observed that music can evoke emotions in the same way as emotion-eliciting events themselves. Also, music can lead to imagination or recall of memories that are loaded with strong emotional associations. By arousing those memories, music can create similar but weaker emotions compared to the original experienced ones (Scherer, 2004). Important to note here is that musical memory is mostly preserved over the lifespan and it has the power to stimulate personal memories. This is not only the case for healthy ageing people but also for many dementia patients which also explains why patient Henry could remember memories that were inaccessible to him before listening to music (Cuddy, Sikka, & Vanstone, 2015). Music can also facilitate the experience of emotions. Pre-existing feelings can be triggered by music which makes it harder to control these emotions and they are more likely to be revealed (Scherer, 2004). Music-induced experiences are also dependent on other factors, like on mood and personality which can influence the intensity of experienced emotions. It was found that positive and active moods, as well as the personality traits agreeableness and openness, are associated with a bigger impact on the perception of emotions (Vuoskoski & Eerola, 2011).

Emotions also have an arousing and relaxing impact on people. In psychology, arousal is defined as "the state of being physiologically alert, awake, and

attentive" (Study.com, n.d.) while relaxation is defined as the "reduction of the mind's noise and the body's activity" (Kramer, 2001, p.192), meaning that arousal and relaxation have opposing effects on people. Arousal is triggered by emotions and as music influences emotions, arousal is elicited in a more intense way. This underlies the view that music-induced emotions do not differ from natural or real experienced emotions (Rickard, 2004). Also, arousal has an effect on cognitive performance which enhances people's spatial abilities (Schellenberg, 2005). Music does not only arouse people, but it also relaxes them which can be seen as for instance in decreased anxiety states   (Davis & Thaut, 1989). It was found that the perceived relaxation was highest while listening to classical and self-selected relaxing music compared to listening to hard rock music (Burns, Labbé, Williams, & McCall, 1999). Also, listening to familiar music relaxed people and created a positive mood, whereas depressive symptoms decreased (Chu et al., 2014). Due to the previously mentioned indications, it can be assumed that music influences emotions, arousal and relaxation, well-being and the quality of life, cognition and social behaviour.

Music comprises of several elements that taken together lead to what is experienced as music. According to Jacobsen (2000), music basically is made up of seven different elements: rhythm, dynamics, melody, harmony, texture, tone colour and form. Changes in these can account for all variations in various kinds of music and each element may have a different effect on the listener. Hence, it is important to introduce these properties and be able to differentiate between them. The rhythm of a piece of music consists of four sub-elements: the beat, the tempo, the meter and the syncopation. The beat is the basic unit of regularly repeating pulses, the tempo is the speed of the beat which can range from slow (40-107 beats per minute) to fast (108-208 beats per minute), the meter is a recurring accent pattern and syncopation is an indication for a tune to be off-beat. The dynamics of music are about the relative quietness or loudness ranging from piano (quiet) to forte (loud). The element melody is the arrangement of sounds and comprises the pitch which is the frequency of sounds (Jacobsen, 2000). The mode of a song is connected to the pitch. There is a differentiation between a major and a minor mode, a major mode having larger intervals between the first and third and the first and sixth pitch, compared to a minor mode (Gagnon & Peretz, 2003). Harmony is the sound when tones are played simultaneously and can create dissonance which is a harsh harmony or consonance which is pleasant harmony. The texture is about the relationship between musical

lines and melodies. A further element of music is the tone colour. It is described as "the characteristic sound of an instrument or voice" (Jacobsen, 2000, p. 25). Therefore, due to the tone colour, one can differentiate a voice or an instrument from another. Lastly, the form of music combines all described elements in a composition (Jacobsen, 2000).

Research has shown that music as a combination of all musical elements has a positive effect on people. But some studies did not only explore the effect of music as a whole but also tested the impact of individual musical elements on people. It was observed that a rapid pitch stimulates people and a slow pitch relaxes them (Kramer, 2001). Stimulation is also triggered by a fast tempo and a major mode which enhances people's cognitive performance through increased mood and arousal levels (Husain, Thompson, & Schellenberg, 2002). An example of the relaxing impact of music can be seen in Buntrock's (n.d.) "Integrative Music-Relaxation". This relaxation music does not only make use of the music's pitch but also makes adaptations of features like tempo, dynamics and frequency scope. According to Kramer (2001), the intensity of music creates feelings of intimacy or protection by being soft or loud, respectively. Concerning emotions, it was seen that tone colour and its dependency on rhythm trigger different emotions in people due to its associations on previous emotional experiences (Kramer, 2001). With regard to the elderly's mental health, soft and slow music improves sleep quality and alleviates depressive symptoms (Chan, Chan, & Mok, 2010).

So far, it could be seen that music has a potential positive influence on people. Especially, in the context of elderly people, music showed a promising groundwork and health benefits which makes it worth to look further into this issue. Until now, there is a gap in the literature as no systematic literature review was conducted on the effect of music and musical elements on elderly people. Therefore, the following scoped systematic literature review tried to enhance the evidence-based practice by summarizing existing findings and aimed at creating an overview in this field. The purpose of this study is to explore the effect of music and musical elements on elderly people, in particular on their emotions, arousal and relaxation state, well-being and quality of life and cognition. This will be explored by tackling the five below mentioned research questions.

1. What kind of music and which musical elements are currently applied in the care of the elderly?

2. What are the effects of music on the arousal and relaxation of the elderly?

3. What are the effects of music on social behaviour like communication/ participation in the elderly?

4. What are the effects of music on well-being and the quality of life?

5. What are the effects of music on the elderly's cognition or performance?

Method

Scope of the study

The study was a scoped systematic literature review that explored existing literature regarding the usage and effect of music and its elements on elderly people with respect to the elderly's arousal/relaxation level, their social behaviour, their well-being and quality of life, their cognition and their emotions.

Eligibility criteria

The 203 found documents were systematically analysed with regard to the following eligibility criteria in accordance with "PICO" (Population, Intervention, Comparison/Context, and Outcome).

The chosen target population was elderly people, so only studies that explored an effect on elderly people were included. As some articles do not use the term elderly but older or old adult, a limitation of at least 50 years of age was set. Excluded from the search were all other population groups. The systematic review aimed at synthesising research on music and in particular musical elements on elderly people. Therefore, various kinds of interventions including music and musical elements were of relevance. With regard to the 'C' of the PICO, a comparison group was not applicable and studies including single groups or reviews were also taken into account. The outcomes included at least one aspect of music in combination with elderly people, combined with the impact on them in the form of arousal, relaxation, social behaviour, well-being, quality of life or cognition. Further exclusion criteria were studies that were published in 2009 or earlier or studies published in a language different than English Also, studies that were neither articles nor reviews, as well as published other than in journals, were excluded.

