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Anita Forsblom

Experiences of Music Listening and Music Therapy in Acute Stroke Rehabilitation

JYVÄSKYLÄN YLIOPISTO

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Editors
Jaakko Erkkilä
Department of Music, University of Jyväskylä
Pekka Olsbo, Sini Tuikka
Publishing Unit, University Library of Jyväskylä

Cover picture "Mummo ja minä" is from the author´s family album

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ABSTRACT

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Diss.

Stroke claims the lives of nearly six million people each year. It is the second biggest cause of death for people over the age of 60. Every year in Finland, approximately 15 000 people suffer a stroke, and it is widely accepted that the prevalence of stroke will increase as the average age of the population increases. As we come to a better understanding of stroke recovery and the most effective rehabilitation strategies, most discussions on the subject usually focus on how pharmacotherapy and physical and cognitive therapies can remodel and affect the plasticity of the brain. However, very little is known about how music or music therapy affects this plasticity, nor how patients experience this kind of therapy. The present work explores the personal and subjective experiences of patients who have listened to music or audio books after acute stroke, as documented in material from the MuKu-project, published during years 2004-2006. The participants consisted of 60 people from the Department of Neurology at the Helsinki University Central Hospital who had been admitted to the hospital for treatment of acute stroke. Results showed that patients in the music listening group experienced less depressive and confused moods. Also recovery in the domains of verbal memory and focused attention improved more in the music group than in the audio book and control groups (study I). The therapeutic role of music listening for a smaller group of these patients was then investigated more deeply and the results suggest that music listening can be used to relax, improve mood, and provide both physical and mental activation during the early stages of recovery from stroke (study II). Study III investigated how music and audio book listeners differ in their experiences, and it was found that music listening was specifically associated with better relaxation, increased motor activity and improved mood, while both music and audio book listening provided refreshing stimulation and evoked thoughts and memories about the past. The rehabilitation process was also looked at from the perspective of music therapists (N=6) who have been specifically working with acute stroke patients. The results shed light on the kind of tacit knowledge that music therapists require, and also show that there is a special need for multidisciplinary knowledge and multimodal training approaches in the field of music therapy education (study IV). This work increases understanding of how music affects emotional processing from the point of view patients, and how music listening and music therapy can be used in the treatment of acute stroke. It helps to develop the quality of treatment of patients in stroke units and aftercare units.

Keywords: music listening, music therapy, rehabilitation, acute stroke, experience

Author's address

Anita Forsblom
Music therapist, FAMI, Supervisor
Music therapy clinic
Ojahaanrinne 4, 01600 Vantaa, Finland
anita.forsblom@elisanet.fi

Supervisors

Professor Jaakko Erkkilä
Department of Music
University of Jyväskylä, Finland

Dr. Esa Ala-Ruona
Department of Music
University of Jyväskylä, Finland

Reviewers

Professor Heidi Ahonen
Faculty of Music, Music Therapy Research
Wilfrid Laurier University, Waterloo, ON, Canada

Dr. Marko Punkanen
Nyanssi Therapy Centre Lahti, Finland

Opponents

Professor Heidi Ahonen
Faculty of Music, Music Therapy Research
Wilfrid Laurier University, Waterloo, ON, Canada

FIGURES

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Vantaa 8.10.2012

Anita Forsblom

LIST OF ABBREVIATIONS

AC	Auditory Cortex
ANOVA	Analysis of Variance
ANS	Autonomic Nervous System
HUCH	Helsinki University Central Hospital
MCA	Middle Cerebral Artery
MEG	Magnetoencephalography
MIT	Melodic Intonation Therapy
MRI	Magnetic Resonance Imaging
MT-STROKE	Active Music Therapy Project
MuKu	Music Listening Project
POMS	Profile of Mood States
RAS	Rhythmic Auditory Stimulation
RCT	Randomized Controlled Trial

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following original publications, referred to in the text by Roman numerals (I-IV)

I Särkämö, T., Tervaniemi, M., Laitinen, S.,Forsblom, A., Soinila, S., Mikkonen, M., Autti, T., Silvennoinen, H.M., Erkkilä, J., Laine, M., Peretz, I., Hietanen, M. (2008). Music listening enhances cognitive recovery and mood after middle cerebral artery stroke. *Brain, 131,* 866-876.

II Forsblom, A., Laitinen, S., Särkämö, T., Tervaniemi, M. (2009). Therapeutic role of music listening in stroke rehabilitation. *Annals of the New York Academy of Science, 1169,* 426-430.

III Forsblom, A., Särkämö, T., Laitinen, S., Tervaniemi, M. (2010). The effect of music and audiobook listening on people recovering from stroke: the patient´s point of view. *Music and Medicine, 2,* 229-234.

IV Forsblom, A. Ala-Ruona, E. (2012). Professional competences of music therapists working in post-stroke rehabilitation. *Voices-A World Forum for Music Therapy, 12,*(3)

SUMMARY OF PUBLICATIONS

I The first publication studied whether everyday music listening can effectively facilitate the recovery of cognitive functions and mood after a stroke. Sixty patients were randomly assigned to a music group, an audio book group, or a control group. During the following two months, the music and audio book groups listened to self-selected music or audio books on a daily basis, while the control group received no listening material. Recovery in the domains of verbal memory and focused attention improved significantly more in the music group than in either the audio book or control groups. The music group also experienced less depressed and confused moods than the control group.

The author was partially responsible for the study design, data collection, analysis, interpretation of data and the writing of this manuscript. She was one of the two music therapists implementing the music and audio book intervention within an RCT framework. This consisted of firstly performing a short behavioural listening experiment; secondly interviewing patients about the music and audio books during the two-month intervention; and finally conducting a six-month follow-up investigation about leasure activities.

II The second publication investigated the therapeutic role of music listening in stroke rehabilitation by first interviewing twenty stroke patients about the subjective emotions and cognitions evoked by music listening; and then interviewing five nurses about the clinical use of music listening in a stroke rehabilitation unit. In most patients' opinion, music listening can be used to relax, improve one's mood, and provide both physical and mental activation during the early stages of recovery from stroke. Also nurses regarded it as a useful clinical tool.

The author was responsible for the major part of the work, including study design, writing and analysis of the patient interviews. Data collection was made together with Sari Laitinen, and benefited from the statistical help of Teppo Särkämö.

III The third publication investigated the emotional and psychological factors underlying the therapeutic effects of listening to music after a stroke, by combining both qualitative and quantitative methods. Thirty-nine patients were interviewed about their subjective experiences when listening daily to either self-selected music or audio books during the first two months after the stroke. Music listening was specifically associated with better relaxation, increased motor activity, and improved mood, whereas both music and audio book listening provided refreshing stimulation and evoked thoughts and memories about the past.

The author was responsible for the major part of the work, including study design, writing and the qualitative analysis of patient interviews.

Data collection was made together with Sari Laitinen, and Teppo Särkämö gave statistical help with the quantitative analysis.

IV In the fourth publication, six music therapists were interviewed about their subjective experiences of post-stroke rehabilitation work in hospitals and health care units. Three meaningful factors were seen to affect their clinical thinking: knowledge concerning the neurological basis and consequences of strokes; how they interacted with a patient face to face; and the ability to observe both psychological and physiological aspects while doing music therapy.

The author was responsible for the major part of the work, including the study design, analysis, writing, and data collection. Dr. Esa Ala-Ruona helped the author in methodological design and data analysis.

CONTENTS

PREFACE

Music has the ability to bring people into contact and communicate emotions in ways that few other forms of human interaction do. It is these holistic qualities that readily match the needs of patients in care. However, there are surprisingly few qualitative studies of how chronically ill people engage in musical activity and how they perceive this activity as providing benefits to their health and wellbeing. Qualitative methods could be used to explore the ways in which patients see music improving their quality of life, in the same way that qualitative methods have been used to describe the processes and changes that occur in a patient´s experiences during illness.

Music listening has always been part of my research interests, and a focus also for my clinical work as a music therapist. My Master's thesis was a case-study looking at the pieces of music that one 40 year old woman had found to be meaningful over the course of her life. She had used music listening to grow up with, and cope with her emotions from childhood to adulthood (Forsblom, 2003). My clinical work as a music therapist for over 15 years, and working as a supervisor for 12 years has had an impact on the theoretical thinking I have about meeting clients and working with patients. The importance of music listening has arisen from practice. In my clinical music therapy work, I have been working with adolescents, who have been listening to their favourite music. I have learned to appreciate their choices of meaningful music, and seen many times how music listening has helped them to find their voice. I have also worked with adults of many different ages in health care units and palliative care units, who have found that listening and singing along to familiar songs is very important. I have learned from my clients that self-selected music evokes memories, comforts, and provides essential company in varying situations during the course of one's life.

My specialist training in GIM (Guided Imagery and Music), led by Torben Moe, has strongly influenced my view of music listening as an ongoing process for coping with hardships in patients' and clients' lives. According to Helen Bonny, the founder of the model, GIM is a process where imagery is evoked during music listening. It is a holistic, humanistic and transpersonal model that respects all aspects of human experience (Bonny, 1990; Goldberg, 1995; Wigram, Nygaard-Pedersen & Bonde, L. (2002) In GIM, the music therapist, patient, and the music itself are working interactively with each other. This delicate balancing act means, according to Bruscia (1998 a), that during the therapy session music therapists must continuously move between the therapist's and patient's world so that they can reflect on the experience from the other's perspective as well as their own, and for this reason they must not stray too far either side of the border between these two worlds in case they cannot find a way back. It is also very important for a music therapist to understand the phenomenon of transference and counter transference to help when face to face with a client,

and thus avoid miscommunication. Listening to music is important, but listening to the patient is perhaps more so.

The idea of studying the music listening experiences of patients first came to me during the MuKu music listening project (2004-2006). In this project, my job was to interview acute stroke patients at the very start of the project and at the very end, when they had finished their two month course of listening to music. I was in close touch with them, bringing them the new music that they had selected themselves. The patients liked to go through their stories of having their strokes all over again. They also liked to talk about the music they had chosen, and share stories about the people who had made that music. They told me about the memories music evoked, and also their fears and hopes for the future. I noticed that music listeners had stories to tell that were very meaningful and deserved more attention. As a music therapist and a researcher, I was therefore interested to explore in greater depth how music has helped them.

To become better qualified at writing about the music listening experiences of patients, I enrolled in the Gubriums' Master Class in Qualitative Methodology at Tampere University. People's abilities to both tell and understand stories depend on their narrative resources. The master class helped me, not only to understand the situation from the perspective of patients, but also from the perspective of environment and culture. For example in hospitals there are some metanarratives that describe what kind of person is a good patient or a good nurse and how that kind of person should behave. As I was interested in how patients experienced care themselves, I wanted to deepen my understanding of this, and so took part in Vilma Hänninens´ Narrative Research Workshop at Jyväskylä University. I learned that narratives are templates that people use as a resource to construct and understand various kinds of stories. Documenting experiences of illness through a written narrative enables individuals to tell their own story as they have experienced it much better than other forms of documentation might allow. Indeed, in health research these illness narratives are increasingly recognized as legitimate data sources. Illness narratives provide a useful means of describing experiences that best show how illness has affected patients' lives (Kilty, 2000: Hänninen, 2000; Frank 1995, 2010).

Narrative research method has been very popular in the last twenty years, especially in psychology, anthropology, sociology and linguistics. It is very useful when trying to understand, for example, a storyteller's identity, lifestyle and culture. It is also a good way to deal with changes in life and to create a new identity and place in one's social life (Lieblich et al. 1998). Research based on illness stories aims to get the whole picture of a sick person's situation and their experience, with the assumption being that this experience is much greater than simply medical diagnosis alone (Hydén, 1997; Kleinmann, 1988; Sacks, 1985; Faircloth, Boylstein, Rittman & Gubrium, 2005).

During the writing process I started my training in dance-movement therapy. Dance-movement therapy has affected my theoretical thinking about the mind and body, as I have learnt that humans are a whole entity, where the state of the body influences the mind and vice versa. Embodied and enactive ap-

proaches strengthen the assumption of the body as the basis of thought and affect and attribute scientific value to experience-based approaches and validate major theoretical principles in creative arts, like music, art, or drama therapy. However, art and science need to define and negotiate how to conceptualize and represent experience as an ongoing translational process (Koch & Fischman, 2011).

I see the past 9 years as a huge hermeneutic circle; a never-ending process of knowledge and understanding. Deep reflection is needed not only to understand the past and present but also anticipate the future (Kenny, Jahn-Langenberg, Loewy, 2005). In this approach I have been in two roles. I have been working as a music therapy-clinician, but also as a researcher. There are some benefits, since I could use knowledge and experience from my work as a music therapist. At the same time, my role as a researcher has helped me to develop my work as a music therapist. However, it was sometimes difficult for me to work only as a researcher, when meeting for example patients during the music listening intervention. I always felt, that my role is to help them as if they were in music therapy.

The great experiences that nurses, patients and music therapists have described during their time listening to music and when in music therapy gave me some new ideas and raised the following question: why is music therapy not treated as equally important a rehabilitation method as occupational, speech, neuropsychological and physiotherapy in acute stroke care in Finland?

1 INTRODUCTION

1.1 Stroke

According to the WHO (World Health Organization), 15 million people suffer a stroke each year and of these, 6 million will die. In fact, every six seconds someone somewhere dies from a stroke, making it the second most common cause of death for people over the age of 60, and the fifth most common for 15-59 year olds. Stroke is also the principal cause of long-term disability regardless of age, gender, ethnicity or country, and figures show that it is responsible for more deaths in the world annually than those attributed to AIDS, tuberculosis and malaria put together (World Stroke Organization, 2011).

In just one year in Finland, there were approximately 15, 000 cases of ischemic stroke reported in the adult population (Kansanterveyslaitos, 2009). Taken together, these figures show how important it is therefore to find effective ways of working with stroke victims, as they form such a large proportion of the hospital population.

1.1.1 The trauma of stroke

Besides being life threatening, a stroke caused by brain infarction, is also a shocking experience for both the patient themselves and their families. For the first few days after a stroke, patients may have strong and wildly varying emotions, ranging from sadness and listlessness, to insecurity and aggressiveness. It is therefore very usual that patients get depressed in the first two months after a stroke. Depression after an acute stroke can even last over a year in some cases, and in this case it becomes chronic. This of course affects those in regular contact with the stroke victims, and consequently, the risk of getting depressed for caregivers is also very high (Berg, Palomäki, Lehtihalmes, Lönnqvist & Kaste 2003, 2005).

The physical and emotional consequences of a stroke are manifold. Motor-dysfunction and aphasia are two of the most well known and studied symp-

toms, but patients can also suffer from cognitive dysfunctions such as deficits in attention, in visuospatial cognition, in language, in reasoning and in memory. Cognitive impairment, neurological deficits and depression are actually all very common symptoms after a stroke (indeed, 60% of stroke sufferers have some form of cognitive dysfunction), and yet only a few studies have focused on these disorders, and they are also often overlooked in clinical practice (Nys, 2005; Tatemichi et al. 1994; Nyrkkö, 2010).

1.1.2 Standard rehabilitation

An essential goal in rehabilitating stroke patients is to get them back in control of the skills they need for day-to-day living and simple leisure activities, otherwise known as their ADL (Activities of Daily Living). In the ICF for Disability and Health (International Classification of Functioning), the ADL are distributed over three domains as follows: 5 are in the domain of Self-Care, 6 are in Domestic Life, and 9 are in the domain entitled Community, Social and Civic Life (WHO, 2001). People with cognitive problems after a stroke cannot always get help, because they don't necessarily have any other symptoms (like motor dysfunction or aphasia). And even if they do, the cognitive problems and the need for rehabilitation are still quite often overlooked. In the ICF, these problems have been placed in class 1: b110-b139, and b130-b189 (Nyrkkö, 2010).

In Finland there is a huge difference in remedial resources depending on the town stroke patients live in. There are only 5 rehabilitation centres for stroke survivors in the whole country, and in some places it is not even possible to get any intensive or multimodal training within the public healthcare sector. The situation is perhaps even worse for older patients, as they are kept mainly in health centres. (Duodecim, 2006; Takala et al., 2010). Although in such centres, patients get the required standard of rehabilitation, they still spend the most of their time in bed, without any other designated activity, even though music or audio book listening could be very easily arranged through the hospital library or by family members.

1.2 Using music and music therapy in stroke rehabilitation

Music therapists are often asked what is music therapy and how does it differ from music in medicine. According to Dileo and Bradt (2009), it is important to make a clear distinction between music interventions administered by medical professionals and those implemented by trained music therapists. Bonde (2001) states that some of the music therapists would not always consider the use of music in medicine to be a form of music therapy, if it does not involve developing a musical relationship with the patient, nevertheless therapeutic use of music is still considered helpful.

In this dissertation, this distinction between the two kinds of intervention is quite well illustrated. MuKu (the music listening project) can be seen more as

music in medicine, while MT-STROKE (the active music therapy project) can be seen as pure music therapy.

1.2.1 Music in Medicine

Music has been used before in medicine to influence a patient's physical, mental, or emotional states during or after medical treatment (Bruscia, 1998 a). For example, recorded music is sometimes played as a therapeutic intervention during certain medical operations (Wigram et al. 2002). Hospitals may also use music during magnetic resonance imaging (MRI) to help patients be calm during stroke diagnoses. An MRI scanner can be quite claustrophobic, as there is barely room for a person to fit in the tube in which the scans take place, and where there are also loud noises. During the operation patients have to lie perfectly still, or the scanning has to start all over again. Many patients prefer to listen to music during the whole operation to be able to cope with staying calm in there. Indeed, music has also been used as a mood regulator elsewhere in hospitals, because it is an effective way to reduce tension, pain, stress and anxiety (Saarikallio, 2007; Pelletier, 2004; Kenny & Faunce, 2004).

A stroke may cause a patient to suffer a loss in speech and language capacity. Interestingly however, although different pathways in the brain mediate melody and lyrics, they are integrated within the memory for songs. In this way, familiar music may also activate vocal expression (Gagnon L. 2004). For a similar reason, another application of music used by speech therapists for stroke rehabilitation with aphasic patients is MIT, or Melodic Intonation Therapy (Albert, Sparks & Helm, 1973; Norton, Zipse, Marchina & Schlaug, 2009). The melody and rhythm in speech have their musical elements highlighted, with the idea that this will improve articulation. The therapist starts by rhythmically tapping out phrases and continues with singing those phrases together with the patient (Hartley, Turry & Raghavan, 2010). Many aphasic patients have benefited greatly from MIT (Schlaug, 2008) and, perhaps as a consequence, this kind of music-speech protocol has therefore been developed further (see Rodgers & Fleming 1981; Jungblut, Suchanek & Gerhard, 2009; Tomaino, 2010). And yet another positive aspect of music-supported therapy is that it has been shown to lead to marked improvements in motor skills after a stroke (Altenmüller, Marco-Pallares, Münte & Schneider, 2009; Malcom, Massie & Thaut, 2009; Thaut, McIntosh & Rice, 1997; Thaut et al., 2007; Thaut & Abiru, 2010).

1.2.2 Music Therapy

Aldridge (1996) has stated that music can influence humans both mentally and physically. And this might explain why in music therapy many different musical elements feature in the interaction between patient and therapist: namely rhythm, harmony, melody, timbre, tempo and dynamics. According to Bruscia (1998b), music therapy is a systematic process wherein the therapist helps the client to promote health through musical experiences. The relationship devel-

ops between patient and therapist by using these musical elements as dynamic forces for change.

In rehabilitation with stroke patients, both receptive and active approaches to music therapy are used. The music therapy may either play a supportive role in the medical treatment of the patient; or be equally as important as the medical treatment; or even be used as the primary intervention for a medical condition (Dileo, 1999). In receptive music therapy, the chief activity of listening to music has deeper significant effects than just helping one to relax or taking one's mind off worries. Because listening to music entails a widespread activation of temporal, prefrontal, premotor, and parietal cortical areas, it can also affect the other activities of the brain that these parts govern. In other words, many cognitive functions such as attention, semantic processing, syntactic processing, and especially memory can be stimulated using receptive music therapy. The most significant influence music has, is on the emotions and so it can also be effectively used to regulate mood, emotions and attention (Sloboda & O´Neill, 2001; Trainor & Schmidt, 2003; Baumgartner, 1992). Also patients with traumatic brain injury have gained from music therapy, because it provides an adequate form of emotional expression (Bright & Signorelli, 1999; Burke et al., 2000; Jochims, 1992).

The most common repercussions after a stroke are aphasia and physical disability; paralysis and problems in controlling movement. In active music therapy, training with musical instruments such as drums can improve movement a lot after a stroke. An application called Rhythmic Auditory Stimulation (RAS) has been useful in helping hemiparetic stroke patients recover their arm movements and retrain their gait (Thaut et al. 1997, 2007). Kim and Tomaino (2008) also found that using a form of melodic intonation therapy (Sparks & Holland, 1976) and musical speech stimulation (Thaut & Abiru, 2010) to motivate aphasia clients was a key component in successful music therapy.

1.2.3 Stroke rehabilitation in music therapy research

Even though research into the effects of music and music therapy within healthcare has grown rapidly over the past 20 years, there are not as many reports about music or music therapy used in neurological rehabilitation. Cross, Mc Lellan, Vomberg, Monga & Monga (1984) were among the first of those to examine the use of music with stroke patients, although this was not specifically music therapy. Thomson, Arnold and Murphy (1990) addressed the need for the profession to examine stroke patients more closely, trying to work out how music therapists might assess a client for specific goals and objectives.

Hommel, et al.,(1990) and Soto et al., (2009) have found in their studies, that music listening improved visual awareness of the environment to the left for stroke patients suffering from left side neglect. A stroke in the right hemisphere is usually the reason for left side neglect, which causes patients to behave as if the sensory space to their left is nonexistent. Patients with neglect might for example fail to eat food on the left half of their plate, or they might draw a clock with only the numbers from 12 to 6 on one half. Neglect patients may also ig-

nore the left side of their body, shaving or adding make-up only to the right side. These patients may also frequently collide with objects such as door frames to the right. Neglect is a typical symptom among stroke patients, which therefore has clear repercussions on everyday life (Unsworth, 2007).

Problems in the right hemisphere may often cause a narrowing in emotional expression and abstract ways of thinking. In Denmark music therapists used GIM (Guided Imagery and Music) to help such patients in rehabilitation to think of images while listening, for example, to Mahler's 4th symphony. The results were very promising - after 9 group therapy sessions, patients came up with more images and could also relax better than before. This combination of music with images is, however, very demanding for patients as it needs good activation to be happening on both sides of the brain (Moe & Thorstrup, 1995).

When Cochrane's review examined the effects of music therapy on standard care for ABI (Acquired Brain Injury), by comparing the effectiveness of standard care alone with that of standard care combined with other therapies, the results suggested that, of all the therapies, rhythmic auditory stimulation (RAS) was the most beneficial for improving gait parameters in people who had suffered a stroke. This was concluded after looking at the respective effect of each kind of therapy on a range of abilities and attributes: gait, upper extremity function, communication, mood and emotions, social skills, pain, behavioural outcomes, daily living skills and the ability to cope with adverse events (Bradt, Magee, Dileo, Wheeler & McGilloway, 2010).

Further research is however needed regarding the effectiveness of music and music therapy in acute stroke rehabilitation. Some potential rehabilitative effects of music listening and music therapy are therefore looked at more closely in the studies to follow.

2 AIMS

This thesis aims to explore the potential effectiveness of two particular kinds of tool that could be more widely used in stroke rehabilitation. The tools in question are music therapy, and music listening in a therapeutic context.

Our understanding about how stroke recovery occurs, and how current stroke rehabilitation strategies actually work is continuously improving. There have been some studies about rehabilitation methods that use music or music therapy, but not so many that looks at the issue from the perspective of the stroke patients themselves. This present work therefore explores more fully the personal experiences of patients who listened to music after their acute stroke, and also the experiences of those nurses and music therapists, who worked with them.

