Music in the Retiring Life: A Review of Evaluation Methods and Potential Factors

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Abstract. People retiring now differ greatly in knowledge, motivation, attitudes towards and use of digital music-related technologies to younger generations or their predecessors. This paper reviews the methods that have been used to investigate why people use music-related technologies, how they use them and why. Using a lens provided by social cognitive theory it identifies future themes for research into music and ageing. Hopefully, these analyses will inform the design of future music related technologies for people at the transition to retirement, and the elderly.

Keywords: Retirement · Transition · Music · Social cognitive theory

1 Introduction

Life is full of transitions. Retirement is one such major transition, which results in major differences in patterns of activity, sense of self, and social relations. These changes are correlated with and often consequential for a person's physical and psychological well-being [1, 2]. The "individual's normative role as an elderly person" [1], may have an important impact on their attitudes and behaviours [3], at a time when adopting and adapting to new leisure, voluntary and other social activities is important for enjoyment and health. On such activity is community music, and many forms of engagement with or enjoyment of music have been greatly affected by new music-related technologies over the past decade and longer.

Even though older people are often stereotyped as being resistant to novelty, many actually "continue and even increase their use of technology" [4], because they tend to focus more on maintaining close relationship and personal life interests when they are getting older. We define music-related technologies as all types of digital or mass media technologies that are involved in music practices. For example, not only music streaming services and digital instruments are included, but also traditional media technologies such as TV, CD, and radio. Technology use by older adults has been extensively studied by researchers from multidisciplinary areas, and in this paper we will build on the work of Wagner et al., applying Social Cognitive Theory (SCT) as a lens to view and organise the literature related to music-related technology use behaviour of people at retiring.

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Social Cognitive Theory (SCT), addresses "how people motivate and regulate their behaviour and create social systems that organise and structure their lives" [5]. According to Compeau and Higgins, SCT is "based on the premise that environmental influences such as social pressures or unique situational characteristics, cognitive and other personal factors including personality as well as demographic characteristics, and behaviour are reciprocally determined" [6]. In other words, there are important inter-dependencies between these three domains.

In this paper, we adopt the Wagner framework and define Person as people who actively engage in music activities at their transitions to retirement, Behaviour as using digital media technology for music-related activities, and Environment as the social context of group/individual music making and technological system.

1.1 Review Method and Definitions

For this review, we gathered articles from 2004 to 2014 by searching various databases for peer-reviewed journal articulate and conference proceedings on the subject of music and retirement. We used nine databases specifying gerontology and psychology (PubMed, PLoS ONE), computer science (ACM Digital Library, IEEE), and multi-disciplinary subject areas (Web of Knowledge, SpringerLink, ProQuest, Elsevier, JSTOR). Search keywords include reference to retirement and ageing (age or ageing or old or senior or elderly or retirement), music (music or music making or choir or singing), technology (technology or media or digital technology). The total size of this sample is 52 papers, covering the period 2004–2014. The following information was analysed: the sample studied, methods, variables or constructs studied, research questions, evaluation goals, evaluation measures, theory involved, and key findings.

Thus using Wagner's Social Cognitive Theory (SCT) to organise the literature from psychology, gerontology, as well as HCI and human factors, we first examine the methodologies used and then the factors affecting the interaction between people at the transition to retirement relevant to their use of music-related technologies. Thereby we focus on the three reciprocal determinants: person, behaviour and environment. The paper then concludes with a discussion of future themes of HCI studies concerning music and ageing.

2 Methods to Understand Technology and Community Music

A common feature of the methods used in reviewed studies is that they often use several different methods to "triangulate on a particular question" [7]. There are many reasons to recommend this approach as it ensures that a study is not vulnerable to the weaknesses of any single method. Nevertheless, we will consider the separate methods independently so as to identify their value across this domain of interest.

2.1 Qualitative Methods

27 of the 52 papers use qualitative methods, ranging from interviews, focus groups, qualitative survey, contextual observations, ethnographic studies, to diary journals and

cultural/technology probes. Interviews (40.7 %) and qualitative survey (29.6 %) are the most common used methods for understanding how people use technology to conduct their music-related practices.

Interviews. Interviews are among the most widely used method [7]. When engaging in a conversation with individual participants, interviewers have explored the interviewee's subjective opinion about the use of technology, and how they are influenced by the social or technological environment. Interviews are conducted either in the interviewee's own place (homes, workplace) or in the lab environment. Compared to lab environment, conducting contextual interviews at the participant's place allow researchers to better understand why certain technologies are used or barriers exist, and provide an opportunity to see how environmental factors might have an effect. For example, Vaisutis and colleagues explored the role of objects and social relations in place through contextual interviews, then identified objects with different functionalities and how people attribute emotional meanings to them [8]. The interview is a flexible and adaptable way of finding out the relationship between user, behaviour and the environment. However, interview findings can be subject to a variety of errors including participant recall [7], leading questions, and a desire to provide the answers the interviewee believes the interviewer wishes to hear. This entails that high quality interview data depends on the skill and experience of the interviewer [9].