Information source

As this review was conducted in the form of a scoped systematic literature review in terms of a Bachelor thesis, only one electronic database was screened for results. It was chosen to research within the database Scopus in order to find peer-reviewed journal articles aimed at answering the research questions.

Search strategy

The search strategy included controlled vocabulary through the usage of MeSH words (Medical Subject Headings) and text words. It also included three key concepts. The first set was about music and its properties. The review aimed at exploring the effect of music, but especially the effect of musical elements on elderly people. Therefore, music was searched only in combination with its elements. The following search string was created:

music* AND (rhythm OR dynamics OR melody OR harmony OR texture OR "tone colour" OR beat OR tempo OR meter OR syncopation)

The second key concept involved the target group of elderly people. Here, synonyms and commonly used words in the research were chosen to ensure receiving all available studies on this target group. This led to the following search string:

Elder* AND ageing OR aging OR aged OR "older adult"

The third set of words revolved around the factors that are influenced by music in the elderly. This comprised the arousal and relaxation state, social behaviour like communication and participation and the well-being and the quality of life. The following search was used for this set:

Arousal OR "arousal state" OR relax* OR "social communication" OR "social participation" OR "social inclusion" OR wellbeing OR "well-being" OR "quality of life"

The combination of those three sets were connected with the Boolean operator "AND". From each set of words, at least one word had to be in either the title, the keyword or the abstract. This resulted in a total amount of 203 documents. The following table (Table 1) represents the creation of the search string and summarizes the screening process that is explained in the following.

Table 1: *Summary of the search strategy*

Set	Search string	Scope	Number of entries
1	music* AND (rhythm OR dynamics OR melody OR harmony OR texture OR "tone colour" OR beat OR tempo OR meter OR syncopation)	All	166,842
2	Elder* AND ageing OR aging OR aged OR "older adult"	All	7,793,617
3	Arousal OR "arousal state" OR relax* OR "social communication" OR "social participation" OR "social inclusion" OR wellbeing OR "well-being" OR "quality of life"	All	3,198,183
1+ 2+ 3	((music* AND (rhythm OR dynamics OR melody OR harmony OR texture OR "tone colour" OR beat OR tempo OR meter OR syncopation)) AND (elder* OR ageing OR aging OR aged OR "older adult") AND (arousal OR "arousal state" OR relax* OR "social	All	9,414

	communication" OR "social participation" OR "social inclusion" OR wellbeing OR "well-being" OR "quality of life"))		
1+ 2+ 3+ Scope	TITLE-ABS-KEY ((music* AND (rhythm OR dynamics OR melody OR harmony OR texture OR "tone colour" OR form OR beat OR tempo OR meter OR syncopation)) AND (elder* OR ageing OR aging OR aged OR "older adult") AND (arousal OR "arousal state" OR relax* OR "social communication" OR "social participation" OR "social inclusion" OR wellbeing OR "well-being" OR "quality of life"))	Title, keyword and abstract	203

Data extraction

All relevant data giving an overview of the study or answering the research questions were extracted from the ten articles and summarized in three tables to improve the clarity of data. First, results that created a general overview of the studies were pointed out. This included the contributing authors, the date of publication, the study location, the population, the study design and the study context (Table 3). Second, information on the study's objective, its musical intervention, the measurement, the study's quality, the intervention or treatment conditions and the used musical elements within the intervention were comprised and depicted. With regard to the study's quality, the study design and the study's measurement were taken into account and ranked from 1 to 5 in descending order, 1 being the best quality (Table 4). The extracted information from the articles was used to answer the first research question, namely which music or which musical elements are currently applied in the care of the elderly. Lastly, findings giving information on the second to fifth research question (RQ), namely the effect of music on: emotions or physiological arousal, relaxation (RQ2), social behaviour including social communication and social participation (RQ3), well-being or the quality of life (RQ4) and cognition or performance (RQ5), are summarized (Table 5). The sequence of the studies was the same for all tables, being listed alphabetically and being labelled with a number from 1-10.

The extracted data was of three kinds, being statistically significant or representing a suitable finding regarding the research question. A result was considered as statistically significant having a p-value below .001 and .05 or a confidence interval of 95 or 90 per cent. Other findings that did not show statistical relevance but offered a good insight into the item of question were also included. Those results were either taken from interviews or from the author's conclusion and were marked accordingly.

Results

Study selection:

In order to downsize the identified results to relevant ones to perform the further analysis on, several steps were conducted. First, the duplicates were removed and the above-mentioned eligibility criteria were applied. The remaining articles were screened for the title and abstract and non-relevant articles were not further taken into account. All remaining articles were read in the full-text, besides the inaccessible one. Reference checking and citation tracking were undertaken to include further relevant studies. The total amount of articles that were included for further analysis was 10, two of them being reviews. The below-listed figure represents the screening process in more detail.
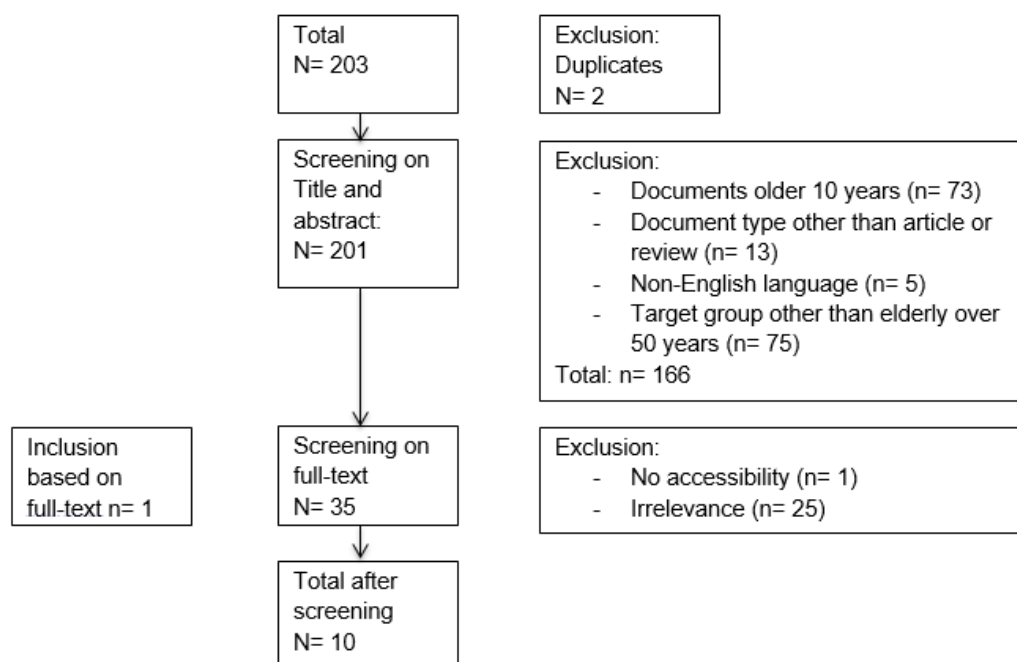

Figure 1 Summary of Study Selection

Study characteristics

In total, N=10 studies were selected based on the given eligibility criteria (see Table 3). The used study designs were predominantly RCTs [4,5,6,8,10], while also two reviews were included [2,3], as well as a qualitative study [1], a quasi-experimental study [9] and a single group study [7]. The ten found articles were published within the last seven years, were conducted all over the world and included the elderly

population older than 50 years. The studies tested their intervention on dementia patients [2,3,8,9], Parkinson's disease patients [2, 6], depressed elderly [7], graduates from a cardiac rehabilitation [1] and healthy elderly people [4,5,10]. All studies were conducted in a controlled setting, including care contexts [1,3,6-10] or laboratory settings [4,5]. A summary of those findings is depicted in Table 3.