The whole dissertation process proved to be a continuous form of qualitative research, which embraced the fact that it is first necessary to consider the rehabilitation process from as many aspects as possible to then be able to draw any conclusions about its effectiveness. It therefore consists of three studies that examine the patients' experiences of music therapy and listening, with some help from the music therapists, nurses and family members that worked with them (studies I-III); and one study that examines more closely our understanding of the rehabilitation process from the particular perspective of the music therapists involved (study IV).

3 METHODS

The dissertation includes data from two stroke projects conducted in Finland: MuKu, a music listening project that took place between 2004 and 2006; and MT-STROKE, an active music therapy project that is still ongoing.

3.1 Participants and procedure

In MuKu, the participants consisted of 59 patients from the Department of Neurology of the Helsinki University Central Hospital (HUCH), recruited between March 2004 and May 2006. They had been admitted to the hospital for an acute ischaemic MCA stroke in either the left or right temporal, frontal, parietal or subcortical brain regions. Interview material from patients in Studies I, II and III is based on the data which was gathered from these patients during the project. The HUCH Ethics Committee approved MuKu, and all participants made an informed consent, which meant they were in effect making a conscious decision to participate.

All patients underwent an extensive neuropsychological assessment one week, three months and six months after the stroke, which included a wide range neuropsychological tests measuring differrent cognitive domains (short-term and working memory, verbal memory, verbal and visuospatial skills, music cognition, focused and sustained attention, and executive functions) as well as questionnaire concerning mood (Profile of Mood States, POMS) and quality of life (Stroke and Aphasia Quality Of Life Scale, SAQOL) In addition, also auditory magnetoencephalography (MEG) measurements and magnetic resonance imaging (MRI) were performed repeatedly during the follow-up. There were 60 patients originally recruited for the study, but one dropped out after the two month intervention (in StudyIII), and five dropped out before the three-month follow-up (in studies I and II). Interview material from five professional nurses and six music therapists was also gathered for studies II and IV.

3.2 Interventions and interviews

Patients were randomized and put into three different groups: 20 music listeners (12 women and 8 men, with a mean age of 56.7 years); 19 audio book listeners (10 women and 9 men, with a mean age of 59.3 years); and 20 control group members, who also got standard care but, unlike the other two groups, did not get special listening material (9 women and 10 men, with a mean age of 62.1 years).

They were all interviewed by music therapists at the beginning of their hospitalization - between three and 21 days after their admission, which on average meant after 8.6 days. The music therapists asked them about their pre-stroke leisure activities, in particular whether they liked music listening and reading. There was then a short behavioural experiment to detect differences not only in their preferences, but also in their emotional response to these two kinds of stimulus. They were presented with two short musical pieces and two narrated poems, which were either happy or sad. After that, they were interviewed about the emotions, thoughts and memories evoked by them. From these results, qualitative data could be gathered that shed light on what emotions if any were evoked by each stimulus, and which kind of stimulus (music or poem) was preferred. Both listening groups were also shown how to use the CD players used in the experiment for them, and they were asked to listen independently to the material given to them for at least one hour every day for the following two months, whether in hospital or at home.

Music therapists met with each patient every week to encourage them in their listening, to bring them more material, and to give practical aid with CD players and head phones if patients needed it. Family members and nurses were also recruited to help patients write a listening diary or put a CD on, if they were not able to do these things themselves. During the two-month listening projects, patient participation was verified using listening diaries, questionnaires on their leisure activities, and interview material obtained after the intervention period.

Patients selected music for themselves with the help of the music therapist. Analysis of the listening diaries kept by the music group patients showed that 62 % of all music selections were of popular music: i.e., pop, rock, or rhythm and blues. Of the other genres, 10 % chose jazz, 8 % chose folk music and 20 % chose classical or spiritual music to listen to. The total range of musical artists was large - from Mozart to Uriah Heep. But what all the music chosen had in common was that for each patient it was particularly familiar, and very often something that they used to listen in their adolescence. Audio book listeners also selected books for themselves, and these ranged from novels and detective thrillers to romance, sci-fi and humour. The researcher´s role during the study I was to be one of the two music therapists involved. She was partially responsible for the study design, data collection, analysis, interpretation of data and the writing of manuscript and implementing the music and audio book interven-

tion within an RCT framework. This consisted of firstly performing a short behavioural listening experiment; secondly interviewing patients about the music and audio books *during* the two-month intervention; and finally conducting a six-month follow-up investigation about leasure activities.

Another intervention took the form of participatory action research to determine how nurses use music listening as a tool in stroke rehabilitation (in study II). Five nurses were recruited from two rehabilitation hospitals in the Helsinki metropolian area to arrange music listening for stroke patients in their unit as part of the hospital rehabilitation programme. Altogether, 26 patients took part in this intervention, which lasted two weeks. After the programme, the nurses were interviewed about their experiences in a total of 10 group interviews held during the six-month follow-up period. This intervention is described in more detail way in participative action research called "Arranging music listening in a hospital setting to enhance rehabilitation among stroke patients" (Laitinen, 2008).

In Study IV six music therapists were also asked about their subjective experiences of post-stroke rehabilitation work in hospitals and health care units, during the course of the MuKu and MT-STROKE projects. The interviews with each music therapist were conducted in an open-ended manner. One of these interviews was more in-depth than the others, as the therapist had brought video-material from three separate patients that could be referred to throughout the course of the interview. During the interview he showed three 60-minute video clips for each of the different patients. One was taken from the first session, another from the tenth session and the last from the twentieth session at the end of their rehabilitation programme, which meant altogether nine hours of video footage was watched for this single interview. The in-depth interview enabled some parallels to be drawn with the other therapists' interviews, and helped to understand the most pivotal and meaningful factors in stroke rehabilitation from a music therapist's perspective.

3.3 Data analyses

All of the data analysis methods used in studies I to IV are described in detail in the original publications. Therefore, the main analysis methods outlined below are in more general terms.

In Study I, group differences in the recovery of cognitive functions and mood were analysed using a mixed-model analysis of variance (ANOVA) with time (one week (baseline), three months, and six months), group (music, audio book, and control) and lesion laterality (left and right) as factors. Owing to the large variability in mood at the acute post-stroke stage, the group differences in mood were also analysed cross-sectionally at the three-month and six-month post-stroke stages using a one-way ANOVA. All post hoc analyses were performed with Tukey´s honestly significant difference test (HSD). For the mixed-model ANOVA, post hoc tests were performed on change scores for baseline to

the three-month stage, and for base line to the six-month stage. Relationships between the cognitive domains were analysed with Pearson´s correlation coefficient. All statistical analyses were performed using SPSS (version 14.0).

In study III the goal was to compare the experiences of audio book listeners with those of music listeners. By combining both qualitative and quantitative approaches, the narrative content of both groups of interviews was analyzed and classified using a phenomenological research model developed by Giorgi (Giorgi, 1975). This patient interview data was then statistically compared using χ^2 tests, which determined the number of music and audio book group patients whose responses fell into each of the six categories. Those categories had been built using interview material from the 20 music listeners in study II.

The interview data in study II ja III was analyzed qualitatively using the method developed by Giorgi (Giorgi, 1975) The data was also set within a crisis theory framework (Cullberg, 2007). Participatory action research with the nurses' data was analyzed using qualitative content analysis method that took into account phenomenographic and phenomenological viewpoints (Marton & Booth, 1997).

In study IV the qualitative analysis was performed as an inductive process that aimed to whittle down the specific data, gleaned from the open questions of the interviews, into a more applicable form. Qualitative research and especially phenomenological thinking in content analysis therefore was the ideal way to study the process of how music therapists feel they develop the skills and knowledge they require in order to work successfully with stroke patients. In order to filter out irrelevant data, only the information, which met the focus of the present study, therefore, was kept for the final data analysis (Tuomi & Sarajärvi, 2009). This type of purposive sampling was performed on a computer using the HyperRESEARCH application (version 2.7), which helped to organize and code segments of text.

3.4 Trustworthiness, ethics and usefulness

The current work was based on a variety of data collection methods that involved statistically analysing survey data; analyzing and classifying narrative content in the interviews with patients, nurses and music therapists; and then synthesizing the results of these measurements, tests and questionnaires with an overview of the literature. Using a phenomenological research model, the results were comparable with statistically reliable conclusions about the specific nature of observed rehabilitation effects.

As mentioned earlier, the narrative data from interviews was analyzed using a method borrowed from Giorgi´s phenomenological research model (Giorgi, 1975). This was to understand the depth and the meaningfulness of the experiences, as they were actually lived. And Cullberg´s (2007) theory of crises was used as a theoretical framework to figure out what patients were going through

emotionally and psychologically. This kind of combination gave strong empirical evidence of trustworthiness for the whole process.

Ethical confidentiality for patients was also ensured. Only those patients participated in the studies who had made a conscious decision to do so, by signing an informed consent. And before any research got under way, the HUCH Ethics Committee had approved the project.

The consequence of this was that the work actually yielded new knowledge about how patients, nurses and music therapists were using music and music therapy and it should therefore be very useful in developing rehabilitation processes further for acute stroke patients in care.

4 STUDIES

The current dissertation is based on four studies: two that address patients' experiences of music listening after having suffered from acute stroke; one study about how nurses used music listening in their work; and one study about music therapists' experiences of rehabilitating stroke patients with music therapy. The aims, methods and results of each study are summarized below. The studies are of course described in greater detail in the original publications. Studies I, II and III were about the experiences of patients recruited between 2004 and 2006 from the Department of Neurology at the Helsinki University Central Hospital. In study II, also a participatory action research approach was used to determine how nurses used music listening as a rehabilitative tool with stroke patients in a hospital setting. As mentioned before, their experience about clinical use of music listening in a stroke rehabilitation unit is explained in more detail way in S. Laitinen´s thesis (Laitinen, 2008). The last article (study IV) was about the experiences of music therapists, who had been working with acute stroke patients. The studies are numbered chronologically.

Study III examines the differences between the subjective experiences of patients listening to audio books and those listening to music. In both cases the material was chosen by themselves. To give the results of study III greater significance, it was decided to also include the first article published in 2008 that had used patients from MuKu, and had also been used as part of Teppo Särkämö's dissertation (Särkämö, 2011). This article became study I, and focuses more on neuropsychological details. It demonstrates that music listening during the early stages of stroke rehabilitation can enhance cognitive recovery and prevent negative mood swings. That study therefore provides more evidence as to why music listening could be so meaningful and effective, as was indeed indicated by patients in the subjective accounts that were recorded in the previous article. Study II delved deeper into the experience patients had of listening to music, by forming six categories to describe their subjective experiences as a result of intervention. Since music therapists have been involved in both MuKu and MT-STROKE, it was also important to explore acute stroke rehabilitation from their perspective. These were examined at some depth in study IV.

4.1 Study I: Music listening enhances cognitive recovery and mood after middle cerebral artery stroke

The aim of this study was to find out whether everyday music listening could improve mood and facilitate the recovery of cognitive functions after stroke. Participation and procedure was as detailed for MuKu in the methods section above (chapter 4), as is the short behavioural experiment that was conducted before the intervention. The purpose of this introductory experiment was also partly to break the ice and help the client talk more easily about their preferred music or literature. Importantly, the results of the experiment showed that the patients in music and audio book groups experienced emotions to music (63% versus 81%; $\chi^2 = 0.3$, $p = 0.567$, Yates' correction) and poems (72% versus 94%; $\chi^2 = 1.4$, $p = 0.233$, Yates' correction) and also preferred music (50% versus 56%; $\chi^2 = 0.1$, $p = 0.716$) to a similar degree, suggesting that the emotional response to and preference for music and verbal material were comparable at baseline. Moreover, there were no significant group differences at baseline in any demographic or clinical variable, in cognitive performance or mood, or in the amount of other rehabilitation received during the follow-up, suggesting that the groups were comparable.

Group differences between the music (n = 19), audio book (n = 19), and control groups (n = 17) in cognitive recovery were analysed using mixed-model ANOVAs with time, group, and lesion laterality as factors. As illustrated in Figure 1, there were significant time x group interactions in the domains of verbal memory [$F(4, 96) = 4.7$, $p = 0.002$] and focused attention (hits) [$F(3.2, 59.3) = 3.9$, $p = 0.012$]. Post hoc (HSD) analyses of the change scores indicated that both verbal memory and focused attention scores improved more in the music group than in the audio book ($p = 0.006$ and 0.058) and control ($p = 0.049$ and 0.049) groups during the three month follow-up period. At the six month stage, verbal memory recovery was still better in the music group than in the audio book group ($p = 0.006$). Also, focused attention recovery remained better in the music group than in the control ($p = 0.008$) and audio book ($p = 0.016$) groups. Pearson correlation analyses across all patients indicated that the focused attention and verbal memory scores were significantly correlated at the one-week ($r = 0.32$, $p = 0.037$), three-month ($r = 0.54$, $p < 0.001$), and six-month ($r = 0.49$, $p < 0.001$) stages, suggesting that the changes in memory and attention were clearly interrelated.

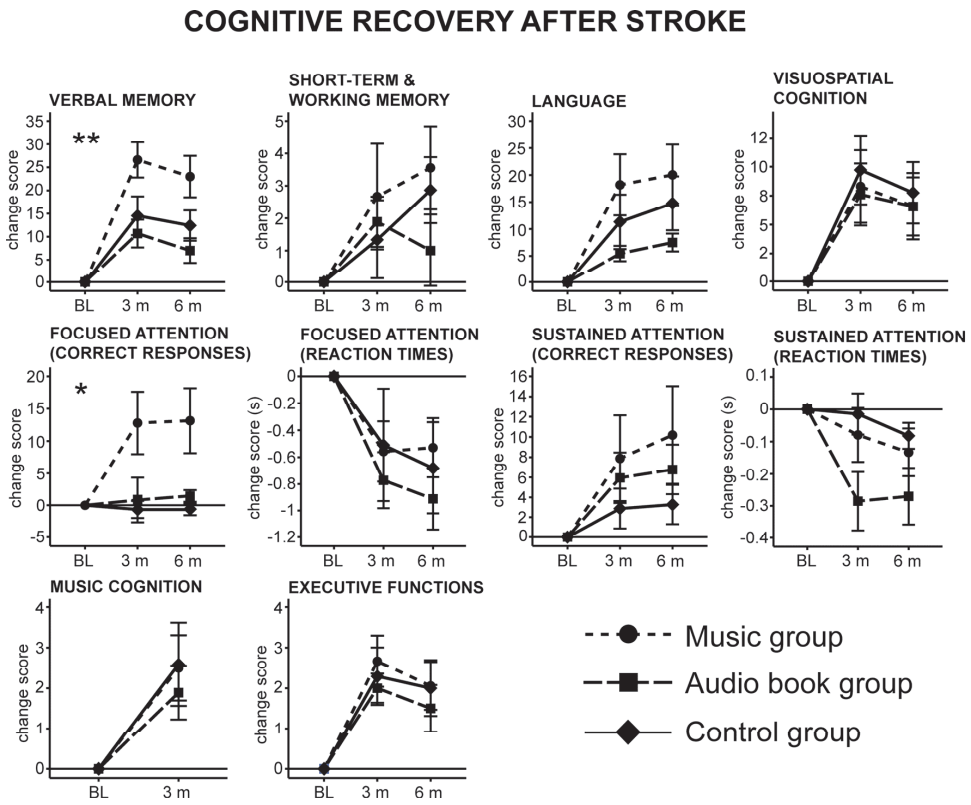


FIGURE 1 Changes in the 10 cognitive domains (mean ± SEM) from the baseline (BL; one-week post-stroke stage) to the three-month (3m) and the six-month (6m) post-stroke stage (baseline score subtracted from the values) in the three patient groups. ** $p < 0.01$, *$p < 0.05$ by mixed-model ANOVA.

Regarding the POMS, mixed-model ANOVAs of the eigth mood scales (see Figure 2.) yielded no significant time x group effects, but cross-sectional one-way ANOVAs showed that there were significant group differences in depression [$F(2, 51) = 3.7$, $p = 0.031$] and confusion [$F(2, 51) = 3.3$, $p = 0.045$] scores. Post hoc tests indicated that the depression score was significantly lower in the music group than in the control group ($p = 0.024$). Also the confusion score was marginally lower in the music group than in the control group ($p = 0.061$). At the six month stage, the group differences in depression and confusion were still marginally significant with post hoc tests showing a tendency for the music group to experience less depressed ($p = 0.071$) and confused ($p = 0.064$) moods than the control group. No significant effects were observed for the SAQOL.

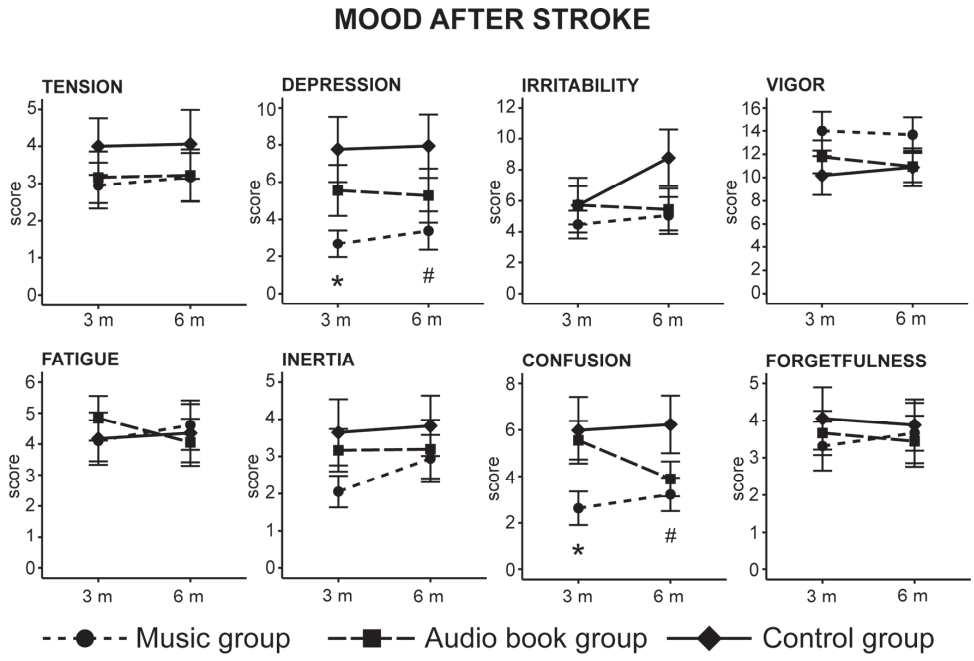


FIGURE 2 Profile of Mood States (POMS) scale scores (mean ± SEM) in the three patient groups at the three-month (3m) and the six-month (6m) post-stroke stage. * $p < 0.05$, #$p < 0.05$ by one-way ANOVA.

In summary, the results of this study suggest that listening to music daily during the first months after a stroke can enhance the recovery of memory and attention as well as prevent depressed and confused moods.

4.2 Study II: Therapeutic role of music listening in stroke rehabilitation

The purpose of the study was to gain more insight into the therapeutic role of music listening in stroke rehabilitation by interviewing stroke patients (n=20) about the subjective emotions and cognitions evoked by music listening. In this study nurses (n=5) were also interviewed about the clinical use of music listening in a stroke rehabilitation units. Patients received portable players and, with the aid of music therapists, selected music and audio books to listen to for at least one hour every day for a two month period. They also kept a diary of their experiences throughout the two month intervention and were interviewed afterwards about how they felt it had contributed to the recovery process.

The aim of the study was to understand the meaningfulness of human experience as it was actually lived during the intervention. The interview data was analyzed as mentioned above in section 3.3 using a combination of methods borrowed from Giorgi (Giorgi, 1975) and Cullberg (2007).

According to Cullberg's crisis theory the first one to three days of a crisis are spent in shock. A patient can feel confused, weak and helpless, while everything seems to be in chaos. This initial shock period is followed by a one to three month reaction period, which is characterized by the activation of psychic defence mechanisms, as well as experiences of anxiety, hypersensitivity, irritable mood, tiredness and depression. Many patients also experience sleeping disorders during this time.

In study II, 80 % of patients said that music listening helped them to calm down, relax and sleep better. This might also explain other findings that show music can decrease arousal during times of acute stress (Pelletier, 2004). Also, during the first post-stroke months, 95% of the patients reported that music listening influenced their mood in a positive way. Similar responses were also given by the nurses when interviewed. They considered music listening as a form of emotional support that decreased anxiety, improved mood and encouraged the patients to communicate. In addition, 90% of patients also reported increased motor activity during music listening, in the form of dancing or moving in time to music. Very importantly, music listening took their mind off negative aspects of their situation and allowed them to focus their energy on productive work, such as doing household chores. According to Cullberg (2007) the reaction period is followed by a recovery period of two to twelve months after the crisis during which adjustment begins and plans for the future are prepared. Indeed, 85 % of patients said during this period that music listening evoked a lot of memories and reflective thoughts about their past and future. Overall, 75% of them felt music listening had contributed positively to their recovery. (See details in figure 3).

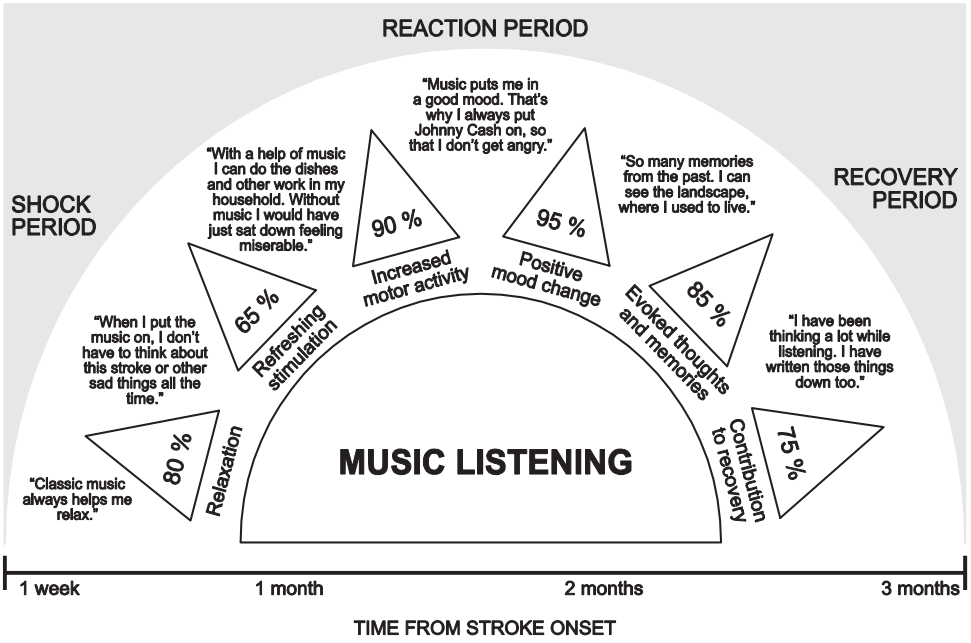


FIGURE 3 The personal meaning of music listening during stroke recovery. Data from interviews with patients (n = 20) are summarized in six categories. Triangles show the percentage of patients whose responses fall into each category. See text for details.

How 20 patients experienced the benefits of music listening during stroke recovery, in terms of six categories: 1) helping to relax; 2) providing refreshing stimulation; 3) increasing motor activity; 4) influencing mood positively; 5) evoking thoughts and memories; and 6) contributing overall to their recovery.

The results of this study suggest that music listening could provide a useful clinical tool for patients during the early stages of their recovery from stroke. It could also benefit the professional nursing staff, if the hospital facility has a positive attitude towards using music listening as a tool in stroke rehabilitation.