Focus Groups. The focus group originated in market research in the 1920s, and is now widely used in many fields of applied social research [9]. Examples include examining exploring technology usage and attitudes among older adults [10], investigating older adults' motivation to adopt technological innovation [11], and how older people keep in touch with friends and relatives [12]. Even though the focus group method is efficient in obtaining the most important topics and flexible to conduct, it may produce a false consensus in attitudes [9] and may not elicit confidential issues. Hence, researchers who would like to use focus groups need to use other techniques to validate the information generated by the group.

Diary Study. Diary studies allow participants to record their experiences as and when they occur, and enable the capture of substantial amounts of data with much less effort on the part of the investigator [9]. A diary could also serve as a proxy for observation in situations which are hard to make direct observation [9], and might help to improve the accuracy of participant recall [7]. For example, Salovaara et al. used diary-aided interviews to investigate the interplay of technologies and transitions of people at the age of 55–65 [13]. The concrete diary data provides use practices and communication circles of participants within one week, and later serves as a means of generating specific questions of interviews. It was identified that life interests at the transition stage were always conflicting, forcing people to choose among "possible selves". There are two diary methods that are widely used in HCI. One of them is to keep the diary with "critical incident". This approach allows participants to record the "incidents that they perceive to be important or critical in obtaining a satisfactory outcome" [9]. Another diary method is known as "reflective journal", where participants are asked to provide an account of their experience in a particular situation, and a reflection on that experience.

Ethnographic Study. Ethnography is growing in popularity as the first step in any investigation. The virtues of ethnography in HCI are: (1) to make visible the context of system usage, social practice that might not be encountered, and (2) to provide exploratory frameworks for observed context to offer designers a view of interaction between people and technology. In the field of technology and music, examples using ethnographic study include how nightclub DJs mix tracks, collect music, prepare for performances, conduct promotion and networking with the help of music technologies [14], how older people understand their relationship with technology [15]. Ethnographic methods are beneficial in observing the naturally "accountable" ways [16] of the social context of use, real-life interactions and expectations [17]. However, the richness of ethnographic findings are often set against concerns as to their validity and reliability and depend greatly on the training and skills of the ethnographer. The latter should always be borne in mind when using the results of such work.

Probes. The concept of cultural probes was introduced by Gaver et al. [18], originally aiming at eliciting "inspirational material while avoiding the understood social roles of researchers and researched" in design-oriented research. Example includes Leonardi et al.'s work on investigating the functional and emotional geography of older adults' domestic space [19]. An example of X probe (or technology probes) is the study conducted by Rogers and colleagues on reframing the relationship in terms of wisdom, creativity and invention among retired people. They used a Makey MaKey inventor's toolkit to engage retired people in the design-oriented workshop, asking them to invent future technologies and suggest ideas for new technologies. Interestingly, the participants in this study were able to master the technology and collaborate in its use [20]. Probes provides open-ended, provocative, and oblique tasks which inspire design responses, but are surprisingly regarded as non-scientific [21] giving their rich idiosyncrasy. However, as Boehner et al. observe, the use of probes provides an alternative way to encourage participative engagement between individuals, which can reveal facets of an issue that traditional HCI methods have left unexplored [22].

Qualitative methods in our reviewed study typically follow either a data-driven or theory-driven logic. In data-driven logic, bottom-up coding is used to derive themes from the recorded transcripts, field notes, and verbal protocols. In theory-driven logic, top-down coding is used to "identify existing constructs in a particular dataset" [7]. The time-consuming process of qualitative data analysis can be assisted with computer aids, e.g., key-word-in-context (KWIC), and qualitative data can be subjected to quantitative analysis e.g., word frequency lists and category counts. However, whatever analysis techniques are used, most writers using these techniques stares that it is essential to return to the original text document to "validate the interpretation of themes derived from statistical results" [9].

2.2 Quantitative Methods

While qualitative methods are valuable in developing a rich description of our target population of retiring and retired people and how they vary in their use of technology, the richness and local validity comes at a cost to our ability to generalise away from the

particular. This problem is addressed by methods that seek to deliver a broader if less rich understanding from larger samples, and which offer quantified parameters to aid our investigations.