The studies tested different musical interventions on the elderly and made use of music in different ways. Some interventions exposed the elderly to self-selected music [1,7] others confronted them with melodies or excerpts with different features [4,5] or participants had to attend a more complex intervention going beyond the sole listening to acoustic stimuli by being interactive [6, 8-10]. Those interactive interventions included an additional engagement to music by playing an instrument or performing exercises [6,8,10] or taking part in listening and engaging with a live performance [9]. The study's objectives, the interventions and the kind of used music are summarized in Table 4.

Assessing the quality of studies

In order to weight the results of the studies, the quality of the studies needed to be assessed. This aimed at preventing from over- or underestimating given results of studies. With regard to the study's quality, the quality of the study's design and the study's measurement was assessed. The study design and, therefore, the level of evidence was evaluated with the below-mentioned table developed by Ackley, Swan, Ladwig & Tucker (2008) (see Table 2). The level of evidence ranged from Level I to Level VII.

Most of the studies had a good level of evidence, by being the second level of evidence as RCT's [4,5,6,8,10] or the third level of evidence by being quasi-experimental studies [9]. Less good study designs were systematic reviews of descriptive and qualitative studies (Level V) [2,3] and single group or qualitative designs (Level VI) [1, 7].

The quality of the study's measurement was assessed by two criteria. First, it needed to be clear to the reader how a given construct was measured, exceptionally well-known measures. Second, a good study needed to possess good psychometric properties. Good psychometric properties were indicated by a good reliability coefficient (r>.80) and if given -but not necessarily- a good validity (r>.30). A study of bad quality did not mention the measurement or had no available outside

information. The second criterion for a study of poor quality included measures with reliability coefficients below .80 and validity coefficients below .30. A study not giving information about the reliability or indicating reliability without giving information about its reliability coefficient was as neutral considered. With the exception of the two reviews that neither included reported measures nor reliabilities, all studies could be screened for the criteria of the measurement's quality. Concerning the first criterion, namely the usage of a well-known or a well-explained measure, it could be seen that all studies [4-10] but one [1] fulfilled the criterion and had good quality in this aspect. The one study failing this criterion made use of a not explained measure which also had no available outside information on it.

The second formulated criterion to assess the quality of the measurement was about the reliability of the study's measure. A study was regarded of good quality if the reliability coefficient was at least .80. It was found that no study [1,4-8, 10] except for one [9] recorded reliabilities for their measurement. But for this study, it also needs to be noted that the Cronbach's alpha was only higher than .80 in all sub-dimensions for mild dementia patients, but not for severe dementia patients. The Cronbach's α ranged from not reliable to reliable depending on the subscale (α=.61-.85). One study reported a good reliability of its measure but did not indicate the reliability coefficient, leaving it open to the reader what a good reliability means to the author [7]. Another study did not explicitly indicate the reliability of the measure but it became clear to the reader that the codes of the interview possessed a good inter-rater reliability [1]. Though, both studies were handled as a study that did not report on reliabilities at all. No study gave information about the validity of the used measure [1, 4-10].

Taken together, the quality of studies could be expressed in five degrees. The first-degree study had a good quality of its study design (Level III) and contained both, a well-known measurement and a good reliability coefficient [9]. Second-degree studies were RCTs (Level II) and comprised a well-known measure but did not indicate the measurement's reliability [4,5,6,8,10]. Studies of third-degree were reviews of qualitative or descriptive studies (Level V) that neither reported a measure, nor its reliability due to its study design [2,3]. The fourth-degree study was a single group design (Level VI) which included a good measurement but did not state its reliability. The study with the overall poorest quality was of qualitative nature and did neither contain a description of its measurement -not being available on the internet as

well-, nor a reliability of its measure [1]. A summary of the study's quality can be seen in Table 4, indicating the quality of a study from 1-5, one being the best.

Table 2.

Levels of evidence to assess the study's design

Levels of evidence	Description
I	Evidence from a systematic review or meta-analysis of all relevant RCTs (randomized controlled trial) or evidence-based clinical practice guidelines based on systematic reviews of RCTs or three or more RCTs of good quality that have similar results.
II	Evidence obtained from at least one well-designed RCT (e.g. large multi-site RCT).
III	Evidence obtained from well-designed controlled trials without randomization (i.e. quasi-experimental).
IV	Evidence from well-designed case-control or cohort studies.
V	Evidence from systematic reviews of descriptive and qualitative studies (meta-synthesis).
VI	Evidence from a single descriptive or qualitative study.
VII	Evidence from the opinion of authorities and/or reports of expert committees.

Note.

The mentioned table was designed and written by: Ackley, B. J., Swan, B. A., Ladwig, G., & Tucker, S. (2008). *Evidence-based nursing care guidelines: Medical-surgical interventions.* (p. 7) Mosby Elsevier.

Results answering the research questions

1. *What kind of music and which musical elements are currently applied in the care of the elderly?*

Currently, different kinds of music and musical elements are applied in the care of the elderly. Two interventions made use of self-selected music [1,7]. One of them researched the commonalities between those selected musical pieces that were chosen for a walking-based exercise with the aid of the SMMA (Structural Model of Music Analysis) and came to the conclusion that many musical features were similar and, therefore, considered them as important for exercises. Among others, the selected music pieces predominantly contained the following musical features: a single duple and consistent metre, a predictable and consistent rhythm with repeating motives, no alterations in tempo, a diatonic and major tone, consonant and predictable harmony, thick texture and a variable volume [1]. The other study focussing on self-selected

music explored, in particular, the effect of volume and tempo. The participant's task was adjusting the tempo and volume in accordance with their arousal and valance values in order to make the music sound happier [7].

Another intervention also focussed on the effect of tempo but in combination with the mode of the music. In this intervention, unfamiliar melodies based on four emotions (happy, sad, fearful, and peaceful) were presented to the participants. Those emotions were made by the combination of tempo and mode. Happy excerpts included a major mode and a high tempo and were, therefore, positive and high in arousal; peaceful excerpts had an intermediate tempo, being positive and low in arousal; sad excerpts consisted of a minor mode and a slow tempo, being negative and high in arousal; and lastly, fearful excerpts had a minor chord on the third and sixth degree and represented negative valence and low-arousal [5].