4.3 Study III: The effect of music and audio book listening on people recovering from stroke: the patient´s point of view

The aim of the study was to extend our previous work in study II by comparing the experiences of audio book and music listeners by interviewing them, in the hope that this would shed more light on the emotional and psychological factors underlying the therapeutic effects of listening to music. The narrative content of the interviews with both music and audio book listeners were first analyzed and classified qualitatively using the abovementioned phenomenological research model. The groups were then compared statistically and therefore quantitatively in terms of which of six categories of subjective expe-

rience each patient's interview fell into. These categories are described in greater detail in study II. Participation and procedure was as detailed for MuKu in the methods section above (chapter 3).

Results from study III showed that patients in the music group found significantly more often than patients in the audio book group that the listening experience helped them to relax ($\chi^2 = 25.8$, $p < 0.0001$), to increase their motor activity ($\chi^2 = 31.8$, $p < 0.0001$), and to improve their mood ($\chi^2 = 31.4$, $p < 0.0001$). Since most of the patients had deficits in attention, memory, or verbal comprehension, many of the audio book listeners reported having difficulties concentrating on, or understanding what they were listening to. They also found the stories to be boring, funny or exciting; but they did not say that the listening had actually made them feel any different or had generally improved their mood in the same way that the music listeners did. In particular, the difference in motor activity between the two groups was huge: whereas the music listeners reported often walking, doing household chores, and even dancing to the music, the audio book listeners found that they could not move too far away from the player because they had to concentrate just on listening. Both music and audio group patients however, reported equally often that the listening had felt like refreshing stimulation ($\chi^2 = 1.0$, $p = 0.31$, Yates' correction) and had evoked thoughts and memories about the past ($\chi^2 = 1.4$, $p = 0.25$, Yates' correction). Overall, patients in the music group felt more often than patients in the audio book group that listening had contributed positively to their recovery ($\chi^2 = 11.4$, $p < 0.001$). Interestingly, when talking about their mood, some audio book listeners actually said that they felt depressed as they were made more aware of the debilitating effects of their stroke, whereas the music listeners typically did not say that they felt depressed but rather that music improved their mood. See details in figure 4.

“Listening to audio books doesn’t help me relax or calm down.”

“It’s always nice to hear a story.”

“It was such a nice experience to just lie down and listen to an audio book.”

“I found the story called Juurakon Hulda so funny!”

“Listening to audio books was so interesting that it kept me inside the whole day.”

“Hearing a sad story changes your mood more than reading it from a book, and you also cry more easily.”

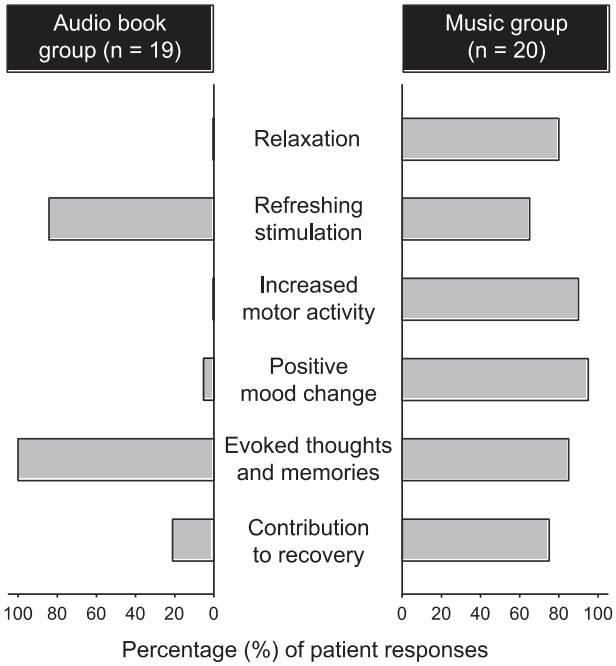
“Somehow I feel sad and lost although everything is all right. It is so hard to go shopping even though I can. I don’t think I can go back to work in March, yet.”

“Audio books evoked so many memories.”

“Audio books are so interesting. They bring back childhood memories, the landscape of your youth.”

“I remember we used to listen to Suomisen perhe and other radio plays during the war. I also remember the stories that my father told.”

“Every stroke patient should be encouraged to be active in the recovery process so that he can feel that life goes on despite all the struggle. Afterwards he can feel that he is alive.”



“Classical music always helps me relax.”

“When I was listening to music in the hospital, I fell asleep at once. It was great that I could relax with it.”

“When I put the music on, I don’t have to think about this stroke or other sad things all the time.”

“Music listening was a positive experience for the whole patient room. Everyone was lying in their beds listening, even nurses started to hum along to the music. Lazy Sundays in a hospital, nothing else to do there.”

“With the help of music I can do the dishes and other work in my household. Without music I would have just sat down feeling miserable.”

“At home we have tried dancing together. Rock, baby, rock like we used to! I was surprized that I could still do that.”

“Music puts me in a good mood. That’s why I always put Johnny Cash on, so that I don’t get angry.”

“In the middle of all the sorrow in my life, music brings me joy and can change my mood.”

“I feel that my thoughts are coming easier with music.”

“I remember when I was a 4 year old boy watching the prisoners of war with my father, an empty rifle on my shoulder.”

“This is an excellent method. In the beginning, I felt so confused in the hospital. Music was like a key that unlocked me.”

“At the hospital, I could not find words or concentrate in reading. Now I listen to music before I start reading. It helps.”

FIGURE 4 The subjective experience of music and audiobook listening after stroke. Data from patient interviews are summarized in 6 categories. Bars show the percentage of patients in the music listening group (right) and the audiobook listening group (left) whose responses fall into each category

In sum, this study showed that for patients recovering from acute stroke, music listening is a useful leisure activity that specifically helps them to relax, improves their mood, and increases their motor activity. These results also highlight the clinical importance of providing stimulating and pleasant leisure activities for stroke patients and that music is possibly the most important of these in stroke rehabilitation.

4.4 Study IV: Professional competences of music therapists working in post-stroke rehabilitation

The aim of this study was to gain more insight about the specific skills and competencies that music therapists feel they need to acquire through the course of their education and work experience, to be able to work well in acute stroke rehabilitation. For this purpose, six music therapists were interviewed about their subjective experiences of post-stroke rehabilitation work in hospitals and health care units, during the course of MuKu and MT-STROKE, the latter of which used more active music therapy techniques. The interviews pointed to three key categories regarding the factors which are seen to affect clinical thinking: the first hinges on knowledge concerning the neurological basis of strokes; the second focuses on patient interaction itself; and the third area concerns the importance of observation on physiological and psychological aspects of music therapy.

Music therapists valued their interaction with patients very highly, and realized how important it was to be aware of both the physical and mental hardships their patients face after a stroke. In their therapy sessions they observed both physiological and emotional aspects of music therapy at the same time, which they found quite challenging and demanding. However, they found the supervision and special training they had for interacting with stroke patients very helpful. As confirmed in the interviews here, from the very start of clinical training music therapists must work with all of their senses and be fully aware of the present moment. To observe, interact and utilize their neurological knowledge successfully, they have to reflect upon their way of work, and try to understand what is going on in their patient's mind at the same time. Empathy is also needed when they are building up a relationship with their patients, and yet they must also feel confident enough to intervene where necessary. It is particularly important for a music therapist to understand the phenomenon of transference and countertransference when interacting with clients. The quality of interaction with patient has been very important theme in this interview-study. According to the findings, music therapists had good interaction skills with their patients. When therapist and the patient share the musical space by playing together, various levels of transference can occur. Music therapists are usually trained to recognise and make use of unconscious processes like trans-

ference and countertransference. How ever, it takes time to fully understand and work with these kind of unconscious processes

In both projects, music therapists were starting with the patients that were already in hospital. They treated them however, as they would treat someone outside hospital, asking about their favourite music and hobbies which, as Laitinen (2008) from the MuKu project notes, was particularly appreciated by the patients. And because a number of studies have shown that the quality of the relationship between therapist and client is indeed pivotal to the effectiveness of any therapy (Orlinsky, Ronnestad & Willutzki, 2004), this is a serious consideration that must be taken into account. One thing that was common to all the therapists interviewed in this study was that their clients were the priority, and this no doubt affects the quality of patient interaction in terms of intensity and sensitivity.

The music therapists in MT-STROKE all mentioned how important and challenging it was to continuously be paying attention to each of their clients while simultaneously conducting the sessions. The sorts of things they were looking out for was each client's motivation; their body language; what motor functions were particularly difficult; any changes in mood; their cognitive performance and the things that clients were able to cope with well, and not so well. Usually patients were motivated, which made therapy easier, but very often they also got quite exhausted in sessions. Observing this in time was very important to ensure that they did not get demotivated and stuck in one particular movement. The music therapist had to watch carefully to ensure that intervention did not come too late. Another priority for observation among the therapists was each patient's mood, in other words, to be aware of how they might be coping with mood swings, since depression is a very typical symptom among stroke sufferers.

The results of this study improves our understanding of the tacit knowledge that music therapists require, and also shows that multidisciplinary knowledge and multimodal training approaches are very useful for music therapists in the field of post-stroke rehabilitation. But perhaps the most original point that the qualitative data in this study raised was that music therapists are in fact in a better position than many think, to know how best to deal with the challenges facing stroke survivors. It suggests that music therapy could be used to improve functional skills in a wider context, and be transferable in some capacity for use outside treatment sessions as well.

5 DISCUSSION

The current work contributes towards a more detailed understanding of the experiences of music and music therapy in the treatment of acute stroke in Finland, from the point of view of the patients, nurses and music therapists involved. The general findings, limitations, and implications of the current research are discussed below.

5.1 Music listening in stroke rehabilitation

Study I showed quite clearly that listening to music every day during the very earliest stages of stroke rehabilitation can aid the recovery of verbal memory, help maintain attention, and prevent depressed and confused moods. In the conclusion to his dissertation, Särkämö (2011) notes that in addition to its effect on cognition and mood, music listening may also have general effects on brain plasticity, as the activation it causes in the brain is in both hemispheres, and more widely distributed than that caused by verbal material alone. This kind of auditory environment can therefore induce long-term plastic changes which help the brain to recover more quickly.

The depression and confusion scores in the Profile of Mood States (POMS) were significantly lower in the music group at the three-month stage. Post hoc tests (HSD) indeed indicated less depression and confusion in the music group than in the control group. The difference was also marginally significant at the six-month stage too. Further correlation analyses indicated that the improvement in verbal memory correlated significantly with reduced depression and confusion between three and six months after stroke within the music group, but not within the audio book or control groups (Särkämö, 2011).

Depression and confusion scores were included as covariates in the aforementioned ANOVA analyses of the cognitive test scores, and yet they did not affect the significance of music's effect on verbal memory (Särkämö, 2011). These results indicate that the enhancing effects of music on cognitive recovery

and mood seem to go hand in hand, while at the same time implying that the improvement in cognitive recovery was not entirely due to improved mood alone. These findings suggest that listening to music during the early stages after a stroke adds to the recovery of verbal memory, improves focused attention, and prevents a depressed and confused mood. Accounts of the patients' listening experiences in study II confirm these findings, and are discussed in the section below in greater detail.

To picture more fully how patients found the music listening intervention over the whole two months, the examples cited below (from study II) cover each of the six categories of helpful effect: positive mood change; increased motor activity; evoked thoughts and memories; relaxation; contribution to recovery; and refreshing stimulation.

5.1.1 Music as a mood regulator

"Music puts me in a good mood. That´s why I always put Johnny Cash on–so that I don´t get angry"

Depression affects clients' motivation and cognitive ability during their rehabilitation process. And it is one of the most common mood disorders following a stroke affecting 30-50 % of survivors (Ramasubbu, Goodyear, 2008). Lack of dopamine in the neurotransmitters of the brain is believed to be a factor in depression, especially in the experience of anhedonia, the inability to experience pleasure from activities usually found enjoyable. Listening to preferred music stimulates a reflexive, neurological pleasurable response increasing the brain´s release of dopamine (Magee & Davidson, 2002; Menon &Levitin, 2005 ; Koelsch, 2010 ; Salimpoor, Benovoy, Larher, Dagher & Zatorre, 2011).

There is usually a wide variety in the different kinds of emotion experienced by patients during the first days after a stroke (Bogousslavsky, 2003). Patients may cry and totally lose control, a stage Cullberg (2007) calls the"shock-period". This loss of control is often accompanied by feelings of fear, panic and uncertainty. In this kind of situation familiar things from the past can be helpful to allay those feelings. Most of the patients did indeed inform us that listening to music changed their mood for the better. This is in line with the music as a mood regulator hypothesis (Saarikallio, 2011), which states that music is an important means of emotional self-regulation, especially during hardship and difficult life experiences. It is safe to assume that having a stroke is definitely one such experience. Saarikallio's study, that focused on how music-related emotional experiences can meaningfully serve as a functional part of an adult's psychosocial development, also points to the fact that music comforts, distracts, empowers and provides "co-experiences" for people. This description resembles the accounts of music listening experiences related by the patients in studies II and III.

Patients said that when they were feeling miserable with nobody to talk to, they could change their mood in a positive way with music. One of the patients in particular said that without music she would have felt like an orphan, com-

pletely alone. Her friend had just had a stroke too, and she wanted to visit him but couldn't because of her own stroke. Music provided a link with him that otherwise would have been lost.

5.1.2 Music as a relaxant

When I was listening to music in the hospital, I fell asleep at once. It was great that I could relax with it"

A very common symptom among stroke survivors is anxiety, and the most frequently used medical treatment for it is oral or intravenous sedative drugs. Common side-effects of this treatment are extreme muscle relaxation and central nervous system depression, which can cause further delays in the rehabilitation process (Chlan, 2000 ; Knight and Wiese, 2011). Music, as a nursing intervention, can provide a nonpharmacological alternative to this which has no such effects.

In big central hospitals there is always the hustle and bustle of something going on: the lights are on, nurses walk up and down the corridor at all times, keeping a check on everyone and everything. Ambulances and even helicopters come and go with loud sounds. Patient rooms are usually big so there is little privacy. Other patients may snore or need constant help from the nurse, who turns the lights on every now and then. So it is no wonder that patients find it sometimes hard to sleep or relax. One of the patients stated that listening to music saved her from having to endure the snoring of others. During the daytime, listening also made it possible to think about other things, and to have some privacy to dwell on perhaps more pleasant thoughts associated with her favourite music. According to a recently published study, patients in intensive care units (ICU) do not rest for a sufficiently continuous length of time, which can lead to a lower psychological quality of life. According to Meriläinen (2012), 30.5 % of patients in ICU suffer from delusions, nightmares and panic disorders after three months.

In this study, patients took the CD player with them to their rehabilitation centre or home after leaving the hospital. After the two month period of listening, the music therapist paid them a visit and interviewed them about the listening project. Almost everyone wanted to continue listening and some of them even didn't want to give the CD player back. They much preferred using that than the sleeping pills the doctor had prescribed them. Many patients also said that they were going to use their own stereos or radios to continue their daily listening when they got back home.

5.1.3 Music as an activator

"At home we have tried dancing together. Rock, baby, rock like we used to! I was surprised that I could still do that"

Patients reported that rhythm in music made them want to move, dance or tap to the rhythm with their hand, leg or finger. Some of them actually tried to dance with the help of their husband or wife. One of the patients said that whenever he heard Viennese classics, he always wanted to make as if he was conducting the music himself. This ties in quite well with research by Hodges (2009), which indicates that bodily responses to music suggest that music indeed stimulates motor activity.

As well as emotional distress and social dysfunction, stroke often leads to severe motor and cognitive deficits. According to our present knowledge of the acute treatment of stroke and the pattern of spontaneous recovery, the first weeks immediately after a cerebral infarction are the most important for enhancing the eventual outcome in patients' functional capacity. However, in hospital and in rehabilitation units as well as at home, patients are very often quite passive, spending most of the day in bed (Bernhardt, Dewey, Thrift & Donnan, 2004). Daily listening to music therefore provided a welcome break from this and, according to patients in study II and III it often made them get up and move around more.

Guidelines for stroke rehabilitation management recommend starting treatment as early as possible (Duncan et al., 2005). Although rehabilitation does not reverse brain damage, it can substantially improve function, which leads to better quality of life. To improve management of early intervention, Nijland, van Wegen, Harmeling-van der Wel & Kwakkei (2010) performed a study among patients with motor deficits in an upper limb. They used two simple clinical tests: finger extension and shoulder abduction. Motor activity was measured with candidate determinants in 188 stroke patients at three points in time: within 72 hours, at 5 days, and at 9 days after stroke. Logistic regression analysis was then used to develop a model, which could then predict upper limb function at 6 months. Results, measured with the action research arm test (ARAT), showed that patients with an upper limb motor deficit who exhibit some voluntary extension of the fingers and some abduction of the hemiplegic shoulder on day 2 have a 98% probability of regaining some dexterity at 6 months, whereas the probability is only 25% for those without this voluntary motor activity (Nijland et al., 2010). This research therefore points towards a realistic possibility for managing stroke within the first days of rehabilitation

Stroke survivors get better functional outcome if they are admitted to dedicated stroke units, staffed by experienced physicians, nurses and therapists. Sadly there are not enough such places for everyone. According to our findings in MuKu-project some motor activity could be reach by music listening, too. Arranging music listening in hospital is an inexpensive mean to facilitate cognitive, emotional and physical recovery. Active music therapy interventions like in MT-STROKE project could also be very beneficial in recovery process. Felicity Baker and Jeanette Tamplin (2010) presented in their book; "Music Therapy Methods in Neurorehabilitation"very useful step-by-step instructions how to implement music therapy techniques for gross motor movement of the upper

limb to improve physical rehabilitation, as many activities of daily living require the ability to grasp, hold and move objects (Baker & Tamplin, 2010).

5.1.4 Music helps with cognitive recovery

"I feel that my thoughts are coming more easily with music"

Patients reported that listening to music helped them organize their thoughts and memories more clearly. According to correlation analyses the positive changes in both mood and cognition were clearly interrelated among music listeners. As mentioned previously in section 5.1, verbal memory and focused attention recovery was found in study I to be significantly greater in the music listening group than in either the audio book or control groups at both three and six months after the stroke. The results of study I suggest that listening to music during the first months after stroke can enhance the recovery of memory and attention as well as prevent a depressed and confused mood.

This is good news for those patients who have cognitive problems, since although the current evidence suggests that music has a general non-specific effect on cognition; the need for their rehabilitation is often overlooked (Tatemichi et.al. 1994; Nyrkkö, 2010). This corresponds to the arousal and mood hypothesis (Thompson, Schellenberg & Husain, 2001), which postulates that any stimulus, which induces positive feelings and heightened arousal, like music for example, will lead to improved cognitive performance (Särkämö, 2011).

5.1.5 Communal music

"Music listening was a positive experience for the whole patient room. Everyone was lying in their beds listening, even nurses started to hum along to the music. Lazy Sundays in a hospital, nothing else to do there"

As mentioned before, it is very typical, that people with stroke spend most of their time lying in bed with nothing to do. During the weekends there are usually less activities in hospital than on weekdays. To get the best results out of rehabilitation, it should be very intensive for the first few months and contain enough refreshing activities to be stimulating. The patients, who took part in the music listening group, had the chance to listen to their favorite music and found this refreshing stimulation. Talking about the different kinds of music they liked, and the people this music involved, was easy to do. Music listening was also, for some of them, the only form of rehabilitation they could get at the start. But one advantage of this was that it was an unrestrictive kind of activity, in that they could share with nurses or each other too.

Talking about music they had listened to often provide a way into a conversation for nurses with patients who otherwise found it hard to have a normal conversation due to being seriously ill. What was particularly beneficial was that this kind of normal conversation focused on positive and healthy sides

of the patient's life and therefore reinforced any progress that was already being made in their health (Laitinen, 2008).

In New York, music therapists of the Louis & Lucille Armstrong Music Therapy Department treat adults who have Parkinson's, or Alzheimer's disease, and also those who have had a stroke. The music therapists at the clinic conduct daily sessions with patients in many areas of the hospital: NICU, Pediatrics, Family Medicine, Maternity, Oncology, Respiratory Step Down, ICUs, the Peter Kruger Clinic, Orthopedics, the Hospice, Radiation Oncology, and Pain Medicine and Palliative Care (Louis Armstrong Educational Foundation, 2012). This kind of communal music making together gives the patients a sense of belonging. Music as a social activity can provide an important conduit for community involvement. For patients in a "sick role" this kind of music group may open doors to the larger community. Also new values and social experiences are established (Ruud, 1998).

5.1.6 Music as a key for locked emotions

"This is an excellent method. In the beginning, I felt so confused in the hospital. Music was like a key that unlocked me"

People, who listened to music in the first months after an acute stroke said very often, that music was easy to understand. The fact that music therapists brought them music that the patients had chosen for themselves seemed to be very important. In discussing the music they chose, patients found themselves talking about past memories. The music itself, as well as the people who took part in the music in any way, were also very good topics to talk about.
For people who have suffered a stroke, just as for others who have suffered some hardship in life, music may be a transitional object through which it is safe to express negative emotions, a defined space where the patient can experience those emotions and yet also leave them when the music is finished. In this way, it can prove to be a great method for coping when there is something otherwise too painful to think about.

Results from studies I and III showed that the music listeners reported feeling less depressed and confused than the non-listeners, when they filled in the POMS (Profile of Mood States questionnaire) three months after the stroke. This result is also in line with evidence from many physiological, neuroimaging, and clinical studies showing that music listening over set periods of time is associated with and can lead to positive changes in arousal, emotions and mood (Janata, Tillmann & Bharucha, 2002; Trainor & Schmidt, 2003; Sloboda & O´Neill, 2001; Juslin & Laukka, 2004). McCaffrey and Locsin (2002) examined active listening to music, as a nursing intervention, and found that music can facilitate the healing and rehabilitation process by reducing anxiety, pain and overall stress.

5.2 Comparing the effects of music and audio book listening using the listeners' points of view

Study III was performed after some critical analysis of study II highlighted the fact that all the material analysed in it only came from music listeners in acute stroke care, and that it might be better to have some other kind of post-stroke rehabilitative tool to compare it to (i.e., audio book listening). So study III compared these two, and some positive effects were indeed found to be specific to music listening, and not audio book listening. According to patients, music listening helped them to relax, and it improved their mood more than audio book listening. Nevertheless, both music and audio books were experienced as refreshing and pleasant leisure activities that also evoked a lot of thoughts and memories.

It is perhaps not so difficult to see why audio books might be less effective than music immediately after a stroke when we think about it a little more closely. Patients are often very confused, insecure and lost in the first few days after a stroke. Concentrating on a story for more than a few seconds at a time may be very difficult, and therefore irritating, rather than relaxing. Some patients, for example, didn't understand the words they heard. And even when some time afterwards they could understand the words, they couldn't do anything else at the same time, but were forced to keep quite focused, and therefore probably quite still (which cannot have been good for increasing motor activity). Music however encouraged movement and patients could get on with other things at the same time, like household chores for example. Relaxing with an audio book was therefore impossible, because concentrating on hearing was hard work. However, as time wore on patients said that they could concentrate quite well on their listening, so well in fact, that they listened to audio books for many hours on end, instead of just one hour every day (which often wasn't long enough for a whole story). At this point they found it a very refreshing form of stimulation. Nevertheless, processing the stories took time and concentration, which isn't always easy in a noisy hospital. Another patient used music listening before he listened to news from the radio. He said that it helped him to understand the news better, allowing him first to relax. He used the same method also before he started to read a book: first some music, and then reading.