Quantitative Surveys. Surveys are often used to capture user perception, their psychological status, behaviour patterns, attitudes, and motivations. Surveys are not typically suited to exploratory work; but often build on good qualitative work to deliver a focussed and substantial data set in a standardised form which facilitates comparisons [9]. In the literature under consideration here, 29 % of the studies adopted questionnaire-based survey as their primary research method. Two-thirds of them use surveys to assess participants' psychological status (e.g., quality of life, well-being measures, psychological needs, age-related symptoms), and just over half of them assess technology use and relevant motivation and attitudes. A small subset of these (4 papers) conducted cross-sectional or longitude surveys, in order to investigate the changes in participants' psychological status or behaviour over time. For instance, Tamplin et al. measured participants' mood, visual analogue mood, cognition and global functioning, as well as social functions at the 12th week and the 20th week after joining a community choir established to support music therapy for elderly patients recovering from a stroke [23]. This study reported that singing in a community choir has positive effect on mood and social engagement in such cases. Survey data collection is mostly done via self-completion questionnaires, face-to-face and telephone interviews, although more expensive to conduct permit the use of more complex item sequences and the possibility of unstructured follow up questions to explore specific answers. Thus, general considerations such as the questionnaire length, question complexity, close/open-ended questions should be taken into account when designing surveys for late mid-aged and older people.

Experimentation. Controlled laboratory experiment clearly provide the most informative way to evaluate if a certain intervention is successful [7], and it has been used widely to evaluate the effects of music (training, performing) on psychological status or the alleviation of symptoms. A fifth of studies in the papers under review here use controlled experiments to answer such research questions. The tasks used can be categorised into three groups: (1) behaviour tasks; (2) cognition and perception, (3) collaboration. The performance-oriented tasks, usually involved a new/unfamiliar technology/tool so as to test the possibilities of using the technology/tool freely and safely. Tasks include gambling, information searching and multitasking with different media. Time and accuracy were the most common measures used to assess performance, and, behavioural and physiological measures such as gaze durations and eye movement are also used in multitasking and searching tasks. Just over half the papers (55 %) used cognitive and perceptual tasks and measures [24–27], such as auditory Stroop task, Simon tasks, and [24, 28]. Outcome measures linked to psychological well-being focussed on anxiety, dysphonia severity, cardiac and respiratory patterns, mood states, and even immunological profile. A common focus for "community music" is collaboration tasks where synchronisation tasks such as the drumming experiment, body movement synchrony tasks, entrainment building, and resonance within instrument are among the most frequently used paradigms [26, 29–31]. A good example of this approach to the investigation of recreational music-making and the

health of older adults is Koyama et al. which measured blood sample and mood state during a series of synchrony tasks, finding that creative music-making does have improvement effect in immunological profile and mood states in the older group [30].

Technology Logs. The recording of detailed logs from systems or applications that participants are using is an effective method to gain an extensive source of quantitative data. Technology logs reflect the a deeper analysis to actual use of technology [7], compared to limited scenarios and data in controlled laboratory experiments or trials. In the case of digital media technologies and music for late midage and older adults, commonly used logs include system visiting rate [32], text comments, as well as user-generated contents [33]. The log data can be further used in analysing psychological measures, such as psychological well-being [34], caregiver burden [7].

Experience Sampling Methods. A key issue for survey questionnaires that require the recall of past behaviour is the various biases that can affect recall. An *in situ* measure of behaviour, which avoids this problem, is the Experience Sampling Method (ESM). ESM collects self-report experience throughout certain moments of interest [7] or at random occasions during the day [35]. In the case of HCI and ageing, there are two ways of collecting experience through this kind of sampling: (1) participants have to either complete a questionnaire immediately after they interact with the system; or (2) behavioural parameters (e.g., limb positions, right hip positions) or physiological status (e.g., eye movement, mood status, heart rate, respiration, ECG, skin conductance) can be collected at key moments. Researchers tend to use ESM to assess user experience in context-aware situations often with the use of embedded sensors [36]. This method has benefits in gaining in situ "observation" results, which are hard to obtain outside lab settings; but they can be burdensome to some participants and necessarily might "miss important activities" [36]. There is no use of ESM in our surveyed studies. Taruffi & Koelsch's work on mood experience with sad music mentioned that the validity of their study could be potentially improvement if ESM were used [35]. Their use offers an important additional avenue for research in this area.

3 Key Influencing Factors

Together these studies focus on three different factors, the nature of the persons involved; their behaviour; and their environment.

3.1 Person

Given our focus on retirement the persons being considered are typically late middle age and older adults who engage in music activities (individual or community-based) with a focus on their physical, emotional and cognitive aspects of personal attributes. The musical background of those studied is extensively addressed.