Among the interventions, there were five with a special kind of music, mostly being interactive or including a specifically developed form of music [4,6,8-10]. Two of them researched the effect of rhythm [6,10]. One is the Ronnie Gardiner Rhythm Music (RGRM), the other is the Rhythm-centred music making (RMM). Both interventions made use of rhythmic exercises. While the RMM solely focussed on engaging with simple rhythmic instruments like drums, shakers or wood blocks, the RGRM also included other elements like classical music and relaxation tasks. Another interactive intervention was a live music performance where residents of an elderly home were actively engaged to sing and move along the music [9]. The last interactive music intervention used a facilitator engaging with the participant who listened to individualized music which was related to the participant's own positive memories of joy and pleasure [8]. There is also an intervention aiming at relaxing the participants with the aid of Meditative Binaural Music (MBM). This intervention was based on sine tones which were presented to each ear with slightly different frequencies [4].

Lastly, there were two reviews [2,3]. One of them evaluated interventions about the nutritional status of elderly in the care context and reported about the impact of music in general [3]. The other reported about underlying mechanisms of music and potential explaining theories giving examples of partly musical interventions like the Rhythmic Auditory Stimulation intervention which was described to activate the neural circuits and, therefore, facilitating the motor functioning in Parkinson's disease patients through rhythm [2].

To summarize, currently, different kinds of musical interventions were explored on the elderly. With regard to the musical elements, some were researched in more detail, including tempo [7,5], volume [7], mode [5] and rhythm [6, 10].

2. What are the effects of music on the arousal and relaxation of the elderly?
Several studies [N= 8] reported in any form on the impact of music on the arousal and relaxation level of elderly people [1-5,7-9]. With regard to the arousal of elderly and their emotions, five studies noted statistical significant effects of music on the elderly [4,5,7-9]. While four of them reported either improvements on emotions or the arousal level [4,5,8,9], one study only observed improvements in the elderly's emotions but not in the arousal level [7]. Concerning the quality of the study, it can be said that all [4,5,8,9] except one [7] had a calculated quality level of 1 or 2 while the study that did not find a statistical effect of music on arousal but on emotions had the quality level of 4. With respect to an intervention that tested the effect of preferred music on depression, significant pleasant emotional states ($p<.05$) were found after the intervention took place [8]. Live music performances were also shown to have a significant positive effect in mild ($p<.001$) and severe ($p<.04$) dementia patients [9]. The intervention that tested the adjustments of volume and tempo in accordance to arousal and valence values in people with depression showed that the arousal states did not change significantly ($p=.33$) but emotions did, being indicated by significantly increased valence values ($p<.001$) [7]. It could be observed that classical, high-arousing music is significantly different from the other conditions, namely classical low-arousing music or music with or without binaural beats [4]. Concerning the findings, other than statistically noted ones, music has been reported to trigger arousal or emotions through different mechanisms, namely through memories that are connected to the music that also reconnect with the past, by being positive or happy or by possessing musical elements [1,2,5]. Musical elements that influence the arousal level of elderly were predominantly observed in selected music pieces and include rhythm and time qualities like a consistent meter in duple time and a consistent and predictable rhythm. Also, a faster tempo (<120bpm) aroused the elderly, as well as a thick texture and a variable volume. Additional interviews showed that people, especially, perceived beat and rhythm as energizing and stimulating with regard to their emotions [1].

With reference to the relaxing impact of music on elderly, no statistically significant effects could be observed. Though in four studies, the authors concluded or participants reported that engaging in musical behaviour like singing or listening to music relaxes the elderly [2-4,8]. All studies had a good calculated quality of being either second or third level quality. Interviews with participants who took part in the MBM intervention recorded that listening to MBM relaxed people, or helped them to relax, especially low-arousing classical music had a relaxing impact on elderly due to its high positive affective states [4].

3. What are the effects of music on social behaviour like communication and participation in the elderly?

Regarding the statistical significance, only two [9,10] out of six studies [1-3,8-10] reporting on social behaviour, noted statistical effects but the effect of music on social behaviour depends on the intervention. While one study [9] found statistically significant positive effects, the other [10] did not, both being of good quality (1 and 2, respectively). The live music performance intervention showed statistically significant results on participation for mild ($p<.0001$) and severe dementia patients ($p= .012$), but only significant results on social communication in mild dementia patients ($p=.001$) but not on severe dementia patients ($p=.072$) [9]. A study measuring the effect of RMM on social engagement did not note statistically significant finding ($p=.21$) [10]. Other findings revealed, though not statistically, an impact of music on social behaviour in terms of social communication and social participation [1-3,8,9]. With respect to social behaviour, four out of five studies mentioned especially the effect of music on dementia patients [2,3,8,9]. In dementia patients, music created feelings of safety as it brought back memories and had the most positive effects when it is perceived in the company of others. It also improves the relationship with others [2,8]. Interviews suggested that music diverted people from negative thoughts like loneliness and offered security as people felt a companionship through music while being alone [1].

4. What are the effects of music on well-being and the quality of life?

Three [6,9,10] out of five [1,6,8,9,10] studies researching the effect of music on well-being and the quality of life found statistically significant effects. Two interventions found significant improvements of quality of life ($p=.031$) and well-being ($p=.001$) on

the participants [8,9], while another did not report statistically significant effects of the intervention on the quality of life (p=.95) [10]. No study outweighs the other because all three studies were considered of good quality being ascribed of level 1 or 2. With regard to other, non-significant findings, music was seen to have a positive, increasing effect on both, quality of life and well-being [1, 8]. While the former concluded from the findings that well-being is promoted by the pure listening of preferred music because of the reconnection to people's past and life history [1], the latter concluded the quality of life to increase due to the overall positive effect of the music intervention on the participants like reduced stress and BPSD symptoms or increased relaxation and positive emotions [8].

5. What are the effects of music on the elderly's cognition or performance?
Lastly, cognition and performance were shown by four [5-8] out of six [1,2,5-8] studies to improve statistically through musical interventions. In terms of cognition [5-8], it was observed that dementia patients had a better recall of memories after singing a familiar song, resulting in improved clarity, alertness and overall cognition, specifically in verbal memory (p=.036), language (p=.033) and executive functions (p=.007) through musical interventions [5,6,8]. A significant effect of low and high-arousing music was observed on recognition ratings (p<.05; p<.001, respectively). Highest recognition ratings were documented for happy music compared to sad, fearful or peaceful music (p=.001). Though, the author concluded an age-related decline of recognition of music, except for happy music in older adults compared to younger ones [5]. Music also had a positive effect on some conditions, including dementia and depression. Studies showed significant reductions of the BDI score (p=.018) and also a decrease in BPSD, indicated by reductions in the subscale's values [7,8].