From these results concerning the listeners' point of view, both music and audio book listening would seem to fit quite well in a programme of acute stroke rehabilitation. To begin with, for example, patients could listen to their favourite music to calm down and relax first and then, when they felt ready, they could do some audio book listening. Many central hospitals have libraries of their own, and staff could easily find suitable reading material there too. Working together with Celia library was another good way to get audio books to patients, as they could be delivered to them at home by post. Celia is a Finnish state-owned specialist library, which produces and provides literature in

accessible formats for people who are unable to read books in standard print, due to illness or disability. Celia also lends works of fiction and non-fiction in the form of audio books to users free of charge. During the project, some of the patients who listened to audio books noticed that with the same CD player they could also listen to music. At first there was a concern that this might somehow affect the results, but from the listening diaries it could be seen that these patients still listened to audio books more. Some problems did occur with very sick patients, too. Some of them were in the beginning irritated, confused and unable to use the players by themselves. Nurses and family members therefore also helped a lot so that these patients could listen to audio books for 1-2 hours a day like the other participants in their group.

Some of the music patients chose was hard to get hold of but, despite that, everybody got at least 10 CDs worth of listening material. Family members also wanted to bring music into hospital, because that was something concrete they felt they could help with. Sometimes the patients didn't like the music their adult children brought them - for example fuzion jazz - but they would politely listen to at least one or two pieces before changing it to their music later. There were sometimes difficult situations, when at first a patient would inform us that they never usually listen to music and sometimes even hate it. Despite this kind of problem, 39 out of the 40 participants in the audio book and music groups completed the two month intervention.

5.3 Music therapists in the field of stroke rehabilitation

A stroke, or cerebral circulation disorder, normally occurs as a result of the bleeding or blockage of a blood vessel within the brain. Cognitive and motor disorders are among the most common impairments caused by strokes. Left-side neglect is the most typical disorder after a stroke in the right hemisphere's middle cerebral artery (MCA). Other common disorders are related to memory, orientation, verbal functioning, spatial and constructive perception, calculation, concentration and information processing (Tatemichi et al., 1994; Hochstenbach, Mulder, van Limbeek et al., 1998).

According to former studies, music therapy has a beneficial effect in the field of stroke rehabilitation, because it enhances neurological functions, speeds up the recovery of cognitive functions, and improves mood and the quality of life experienced (So-Young & Grocke, 2008; Thaut & Abiru, 2010). As mentioned before, Cochrane's review examined the effects of music therapy on standard care for ABI (Acquired Brain Injury) by comparing the effectiveness of standard care alone, with that of standard care combined with other therapies. The results suggested that of the other therapies, rhythmic auditory stimulation (RAS) is the most beneficial for improving gait parameters in people who have suffered a stroke. Future studies are however needed to lend further support to the claim that music therapy improves upper extremity function, speech, agitation and cognitive orientation (Bradt et al., 2010).

Ridder (2003) from Denmark has studied the music therapy intervention of singing with persons in advanced stages of dementia. Singing had a positive influence on the participants, defined by degrees of compliance, by changes in heart rate levels, and by various ways of taking part in the music therapy. According to the results, participants clearly profited from the music therapy sessions. Music therapy also had an influence on aspects of residential daily life, as defined in a statistically significant decrease in heart rate levels pre/post therapy. In Finland too, it was found that patients with dementia gained something from singing, as it improved their mood and their quality of life which suggests that this kind of musical activation will not only improve the psychological/cognitive well-being of patients, but that it could help their immediate family too (see Särkämö et al., 2011).

There are not as many music therapists in stroke units and hospitals in Finland as there are physiotherapists, speech therapists or occupational therapists. But in some rehabilitation units many positive effects have been found in projects that are using active music therapy in group- sessions. For example playing instruments together using "Figurenotes" has been found effective (Laitinen & Pataila, 2000; Laitinen 2003, 2008). Figurenotes© is a therapy-oriented method of teaching, in which each note has a symbol, so patients with stroke, who might find it difficult or nigh impossible to assimilate abstract sound representations, should be able to play piano or other instruments more easily. Figurenotes promotes neurocognitive rehabilitation by helping to strengthen a player's commitment and encouraging independent, unassisted practice. From the point of view of information processing, the cognitive processes involved in playing an instrument from Figurenotes is very similar to that involved in reading (Resonaari, 2012).

Another Finnish intervention is Physioacoustic Sound Wave Therapy, which focuses on the musculoskeletal system, releasing stress and tension through deep body massage. It works on the circulation, lowering high blood pressure and reducing both anxiety and pain. There is evidence that Physioacoustic stimulation also has some success in tackling insomnia, spastic muscles and pain (Lehikoinen, 1988; Ala-Ruona, 1999; Punkanen & Ala-Ruona, 2012).

An essential goal in rehabilitating stroke patients is to get them back in control of the skills they need for day-to-day living and simple leisure activities, otherwise known as their activities of daily living (ADL). Speech therapy, occupational therapy, physiotherapy, neuropsychological therapy, art therapy and music therapy are all benefical in the rehabilitation process. However, in Finland only 15-20% of all stroke patients are able to get the full range of multiprofessional rehabilitation, and the situation for older people is even worse (Duodecim, 2006; Takala et al., 2010).

Fortunately, in the last few years there have been projects, like MuKu and MT-STROKE, where music therapists have been able to use music therapy interventions in post-stroke rehabilitation. In study IV, five music therapists took some specialist training as part of MT-STROKE, and one music therapist was interviewed from the MuKu project. In MT-STROKE, which is still ongoing,

neurologists, neuropsychologists, physiotherapists, and music therapy experts formed a multidisciplinary group at the outset to develop a music therapy model where structured and non-structured episodes could alternate within each therapy session. Different therapeutic approaches were observed and reflected upon during the piloting phase of the project, and finally an ideal combination of the activities was defined. The clinical model that resulted from this has aimed to meet the special needs of MCA stroke patients. Music therapists recruited to both projects, were interviewed about their way of working with stroke patients. Music therapists that had worked in acute stroke rehabilitation valued their interaction with patients very highly, and realized how important it was to be aware of both the physical and mental hardships their patients faced after a stroke.

The competence and skills of music therapists are described in Figure 5 and discussed in more detail in the following sections.

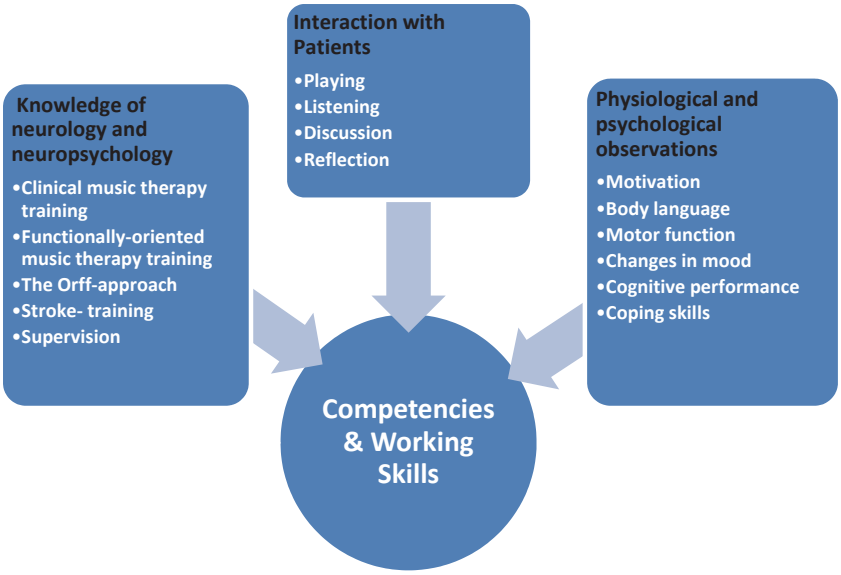


FIGURE 5 Three themes arising from 15 categories that music therapist found necessary to achieve when rehabilitating acute stroke patients.

5.3.1 The neurological aspects in music therapy

Stroke affects patients cognitively, psychologically, emotionally and physically. Neurological aspects like neglect and weak motor skills are crucial challenges in music therapy. The music therapists interviewed in study IV learned to pay attention to the phenomenon that occurred quite often with stroke patients, which was that they sometimes got easily stuck doing one particular movement

and this meant it was hard for them to do anything more varied. Psychologically, it was easier to stay stuck, even if cognitively, physically and emotionally this could prove to be detrimental. The technique the training required was to start the same action all over again from the beginning, with music therapists giving both verbal and musical hints, as well as interventions to help and motivate patients if necessary to progress with their drum playing. The important thing was not to learn and adopt patterns and models that could in fact also prove neurologically detrimental.

The clinical model for active music therapy in the MT-STROKE project was based on a combination of structured musical exercises, pitched at various levels of difficulty; dynamically rhythmic playing, with sequences of movement that changed; interactive clinical improvisation; music-assisted relaxation, and therapeutic discussion. The training that this project provided helped music therapists understand the neurological importance of certain techniques, such as being in the right position when drumming. It also helped them to see more global consequences, such as how important it is in rehearsals to motivate patients to play to the best of their ability. Concentrating on widening motor skills is something, that all the music therapists found to be very important for the patients. Very often people with stroke and neglect can´t concentrate well on they are doing, effectively having to focus on, and relearn some actions that were perhaps previously taken care of by the autonomic nervous system (ANS) before the stroke. Aware of that, music therapists tried to encourage their patients to play drums in the best way from beginning to end, maintaining the players' conscious focus on their actions, by making the activity a little bit harder each time, so that ANS functions could be regained the most effectively. Ellis and Thayer (2010) have explored further the association between the ANS and music, suggesting that the ANS may indeed be one of the most important pathways through which music establishes its therapeutic health effect.

According to recent findings (Thaut et al., 2007; Altenmüller et al., 2009; Schneider et al., 2007, 2010), using musical instruments to improve motor skill recovery is a very effective form of stroke rehabilitation in other ways. Besides ANS recovery, it also helps the respiratory and circulatory systems, and there is now research that shows there is a neurological basis to showing how it has an effect on the emotions. According to Alluri (2012) there is a connection between monophonic timbre in music and the emotions. Her dissertation introduces a new paradigm, that combines neuroimaging, acoustic feature extraction, behavioural methods, and a novel neuroinformatic procedure for the investigation of music feature processing within the brain. It shows how certain aspects of timbre in music might more likely to trigger certain emotions in the brain than others.

Not only the music therapists believed in the effectiveness of their work in post-stroke rehabilitation, but the patients also appreciated the value of music therapy. Indeed, without any of that positive feedback at all, the music therapists would of course not have felt they were doing a good job. One of the patients in MT-STROKE summarized his experience as follows:

"This has been excellent, and I am truly grateful that I got music therapy. I have progressed a lot. In my music therapy all the elements of physiotherapy, occupational therapy and neuropsychological rehabilitation were combined successfully."

5.3.2 Interacting with the patient

From the very start of clinical training, music therapists must use all their senses to be fully aware of the present moment. To observe, interact and utilize their neurological knowledge successfully, they have to reflect upon their way of work, and try to understand what is going on in their patient´s mind at the same time. Empathy is also needed when they are building up a relationship with their patients, and yet they must also feel confident enough to intervene when necessary. This delicate balancing act means, according to Bruscia (1998a), that during the therapy session they must continuously move from the therapist's world into the patient's world so that they can reflect on the experience from that person's perspective, and yet they must not stray too far either side of the border between these two worlds. According to music therapists it is also very important for a music therapist to understand the phenomenon of transference and counter transference when interacting with clients. As a number of studies have shown that the quality of the relationship between therapist and client is pivotal to the effectiveness of any therapy (Orlinsky, Ronnestad & Willutzki, 2004). Benedikte Scheiby (2005), who has been working as an adjunct assistant professor in the music therapy program at NYU, states that the identification and management of countertransference is one of the most essential skills required by a music therapist (Scheiby, 2005). The intimacy of creating music together is especially challenging because the unconscious contents; feelings, strengths and vulnerabilities for both of them are easily accessed through playing, as Austin (2002) points out.

The quality of interaction with patient has been very important theme in this interview-study. According to the findings, music therapists had good interaction skills with their patients. Music therapists are often asked whether it is music therapy, or just music in medicine that they are doing. As mentioned before in chapter 1.2, it is important to make a clear distinction between music interventions administered by medical professionals and those implemented by trained music therapists. This is because music therapists tailor their interventions to meet each patient's specific needs, and engage the patients also in actual music making. In order to achieve the clinical goals, there is a systematic therapeutic relationship established with the patient first, which includes assessment, treatment and evaluation.

In psychotherapy, as well as in music therapy research, there has been an increasing focus on providing evidence that only certain approaches or techniques work effectively for certain groups of clients. This is an attempt to meet all the requirements necessary to provide evidence-based practice (Ronnestad, 2008). But as a consequence of needing to provide as objective evidence as possible, which can compromise the subjective relationship between therapist and

patient, some of the advantages that a therapist brings to the therapy are lost. And because a number of studies have shown that the quality of the relationship between therapist and client is indeed pivotal to the effectiveness of any therapy (Orlinsky et al. 2004), this is a serious consideration that must be taken into account.

In both projects, music therapists were starting with the patients already in hospital. They treated them however, as they would be someone outside hospital, asking about their favourite music and hobbies. Although there were also music therapists working in MuKu, it wasn't the same kind of music therapy as was used in MT-STROKE. But there were lots of similarities in interacting with the patient: music therapists built up a warm relationship and talked about the project with the patients to get an idea of what worked best with each of them, as well as what kinds of music they liked. After hospital, patients were moved to a rehabilitation unit or home. Patients who were at home often found themselves quite lonely and felt glad to get a visit from a music therapist. In MuKu, music therapists kept in weekly contact with listeners, and were able to chat about many things. In both MuKu and MT-STROKE, music therapists were there for their clients, looking out for them, listening to them, empathising with them, encouraging them to do their best, to do the activity, and to discuss the situations they found themselves in. During the sessions in MT-STROKE, the patients were not just left to play on their own, but the level of interaction was maintained by encouraging and helping them to play to the very best of their abilities. At the end of each session there was also a moment to listen to music, reflect, and to give global feedback about the whole recovery process and talk about how they felt the stroke rehabilitation was progressing. One thing that was common to all the therapists interviewed in study IV, was that their clients were the priority, and this has no doubt affected the quality of patient interaction in terms of intensity and sensitivity.

Columbia University Medical Center provides international leadership in basic, pre-clinical, and clinical research in medical and health science education and in patient care. The medical centre trains, for example, physicians, scientists, public health professionals, and nurses. The Programme in Narrative Medicine (PNM) was established in 1996 to break down barriers in health care by providing practitioners with the clinical tools to listen, encourage patient stories, honour the intentions of their patients' and their own stories, and share thoughts and concerns. The PNM brings together health care professionals, patients, faculty and researchers in new ways: it unifies disciplines in a shared university goal – to improve health care through the power of narrative. As a result, patients are treated more empathically and have the opportunity to engage more fully with their own care; understanding and articulating it beyond simply a description of physical symptoms (Columbia University (n.d).

Illness stories were used initially as a way to try and learn about patients' experiences in a hospital setting and also to better understand the experience of suffering. Illness stories are therapeutic for the tellers, because by telling them they have a real opportunity to be heard and to hear themselves, too. By telling

their story they can begin to adjust to the person they have become and even find some kind of explanation for themselves that can comfort. Illness stories can also be therapeutic for others, who have had a chronic illness or disability themselves. Hearing the stories allows them to recognize that they are not alone, and that there are other people who can understand their experience and might even be able to help them. The more stories are told, the more illness stories are enlightening for everyone outside the illness experience too: family, friends, health care professionals and politicians (Hänninen, 2000; Kilty, 2000). With cardiac patients it has been noticed that they find it very important to be able to discuss again and again what happened to them at the beginning of their recovery (Valkonen, 1994). The same kind of behavior was also found among stroke patients when they were interviewed for the present dissertation.

By examining more thoroughly the subjective experience of illness in this dissertation, a dialogue about the treatment of acute stroke and the political role of illness narratives in nursing and health care has been established. According to Sakalys (2000), the empiricist tradition of medicine in the West, with its accompanying objectivism, reductionism and materialism, effectively narrows medicine's focus down to the body and stroke rather than the whole individual who has a stroke. This was seen in hospital, where patients were more easily described by their particular complaint:

"the left hemiplegia in room 15"
"the neglect by the window"

These are systems of identification that are endemic to health care institutions in general, where it is all too easy to objectify the person who is the patient and, in so doing, dominate them quite unnecessarily and perhaps detrimentally. Understandably getting to know a person has to start somewhere, and in a hospital, the fact that all staff knows what is wrong with a patient will of course be very important. But music listening could be helpful in these kinds of situations as a counterbalance to this objectification. As mentioned above in section 5.1.5, talking about music that patients had listened to provide a way into a conversation for nurses with patients who would otherwise find it hard to have a normal conversation due to being seriously ill (Laitinen, 2008). So music listening as a rehabilitative tool could also make it easier for hospital staff to develop constructive subjective relationships with patients.
It no longer has to be the case that sometimes, in health care, the particular physical complaint gets more attention than the whole human being that has a history, interests and dreams for the future of his own.

5.3.3 Observing the physiological and psychological aspects in music therapy

The music therapists in MT-STROKE all mentioned how important and challenging it was to continuously be paying attention to each of their clients while simultaneously conducting the sessions. As mentioned earlier, the sorts of things they were looking out for was each client's motivation; their body lan-

guage; what motor functions were particularly difficult; any changes in mood; their cognitive performance and the things that clients were able to cope with well, and not so well. Usually patients were motivated, which made therapy easier, but very often they also got quite exhausted in sessions. Observing this in time was very important to ensure that they did not get demotivated and stuck in one particular movement. The music therapist had to watch carefully to ensure that intervention did not come too late.

Another priority for observation among the therapists was each patient's mood, in other words, to be aware of how they might be coping with mood swings, since depression is a very typical symptom among stroke sufferers (Berg et.al. 2003). Some of the therapists suggested that, immediately after a stroke, more attention should be paid to patients' mental well being - in other words, not just the immediate physical effects of stroke, but also their state of mind. Since emotional disturbances and fatigue are frequent after the acute stroke, it is very important to observe these during music therapy sessions (Ferro, Caeiro, & Santos, 2009; Annoni, Staub, Bogousslavsky & Brioschi, 2008).

6 FUTURE DIRECTIONS

6.1 Future implications for research

The current research has revealed more about what music and music therapy really feels like for patients in stroke rehabilitation. The aim was to increase understanding of the patient's perspective in acute stroke rehabilitation, so that good practice in stroke rehabilitation can be better appreciated.

This research also shed some light on the possibilities of music therapy in stroke units and hospitals, and what it is music therapists actually need to do. But since there are not so many music therapists working in acute stroke care, more evidence-based research is needed in this area at least in Finland.

One possible future direction for me as a researcher would be to find out how music listening using a modified guided imagery model (GIM) might work most effectively with stroke patients. Deepening the music listening experience with a form of GIM could give more information about patients' affective experiences, their coping mechanisms, and the model could have a neurological basis to find out more about what actually happens in the brain during GIM-session.

Music therapy, as well as dance-movement therapy actively engages the brain through interventions that impact the psychological through working through aspects of how we function physically. Recent discoveries in implicit and explicit memory processing, and on the mirror neuron system provide insights into the very physical nature of perception (e.g., through imitation), thus redefining the interrelationship between body and mind (Hart, 2008; Cruz, 2006; Homann, 2010). Because of this, it could be interesting to compare music therapy and dance movement therapy from a neurobiological perspective in acute stroke rehabilitation.

6.2 Future implications for clinical practice

I have always felt more of a clinician with "a mission" than a researcher. These quite novel findings encourage the use of music for stroke rehabilitation not only in Finland, which has its own cultural characteristics in hospitals, but also worldwide. In study II, it seemed that nurses would have liked to have more multidisciplinary education into the possibilities of using music more often in their work. This leads us to a question: how could music listening as a therapeutic activity be arranged more easily in hospitals? One answer to this question could be that music therapists educate nurses to conduct music listening in hospitals as a form of first aid as Laitinen suggests (2008).

Indeed, one possible future application of these findings would be to show further how therapeutic activities using music listening are easy to implement and are of course far better than no stroke rehabilitation tools at all, which is sometimes the case. This research has shown how music listening as a therapeutic activity can make use of resources presently available (libraries and CD players) and perhaps it has shown how this kind of activity could be very practical even in hospital wards where staff have few resources and little time. With the help of library and family members, suitable music CDs can be found for everyone. Also, active music therapy should start as soon as possible. Projects like MuKu and MT-STROKE can show the way for other hospitals and stroke units to hire music therapists and start music listening and the use of active music therapy in tandem with other therapists, nurses and neurologists.

However, interacting with acute stroke patients has to be done in a sensitive, affective, reflective and intuitive way. Not everyone is able to do that, because of lack of time or resources in the hospital. This is why music therapists receive the education they do, to interact with their clients in a special way, and they can focus on this unlike most nurses who are likely to be very busy with many other tasks simultaneously. Getting music therapists into settings where they can share their knowledge with as many health staff who are in the front lines of stroke rehabilitation might be one way to maximize all the good clinical practice that this dissertation has shown to be effective.

TIIVISTELMÄ

Suomessa aivoverenkiertohäiriöt (AVH) ovat kakkossijalla kuolemaan johtavissa sairauksissa. AVH aiheuttaa lisäksi maailmanlaajuisesti ajatellen kolmanneksi eniten vammautumisia ja muita liitännäissairauksia. Terveydenhoidon kustannuksista pelkästään Suomessa AVH vie kolmanneksi eniten rahaa heti Alzheimerin taudin ja skitsofrenian jälkeen. Kuntoutuskäytännöt ja mahdollisuus päästä kuntoutukseen vaihtelevat suuresti Suomessa alueittain, vaikka tiedetään, että AVH-potilaan on tärkeää päästä kuntoutumaan mahdollisimman pian sairastumisen jälkeen.

Musiikkiterapian käyttö aivoinfarktipotilaiden akuutissa hoidossa ei ole kovin yleistä. Tämän tutkimuksen tarkoituksena on ollut kerätä potilaiden ja heidän kuntoutukseen osallistuneiden musiikkiterapeuttien kokemuksia musiikin kuuntelun ja musiikkiterapian käytöstä aivoinfarktin akuutissa vaiheessa. Musiikin kuuntelun vaikutusta tutkittiin v. 2004-2006 toteutuneen Musiikin kuuntelu-projektin (MuKu) aikana, jolloin 60 aivoinfarktiin sairastunutta potilasta jaettiin satunnaisesti musiikin kuunteluryhmään, äänikirjojen kuunteluryhmään ja kontrolliryhmään. Potilaat haastateltiin alussa ja lopussa, ja heidän subjektiivisia kokemuksiaan verrattiin keskenään. Päivittäinen musiikin kuuntelu paransi kielellisen muistin ja tarkkaavaisuuden suuntaamisen toipumista ja ehkäisi masentuneisuutta ja sekavuutta aivoinfarktin jälkeisinä kuukausina. Verrattaessa musiikin kuuntelijoiden kokemuksia äänikirjojen kuuntelijoiden kokemuksiin, huomattiin erityisesti musiikin rentouttava, virkistävä ja mielialaa muuttava vaikutus. Musiikin kuuntelu aktivoi potilaita liikkumaan ja tekemään kotitaloustöitä, kun taas äänikirjojen kuuntelijat keskittyivät pelkästään kuuntelutehtäväänsä. Potilailla oli aikaa kuunnella potilashuoneissaan varsinkin viikonloppuisin, jolloin mitään muuta ei ollut tarjolla. He saivat myös kotiuduttuaan musiikin kuuntelusta seuralaisen, joka kannusti liikkumaan, tekemään kotitaloustöitä ja lähtemään ulos. Musiikin kuuntelun emotionaaliset vaikutukset mielialaa kohottavana koettiin hyvin tärkeinä. Musiikki herätti myös muistoja, joista potilaat mieluusti keskustelivat musiikkiterapeutin, hoitajien ja potilastovereiden kanssa. Kontakti levyjä tuoviin musiikkiterapeutteihin oli viikoittaista kahden kuukauden seurantajakson ajan ja yhteydenpito koettiin merkityksellisenä.