Key dimensions of music background include musical expertise, length of music training (e.g., instrument, vocal), music practice style (e.g., long-term or short-term). Existing studies have identified the positive relationship between music background

and psychological well-being, cognitive abilities, and quality of life [24, 28, 37]. There have been an increasing number of HCI studies focusing on the experience of amateur musicians, since this group of users are "serious about their leisure" and are "distinct from the professional as from the novice and hobbyist" [38]. The relationship between music background and wellbeing appear to combine with personality traits [39]. Researchers have investigated the relationship between trait empathy and the sadness perception of people who listen to music, with the finding that empathy contributes to the evocation of sadness via appraisal and nostalgia - which in turn are related to well-being factors [35].

Another bunch of factors affects engagement or adoption: perceived benefits, prior similar experience, and self-efficacy [10, 40–42], mono-chronicity [43], self-construal are among the most frequently mentioned factors. Three forms of self-efficacy - technology efficacy, information efficacy, and connective efficacy – may influence one's desire and confidence to engage in community music or accept related technologies [44].

3.2 Behaviour

Unsurprisingly, people at the transitions to retirement tend to use computer and the Internet to a less extent than the younger generation, but spend more time on face-to-face activities like community music making or connection to close relation ships (e.g., relatives and good friends). The most extensively studied technology use for older people is communication and social support [11, 45–48]. Different types of communication technologies include email, telephone, text messages, social network sites, and online forums or blogs, to provide specific support.

Individual music-related behaviours include music listening [35, 49], managing music crates (both physical and digital), self-promotion [14]. Social music-related behaviours include music-sharing [50, 51], community singing [23, 26, 27, 30, 37, 40, 52, 53], and collaborating with other musicians [14].

3.3 Environment

Environmental factors can be cast along two dimensions: artefacts and socio-musical environment. The artefacts dimension refers to the instruments, devices, hardware and software systems related to music that users are using. In our reviewed studies, artefacts include instruments, sheet music, lyric sheets, as well as MIDI files used for learning and archiving. Technology systems include media devices (e.g., MP3, radio, TV, computer), the Internet services (e.g., music streaming services, social network sites, personal websites, video gaming), computer-mediated communication technologies (e.g., telephone, email, video camera, smart phones, cell phones), as well as music-making applications (e.g., Sibelius, synchroniser, GarageBand, etc.) The socio-musical environment dimension especially applies when more than one person is involved (e.g., sharing music with friends, engaging in a choral life). Usability of the artefacts has been found to have a direct correlation with adoption and decreased cost, and further, engagement in the community [54] (Fig. 1).

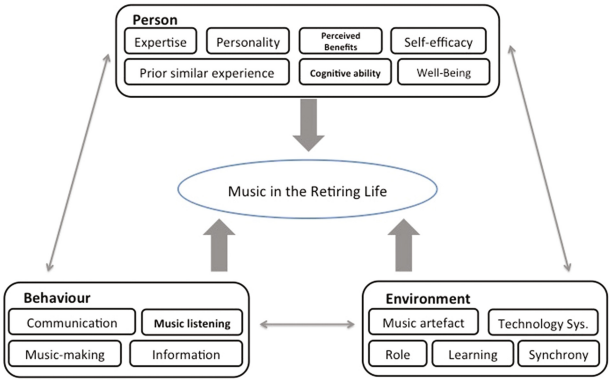

Fig. 1. Triadic reciprocal relationship of influencing factors on music and ageing

One important scenario in socio-musical interaction is group music-making. Such groups always develop shared social habits naturally, which is known as "chameleon effect" [55]. Firstly, the role (e.g., conductor, or chorister) that people undertake in group music-making impact their experience. As a chorister, the kinaesthetic relationship with the conductor will reinforce or undermine individual's habits for reaching the consensus condition. Second, learning style (e.g., singing by ear or sight reading) requires different memory modals (e.g., aural memory, kinaesthetic memory, factual memory), which in turn impacts experience in music-making and relevant technology use. Third, a strong group identity can lead to a greater number of member contributions and build stronger ties among members [44].

4 Conclusion

In this paper we have examined the literature on music-related technology use by people who are at the transitions to retirement through the lens of Social Cognitive Theory. Through this approach when can see that the personal characteristics at the retiring age, their use of music-related technologies, as well as the technologies and socio-musical environment exist in a triadic reciprocal relationship. Although there has been extensive research addressing the use of technologies among people during late middle age and older age, there are still many opportunities for further study in addressing this field through the lens of music and life transitions. We hope that this study will draw attention to this specific area of study and provide researchers with a foundation upon which future knowledge can be built.

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