The performance was also improved by several musical interventions or was related to musical features [1,2,6]. A musical intervention showed a significant improvement in mobility (p=.006) [2] which goes along with another finding concerning Parkinson's disease patients who had improved walking skills through rhythmic stimulation [6]. Interviews revealed that many elderly perceived the music's tempo to be related to their walking speed. While some liked a matching tempo and rhythm with their own walking pace best, others liked diverse tempos better [1]. Table 5 summarizes all results concerning research question 2- 5 in more detail.

Table 3.
Description of Studies

Study Number	Authors	Date of publication	Study location	Population (number, age)	Study design	Study context
1	Clark Ramirez, Palencia-Lefler, Giraldo, & Vamvakousis	2016	Australia	Elderly with cardiac disease (N=27; age= 60+; 21 men, 6 women)	Qualitative study	Care context
2	Clements-Cortes & Bartel	2018	Canada	Elderly with dementia, Alzheimer disease, Parkinson's disease, aphasia, stroke	Review	Not applicable
3	Douglas & Lawrence	2015	United States	Elderly with dementia (65+ years)	Review	Institutionalized care context
4	Lee-Harris, Timmers, Humberstone, & Blackburn	2018	United Kingdom	Group 1: Young adults (N= 15, 18-25 years) Group 2: Elderly (N=15, 50 – 80 years)	Counterbalanced RCT (4 x 2 Experimental study)	Laboratory setting
5	Narme, Peretz, Stub, & Ergis	2016	France	Group 1: Young adults (n= 60, 19-29 years) Group 2: Older adults (N= 53, 65-87 years)	RCT	Laboratory setting
6	Pohl, Dizdar, & Hallert	2013	Sweden	Patients with Parkinson's disease (N= 18, mean age= 68)	RCT	Within a neurological rehabilitation centre
7	Ramirez, Palencia-Lefler, Giraldo, & Vamvakousis	2015	Spain	Depressed elderly (N= 10, mean age = 84)	Single-group pre-test, post-test design	Elderly home setting
8	Sakamoto, Ando, & Tsutou	2013	Japan	Severe dementia patients (N=39, 65+ years)	RCT	Familiar care setting
9	Van der Vleuten, Visser, & Meeuwesen	2012	The Netherlands	Mild and severe dementia patients (N= 45, age= not indicated)	Quasi-experimental design	Living room of nursing homes
10	Yap, Kwan, Tan, Ibrahim, & Ang	2017	Singapore	Elderly (N=54, mean age= 65+)	RCT with cross over	Community living setting

Table 4.
Description of music intervention, the used measurements and its quality and the used music or musical element

Study number	Authors	Study Objective	Treatment/ Intervention For review: Description of review	Measurement/s	Quality of study (1-5) in descending order	Music and musical elements
1	Clark et al., (2016)	Exploring the musical characteristics of preferred music chosen by the elderly during a walking-based exercise after a cardiac rehabilitation	Listening to self-selected music while walking during a 6-month intervention Experimental group: usual care + music listening Control group: usual care alone	Structural Model of Music Analysis (SMMA) to identify the characteristics of the selected music Inductive thematic analysis to analyse experiences	5	Self-selected music with predominantly shared musical features: - Time (simple duple and consistent metre) - Predictable and consistent rhythm with repeating motives - No alterations in tempo - Diatonic and major tone - Consonant and predictable harmony - Thick texture - Variable volume
2	Clements-Cortes & Bartel (2018)	Expanding the scope and efficacy of music therapy and the potential mechanisms involved in different settings and on different conditions	The review summarized the positive effect of music therapy on different groups of elderly people with special needs regarding their cognitive impairments (elderly with Alzheimer's disease, Parkinson's disease and stroke). The review tackles this on four levels and gives to each level explanations and some examples, undermining the positive effect of music on the specific target group.	Not applicable	3	- Music in general or results of interventions (e.g. Rhythmic Auditory Stimulation intervention)
3	Douglas & Lawrence (2015)	Evaluating previous environment-based interventions to improve the nutritional status among institutionalized older adults with dementia	The review reports on the nutritional status of elderly people with dementia in elderly homes. Especially the topics feeding assistance, meal delivery style and the environment of the dining room, including music, were investigated.	Not applicable	3	- Music as a background influence on elderly while eating

18

4	Lee-Harris et al., (2018)	Exploring the effectiveness of Meditative Binaural Music (MBM) on emotional arousal in two age groups	Experimental group: Listening to MBM with and without binaural beats (a form of relaxation music based on sine tones with slightly different frequencies presented to each ear) Control group: Listening to classical music that was found to be experienced as positive in valence and either low or high in emotional arousal	1. Questionnaire 2. Continuous alertness-relaxation response by MIDI slider 3. Measurement of physiological arousal using BioGraph Infiniti hardware 4. Post-study with open-ended questions	2	- Relaxation music called Meditative Binaural Music (MBM) - Classical music which is high or low in arousal
5	Narme et al., (2016)	Investigating how age-related changes in emotion processing influence explicit and implicit memory in healthy elderly	Listening to 48 unfamiliar emotional melodies that differed in terms of valence (positive/ negative) and arousal (high/ low). - Exposure phase: Exposed to music and determining slow and fast tempo - Judgement task: Liking towards an excerpt with a 10-point scale - Recognition task: Confidence about previous exposure of a song using a 10-point scale	All ratings (liking, exposure, recognition) based on 10-point scales. Music was recorded and displayed with Eprime 1.0 software	2	- Happy excerpts: major mode and high tempo (positive, high-arousal) - Peaceful excerpts: intermediate tempo (positive, low-arousal) - Sad excerpts: minor mode and slow tempo (negative, high-arousal) - Fearful excerpts: minor chords on the third and sixth degrees (negative, low-arousal)
6	Pohl et al., (2013)	Assessing the feasibility of a novel intervention (Ronnie Gardiner Rhythm and Music) on patients with Parkinson's disease	Intervention group (N= 12): Music intervention (Ronnie Gardiner Rhythm Music) - Phase 1: relaxation and self-awareness through classical music - Phase 2: begins with easy rhythmic exercises and goes on with more complex tasks - Phase 3: relaxation and finishing the session Control group (N=6): No intervention 12 sessions á 1 hour over six weeks	Mobility measured by a computer-based, two-dimensional motion analysis system based on the Posture-Locomotion-Manual (PLM) method Movement performance was recorded by an opto-electronic measurement system Quality of life was measured by the Swedish version of the Parkinson Disease Questionnare-39 summary index Cognitive ability measured by Cognitive Assessment Battery (CAB) Interviews	2	Ronnie Gardiner Rhythm Music: - Rhythm
7	Ramirez et al., (2013)	Exploring the effect of preferred music in elderly people with depression	Listening to 5-6 self-chosen music pieces while adjusting the loudness and tempo of the music in accordance to their arousal and valance levels so that the music sounds happier. Sessions were held ten times (2 sessions per	Qualitative data gathering (interviews) EEG data acquired through the Emotiv EPOC EEG system	4	- Volume - Tempo