Aktiivinen musisointi musiikkiterapian keinoin vaatii sekä aivoinfarktipotilaalta, että musiikkiterapeutilta paljon. Potilastyössä musiikkiterapeutti tarvitsee neurologista tietämystä aivoinfarktista ja potilaan kyvyistä selviytyä erilaisista liikerajoja laajentavista soittotehtävistä. Tavoitteiden asettaminen realistiselle, mutta riittävälle tasolle kunkin potilaan kohdalla vaatii tarkkaa suunnittelua, havainnointikykyä ja hyviä vuorovaikutustaitoja. Musiikkiterapeuttien (N=6) haastattelutulosten perusteella on nähtävissä, että täydennyskoulutuksen käyneiden musiikkiterapeuttien kompetenssia ja taitoja työskennellä AVH-keskuksissa voisi laajemminkin hyödyntää.

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ORIGINAL PAPERS

I

MUSIC LISTENING ENHANCES COGNITIVE RECOVERY AND MOOD AFTER MIDDLE CEREBRAL ARTERY STROKE

by

Teppo Särkämö, Mari Tervaniemi, Sari Laitinen, Anita Forsblom, Seppo Soinila, Mikko Mikkonen, Taina Autti, Heli M., Silvennoinen Jaakko Erkkilä, Matti Laine, Isabelle Peretz & Marja Hietanen 2008

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Music listening enhances cognitive recovery and mood after middle cerebral artery stroke

Teppo Särkämö,[1] Mari Tervaniemi,[1] Sari Laitinen,[2] Anita Forsblom,[2] Seppo Soinila,[3] Mikko Mikkonen,[1] Taina Autti,[4] Heli M. Silvennoinen,[4] Jaakko Erkkilä,[2] Matti Laine,[5] Isabelle Peretz[6] and Marja Hietanen[3]

[1]Cognitive Brain Research Unit, Department of Psychology, University of Helsinki, and Helsinki Brain Research Centre, Helsinki, [2]Department of Music, University of Jyväskylä, Jyväskylä, [3]Department of Neurology and [4]Department of Radiology, Helsinki University Central Hospital, Helsinki, [5]Department of Psychology, Åbo Akademi University, Turku, Finland and [6]Department of Psychology, University of Montreal, Montreal, Canada

Correspondence to: Teppo Särkämö, MA, Cognitive Brain Research Unit, Department of Psychology, PO Box 9 (Siltavuorenpenger 20 C), FIN-00014 University of Helsinki, Finland
E-mail: teppo.sarkamo@helsinki.fi

We know from animal studies that a stimulating and enriched environment can enhance recovery after stroke, but little is known about the effects of an enriched sound environment on recovery from neural damage in humans. In humans, music listening activates a wide-spread bilateral network of brain regions related to attention, semantic processing, memory, motor functions, and emotional processing. Music exposure also enhances emotional and cognitive functioning in healthy subjects and in various clinical patient groups. The potential role of music in neurological rehabilitation, however, has not been systematically investigated. This single-blind, randomized, and controlled trial was designed to determine whether everyday music listening can facilitate the recovery of cognitive functions and mood after stroke. In the acute recovery phase, 60 patients with a left or right hemisphere middle cerebral artery (MCA) stroke were randomly assigned to a music group, a language group, or a control group. During the following two months, the music and language groups listened daily to self-selected music or audio books, respectively, while the control group received no listening material. In addition, all patients received standard medical care and rehabilitation. All patients underwent an extensive neuropsychological assessment, which included a wide range of cognitive tests as well as mood and quality of life questionnaires, one week (baseline), 3 months, and 6 months after the stroke. Fifty-four patients completed the study. Results showed that recovery in the domains of verbal memory and focused attention improved significantly more in the music group than in the language and control groups. The music group also experienced less depressed and confused mood than the control group. These findings demonstrate for the first time that music listening during the early post-stroke stage can enhance cognitive recovery and prevent negative mood. The neural mechanisms potentially underlying these effects are discussed.

Keywords: stroke; rehabilitation; music; cognition; emotions

Abbreviations: FLAIR = fluid-attenuated inversion recovery; MCA = middle cerebral artery; MRI = magnetic resonance imaging; QOL = quality of life; RT = reaction time

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Introduction

During the first weeks and months of recovery after a stroke, the brain can undergo dramatic plastic changes (Witte, 1998; Kreisel *et al.*, 2006) that can be further enhanced by stimulation provided by the environment. Post-stroke motor and somatosensory environmental enrichment (Johansson, 2004; Nithianantharajah and Hannan, 2006), virtual environments (You *et al.*, 2005), and electrical cortical and peripheral stimulation (Hummel and Cohen, 2005) have all been shown to improve motor recovery. Interestingly, multimodal stimulation, including auditory, visual and olfactory stimuli, combined to the enriched motor environment enhanced motor and cognitive recovery more than the enriched motor environment alone (Maegele *et al.*, 2005). Evidence from developmental animal studies also suggests that an enriched sound environment can enhance auditory cortical functions (Engineer *et al.*, 2004) as well as learning and memory (Chikahisa *et al.*, 2006; Kim *et al.*, 2006;

Angelucci *et al*., 2007*a*). In humans, the effects of an enriched sound environment on recovery from neural damage have, however, not been systematically studied.

In the human brain, one of the most powerful sources of auditory stimulation is provided by music (Sacks, 2006). Listening to music is a complex process for the brain, since it triggers a sequel of cognitive and emotional components with distinct neural substrates (Peretz and Zatorre, 2005). Recent brain imaging studies have shown that neural activity associated with music listening extends well beyond the auditory cortex involving a wide-spread bilateral network of frontal, temporal, parietal and subcortical areas related to attention, semantic and music-syntactic processing, memory and motor functions (Bhattacharya *et al*., 2001; Janata *et al*., 2002; Koelsch *et al*., 2004; Popescu *et al*., 2004), as well as limbic and paralimbic regions related to emotional processing (Blood *et al*., 1999; Blood and Zatorre, 2001; Brown *et al*., 2004; Koelsch *et al*., 2006; Menon and Levitin, 2005). Music has a well-documented effect on alleviating anxiety, depression and pain in patients with a somatic illness (Cassileth *et al*., 2003; Cepeda *et al*., 2006; Siedliecki and Good, 2006). Recent cognitive and neuropsychological studies suggest that it may also enhance a variety of cognitive functions, such as attention, learning, communication and memory, both in healthy subjects (Wallace, 1994; Thompson *et al*., 2001; Thompson *et al*., 2005; Schellenberg *et al*., 2007) and in clinical conditions, such as dyslexia (Overy, 2003), autism (Gold *et al*., 2006), schizophrenia (Talwar *et al*., 2006), multiple sclerosis (Thaut *et al*., 2005), coronary artery disease (Emery *et al*., 2003) and dementia (Brotons and Koger, 2000; Foster and Valentine, 2001; Van de Winckel *et al*., 2004). In stroke rehabilitation, elements of music have previously been used as a part of physiotherapy (Thaut *et al*., 1997) and speech therapy (Belin *et al*., 1996) to enhance the recovery of motor and speech functions. In addition, nonverbal auditory stimuli have been shown to temporarily ameliorate left visual neglect after stroke (Hommel *et al*., 1990). However, the knowledge about the long-term effects of everyday music listening itself on the recovery of cognitive and emotional functions after stroke is very limited.

The purpose of this single-blind, randomized and controlled trial was to determine whether regular self-directed music listening during the first months after middle cerebral artery (MCA) stroke can enhance the recovery of cognitive functions and mood. Since the brain areas involved in music processing are mainly supplied by the MCA (Ayotte *et al*., 2000) we hypothesized that, in addition to engaging cognitive and emotional networks, music listening would also stimulate both the perilesional and healthy brain areas that normally show increased excitability and adaptability in this subacute recovery phase (Kreisel *et al*., 2006), and thereby enhance and speed up the spontaneous recovery process. As listening to real music, especially if it contains lyrics, activates the brain bilaterally, we also hypothesized that it would facilitate the recovery from unilateral stroke more than listening to purely verbal material, which activates primarily the left hemisphere (Zatorre *et al*., 2002; Tervaniemi and Hugdahl, 2003). Thus, we compared the effect of music listening both to the effect of listening to audio books and to normal spontaneous recovery.

Methods

Subjects and procedure

Subjects ($n = 60$) were stroke patients recruited between March 2004 and May 2006 from the Department of Neurology of the Helsinki University Central Hospital (HUCH) after been admitted to the hospital for treatment of acute stroke. Following inclusion criteria were used: (1) an acute ischaemic MCA stroke in the left or right temporal, frontal, parietal or subcortical brain regions, (2) no prior neurological or psychiatric disease, (3) no drug or alcohol abuse, (4) no hearing deficit, (5) right-handed, (6) $\leqslant 75$ years old, (7) Finnish-speaking and (8) able to co-operate. Eligible patients were randomly assigned to one of three groups: a music group, a language group or a control group ($n = 20$ in each) as soon as possible after hospitalization. Randomization was performed with a random number generator by a researcher not involved in the patient enrollment. The study was approved by the HUCH Ethics Committee, and all patients signed an informed consent. All patients received standard treatment for stroke in terms of medical care and rehabilitation. All patients underwent a clinical neuropsychological assessment and a magnetoencephalographic (MEG) measurement 1 week (baseline), 3 months and 6 months post-stroke, and magnetic resonance imaging (MRI) within 2 weeks of the stroke and 6 months post-stroke. The results from the MEG part of the study will be presented in another paper.

Of the 60 subjects originally recruited in to the study, 55 completed the study up to the 3-month follow-up (music group $n = 19$, language group $n = 19$ and control group $n = 17$). Of the five drop-outs, one was due to false diagnosis (transient ischaemic attack), one due to a new stroke, one due to dementia and two due to refusal. One further subject died from myocardial infarction before the 6-month follow-up (music group $n = 18$, language group $n = 19$ and control group $n = 17$ at the 6-month stage).

Interventions

After agreeing to participate in the study, all patients were individually contacted by a music therapist (author S.L. or A.F.) who interviewed them about their pre-stroke leisure activities and hobbies, such as music listening and reading, and informed them about the group allocation. The music therapists provided the patients in the music group with portable CD players and CDs of their own favourite music in any musical genre. Similarly, they provided the patients in the language group with portable cassette players and narrated audio books on cassette selected by the patients from a collection of the Finnish Celia library for the visually impaired (http://www.celialib.fi). The patients in both groups were then trained in using the players and were instructed to listen to the material by themselves daily (minimum 1 h per day) for the following 2 months while still in the hospital or at home. The patients were also asked to keep a listening diary. During the 2-month period, the music therapists kept close weekly

contact with the patients to encourage listening, to provide more material, and to give practical aid in using the equipment, if needed. Also nursing staff of the hospital wards and relatives of the patients were informed about the study, and were asked to help the patients in using the equipment, if needed. The protocol in the music and language groups was therefore identical with the only difference being the type of listening material used. The control group was not given any listening material. All patients were interviewed about their leisure activities again after the 2-month intervention and at the 6-month follow-up.

In order to test for differences between the emotional responses and preferences to music and verbal material, a short behavioural listening experiment was also performed by the music therapists at the acute stage, before the intervention. In this experiment, two short musical pieces and narrated poems, which were either happy or sad (as judged by the therapists), were first presented to the patients. Thereafter they were interviewed about the emotions, thoughts and memories evoked by those. From these qualitative data, we scored individually for each patient whether the stimulus (happy or sad) evoked any emotions, and which stimulus type (music or poems) was preferred.

Structural brain imaging

MRI was performed within 2 weeks of stroke onset and 6 months post-stroke using the 1.5 T Siemens Vision scanner of the HUCH Department of Radiology. The first MRI was used to verify the stroke diagnosis and the second to evaluate the size and location of the lesion without the interfering effect of the acute stage oedema. Size was evaluated from fluid-attenuated inversion recovery (FLAIR) images by measuring the maximum diameter of the lesion, or in case of multiple lesions the sum of the diameters, in the sagittal, coronal or horizontal plane. Following subcategories were used in classifying the location(s) of the lesion(s) within the damaged hemisphere: frontal lobe, temporal lobe, parietal lobe, insula and subcortical structures or white matter.

Outcome measures

Clinical neuropsychological assessment was performed on all patients at the baseline (1 week from stroke onset), and repeated again 3 months and 6 months post-stroke. The researchers involved in these studies (authors T.S. and M.M.) were blinded to the group allocation of the patients. An extensive neuropsychological test battery was used to evaluate the following cognitive domains: verbal memory, short-term and working memory, language, visuospatial cognition, music cognition, executive functions, focused attention and sustained attention. Summary scores of the tests measuring each cognitive domain were used in the statistical analyses. Parallel test versions of the memory tests were used in different testing occasions to minimize practice effects. Reaction time (RT) tests were always performed using the better, non-paretic hand. All assessments were carried out in a quiet room reserved for neuropsychological studies. The baseline assessment was carried out in two or three testing sessions to avoid interference due to fatigue.

Verbal memory was evaluated with the story recall subtest from the Rivermead Behavioural Memory Test (RBMT; Wilson *et al.*, 1985) and an auditory list-learning task. In the story recall, both immediate and delayed recall scores were used. In the list-learning task, a 10-word list was presented orally three times, and after each presentation the subjects were requested to recall as many words as they could. Total score of the three trials and delayed recall score were used. *Short-term and working memory* was assessed with the digit span subtest from the Wechsler Memory Scale—Revised (WMS-R; Wechsler, 1987) and a memory interference task, in which the subjects were first orally presented with three words, then asked to perform a short mental arithmetic or verbal task, and then asked to recall the words again. *Language* was evaluated with the word and sentence repetition and reading subtests from the Finnish version (Laine *et al.*, 1997) of the Boston Diagnostic Aphasia Examination (BDAE; Goodglass and Kaplan, 1983), the verbal fluency and naming subtests from the CERAD battery (Morris *et al.*, 1989), and a shortened version of the Token Test (De Renzi and Faglioni, 1978). *Visuospatial cognition* was assessed with a clock task (Lezak *et al.*, 2004), in which both setting clock hands and recognition of time was evaluated; a copying task (Lezak *et al.*, 2004), in which copying of four geometric drawings (triangle, flag, cube, cross) was evaluated; a shortened version of the Benton Visual Retention Test (BVRT; Benton, 1974); and subtest B from the Balloons Test (Edgeworth *et al.*, 1998). *Music cognition* was evaluated with the scale and rhythm subtests from the shortened version of the Montreal Battery of Evaluation of Amusia (MBEA; Peretz *et al.*, 2003), which was administered at baseline and 3 months post-stroke. *Executive functions* were assessed with the Frontal Assessment Battery (FAB; Dubois *et al.*, 2000). Attention was evaluated with the CogniSpeed© reaction time software (Revonsuo and Portin, 1995), which has previously been used, for example, in studies of multiple sclerosis (Kujala *et al.*, 1994) and brain tumors (Lilja *et al.*, 2001). *Focused attention*, the executive ability to control and perform mental operations and resolve conflicts among responses (Raz and Buhle, 2006), was assessed with summed correct responses and summed RTs of the mental subtraction and Stroop subtests. *Sustained attention*, the ability to achieve and maintain an alert state (Raz and Buhle, 2006), was evaluated with the percentage of correct responses in the vigilance subtest and summed RTs in the vigilance and simple reaction time subtests.

In addition to cognitive functions, also mood was evaluated at baseline and 3 and 6 months post-stroke using the shortened Finnish version (Hänninen, 1989) of the Profile of Mood States (POMS; McNair *et al.*, 1981). It contains 38 items that form following eight subscales: tension, depression, irritability, vigor, fatigue, inertia, confusion and forgetfulness. Also quality of life (QOL) was assessed 3 and 6 months post-stroke with both a self-reported and a proxy-reported Stroke and Aphasia Quality Of Life Scale-39 (SAQOL-39; Hilari *et al.*, 2003) questionnaire.

Data analysis

Group differences in the baseline characteristics of the patients and in the amount of rehabilitation received during the follow-up were analysed with one-way analyses of variance (ANOVA), Kruskal–Wallis tests, *t*-tests and chi-square tests. Group differences in mood and QOL 3 and 6 months post-stroke were analysed with one-way ANOVAs. Recovery in the cognitive domains and mood was analysed using a mixed-model ANOVA with a within-subjects factor of time (baseline, 3-month stage and 6-month stage) and between-subjects factors of group (music, language and control) and lesion laterality (left and right). The Greenhouse–Geisser epsilon was used to correct for sphericity. Main effects of time and group as well as time × group and time × group × lesion laterality

Table 1 Baseline demographic and clinical characteristics of the three patient groups

Variable	Music group ($n = 19$)	Language group ($n = 19$)	Control group ($n = 17$)	*P*-value
Age (years)	56.1 (9.6)	59.3 (8.3)	61.5 (8.0)	0.178 (F)
Gender (male/female)	12/7	9/10	8/9	0.531 (χ^2)
Education (years)	11.2 (4.3)	11.8 (3.0)	9.7 (3.3)	0.198 (F)
Living alone (yes/no)	4/15	5/14	3/14	0.817 (χ^2)
Music listening prior to stroke[a]	4.0 (1.5)	3.2 (1.4)	3.4 (1.6)	0.115 (K)
Radio listening prior to stroke[a]	4.5 (1.1)	4.1 (1.2)	4.3 (1.2)	0.560 (K)
Reading prior to stroke[a]	4.0 (0.9)	4.0 (0.7)	4.2 (0.9)	0.558 (K)
Time from stroke to baseline (days)	5.6 (2.3)	7.1 (3.9)	5.9 (3.0)	0.313 (F)
Time from stroke to treatment (days)	7.4 (2.8)	9.6 (3.4)	9.2 (5.4)	0.191 (F)
Motor deficit severity[b]	1.4 (1.0)	1.2 (1.0)	1.4 (1.2)	0.849 (K)
Aphasia[c] (yes/no)	7/12	6/13	6/11	0.941 (χ^2)
Aphasia severity[c]	2.6 (1.4)	2.8 (1.5)	2.7 (1.0)	0.938 (F)
Visual neglect[d] (yes/no)	5/14	7/12	4/13	0.644 (χ^2)
Antidepressants[e] (yes/no)	6/13	5/14	2/15	0.356 (χ^2)
Lesion laterality (left/right)	10/9	8/11	8/9	0.809 (χ^2)
Lesion size[f]	5.4 (2.7)	5.0 (2.1)	5.8 (2.4)	0.543 (F)
Lesion in frontal lobe (yes/no)	16/3	12/7	13/4	0.322 (χ^2)
Lesion in temporal lobe (yes/no)	11/8	15/4	14/3	0.195 (χ^2)
Lesion in parietal lobe (yes/no)	10/9	12/7	10/7	0.804 (χ^2)
Lesion in insula (yes/no)	11/8	13/6	12/5	0.686 (χ^2)
Lesion in subcortical or WM areas (yes/no)	9/10	11/8	8/9	0.753 (χ^2)

Data are mean (SD) unless otherwise stated. WM = white matter; F = one-way ANOVA; χ^2 = chi-square test; K = Kruskal–Wallis test. [a]Numbers denote values on a Likert scale with a range 0 (does never) to 5 (does daily). [b]Numbers denote values on a Likert scale with a range 0 (no deficit) to 3 (hemiplegia). [c]BDAE Aphasia Severity Rating Scale: scores 0–4 = aphasia, score 5 = no aphasia. For aphasic patients, the mean score (range 0–4) is shown. [d]Cut-off from the Lateralized Inattention Index of the Balloons Test. [e]Antidepressant medication (citalopram or mirtazapin) used in the acute post-stroke phase. [f]Maximum lesion diameter in cm (see Methods for details).

interactions are reported. All *post hoc* analyses were performed with Tukey's honestly significant difference test. For the mixed-model ANOVA, *post hoc* tests were performed on change scores from the baseline to the 3-month stage and from the baseline to the 6-month stage. Relationships between the cognitive domains were also analysed with Pearson's correlation coefficients. The level of statistical significance was set at $P < 0.05$. All statistical analyses were performed using SPSS (version 14.0). Missing values in test scores were considered missing at random.

Results

There were no statistically significant differences between the groups in the baseline demographic or clinical variables or in relevant leisure activities prior to stroke (Table 1). There were also no significant group differences in the baseline cognitive performance or mood (Table 2). The groups did not differ significantly in the antidepressant medication received at the acute stage or in rehabilitation received in public health care during the follow-up period (Tables 1 and 3). In the short pre-intervention listening experiment, emotions were evoked in the majority of both music and language group patients after both music listening (63% versus 81%; χ^2(Yates' correction) = 0.3, $P = 0.567$) and poem listening (72% versus 94%; χ^2 (Yates' correction) = 1.4, $P = 0.233$), and the proportion of patients who preferred music was highly similar in both groups (50% versus 56%; $\chi^2 = 0.1$, $P = 0.716$). Thus, the emotional response to and preference for music and verbal material were comparable at baseline.

There were, however, highly significant differences between the groups in the frequency of listening to music and audio books both at the 3-month and at the 6-month post-stroke stage (Table 3): the music group listened to music more than the language group or the control group, whereas the language group listened to audio books more than the music group or the control group ($P < 0.005$ in all pair-wise comparisons). This indicates that the study protocol worked well. One might expect that the patients with damage to the language-dominant hemisphere would have more difficulties in listening to audio books than music, and would thus spend less time listening to them. However, a further group comparison within the left hemisphere-lesioned patients showed that the amount of daily listening (hours per day) in the music group ($M = 1.6$, SD = 0.7) and in the language group ($M = 1.3$, SD = 0.5) did not differ significantly [$t(13) = 0.68$, $P = 0.511$]. Analysis of the listening diaries kept by the music group patients showed that 62% of all music selections were popular music (pop, rock or rhythm and blues), 10% was jazz, 8% was folk music and 20% was classical or spiritual music. All in all, 63% of the music contained lyrics in a language that the patients could understand (mostly Finnish or English).

Figure 1 illustrates the recovery in the 10 cognitive domains in all three patient groups. In a mixed-model ANOVA, the within-subjects main effect of time was significant in the domains of verbal memory [$F(2, 96) = 56.5$, $P < 0.001$], short-term and working memory [$F(2, 90) = 8.7$, $P < 0.001$], language [$F(1.2, 51.9) = 26.5$, $P < 0.001$], visuospatial

Table 2 Baseline cognitive performance and mood in the three patient groups

	Music group ($n = 19$)	Language group ($n = 19$)	Control group ($n = 17$)	*P*-value
Cognitive domain[a]				
Verbal memory (max. 124)	45.1 (21.2)	60.7 (21.7)	50.0 (25.6)	0.105 (F)
Short-term and working memory (max. 42)	19.7 (9.4)	23.3 (7.2)	17.7 (9.5)	0.164 (F)
Language (max. 162)	109.2 (36.8)	122.1 (28.3)	110.7 (31.7)	0.405 (K)
Music cognition (max. 28)	19.9 (4.5)	19.2 (5.2)	17.1 (3.5)	0.183 (K)
Visuospatial cognition (max. 105)	82.8 (23.4)	89.2 (13.3)	77.3 (23.7)	0.174 (K)
Executive functions (max. 18)	12.6 (3.7)	13.9 (3.5)	12.6 (3.6)	0.344 (K)
Focused attention (correct responses) (max. 90)	74.8 (19.5)	84.3 (8.5)	87.3 (3.2)	0.105 (K)
Focused attention (RT, s)	3.0 (1.1)	3.4 (1.5)	3.7 (2.0)	0.797 (K)
Sustained attention (correct responses) (max. 100)	87.0 (23.0)	91.1 (12.1)	95.9 (7.4)	0.542 (K)
Sustained attention (RT, s)	1.0 (0.3)	1.2 (0.5)	1.0 (0.2)	0.656 (K)
Profile of Mood States (POMS) subscale				
Tension (max. 16)	3.9 (3.4)	4.4 (3.6)	3.9 (2.7)	0.870 (F)
Depression (max. 28)	7.0 (7.3)	6.1 (6.7)	8.5 (7.4)	0.615 (F)
Irritability (max. 28)	4.4 (6.2)	4.7 (6.4)	4.7 (4.2)	0.987 (F)
Vigor (max. 24)	10.7 (5.6)	9.1 (5.3)	10.1 (6.3)	0.698 (F)
Fatigue (max. 12)	5.4 (2.9)	4.6 (2.7)	4.2 (4.1)	0.514 (F)
Inertia (max. 12)	2.7 (2.4)	2.8 (2.8)	3.6 (3.2)	0.578 (F)
Confusion (max. 20)	7.1 (4.0)	7.4 (4.5)	8.8 (4.8)	0.481 (F)
Forgetfulness (max. 12)	4.3 (2.6)	4.5 (2.6)	4.8 (3.1)	0.862 (F)

Data are mean (SD). RT = reaction time; F = one-way ANOVA; K = Kruskal–Wallis test.
[a]Summary scores of the neuropsychological tests measuring each cognitive domain.