			week), 15 minutes each and outcomes were measured by the Emotiv EPOC EEG system			
8	Sakamoto et al., (2013)	Exploring and comparing the effect of two types of music intervention (interactive/ passive) on severe dementia elderly	Intervention group: - Interactive music group (intervention with a music facilitator who directly interacted with each participant) - Passive music intervention group(participants were observed by caregiver and music provider) Control group: - Receiving no intervention Interventions took place once a week à 30 minutes for 10 weeks	Short term effects: Emotional response and stress levels measured by autonomic nerve index and the Faces Scale Long term effects: BPSD changes measured by Behavioural Pathology in Alzheimer's Disease (BEHAVE-AD) Rating Scale	2	Individualized music related to participant's special positive memories (evoking emotions such as pleasure or joy)
9	Van der Vleuten et al., (2012)	Assessing "the effect of intimate live music performances delivered by professional singers on the quality of life of persons with mild and severe dementia in nursing homes" (van der Vleuten et al., 2012, p. 484)	Listening and engaging to live music performances lasting about 45 minutes with a follow- up observation list the next day	Observational rating scales that were filled out by caregivers after live music performance	1	Live music performance
10	Yap et al., (2017)	Exploring the effect of Rhythm-centred music making (RMM) on quality of life, depressive mood, sleep quality and social isolation in elderly	Phase 1: - Group A: Intervention - Group B: Control Phase 2: - Group A: Control - Group B: Intervention Intervention: Participating in a RMM à 1 hour once a week for 11 weeks with a gap of one week due to public holiday. Using instruments in the free play and in interaction	European Quality of Life-5 Demensions (EQ5D), Geriatric Depression Scale (GDS), Pittsburg Sleep Qualiy Index (PSQI), Lubben Social Network Scale (LSNS) (pre-and post tests)	2	Rhythm-centred music making (RMM) - Using simple rhythmic instruments like drums, shakers and wood blocks

Table 5.

The impact of musical elements on arousal, relaxation, social communication, social participation and cognition in elderly people

Author/ Study number	Arousal/ Emotions	Relaxation	Social behaviour (social communication/ social participation)	Well-being or quality of life (QoL)	Cognition/(Performance)
1. Clark et al., (2016)	*Exploratory study without statistically validated evidence. Elements of music were perceived as predominant if they occurred in over 80 % in the preferred musical pieces:* - Increased arousal through: rhythm and time qualities (music with a consistent meter in duple time and consistent and predictable rhythm without syncopation), Faster tempo (>120bpm), thick texture, variable volume, timbre and instrumentation *Interviews suggested:* - Music evokes positive mood and stimulates/energizes people. Some people felt that especially beat and rhythm energized them	*Not applicable*	*Interviews showed:* - Music diverted from negative experiences like loneliness - Music offered security and was perceived as a good companion not to feel lonely while walking alone	*Authors conclusion:* Listening to preferred music reconnects people to their past and their life history which promotes their well-being	*Interviews showed:* - that music reconnected people with the past of and their younger self and triggered memories - some preferred a matching tempo and rhythm with their walking pace, others liked diverse tempos better, again others did not find tempo, beat and rhythm to be important for their pace
2. Clements-Cortes et al., (2018)	*Review showed:* - Music arouses emotions through memories that are connected to music	*Review showed:* Singing makes people feel more relaxed	*Review showed:* - Music creates in dementia patients feelings of connection and safety (because it brings back memories) - Music has the best effect on dementia patients if it is engaged in company	*Not applicable*	*Review showed:* - Dementia patients: better memory recall after singing a familiar song - Alzheimer's Disease patients: improved cognition, clarity and alertness by sound-based RSS with a performance gain of about 12% measured by the St. Louis University Mental Status test (SLUMS) - Parkinson's disease patients: better step length and walking velocity due to rhythmic stimulation (e.g. through RAS)
3. Douglas &	*Not applicable*	*Review showed*: Patients were calmer when music was played while they were eating	*Review showed:* Increased social participation and communication: stayed	*Not applicable*	*Not applicable*

Study			longer at the table when music was played and engaged in singing to and moving along the music		
Lawrence (2015)					
4. Lee-Harris et al., (2018)	*Statistical findings:* - In older adults, classical high-arousing music is significantly different to all other conditions **, measured by MIDI slider - Responses to high-arousal music were significantly different to other musical excerpts in both groups *, measured by BioGraph Infinity software - NS (*p*>.05) between MBM with and without binary beats, measured by BioGraph Infinity *Author's conclusion:* - Less variation in felt arousal across musical pieces compared to the younger age group - MBM and other forms of music create a low-arousal, positive emotional state	*Interview showed:* - Majority would listen to MBM to relax or in calm situations (not statistically validated) *Author's conclusion:* - MBM induces calmness and low activation in elderly - Positive affective state is important to experience relaxation - Highest positivity in older adults was reached by low-arousal classical music, suggesting that it leads to high relaxation but MBM also leads to similar levels of relaxation - Depending on the context, relaxation is associated with low arousal and/ or with a positive emotional state	*Not applicable*	*Not applicable*	*Not applicable*
5. Narme et al., (2016)	*Statistical findings:* - Higher liking rating for happy excerpts (6.6 +- .2) than all other tested emotions * - Older adults liked peaceful and happy excerpts better compared to younger adults * but did not differ in sad and fearful music excerpts (*p*>.2)	*Not applicable*	*Not applicable*	*Not applicable*	*Statistical findings:* - Significant effect of low**- and high-arousing music* on recognition rating - Higher recognition ratings for happy excerpts than those expressing all other emotions * - Measurement: 10-point rating scale *Author's conclusion:*