Table 3 Music and audio book listening and other rehabilitation in the three patient groups at the three month and the six month post-stroke stage

Variable	Music group ($n = 19/18$)	Language group ($n = 19$)	Control group ($n = 17$)	*P*-value
Music listening[a]				
3 m	5.0 (0)	1.6 (1.9)	1.7 (2.2)	<0.001 (K)
6 m	4.5 (0.6)	2.8 (1.7)	2.0 (1.8)	<0.001 (K)
Audio book listening[a]				
3 m	0.1 (0.2)	4.5 (1.2)	0.4 (1.2)	<0.001 (K)
6 m	0.3 (1.0)	3.3 (1.8)	0.4 (1.0)	<0.001 (K)
Physical therapy[b]				
3 m	14.5 (23.9)	11.7 (21.1)	6.8 (10.5)	0.810 (K)
6 m	21.1 (34.9)	21.2 (34.4)	11.6 (19.5)	0.922 (K)
Occupational therapy[b]				
3 m	6.2 (10.0)	3.2 (5.1)	4.0 (6.2)	0.827 (K)
6 m	10.4 (16.7)	5.7 (11.8)	7.1 (14.3)	0.753 (K)
Speech therapy[b]				
3 m	6.1 (7.4)	3.2 (7.7)	2.7 (4.6)	0.403 (K)
6 m	8.3 (14.0)	2.9 (6.7)	5.4 (9.3)	0.476 (K)
Neuropsychological rehabilitation[b]				
3 m	3.2 (6.1)	2.0 (3.2)	0.6 (1.6)	0.269 (K)
6 m	4.3 (7.8)	5.2 (7.6)	2.4 (4.2)	0.849 (K)

Data are mean (SD). 3 m = 3 month post-stroke stage; 6 m = 6 month post-stroke stage; K = Kruskal–Wallis test.
[a]Numbers denote values on a Likert scale with a range 0 (does never) to 5 (does daily). [b]Number of therapy sessions.

cognition [$F(1.4, 58.5) = 18.6$, $P < 0.001$], focused attention (correct responses) [$F(1.6, 59.3) = 3.5$, $P = 0.045$], focused attention (RT) [$F(1.2, 45.7) = 15.7$, $P < 0.001$], sustained attention (correct responses) [$F(1.3, 57.3) = 8.8$, $P = 0.002$], sustained attention (RT) [$F(1.2, 51.4) = 8.5$, $P = 0.003$], music cognition [$F(1, 47) = 20.6$, $P < 0.001$] and executive functions [$F(1.8, 82.8) = 30.6$, $P < 0.001$]. The between-subjects main effect of group was not significant in any cognitive domain.

The time × group interaction was, however, significant in the domains of verbal memory [$F(4, 96) = 4.7$, $P = 0.002$] and focused attention (correct responses) [$F(3.2, 59.3) = 3.9$, $P = 0.012$]. *Post hoc* tests of the change scores showed that at the 3-month stage verbal memory recovery was significantly better in the music group than in the control group ($P = 0.049$) or in the language group ($P = 0.006$). Focused attention recovery was significantly better in the music group than in the control group ($P = 0.049$) and also marginally better in the music group than in the language group ($P = 0.058$). At the 6-month stage, verbal memory recovery was significantly better in the music group than in the language group ($P = 0.006$), and focused attention recovery was significantly better in the music group than in the control group ($P = 0.008$) or in the language group ($P = 0.016$). A further analysis also showed that, across all patients, the correlation between the focused attention (correct responses) score and the verbal memory score was significant at baseline ($r = 0.32$, $P = 0.037$) and at the 3-month ($r = 0.54$, $P < 0.001$) and 6-month ($r = 0.49$, $P < 0.001$) stages.

In addition, the time × group × lesion laterality interaction was significant in focused attention (correct responses) [$F(3.2, 59.3) = 4.1$, $P = 0.009$]. Separate mixed-model ANOVAs for the left hemisphere-lesioned patients and the right hemisphere-lesioned patients showed that the time × group interaction was significant only in the left hemisphere-lesioned patients [$F(3.0, 25.7) = 4.5$, $P = 0.011$]. *Post hoc* tests of the change scores showed that in the left

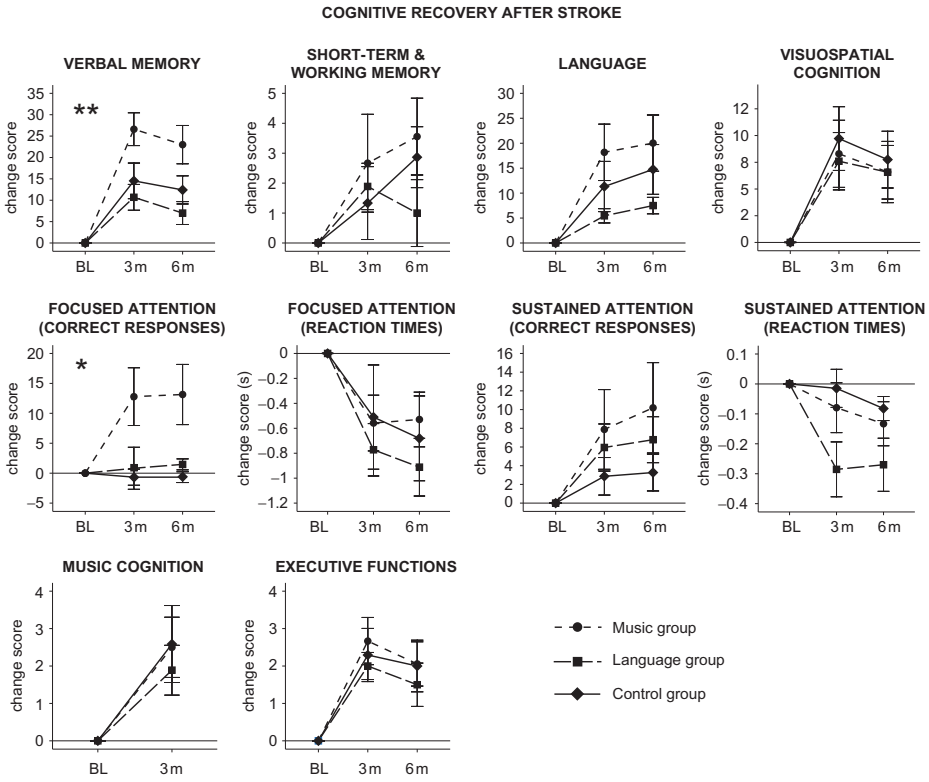

Fig. 1 Changes in the 10 cognitive domains (mean ± SEM) from the baseline (BL; 1-week post-stroke stage) to the 3-month (3 m) and the 6-month (6 m) post-stroke stage (baseline score subtracted from the values) in the three patient groups. $^{**}P < 0.01$, $^{*}P < 0.05$ by mixed-model ANOVA.

hemisphere-lesioned patients focused attention recovery was significantly better in the music group than in the language group ($P = 0.019$), and also marginally better in the music group than in the control group ($P = 0.092$) at the 3-month stage. At the 6-month stage, recovery was significantly better in the music group than in the language group ($P = 0.036$) or in the control group ($P = 0.041$).

Figure 2 illustrates the 3- and 6-month post-stroke POMS scores in the three patient groups. No significant time × group or time × group × lesion laterality interactions were observed in a mixed-model ANOVA ($P = 0.378$–0.859 in all subscales), indicating, thus, that the intervention did not induce systematic changes on mood from the baseline to the 3- and 6-month stages. However, the emotional reactions of the patients are typically highly variable in the acute post-stroke stage, encompassing sadness, passivity, withdrawal, crying, catastrophic reactions, lack of adaptation, disinhibition, anosognosia and aggressiveness (Bogousslavsky, 2003). Consequently, the emotional status of the patients can change rapidly during the first days and weeks after the stroke. Thus, the changes that take place between the acute and the 3-month post-stroke stage vary considerably between patients, and more stable effects on mood, such as post-stroke depression, appear usually later, only about 3–4 months after the stroke (Carota *et al.*, 2002). Therefore, directly comparing mood assessed with POMS at the acute and at the 3- and 6-month stages may not be reliable due to the emotional lability of the patients at the acute stage. For this reason, we also analysed group differences in mood cross-sectionally from the 3- and 6-month post-stroke POMS scores. At the 3-month stage, there were significant group differences in the depression [$F(2, 51) = 3.7$, $P = 0.031$] and confusion [$F(2, 51) = 3.3$, $P = 0.045$] scores. *Post hoc* tests indicated

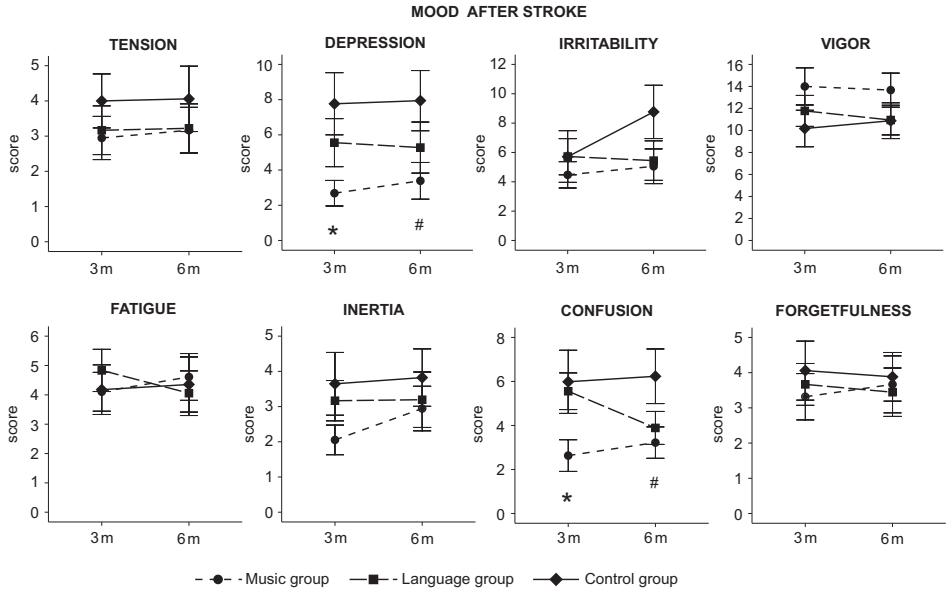

Fig. 2 Profile of Mood States (POMS) scale scores (mean ± SEM) in the three patient groups at the 3-month (3 m) and the 6-month (6 m) post-stroke stage. $^{*}P < 0.05$, $^{\#}P < 0.1$ by one-way ANOVA.

that the depression score was significantly lower in the music group than in the control group ($P = 0.024$). Also the confusion score was marginally lower in the music group than in the control group ($P = 0.061$). At the 6-month stage, the group differences in depression [$F(2, 50) = 2.6$, $P = 0.086$] and confusion [$F(2, 50) = 2.9$, $P = 0.064$] were still marginally significant with *post hoc* tests showing a tendency for the music group to experience less depressed ($P = 0.071$) and confused ($P = 0.064$) mood than the control group. There were no significant group differences in self-rated or proxy-rated QOL at the 3-month stage or at the 6-month stage ($P = 0.094$–0.987 in all domains).

Discussion

The novel main finding of this study was that regular self-directed music listening during the early post-stroke stage can enhance cognitive recovery and prevent negative mood. Specifically, after the 2-month intervention period, patients who listened to their favourite music 1–2 h a day showed greater improvement in focused attention and verbal memory than patients who listened to audio books or received no listening material. Moreover, patients who listened to music also experienced less depressed and, to a lesser extent, confused mood after the intervention than patients who received no listening material. Since the patient groups did not differ in demographic and clinical variables at the baseline or in antidepressant medication and rehabilitation received during the intervention, and since any non-specific effects of therapeutic attention were controlled for, these differences observed in cognitive recovery can be directly attributed to the effect of listening to music. Furthermore, the fact that most of the music also contained lyrics, would suggest that it is the musical component (or the combination of music and voice) that plays a crucial role in the observed recovery of these cognitive functions.

By its very nature, music has strong connections to both attention and memory systems. Brain imaging studies have shown that listening to real polyphonic music calls for rule-based analysis and combination of sound patterns from multiple auditory streams, which naturally recruits bilateral temporal, frontal and parietal neural circuits underlying multiple forms of attention, working memory, semantic and syntactic processing, and imagery (Janata *et al.*, 2002; Peretz and Zatorre, 2005). Recent evidence suggests that listening to music that is enjoyable but unrelated to the cognitive task may even temporarily improve performance in tests of spatial-temporal abilities (Thompson *et al.*, 2001), attention (Schellenberg *et al.*, 2007), verbal fluency (Thompson *et al.*, 2005) and creativity (Schellenberg *et al.*, 2007) in healthy subjects. Moreover,

auditory stimulation with music has also temporarily improved performance in tests of autobiographical recall in dementia patients (Foster and Valentine, 2001) and in tests of visual neglect in stroke patients (Hommel *et al.*, 1990). Furthermore, in healthy subjects (Wallace, 1994) and in multiple sclerosis patients (Thaut *et al.*, 2005) verbal material presented in a musical modality (as song lyrics) is learned and retrieved more efficiently than one presented verbally. It can also increase the coherence of frontal EEG oscillations during learning more than verbally presented material (Thaut *et al.*, 2005; Peterson and Thaut, 2007). Moreover, aphasic patients repeat and recall more words from novel songs when singing than speaking along an auditory model (Racette *et al.*, 2006). Randomized controlled trials have also shown that active music therapy or music-based exercise improves general cognition and verbal fluency in dementia patients (Van de Winckel *et al.*, 2004), symptom scores in schizophrenia patients (Talwar *et al.*, 2006), and communication skills in autistic children (Gold *et al.*, 2006). Similar studies that have used a within-subject design have also shown that music improves phonological and spelling skills in dyslexic children (Overy, 2003), speech content and fluency in dementia patients (Brotons and Koger, 2000), and verbal fluency in cardiac rehabilitation patients (Emery *et al.*, 2003). Collectively, these findings provide evidence that music engages and facilitates a wide range of cognitive functions.

Music is also closely linked to emotions and arousal. Evidence suggests that music listening modulates emotional arousal as indexed by changes in electrodermal, cardiovascular and respiratory activity (Khalfa *et al.*, 2002; Bernardi *et al.*, 2006; Gomez and Danuser, 2007). Listening to pleasant and relaxing music also enhances the recovery of cardiovascular and respiratory functions and decreases cortisol levels after stress (Khalfa *et al.*, 2003; Leardi *et al.*, 2007; Sokhadze, 2007). Music therapy has been shown to reduce anxiety and depression in patients with a somatic illness (Cassileth *et al.*, 2003; Siedliecki and Good, 2006) and anecdotally also in neurological patients (Magee and Davidson, 2002). These findings suggest that music has an analgesic effect in reducing anxiety and directing attention away from the negative experience, thus helping to cope with emotional stress.

In summary, music listening can facilitate a wide variety of cognitive and emotional functions. Whether these effects are truly specific to music, are selective to a few cognitive functions, and are long-lasting is, however, not known due to methodological limitations of most prior studies. Here, we used a single-blind, randomized, longitudinal experimental design with two control groups and extensive neuropsychological outcome measures to evaluate a wide range of cognitive functions. Our results indicate that music, when applied during the most dynamic period of recovery from neural damage, can induce long-term changes on cognition that is indexed by enhanced recovery of focused attention and verbal memory. Interestingly, the facilitating effect of music on focused attention was more pronounced in patients with damage to the language-dominant hemisphere. This most likely reflects the strong verbal component (mental arithmetic and color-word processing) in the tasks we used to evaluate focused attention. Moreover, music listening was associated with less depressed and confused mood, suggesting that music may help to cope with the emotional stress brought about by sudden and severe neurological illness. Here, the possible effect of non-specific therapeutic attention can not, however, be entirely ruled out, since the difference in mood between the music group and the language group was not significant.

An important and difficult question still pertains to the neural mechanisms that can account for the beneficial effect of music on cognition. Most previous studies have attributed the effect to a general positive affective state or enhanced arousal and attention, which, given the wide variability of reported benefits, seems a plausible mechanism. The focused attention and verbal memory scores in our study were also significantly correlated, suggesting that the effect is mostly related to enhanced attention. Thus, current evidence suggests that music has a rather general, non-specific effect on cognition. This is in line with the *arousal and mood hypothesis* (Thompson *et al.*, 2001), which states that any enjoyable stimuli, such as music, that induces positive affect and heightened arousal can lead to improved performance on cognitive tasks. Recent animal studies and functional neuroimaging studies in humans have shed some light on the neural mechanisms that mediate these effects. Listening to pleasant music activates an interconnected network of subcortical and cortical brain regions, which includes the ventral striatum, nucleus accumbens (NAc), amygdala, insula, hippocampus, hypothalamus, ventral tegmental area (VTA), anterior cingulate, orbitofrontal cortex and ventral medial prefrontal cortex (Blood and Zatorre, 2001; Brown *et al.*, 2004; Menon and Levitin, 2005; Koelsch *et al.*, 2006). VTA produces dopamine and has direct projections to the locus ceruleus (LC), amygdala, hippocampus, anterior cingulate and prefrontal cortex (Ashby *et al.*, 1999). The VTA-NAc responses are suggested to be related to suppression of aversive stimuli and pain (Menon and Levitin, 2005), which would account for the effect of music on coping with stress, whereas LC and hypothalamus mediate arousal. Together, this dopaminergic mesocorticolimbic system is crucial for mediating arousal, emotion, reward, motivation, memory, attention and executive functioning (Ashby *et al.*, 1999). In animals, music listening leads to increased dopamine synthesis in the brain (Panksepp and Bernatzky, 2002; Sutoo and Akiama, 2004). Increased dopamine directly enhances alertness, speed of information processing, attention, and memory in healthy humans (Schück *et al.*, 2002) and also global cognitive functioning in patients with cognitive impairment (Nagaraja and Jayashree, 2001). It is, thus, possible that the music-related enhanced

cognitive recovery seen in our study was mediated by positive mood induced by music, and hence the dopaminergic mesocorticolimbic system, especially since the music the patients listened to was their own favourite music and concurrent effects on mood were also observed.

A related topic concerns the pleasurability of listening to music and stories. When comparing the effects of music and narrated story listening on healthy subjects, Nantais and Schellenberg (1999) found that listeners performed better on a cognitive task following the listening condition they preferred. In our study, the music and language groups liked music and story listening to the same degree before the intervention, the material used in both groups was self-selected, and the groups listened to it equally often. This suggests that preference to the type of material did not play a significant role. In general, also anecdotal evidence from the patients' reports indicated that both music and language groups enjoyed the intervention, although music listening was experienced as easier and less demanding, especially in the early recovery phase. Moreover, it is possible that some aphasic patients in the language group had difficulties in listening to the audio books due to comprehension deficits, and, thus, did not find the intervention as enjoyable as patients in the music group.

In addition to the effect on cognition and mood, music may also have general effects on brain plasticity after stroke. Since our patients had a unilateral MCA stroke, and the brain regions involved in music processing are mainly supplied by the MCA bilaterally (Ayotte *et al.*, 2000), listening to music may well have further stimulated both the peri-infarct regions in the damaged hemisphere as well as regions in the contralesional, healthy hemisphere that normally show increased plasticity at this recovery stage (Witte, 1998; Kreisel *et al.*, 2006). The fact that listening to music, especially with lyrics, is associated with activity of a more widely and bilaterally distributed neural network than listening to verbal material alone (Callan *et al.*, 2006), would also account for the observed superiority of music stimulation over purely verbal stimulation, especially in left hemisphere-lesioned patients (Démonet *et al.*, 2005). Animal studies have shown that an enriched post-stroke recovery environment can induce many structural plastic changes in the recovering brain such as decreased infarct volume and increased dendritic branching, spine density, neurotrophic factors, cell proliferation and neurogenesis (Johansson, 2004; Nithianantharajah and Hannan, 2006). Although the effect of an enriched sound environment on recovery from neural damage has not been directly studied, recent developmental animal studies have shown that exposure to music during development improves auditory cortical functions, learning, and memory (Engineer *et al.*, 2004; Chikahisa *et al.*, 2006; Kim *et al.*, 2006; Angelucci *et al.*, 2007*a*). Importantly, exposure to music also enhances brain plasticity by increasing neurogenesis in the hippocampus (Kim *et al.*, 2006), modifying the expression of glutamate reseptor GluR2 in the auditory cortex and in the anterior cingulate (Xu *et al.*, 2007), increasing brain-derived neurotrophic factor (BDNF) levels in the hippocampus (Angelucci *et al.*, 2007*a*) and in the hypothalamus (Angelucci *et al.*, 2007*b*), and also increasing the levels of tyrosine kinase receptor B (TrkB), a BDNF receptor, in the cortex (Chikahisa *et al.*, 2006). Changes in glutamate transmission in the peri-infarct area (Centonze *et al.*, 2007) and increased BDNF levels (Schäbitz *et al.*, 2007) are also crucial plasticity mechanisms that contribute to recovery from stroke. Thus, it is possible that the music-related enhanced cognitive recovery seen in our study was also due to structural plastic changes induced by music stimulation in the recovering brain. At present, this suggestion is, however, tentative, and further research is clearly needed to elucidate the potential effects of a musically enriched recovery environment on brain plasticity after stroke.

In conclusion, the results of the present study demonstrate, to our knowledge for the first time, that regular self-directed music listening during the 2-month subacute phase of MCA stroke recovery enhanced the recovery of verbal memory and focused attention, and also prevented depressed and confused mood. According to a recent study conducted in European stroke rehabilitation centers (De Wit *et al.*, 2005), stroke patients typically spend >72% of their daily time in non-therapeutic activities, mostly in their rooms, inactive and without any interaction, even though from a plasticity standpoint this time-window is ideal for rehabilitative training (Witte, 1998; Kreisel *et al.*, 2006). We suggest that everyday music listening during early stroke recovery offers a valuable addition to the patients' care, especially if other active forms of rehabilitation are not yet feasible at this stage, by providing an individually targeted, easy-to-conduct and inexpensive means to facilitate cognitive and emotional recovery.

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II

THERAPEUTIC ROLE OF MUSIC LISTENING IN STROKE REHABILITATION

by

Anita Forsblom, Sari Laitinen, Teppo Särkämö & Mari Tervaniemi 2009

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Therapeutic Role of Music Listening in Stroke Rehabilitation

Anita Forsblom,[a] Sari Laitinen,[a] Teppo Särkämö,[b,c] and Mari Tervaniemi[b,c]

[a]*Department of Music, University of Jyväskylä, Jyväskylä, Finland*

[b]*Cognitive Brain Research Unit, Department of Psychology, University of Helsinki, Helsinki, Finland*

[c]*Finnish Centre of Excellence in Interdisciplinary Music Research, Department of Music, University of Jyväskylä, Jyväskylä, Finland*

We performed two parallel interview studies of stroke patients ($n = 20$) and professional nurses ($n = 5$) to gain more insight into the therapeutic role of music listening in stroke rehabilitation. Results suggest that music listening can be used to relax, improve mood, and provide both physical and mental activation during the early stages of recovery from stroke. Thus, music listening could provide a useful clinical tool in stroke rehabilitation.

Key words: **music listening; rehabilitation; stroke; emotion; cognition**

Introduction

Music plays an important role in regulating our mood, attention, and identity, and in accompanying our everyday actions. For the brain, music listening is a complex process, which involves many perceptual, cognitive, motor, and emotional components that work in concert to bring about our subjective experience of music.[1] This entails a wide-scale activation of a primarily bilateral network of temporal, frontal, parietal, and limbic regions that are related to arousal, attention, semantic and syntactic processing, memory, and emotions.[2,3] Also, behavioral studies have shown that exposure to music can temporarily enhance emotional and cognitive functioning in healthy subjects and in various clinical patient groups.[4–6] Little, however, is still known about the potential therapeutic role of music listening in neurological rehabilitation.

Address for correspondence: Anita Forsblom, Ojahaanrinne 4, 01600 VANTAA, Finland. Voice: +358-40-5722974; fax: +358-9-5665171. anifor@welho.com

We recently conducted a randomized controlled trial on the effects of everyday music listening on cognitive recovery and mood after stroke. In the study, 60 patients with a middle cerebral artery ischemic stroke were randomly assigned to a music-listening group, an audio book-listening group, or a control group ($n = 20$ in each) 1 week after the stroke. Patients in both listening groups received portable players and, with the aid of music therapists, selected a collection of music tapes/audio books, which they then listened to at least 1 h/day for the following 2 months. All patients underwent extensive neuropsychological testing, which included verbal, visuospatial, music perception, memory, attention, and executive tasks, and a mood questionnaire, 1 week (base line), 3 months, and 6 months post stroke. Results showed that verbal memory and focused attention recovery was significantly greater in the music-listening group than in the audio book-listening group or in the control group 3 and 6 months after the stroke.[7] Furthermore, the music-listening group had significantly lower depression and confusion scores on the Profile of Mood States

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questionnaire than the control group 3 months after the stroke.[7]

The aim of the present study was to gain more insight into the therapeutic role of music listening in stroke rehabilitation by interviewing stroke patients about the subjective emotions and cognitions evoked by music listening and nurses about the clinical use of music listening in a stroke rehabilitation unit.

Materials and Methods

We performed two parallel interview studies. In the first study, the 20 patients [12 women, 8 men; age 35–72 (mean 56.7)] in the music-listening group were interviewed after the 2-month intervention about how they experienced the listening and how they felt it had contributed to the recovery process. During the 2-month intervention period, the patients were asked to listen to the self-selected music tapes at least 1 h/day and keep a diary of the listened-to tapes. Since the aim of the study was to understand the meaningfulness of human experience as it was actually lived during the 2-month period, the interview data were analyzed qualitatively using the method developed by Giorgi[8] and were set in the framework of the Cullberg crisis theory.[9]

In the second study, a participatory action research[10] approach was used to determine how nurses used music listening as a rehabilitative tool with stroke patients in a hospital setting. The subjects were five professional nurses with varying experience [1–20 years (mean 9.8)] in working with neurologically impaired patients. The nurses were recruited from two rehabilitation hospitals in the Helsinki metropolitan area to arrange music listening for stroke patients in their unit as a part of the hospital rehabilitation program. Altogether 26 patients took

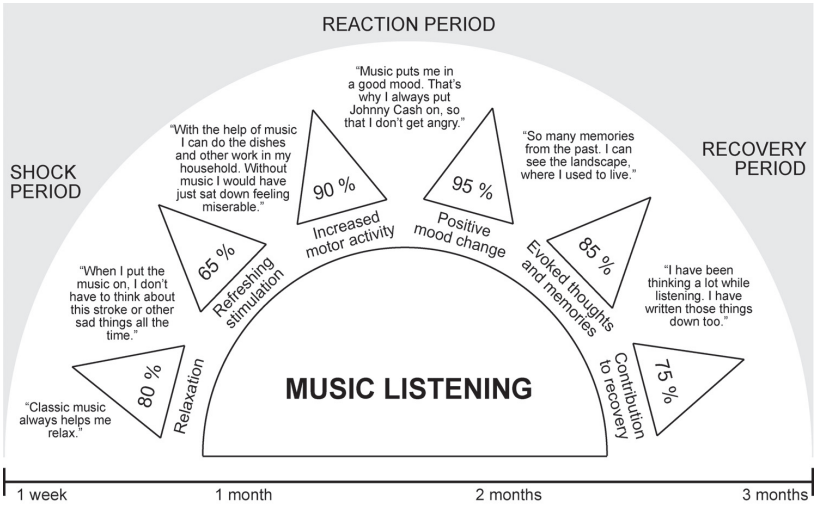

Figure 1. The personal meaning of music listening during stroke recovery. Data from interviews with patients ($n = 20$) are summarized in six categories. Triangles show the percentage of patients whose responses fall into each category. See text for details.

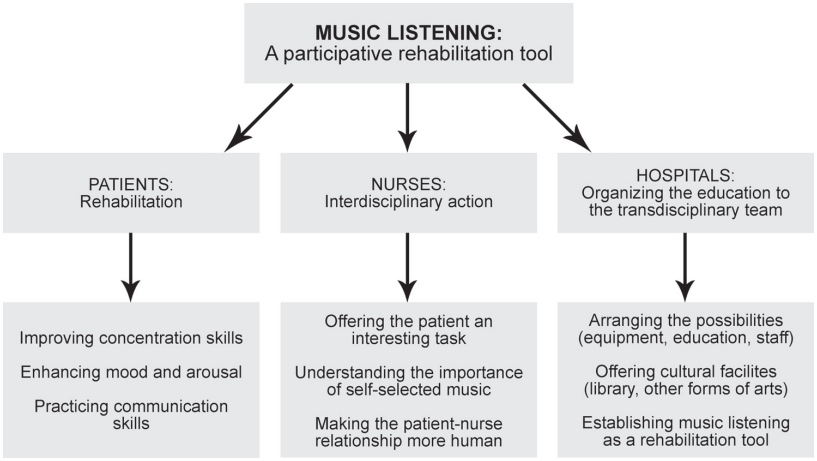

Figure 2. Three aspects of music listening in a hospital setting. These were collected from rehabilitative nurses ($n = 5$) based on their own experiences on how music listening matched with the rehabilitation, the nurses' professional tasks, and the hospital environment.

part in this intervention, which lasted approximately 2 weeks. After the program, the nurses were interviewed about their experiences in a total of 10 group interviews held during the 6-month follow-up period. Data were analyzed with qualitative content analysis method using phenomenographic and phenomenologic viewpoints.[11]

Results

The patient interviews yielded a total 438 meaning units, which were organized around 18 themes and finally formed six distinct categories, which are summarized in Figure 1.

Stroke is a sudden and terrifying life-threatening illness that often evokes a psychological crisis reaction.[12] According to Cullberg,[9] the first 1–3 days in a crisis are spent in shock, feeling confused, weak, and helpless, while everything seems to be in chaos. During the first days and weeks after the stroke, the majority of the patients (80%) reported that music listening helped them to calm down, relax, and sleep better. This is in line with the well-known effects of music in decreasing arousal during acute stress,[13] and suggests that music could be used as a natural sedative during the very first days after stroke.

The initial shock period is followed by a 1- to 3-month reaction period, which is characterized by the activation of psychic defense mechanisms as well as experiences of anxiety, hypersensitivity, irritable mood, tiredness, depression, and sleeping disorders.[9] During the first poststroke months, almost all of the patients (95%) reported that music listening influenced their mood positively. Similar results were also obtained in interviews with the nurses (Fig. 2), who considered it as a form of emotional support that decreased anxiety, improved mood, and encouraged the patients to communicate. In the patient interviews, more than half of the patients (65%) also felt that music listening took their mind off the situation and allowed them to focus their energy on productive work, such as doing household chores. In addition,

a vast majority of patients (90%) also reported increased motor activity during music listening (e.g. dancing or moving to the beat of the music).

Finally, the reaction period is followed by a recovery period 2–12 months after the crisis during which adjustment begins and plans for the future are prepared.[9] Toward the end of the intervention period (3 months post stroke), the majority of the patients (85%) reported that music listening evoked a lot of memories and reflective thoughts about ones' past and future. Overall, 75% of the patients felt music listening had contributed positively to their recovery. Also, in the nurses' interviews, music listening was seen to be helpful for patients who had more severe motor or cognitive deficits. The nurses viewed music listening as a transdisciplinary tool that allowed them to gain more insight into the patient's thoughts and feelings, and, thus, made the nurse–patient relationship more human. Furthermore, the nurses felt that they needed more multidisciplinary education on the possibilities of using music in the treatment of, for example, pain[14] and depression. If the hospital facility has a positive attitude toward cultural activities, it helps in implementing the individual music listening in a hospital rehabilitation program.

Conclusions

In stroke rehabilitation, elements of music have previously been used as a part of physiotherapy and speech therapy, but the potential therapeutic role of everyday music listening has received very little empirical attention. Results of the present qualitative study suggest that music listening can be used to relax, improve mood, and provide both physical and mental activation during the early stages of recovery from stroke. Furthermore, these effects parallel the psychological reactions to a crisis brought about by a sudden severe illness,[9] suggesting that music listening meets the emotional needs of stroke patients struggling to cope with and adjust to the situation. Also, professional nurses, who experimented with using music listening as a part of their own rehabilitation work, regarded it as a useful clinical tool, especially with aphasic, restless, and unsociable patients. Together with our previous experimental results,[7] these findings demonstrate that music listening during the early poststroke stage can enhance cognitive recovery and mood and be helpful also to the professional nursing staff, thus providing a useful rehabilitation tool for stroke patients.

Conflicts of Interest

The authors declare no conflicts of interest.

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III

THE EFFECT OF MUSIC AND AUDIO BOOK LISTENING ON PEOPLE RECOVERING FROM STROKE: THE PATIENT´S POINT OF VIEW

by

Anita Forsblom, Sari Laitinen, Teppo Särkämö & Mari Tervaniemi 2010

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The Effect of Music and Audiobook Listening on People Recovering From Stroke: The Patient's Point of View

Anita Forsblom, MA[1], Teppo Särkämö, MA[2,3], Sari Laitinen, Lic. MusTh[1], and Mari Tervaniemi, PhD[2-4]

Abstract

Recent experimental evidence suggests that musical activities can enhance motoric, cognitive, and emotional recovery after a stroke. The authors' aim was to gain more insight about the emotional and psychological factors underlying the therapeutic effects of listening to music after a stroke, by combining both qualitative and quantitative methods. Thirty-nine patients who had suffered a stroke were interviewed about their subjective experiences when listening, on a daily basis, to either self-selected music ($n = 20$) or audiobooks ($n = 19$) during the first 2 months after the stroke. Results showed that music listening was specifically associated with better relaxation, increased motor activity, and improved mood, whereas both music and audiobook listening provided refreshing stimulation and evoked thoughts and memories about the past. These results highlight the clinical importance of providing stimulating and pleasant leisure activities after a stroke and further encourage the use of music in stroke rehabilitation.

Keywords

audiobook listening, music and medicine, music listening, rehabilitation, stroke

A stroke, caused by a brain infarction, is a dramatic illness that often leads to severe motor and cognitive deficits, as well as causes considerable emotional distress and social dysfunction. Due to the aging of the population in many developed countries, the incidence of stroke still remains high, leaving about 5 million people worldwide each year permanently disabled.[1] In most cases, the public health care system is not able to meet the rehabilitation needs of this population, which places a heavy burden on the patients and their families, who are left to cope with the disability mostly on their own. Furthermore, even in rehabilitation centers, persons with stroke typically spend a large amount of the day in their rooms, inactive, and without any interaction.[2] In their survey of 434 people who had suffered from stroke, Mayo et al[3] found that 72% of the patients lacked an important and meaningful activity to fill the day, suggesting a need for leisure activities, which could promote well-being and also potentially aid recovery. However, there is still very little research about the effects of normal everyday leisure activities on stroke recovery.

Listening to music, the radio, or other material (such as audiobooks) are common leisure activities that can provide enjoyment and mental stimulation as well as help to relax and take one's mind off the worries of everyday life. For the human brain, listening to music[4-7] or narrated stories[8-12] entails a widespread activation of temporal, prefrontal, premotor, and parietal cortical areas. These parts of the brain control many cognitive functions such as attention, semantic and syntactic processing, and memory. But music has perhaps the most significant influence of all on the emotions.

Music listening is often used to accompany our everyday actions and to regulate our mood, emotions, and attention.[13] Emotional self-regulation in particular is one of the core human abilities related to emotions, which is acknowledged as one of the most important reasons for musical engagement at any age.[14] Music can evoke vivid memories of past events[15,16] as well as induce strong emotions and mood states, which is indicated by changes in subjectively experienced emotions,[16,17] physiological reactions[18-20] (eg, heart rate, skin conductance, respiration, and hormone secretion), and behavior.[21] In recent neuroimaging studies, the act of listening to music has been

[1] Department of Music, University of Jyväskylä, Finland
[2] Cognitive Brain Research Unit, Institute of Behavioural Sciences, University of Helsinki, Finland
[3] Finnish Centre of Excellence in Interdisciplinary Music Research, University of Jyväskylä, Finland
[4] Department of Psychology, University of Jyväskylä, Finland

Corresponding Author:
Anita Forsblom, Department of Music of the University of Jyväskylä, Finland
Email: anifor@welho.com

shown to engage virtually the entire limbic/paralimbic emotion system, including the amygdala, hippocampus, nucleus accumbens, ventral tegmental area, anterior cingulate, and orbitofrontal cortex[4,5,22,23] (for a recent review, see Koelsch[24]). There is currently an increasing awareness of the social value of music with respect to its effectiveness in communicating emotions.[25-27] Also, for patients with traumatic brain injury, music therapy has been suggested to be a suitable therapeutic strategy, as it is an adequate form of emotional expression.[28-32]

Based on a hypothesis that active and regular listening to self-selected music or complex verbal material might stimulate the recovering brain and thus lead to a better recovery, we recently performed a randomized controlled trial (RCT) about the effects of music and audiobook listening on people recovering from a stroke (for details, see Särkämö et al[33]). We recruited 60 patients who had had an acute middle cerebral artery stroke, in either the left or right hemisphere, and randomly assigned them to a music listening group, an audiobook listening group, or a control group (n = 20 in each). Results showed that both music and audiobook listening enhanced the recovery of auditory sensory memory functions,[34] as indexed by changes in the magnetic mismatch negativity, which was measured with magnetoencephalography. But only music listening was found to improve cognitive recovery, especially in the domains of verbal memory and focused attention, as well as to prevent depressed and confused moods during the 6-month follow-up.[33] It is possible that these effects could be due to enhanced neuronal plasticity and stimulation provided by the music or to emotional and psychological factors related to the music listening experience. Whereas quantitative neuropsychological and neurophysiological methods can be used to study the former mechanism, a better understanding of the latter mechanism can be obtained only through phenomenological, or qualitative, research. Using the patients' own narratives as a research tool offers a unique opportunity to unravel important elements of human experience (eg, personal history, sense of self, place, and context) that can help us to better understand the patient's life during the recovery process and thereby also gain a deeper understanding and a more holistic view of the role of music in this process.

Our previous results were based on interviews with patients in the music listening group (n = 20) on how they felt the listening had contributed to their recovery during the first 3 months after the stroke.[35] For most patients, music listening was associated with better relaxation (85%), providing refreshing stimulation (65%), increasing motor activity (90%), improving mood (95%), evoking thoughts and memories (85%), and contributing positively to recovery (75%). These 6 categories were found to follow the typical time course of responding and adapting to a life crisis,[36] beginning with a brief shock phase characterized by feelings of confusion, helplessness, and chaos; proceeding to reaction and recovery phases characterized by various psychological reactions (eg, anxiety and depression); and then adjustment. However, without a comparison group, it is impossible to determine which, if any, of these positive effects are specific to music listening and which reflect the more general impact of doing pleasant leisure activities or getting therapeutic attention.

The aim of the present study was to extend our previous work by combining both qualitative and quantitative approaches. Specifically, we first analyzed and classified the narrative content of the interviews of both music (n = 20) and audiobook (n = 19) listeners qualitatively by using a phenomenological research model and then compared statistically the number of music and audio group patients whose responses fell into each of the aforementioned 6 categories. The advantage of using such a mixed design is that it allowed us to draw conclusions about the specificity of observed rehabilitation effects while retaining their phenomenological origin.

Methods

The participants were patients recruited between March 2004 and May 2006 from the Department of Neurology at the Helsinki University Central Hospital, who had been admitted to the hospital for the treatment of an acute stroke. According to the RCT protocol used in the study (for details, see Särkämo et al[33]), the patients were randomly allocated to either a music listening group, an audiobook listening group, or a control group approximately 1 week after their stroke. During the following 2 months, the music and audiobook groups listened daily (minimum of 1 hour/day) to self-selected music or audiobooks, while the control group received no listening material. Only the patients who were in the music group (n = 20, 12 women and 8 men; mean age 56.7 years) and in the audiobook group (n = 19, 10 women and 9 men; mean age 59.3 years) are included in the present study. As reported previously, there were no group differences in baseline demographical or clinical variables or in the amount of rehabilitation (ie, physical therapy, occupational therapy, speech therapy, or neuropsychological rehabilitation).[33]

The patients were interviewed by music therapists (authors A.F. and S.L.) before the intervention (1 week after the stroke) and then a second time after the intervention (2-3 months after the stroke). In the first interview, the patients were asked what kind of music they liked listening to or what kind of literature they preferred (eg, what were their favorite songs/artists/books/authors). If they could not answer, this information was obtained from their relatives, who also volunteered to help find appropriate listening material. During the 2-month intervention period, when patients listened to the material on a daily basis, the music therapist phoned or paid them a visit every week to help them with the CD players and to bring new audiobooks or music CDs. The patients were also asked to keep a log of their listening, and nurses and relatives were there to help them to do so. In the second (postintervention) interview, both groups were asked how they had experienced the listening and whether it had contributed to their recovery in some way or not.

Data of interest in the present context was collected from the audiobook (n = 19) and music (n = 20) listeners during the second interview, using open-ended phenomenological interviews. These interviews were performed individually for

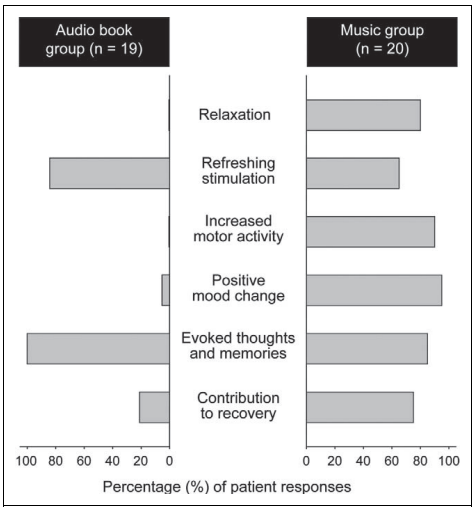

Figure 1. The subjective experience of music and audiobook listening after stroke. Data from patient interviews are summarized in 6 categories. Bars show the percentage of patients in the music listening group (left) and the audiobook listening group (right) whose responses fall into each category.

each patient after the 2-month listening period. To understand the depth and the meaningfulness of the experience, as it was actually lived during this period, the narrative data from the interviews was analyzed following the guidelines of Giorgi's phenomenological research model.[37] As a theoretical framework to understand what the patients were going through emotionally and psychologically, Cullberg's theory of crises[36] was used. In analyzing the data, the interviews were first coded and transcribed using a piece of software called Hyper Research (© 2006 ResearchWare, Inc, PO Box 1258, Randolph, MA 02368-1258). After this, each transcript was read through to get a reflective discernment of the essence of the interviews and an overall sense of the experiences of the patients. Key statements were then identified, placed together, and grouped into different meaning units (eg "audiobooks evoked memories"). These meaning units were put under various themes (eg, "memorizing"), which then formed distinct upper categories (eg, "evoked thoughts and memories"). Finally, the proportion of patients in the music and audiobook groups whose responses fell into each of these upper categories was compared statistically using χ^2 tests.

Results

The patient interviews yielded a total of 523 meaning units, which were organized around 26 themes and finally formed 6 distinct categories. Figure 1 illustrates the percentage of patients in the music and audiobook groups whose responses fell within each of the 6 categories. Examples of the responses within each category are shown in Table 1.

Results showed that patients in the music group, more than the audiobook group, found that the listening helped them to relax ($\chi^2 = 25.8$, $P < .0001$), increased their motor activity ($\chi^2 = 31.8$, $P < .0001$), and improved their mood ($\chi^2 = 31.4$, $P < .0001$). Since most of the patients had deficits in attention, memory, or verbal comprehension, many of the audiobook listeners reported having difficulties concentrating on listening or following the plots of the stories. They also found the stories to be boring, funny, or exciting, but unlike the music listeners, they did not report that the listening had actually made them feel different or generally improved their mood. Also, the difference in motor activity was huge: whereas the music listeners reported often walking, doing household chores, and even dancing to the music, the audiobook listeners found that they could not move anywhere from the cassette player because they had to concentrate just on listening. Both music and audiobook group patients reported equally often that the listening had felt like refreshing stimulation ($\chi^2 = 1.0$, $P = .31$, Yates' correction) and had evoked thoughts and memories about the past ($\chi^2 = 1.4$, $P = .25$, Yates' correction). Overall, patients in the music group felt more often than those in the book group that listening had contributed positively to their recovery ($\chi^2 = 11.4$, $P < .001$).