	- Measurement: 10-point rating scale				- Age-related decline in elderly in recognition for all excerpts except happy ones - Older adults had lower recognition ratings for excerpts heard two or six times, were worse identifying new melodies and had overall higher false alarm rates compared to younger adults, indicating an age-related decline in implicit memory
6. Pohl et al., (2013)	*Not applicable*	*Not applicable*	*Not applicable*	*Statistical findings:* - QoL improved **, measured by Swedish version of Parkinson's Disease Questionnaire-39 summary index	*Statistical findings*: - Improvement in cognition through RGRM **, measured by CAB - verbal memory ** (text recall test) - Language ** (naming items) - Executive function and attention * (Stroop Color-Word test) - Improvement in mobility * , measured by motion analysis system based on PLM
7. Ramirez et al., (2013)	*Statistical findings:* - Arousal: NS($p= 0.33$) - Valence values increased * indicating changes in negative and positive emotional states - Both measured by Emotiv EPOC (EEG)	*Not applicable*	*Not applicable*	*Not applicable*	*Statistical findings:* - Decrease in BDI scores **, measured by Emotiv EPOC (EEG)
8. Sakamoto et al., (2013)	*Statistical findings:* - both music interventions created pleasant emotional states in the short term **, measured by autonomic nerve index and the Faces Scale *Author's conclusion:* - reduced stress and pleasant emotions could be observed in both interventions	*Author's conclusion:* - The severe dementia patients had an increased relaxation in the short term after both, active and passive intervention conditions	*Author's conclusion:* - Interactive music intervention may have a positive effect on restoring the relationship between dementia patients and other	*Author's conclusion:* - Taken together, the overall findings might lead to improved QoL	*Statistical findings:* - BPSD decreased in the interactive intervention group, indicated by a decrease in most of the subscales of the BEHAVE-AD** - BPSD increased in the intervention groups after the sessions have ceased ** *Author's conclusion:*

					The findings indicate a stimulation of cognitive function and improved cognitive focus
9. Van der Vleuten et al., (2012)	*Statistical findings:* - Positive affect in mild * and severe ** dementia patients - Negative affect in the mild dementia group ** but not in the severe dementia group (*p*=.188) - Both measured by observational rating scale	*Not applicable*	*Statistical findings:* - Participation improved for persons with both mild * and severe dementia ** - Improvement in communication in the mild * and severe dementia group ** - Positive effect on care relation for mild dementia patients * but not for severe dementia patients (*p*=.138) - All measured by an observational rating scale	*Statistical findings:* - Improved mental well-being in the mild dementia group* but not in the severe dementia group - Improved QoL (result not reported) - Measured by observational rating scale	*Not applicable*
10. Yap et al., (2017)	*Not applicable*	*Not applicable*	*Statistical findings:* - NS of RMM on social engagement, measured by the PSQI (*p*=.21)	*Statistical findings:* - NS of RMM on the QoL, measured by the EQ5D (*p*=.94)	*Not applicable*

Note:
* = *p*<.01
** = *p*<.05
NS= no statistical significance

Discussion

Summary of evidence

The review aimed at summarizing existing findings in the field of music and its impact on elderly people. First of all, different musical interventions are currently applied in the care of elderly, some being passive, others being interactive and engaging. Some elements of music were studied in more detail, including volume, mode, tempo and rhythm. The study's results showed that the musical intervention either had a positive impact or no impact but no study reported a negative impact of an intervention on elderly people. Musical interventions had a positive effect on arousal and emotions as they increased the elderly's arousal and caused pleasant emotional states. Studies found that self-selected music, classical high-arousing music, live performances and happy music have influenced the arousal level. Concerning social behaviour, the studies reported mixed finding but it can be said that music also influenced the elderly people in a positive way. With regard to the elderly's well-being and their quality of life, more studies reported positive effects than no effects. The elderly's overall cognition was improved, as well as the particular sub-dimensions measuring cognition. Additionally, depression and symptoms of dementia decreased through musical interventions. The mobility of elderly also increased through music, especially pointing out a promising effect of rhythm and tempo on mobility. Although the studies did not find a statistically significant effect of music on relaxation in the elderly, they still showed that music has the potential to relax people. Qualitative data showed that people perceived specially designed music, like music with binaural beats, aimed at relaxing as indeed calming down. A study concluded from their findings that particularly low arousing classical music relaxed the elderly most, indicated by high positive affective states.

Reflection of literature

It will be further examined how especially happy music affects the elderly, what the working mechanisms of rhythm are and what effect music has on elderly's cognition.

The results have shown that elderly people liked happy music best compared to the music of any other emotion and compared to a younger age group (Lee-Harris, Timmers, Humberstone, & Blackburn, 2018). Generally, the happier a piece of music was perceived, the more the elderly liked it (Vieillard & Bigand, 2014). Happy music is characterized by a major mode and a fast tempo (Brattico et al., 2011; Gagnon & Peretz, 2003; Narme, Peretz, Strub, & Ergis, 2016). A study also found the lyrics of a song to have an impact on the perceived evoking happiness of a song. The study reported that music without lyrics invoked

happier emotions than with lyrics (Brattico et al., 2011). Elderly people reported that they like happy music for many reasons. First of all, happy music elicited memories and emotions, leading elderly people to feel reconnected to their past (Clark, Baker, & Taylor, 2016; Saarikallio, 2011). Also, listening to happy music recalled pleasure and positive emotions, reinforced already existing feelings and distracted from negative thoughts by directing the attention to more pleasant ones (Saarikallio, 2011). Happy music as a background influence was perceived as pleasant and comfortable and can produce positive states which trigger the enjoyment of the moment (Martareilli, Mayer, & Mast, 2016; Saarikallio, 2011). In general, older adults were more likely to attend and be aware of positive stimuli, compared to negative ones, indicating a positivity effect (Vieillard & Bigand, 2014). There is a potential explanation for this notion: Research proposes cognitive decline to be responsible for not being able to recognize negative melodies as good as positive ones. Especially the amygdala, which is involved in emotions and reactions to incoming stimuli, declines in its functioning over the life span. It, therefore, might weaken the responses to negative stimuli and emotional arousal, explaining the circumstance of not being as responsive to negative melodies (Narme et al., 2016; Vieillard & Bigand, 2014).

The second topic of interest was the working mechanisms of rhythm. Studies have shown that in particular rhythm was involved in music's positive impact on the elderly (Pohl, Dizdar, & Hallert, 2013; Yap, Kwan, Tan, Ibrahim, & Ang, 2017). The impact of rhythm on people is not limited to elderly exclusively but can already be observed in unborn children. Although the research of neuropsychology on musical emotions is not very extensive until now, Clements-Cortes & Bartel (2018) assume that musical understanding is learned before the person's birth. The fetus is exposed to sounds of its environment, especially to the sounds of the mother which are the first encounters with sounds and, therefore, offer a possibility to learn from it. The mother's voice and her heart beat occur in a rhythmic pattern and influence the arousal level of the child. So, one of the first things that individuals learn in their life is a response to the mother's rhythm; a fast rhythm triggering the arousal in the fetus and a slow rhythm calming it down (Clements-Cortes & Bartel, 2018). A similar perspective is shared by a further theory. Musicality is described as a cognitive adaptation on the environment, giving the example of beat induction which is debated to be innate or learned (Honing & Ploeger, 2012). Beat induction is defined as the "cognitive skill that allows us to hear a regular pulse in music to which we can synchronize" (Honing & Ploeger, p.518, 2012). Some authors argue that this skill is learned within the first year of life by being exposed and rocked to the music, more recent finding whereas point out that this skill is innate as it is already active in

new-borns (Honing & Ploeger, 2012). Those studies have shown the working mechanisms of rhythm which supports the view that rhythm is an important element triggering the stimulation and relaxation of elderly people which creates a reference point for future research and especially for future interventions aiming at arousing or calming elderly people down.

Lastly, the findings showed that music improved the cognitive functioning of elderly people but the findings did not offer a big insight into this topic. Many elderly suffer from cognitive decline as a cause of normal ageing which creates relevance to further explore the positive impact of music on cognitive functioning (WHO, 2017). Studies showed that active listening to music or a passive influence of background music improved the cognitive functioning of elderly people. In particular, memory performance was directly improved by listening to background music. Music also triggered emotions; fast and major music was observed to improve the elderly's performance. Both observations could be explained with the functioning of the limbic system which processes emotions and regulates memory (Bottiroli, Rosi, Russo, Vecchi, & Cavallini, 2014). Another possible explanation can be given by the arousal-and-mood hypothesis. This hypothesis states that "music enhances the level of arousal, and consequently attentional processes benefit, and/or that it promotes positive mood" (Mammarella, Fairfield, & Cornoldi, 2007, p.396), meaning that by increasing the arousal through a pleasant stimuli like music, the performance is indirectly increased (Mammarella, Fairfield, & Cornoldi, 2007).

Assets and limitations:
The review had some strengths and limitations. Considering the strengths of the review, it gave a first, more comprehensive, insight into the topic of question and offered promising starting points for further research. Also, most studies were of good quality with regard to the level of evidence as mostly RCT's were included. A considerable amount of articles was researched and filtered to answer the research questions. Though, not all available data could be assessed as the review was only based on one database (Scopus), which leads to the first limitation. Searching in one database means that some articles were missed. The estimated value of missed articles is about 25%.

A second limitation is the small number of results which is based on the initial restriction to include only articles that contain at least one musical feature. Unfortunately, most studies did not specifically test the impact of the addressed musical element but rather mentioned it as a part of the musical intervention. Those and the studies that tested on

musical elements, in particular, should also be treated with caution as they had small sample sizes and partly high drop-out rates or presented an unbalanced proportion of an intervention versus a control group. Although most studies had a good level of evidence, not all studies could satisfy this standard and almost no study indicated the reliability of the study's measurement. It can be assumed that in the next years more studies on musical elements will follow, as this trend could be observed within this review. But this also means that this study does only give a limited insight into the impact of musical elements on elderly people.

This goes in hand with a further limitation, the non-homogeneity of population. Most studies did not test musical interventions on healthy elderly people but on elderly that had special needs. Among others, the interventions were tested on depressed elderly in varying degrees and Parkinson's-, dementia- and cardiac disease patients. As those groups of elderly differ from healthy elderly in terms of their cognition and behaviour, it cannot be clearly assumed that the findings are applicable to the elderly population in general. For example, depressed patients were found to have a clearly reduced musical ability and experience among others more problems with perceiving and reproducing rhythm and metre, compare melodies and discriminate pitch compared to a matching healthy control group (Reker, Domschke, Zwanzger, & Evers, 2014). Therefore, the results should be treated with caution and are not necessarily transferable to the elderly population in general.

Lastly, a systematic literature review is normally conducted by at least two people, aiming at reducing the subjectivity especially during the screening process and the assessment of quality. Two people should ideally come with the same set of eligibility criteria and the same set of quality assessment criteria to the same results; in case of conflicting perspectives, a third person should intervene. This was not the case for this review as it was written individually in terms of a Bachelors thesis.

Recommendations for future research

The presented results are a promising insight into the topic music and its impact on elderly people. Though, due to the small amount of included studies, its partly varying quality and the non-homogeneity of the population, the findings should be treated with caution and need further research to support them. Most studies did not test on musical elements in particular but rather on the effect of music as a whole. But this can also be seen as a chance for future research to further unfold the effect of the musical elements. In this review, especially rhythm, tempo, mode and volume were found to have a promising individual impact on the elderly which should be further explored. One study additionally mentioned metre, tone,

harmony and texture to be of potential positive impact on arousal which offers a possibility for future research.

But also the reported findings need more research to provide additional validation. Due to the low quality of some studies and their limitations of partly high drop-out rates and/or small sample sizes, some studies should be replicated aiming at improving its meaningfulness. Those studies should preferably take the design of an RCT or quasi-experimental study to keep a good level of evidence and counter some limitations of different study designs. With regard to the impact of music on elderly considering the individual factors of arousal, relaxation, social behaviour, well-being and cognition, some findings of previous research can be used for further investigation. Especially happy, classical and self-selected music, as well as binaural beats and life performances can be taken as reference points or inspirations to go further into detail or explore different versions of it.

To summarize, the next steps for research are to further broaden the knowledge in the field of music and its impact on elderly by first of all validating findings, in terms of replicating studies with a larger sample sizes or with elderly people without special needs to proof its scientific relevance and secondly, by extending the research, especially with regard to musical elements, at best with an RCT design.

Personal advice

With regard to the initial literature search for the introduction and the findings of the review, it can be ascertained that music has notable positive effects on elderly people. Music can counteract many problems that go along with normal ageing and contributes to the elderly's physical but especially to their mental health. In my opinion, this positive effect should be used in a larger extent by implementing the use of music to the daily routine of elderly people, particularly because it was not reported that music can harm the elderly in any way. In their private setting, the elderly could implement the use of music into their everyday life in multiple ways. For example, they could participate in choirs or meet to play music with others together. Also, the elderly could listen to more music in their free time, as a background stimulation or actively. Here, they could make use of various kinds of music that trigger different emotions or reactions in the elderly. Playlists of self-selected music based on their preferences could be used aiming at arousing or relaxing the elderly for example. With respect to elderly homes, music could be applied more extensively in the care of elderly. Making use of music while dining or giving the elderly the possibility to listen individually to music could be a starting point, which could further be extended by offering courses or

sessions to make music or listen to it in company. I consider this as a good strategies because the studies have shown that elderly ate more while music was played while dining, music was better perceived in company and the musical interventions had a large positive impact on the elderly. Either way, first and foremost, elderly people should integrate music actively into their daily routine enabling themselves to profit from the versatile positive effects.

Conclusion

This scoped systematic review aimed at enhancing the evidence-based practice in the field of music and its impact on elderly people by summarizing existing findings. It was found that most musical interventions had a positive effect on the arousal level, emotions, social communication and participation, quality of life and well-being and cognition of elderly people. Though, the findings need to be taken with caution due to the study's limitations. Still, the review offered a first insight into the topic and gave indications for future research. A lot research has already been done with regard to music and its impact on people, fewer reported an impact on elderly and fewer studies tested single musical elements. Some recent studies explored the effect of single musical elements on elderly people and reported promising findings, indicating the relevance for future research on those and other musical elements.

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