Discussion

When we compared the patients' subjective experience of music and audiobook listening, only music listening was considered as an aid to recovery during the first 2 months after the stroke. Music listening seemed to be specifically related to better relaxation, increased motor activity, and improved mood. Both music and audiobook listening were experienced as refreshing and pleasant leisure activities that also evoked a lot of thoughts and memories. Interestingly, when talking about their mood, the audiobook listeners often remarked that they felt depressed, being aware of the stroke, whereas the music listeners typically did not note that they felt depressed but rather that music in fact elevated their mood. Thus, for people who have suffered a stroke, music may be a transitional object for feeling negative emotions safely, a space where the patient can experience those emotions, and a method for coping when there is something too painful to think about. As mentioned earlier, results from our RCT study also showed that the music listeners reported feeling less depressed and confused than the nonlisteners when they filled in the Profile of Mood States questionnaire 3 months after the stroke.[33] This result is also in line with evidence from many physiological, neuroimaging, and clinical studies showing that music listening is associated with and can lead to positive changes in arousal, emotions and mood, and motor activity.[4-7,14-24,38-41] It also lends support to the previous findings that active music therapy can reduce anxiety and depression and improve emotional adjustment and social interaction in patients who have had a stroke and those with traumatic brain injury.[42-44] Recently, music-supported therapy

Table 1. Examples of Responses From Individual Interviews

Response category	Audiobook group (n = 19)	Music group (n = 20)
Relaxation	Listening to audiobooks doesn't help me relax or calm down.	Classical music always helps me relax. When I was listening to music in the hospital, I fell asleep at once. It was great that I could relax with it.
Refreshing stimulation	It's always nice to hear a story. It was such a nice experience to just lie down and listen to an audiobook. I found the story called "Juurakon Hulda" so funny! Listening to audiobooks was so interesting that it kept me inside the whole day.	When I put the music on, I don't have to think about this stroke or other sad things all the time. Music listening was a positive experience for the whole patient room. Everyone was lying in their beds listening, even nurses started to hum along to the music. Lazy Sundays in a hospital, nothing else to do there.
Increased motor activity		With the help of music I can do the dishes and other work in my household. Without music I would have just sat down feeling miserable. At home we have tried dancing together. Rock, baby, rock like we used to! I was surprised that I could still do that.
Positive mood change	Hearing a sad story changes your mood more than reading it from a book, and you also cry more easily. Somehow I feel sad and lost although everything is alright. It is so hard to go shopping even though I can. I don't think I can go back to work in March, yet.	Music puts me in a good mood. That's why I always put Johnny Cash on, so that I don't get angry. In the middle of all the sorrow in my life, music brings me joy and can change my mood.
Evoked thoughts and memories	Audiobooks evoked so many memories. Audiobooks are so interesting. They bring back childhood memories, the landscape of your youth. I remember we used to listen to *Suomisen perhe* and other radio plays during the war. I also remember the stories that my father told.	I feel that my thoughts are coming easier with music. I remember when I was a 4-year-old boy watching the prisoners of war with my father, an empty rifle on my shoulder.
Contribution to recovery	Every stroke patient should be encouraged to be active in the recovery process so that he can feel that life goes on despite all the struggle. Afterwards he can feel that he is alive.	This is an excellent method. In the beginning, I felt so confused in the hospital. Music was like a key that unlocked me. At the hospital, I could not find words or concentrate in reading. Now I listen to music before I start reading. It helps.

has also been shown to lead to marked improvements in motor skills after a stroke.[45–48]

Music is known to have an important role in mood regulation during adolescence,[14] but recently, this topic has also been studied in older adults. In an interview study of subjects aged between 21 and 70 years, Saarikallio[49] found that music is an important means of emotional self-regulation and mental work across the age span. Crucially, music appeared to become emotionally important, especially during hardships and difficult life experiences due to its ability to comfort, co-experience, distract, and empower. This is also well in line with the experience of music listening described by the patients in this present study.

In conclusion, the results of our mixed qualitative and quantitative study show that for patients recovering from an acute stroke, music listening is experienced as a useful leisure activity that specifically helps to relax, improve mood, and increase motor activity. Overall, these results highlight the clinical importance of providing stimulating and pleasant leisure activities for people who have suffered a stroke, and in particular, they encourage the use of music for stroke rehabilitation.

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Bios

Anita Forsblom, MA, is a PhD student at the Department of Music of the University of Jyväskylä, Finland. She is also a Fellow of The Bonny Method of Guided Imagery and Music (FAMI) granted by the Association for Music and Imagery (USA) and works as a private practitioner of music therapy in Vantaa, Finland. Her research focuses on the therapeutic role of music listening on the recovery of cognitive, emotional and motor functions after acute stroke.

Teppo Särkämö, MA, is a psychologist and researcher working at the Cognitive Brain Research Unit (Institute of Behavioural Sciences, University of Helsinki, Finland) and at the Finnish Centre of Excellence in Interdisciplinary Music Research (University of Jyväskylä, Finland). His main scientific interests are in the interplay of music, speech, cognition, and emotions in adult clinical patient groups, especially stroke and dementia patients. Specifically, his research focuses on the therapeutic impact of music on the recovery of cognitive, emotional and auditory functions in the brain.

Sari Laitinen, Lic. MusTh., is a private practitioner music therapist and a research secretory working at the Miina Sillanpää Foundation, Finland. Her main interest is to develop practical and evidence-based music rehabilitation and therapy models for neurological patient groups, such as stroke and dementia patients, and to increase the therapeutic use of music in a multidisciplinary setting. She cooperates with the Finnish Centre of Excellence in Interdisciplinary Music Research (University of Jyväskylä, Finland) and is a member of the Scandinavian Music, Culture and Health organisation.

Mari Tervaniemi (PhD in Psychology, University of Helsinki, 1997) has extensive expertise in cognitive neuroscience of music. She has published 100 empirical papers in peer-reviewed international journals and several influential book chapters and reviews. Their topics cover auditory neurocognition, modularity of speech vs. music perception, and neural determinants of musical expertise. Most recently she also began investigating the brain basis of music emotions. For further information, see www.cbru.helsinki.fi/~mari.

IV

PROFESSIONAL COMPETENCES OF MUSIC THERAPISTS WORKING IN POST-STROKE REHABILITATION

by

Anita Forsblom & Esa Ala-Ruona 2012

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By Anita Forsblom (Finland) & Esa Ala-Ruona (Finland)

Abstract
The aim of this qualitative study is to gain more insight into the skills and knowledge that music therapists feel they need, in order to work successfully with people who have had an acute stroke. For this purpose, six music therapists were interviewed about their own particular specialist education. Another interview topic for them was to recount their subjective experiences of post-stroke rehabilitation work in hospitals and health care units during the course of two projects that they participated in. The first was a project that specifically used music listening during acute stroke rehabilitation; and the second was a project, which used more active music therapy techniques, like drumming during acute stroke rehabilitation.

In the first project, patients who were bedridden in hospitals or health care units could listen to familiar songs that stimulated them in both a physical and cognitive way, and helped them to relax and regulate their moods better. In the second project different therapeutic approaches were observed and reflected upon during the piloting phase of the project and then an ideal combination of the activities was defined for the main phase. The resulting clinical music therapy model was thus created to specifically meet the special needs of stroke patients.

Three crucial factors gleaned from the interviews that were seen to affect clinical thinking were: a) knowledge concerning the neurological basis of strokes; b) good patient interaction; and c) accurate observation of the physiological and psychological aspects of music therapy. In this way, these results provide a better understanding of the tacit knowledge possessed by music therapists who work within stroke rehabilitation.

Keywords: active music therapy, music listening, rehabilitation, stroke

Introduction

Throughout the world, strokes are the principal cause for long-term disability, irrespective of age, gender, ethnicity or country. Strokes are also responsible for more deaths annually than those attributed to AIDS, tuberculosis and malaria put together (World Stroke Organization, 2011). In Finland every year, about 15,000 people suffer a stroke, whether it is a cerebral thrombosis or haemorrhage. Nationally, this means roughly 38 people per day, and it also means that strokes are the most common cause of disability in adults, as well as being the

third most expensive affliction to treat. An essential goal in rehabilitating a stroke patient is to give them the means to once more carry out everyday activities and leisure pursuits. Only 15-20% of stroke patients are able to get the kind of multiprofessional rehabilitation this requires, and the situation for older people is even worse (Duodecim Medical Society, 2006; Takala et al., 2010). Music therapy within neurorehabilitation settings is still a relatively new phenomenon (Baker & Tamplin, 2010). Yet although a number of former studies have striven to show the importance of using music or music therapy in stroke rehabilitation (Särkämö, 2011; Thaut, 1997; Hommel et al., 1990; Soto et al. 2009; Bradt, Magee, Dileo, Wheeler & McGilloway, 2010) not so many have been made from the perspective of the music therapists themselves. Considering these are the people most involved with this part of the stroke rehabilitation process, it seems only fair to ask them more closely as to how it actually occurs. An interview study was therefore carried out, to gain more insight into the skills and knowledge that music therapists feel they need in order to work successfully with people who have had an acute stroke. In this respect, the study assumes that actually working with stroke patients is the best way to supplement existing knowledge in the field. The aim of this study is therefore to gain more insight into the skills and knowledge that music therapists feel they need to have in their clinical work. The implications of this research, are that having knowledge about what is needed to work with this specific and challenging client population will hopefully facilitate the entrance into this type of work for music therapists.

The Consequences of Stroke

A stroke, or cerebral circulation disorder, normally occurs as a result of the bleeding, or blockage of a blood vessel within the brain. Strokes crucially affect the quality of life in physical, cognitive, and psychological ways. Confusion, depression and problems with thinking and memory are very typical cognitive effects (Knight & Wiese, 2011; Hackett, Anderson, House, & Xia, 2009). Other common disorders are related to orientation, verbal functioning, spatial and constructive perception, calculation, concentration and information processing (Tatemichi et al., 1994; Hochstenbach, Mulder, van Limbeek, Donders & Schoonderwaldt, 1998). Out of all of these however, motor dysfunction and aphasia are the most well known symptoms. A less known but equally common syndrome following stroke is spatial neglect. A patient who has suffered a stroke in the right hemisphere can behave as if objects to the left in their visual field did not exist (Unsworth, 2007).

Neuronal plasticity is a significant feature of early postnatal life, but it becomes less prevalent in the adult brain (Castrén, 2010). Such plasticity is also very important in stroke rehabilitation, and has therefore been the focus for some novel interventions in the field (Kleim, 2010). Our present understanding, of acute strokes and patterns of spontaneous recovery, also indicates that the most critical period of time for determining the functional capacity of stroke

patients, and thus the specific details of the rehabilitation, occurs within the first few weeks after an attack (Palo, Jokelainen, Kaste, Teräväinen & Waltimo, 1996).

An essential goal in rehabilitating stroke patients is to get them back in control of the skills they need for day-to-day living and simple leisure activities, otherwise known as their activities of daily living (ADL). According to the International Classification of Functioning, Disability and Health (ICF) that was drawn up by the World Health Organisation, the ADL are distributed over three domains: Self-Care; Domestic Life; and Community, Social and Civic Life (WHO, 2001). As mentioned previously, the most well-known symptoms of stroke are motor dysfunction and verbal difficulties. However, cognitive impairment, neurological deficits and depression are also all very common symptoms after a stroke, and yet although 60% of stroke sufferers have some form of cognitive dysfunction, only a few studies focus on them and they are often overlooked in clinical practice (Nys, 2005). From the basis of clinical experience, it seems apparent then that active music therapy has an important part to play in post-stroke recovery, precisely because it can affect these cognitive, emotional and motor abilities.

Music therapy Research in Stroke Rehabilitation

Even though research into the effects of music and music therapy within healthcare has grown rapidly over the past 20 years, there are not so many research reports about the use of music or music therapy specifically for neurological rehabilitation. Hommel et al. (1990), and Soto et al. (2009) found in their studies that music listening can improve left-side visual awareness in stroke patients suffering from left-side neglect. In Denmark, music therapists used the method of Guided Imagery and Music (GIM) in rehabilitation to help such patients while listening to, for example, Mahler's *Fourth Symphony*. The results were very promising: after nine group therapy sessions, patients were able to think more easily in terms of images and metaphors, and because they seemed to express themselves better emotionally, they could also relax better than before. And yet this method of using imagery when listening to music is demanding, requiring a certain amount of plasticity in the damaged brain, because it needs both hemispheres to be fully activated (Moe & Thorstrup, 1995).

For the human brain, listening to music entails a widespread activation of temporal, prefrontal, premotor, and parietal cortical areas. And these parts of the brain control many cognitive functions such as attention, semantic and syntactic processing, not to mention memory. It is no wonder then, that in receptive music therapy, listening to music is more than just an enjoyable leisure activity, helping one to relax or escape from daily worries. It also requires activation of parts of the brain that are vital to ADL. But perhaps the most significant influence music has is on the emotions, and it can be used to regulate them as well as mood and attention (Sloboda & O'Neill, 2001; Trainor & Schmidt, 2003; Baumgartner, 1992).

When combined with standard care, music therapy therefore has a beneficial effect because it enhances neurological functions, speeds up the recovery of cognitive functions, and improves the mood and quality of life experienced by clients (So-Young & Grocke, 2008; Thaut & Abiru, 2010). Music listening has also been found to particularly enhance motor, cognitive and emotional recovery right after a stroke, and it has been specifically associated with better relaxation, increased motor activity and an improved mood, while music combined with audio book listening has been found to provide refreshing stimulation and evoke thoughts and memories about the past (Forsblom, Särkämö, Laitinen, & Tervaniemi, 2010). The results of these studies highlight the clinical importance of providing stimulating and pleasant leisure activities after a stroke and particularly encourage the use of music in stroke rehabilitation. Music therapists in the music listening-project (MuKu) (Särkämö et al., 2008), focussing as it did specifically on music listening, realised that patients could still listen to music whatever their disabilities. Music listening was also for some of them the only form of rehabilitation they could get at the start. Another advantage was that it was an unrestrictive kind of activity, which they could share with nurses or each other too. For the patients, who otherwise found it hard to have a normal conversation due to being seriously ill, it was easy to talk about different kinds of music they liked and the people this music involved. And for the nurses, talking about music they had listened to with patients often provided a good way into a conversation. This kind of normal conversation focussed on positive and healthy sides of the patient's life and reinforced any progress that was being made in their health (Laitinen, 2008).

There is also more robust experimental evidence to suggest that the clinical use of music can enhance motor, cognitive and emotional recovery after a stroke. Cochrane Reviews are systematic reviews of primary research in health care, and are therefore essential tools for accurately summarising the evidence of the effects of a particular healthcare intervention in a way that minimises bias. In addition to occasionally providing clear clinical answers, when several smaller apparently conflicting studies are brought together, such reviews are a rich resource for people planning to fund or undertake future healthcare research. For example, the Cochrane Review "music therapy for acquired brain injury" (Bradt et al. 2010) examines the effectiveness of music therapy used on patients with Acquired Brain Injury (ABI), by comparing standard care alone for ABI with that of standard care plus various therapies for ABI. It specifically compared the effectiveness of each across a range of abilities and attributes: gait, upper extremity function, communication, mood and emotions, social skills, pain, behavioral outcomes, daily living skills and the ability to cope with adverse events. The results suggested that, of the therapies, rhythmic auditory stimulation (RAS) is the most beneficial for improving gait parameters in people who have suffered a stroke. This technique uses strong rhythmic cues conveyed through music to drive rhythmic movements.

Music therapists Working in Stroke Rehabilitiation

Not as many music therapists are employed in stroke units and hospitals in Finland as are physiotherapists, speech therapists or occupational therapists. As the number of music therapists with substantial clinical experience of neurorehabilitation is small, research into how effective music therapy is still in its early stages. Nevertheless, active music therapy in group sessions has been found to have a positive effect in a significant number of rehabilitation units. These clinical methods are growingly generalised in acute stroke rehabilitation. One such successful therapy-oriented method is Figurenotes© (Laitinen & Pataila, 2000; Laitinen 2003, 2008) that promotes neurocognitive rehabilitation by helping to strengthen a player's commitment and by encouraging independent, unassisted practice. From the point of view of information processing, the cognitive process involved in playing an instrument with the Figurenotes method is very similar to that involved in reading (Resonaari, 2012). Another intervention used in Finland is Physioacoustic Sound Wave Therapy which focuses on the musculoskeletal system, releasing stress and tension through deep body massage. It works on the circulation, lowering high blood pressure and reducing both anxiety and pain. There is evidence that physioacoustic stimulation also has an effect on insomnia, spastic muscles, and pain (Lehikoinen, 1988; Ala-Ruona, 1999, 2003; Punkanen & Ala-Ruona, 2012).

As previously mentioned, an essential goal in rehabilitating stroke patients is to get them back in control of their ADL. Speech therapy, occupational therapy, physiotherapy, neuropsychological therapy, art therapy and music therapy are all beneficial in this rehabilitation process. However, for most of the stroke patients these rehabilitation services are not available (Duodecim, 2006; Takala et al, 2010).

Fortunately however, in the last few years two projects that have been available are MuKu and MT-STROKE, the very projects where music therapists have been able to use their interventions in the rehabilitation of acute stroke survivors. The six music therapists who were interviewed for this study were working in these projects. Indeed, the projects provided a perfect opportunity to look at what music therapists actually do in closer detail.

In the two-month duration of the MuKu-project, music therapists were meeting with patients once a week, encouraging them to listen and share their chosen music with the therapist, while at the same time also bringing in new listening material. Results showed that recovery in the domains of verbal memory and focussed attention improved at a significantly faster rate in the music group than in the language and control groups. The music group also experienced less depression and confusion than the control group (Särkämö, et al., 2008). In MT-STROKE (Ala-Ruona, 2009), a multidisciplinary group, consisting of neurologists, neuropsychologists, physiotherapists, and music therapy experts developed a music therapy model where structured and non-structured episodes would alternate within each therapy session. Different therapeutic approaches were observed and reflected upon during the piloting phase of the

project, and finally an ideal combination of the activities was defined. The clinical model that resulted from this, aimed to meet the special needs of middle cerebral artery (MCA) stroke patients. And it is the combination of these approaches, based on multidisciplinarity and clinical theory, which makes the model special, as every single music therapy approach within it is already individually well known (listening to music, doing rhythmic exercises, using clinical improvisation, utilising rhythmic motor series, using music for relaxing, and having therapeutic discussions). In order to implement the model according to the agreed protocol, the professionally trained music therapy clinicians underwent a further training programme. The training consisted of lectures, clinical exercises, multidisciplinary consultations, and real-time observed pilot sessions, followed by group supervision. In the clinical work, the focus has been wide and has covered the areas of cognition, emotion and motor function, while the therapeutic approaches and interventions have been adjusted to meet the individual needs of clients and their current levels of functioning.

Method

Participants

The six participating music therapists all signed their informed consent to interviews, and it was made sure that all of them specifically had experience in acute stroke rehabilitation. Five of them had also undergone special training in the clinical model developed by the multidisciplinary team in MT-STROKE (Ala-Ruona, Bamberg, Erkkilä, Fachner, & Parantainen, 2010).

Data Collection

Interviews were considered to be an appropriate and effective method for data collection, as they allowed for a more in-depth interaction between the researcher and the clinician. This made it possible to ask for clarification, and thus helped the researcher gain a more elaborate, thorough, and comprehensive understanding of the interviewees' personal experiences (Denzin & Lincoln, 1994). The interviews were consequently conducted in an open-ended manner, and the material was gathered during the years 2009-2010.

The first question in the interviews was: What kind of experiences do you have when working with music or music therapy in acute stroke rehabilitation? It was very open and broad-based, precisely so that the questions to follow could be more carefully honed to the experiences described in the answers of each individual interviewee. The specialist training they had received, as mentioned before, consisted of lectures about neurology and neuropsychology, clinical exercises, multidisciplinary consultations, and real-time observations of pilot sessions, followed by group supervision. Because this kind of model for team-training is new in Finland, therapists were encouraged to talk freely about their experiences of this with other open questions such as: "How was your specialist training?" and "What are the benefits of your specialist training, as you see it?" All but one of the therapists were interviewed for a total of one and a half hours each. The interviews were recorded in audio and transcribed word

for word. As the research project progressed, the clearer the focus of the study became.

One of the interviews was more in-depth however, as it was accompanied with video material from three separate patients that provided points of reference throughout the course of the interview. In this way it was easier to gain more understanding of this music therapist's (and hopefully, by extension, other music therapists') experiences of rehabilitating people who have suffered an acute stroke. During the interview the music therapist showed three 60-minute video clips for each of the different patients. One was taken from the second session, another from the tenth, and the last from the nineteenth session at the end of their rehabilitation programme. Altogether this meant that nine hours of video footage was watched in preparation for this single interview, so it effectively required 6 times longer than the other interviews. This interview was also recorded and transcribed word for word.

However, by watching such extensive videos of one music therapist working together with a number of patients and talking over the findings from the preliminary interviews with the other music therapists could then, in comparison, be properly evaluated. In other words, the in-depth interview enabled some parallels to be more confidently drawn with the other therapists' interviews. It also helped the researcher understand the most pivotal and meaningful factors in stroke rehabilitation for a music therapist. Recordings of the music therapy sessions to be discussed were made on video, which could then be referred to during the in-depth interviews, and member checking was made after first collecting and analyzing the data. Observing the videotapes of music therapy sessions meant the researcher could have access to a genuine setting where music therapists worked. Topics, areas of focus, and data for the research came largely as planned from music therapists' own personal experiences, areas which are of course very sensitive and therefore require an in-depth understanding.

Although in qualitative research each situation is unique, and there is no possibility of generalization, other music therapists should still be able to relate and apply the results of this research to their own work because of similarities that they prompted them to think about (Wheeler & Kenny, 2005; Wheeler, 1999).

Data Analysis

Open questions were preferable to a survey for a number of reasons. Firstly, there is no established terminology as yet that would have adequately communicated relevant observable results to everyone in both a hospital setting and music therapy programme. In this respect this research is grounded in the data and can thus be considered as a modified grounded theory approach (Amir, 2005, p.374). Secondly, a survey would have made it far more difficult to get genuine responses from the music therapists, as it might have framed questions, and therefore answers, in such a way as to be misleading and overly representative of the researcher's point of view. To get a new and authentic understanding of what music therapists really do, a phenomenological way of think-

ing was necessary. By interviewing music therapists about their particular experiences while working specifically with patients in acute stroke rehabilitation, more pertinent data could be gathered. Aigen (1991, 1993) has advocated qualitative research as being the most appropriate for music therapy research, because the focus in both is on the process. The awareness of changing dynamics in the research process reflects an equal awareness of the same dynamics in music therapy sessions. Qualitative research and especially phenomenological thinking in content analysis therefore seems the ideal way to study the process of how music therapists feel they develop the skills and knowledge they require in order to work successfully with stroke patients. It was the same researcher who both interviewed the therapists and performed the qualitative analysis. This was a considered choice, as the process of analysing data for qualitative research generally requires researchers to immerse themselves in the data, looking for patterns, themes and relationships (Wheeler & Kenny, 2005). The analysis was an inductive process that aimed to whittle down the specific data, gleaned from the open questions of the interviews, into a more applicable form. In order to filter out irrelevant data, only the information which met the focus of the present study was kept for the final data analysis (Tuomi & Sarajärvi, 2009). This type of purposeful sampling was performed on a computer using the HyperRESEARCH application (version 2.7), which helps to organise and code segments of text. For this to occur, the verbal expressions of the interviewees had to be first converted into 107 meaning units in order for it to be encoded. Then, with the verbal data now converted into machine-readable codes, they could be compared and sorted into categories of meaning.

Categorisation and analysis were then checked afterwards by the research supervisor and the member check was performed by the same music therapist who had given the in-depth interview earlier. Member checking was made to confirm that the categorisation and analysis had been done correctly, and that the results still corresponded to the information that music therapists had given in interviews.

Results

The results of the data analysis were 15 categories of meaning unit, each of which fell into one of three themes (See Figure 1).

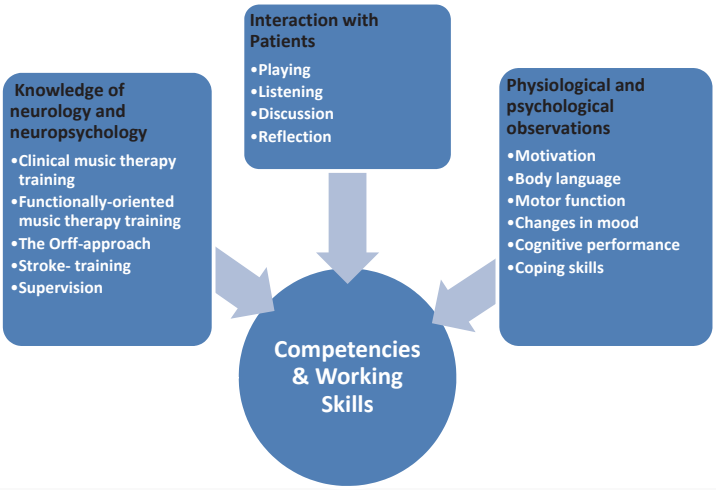

FIGURE 1 The competencies and working skills of music therapists in acute stroke rehabilitation.

Here is an example of how one such meaning unit was categorised:

> Meaning unit: "At the end of the session we always have a nice conversation while listening to music"
> Category: Discussion.
> Theme: Interaction with patient

Each of the three themes that arose from the analysis of these verbal responses is discussed in more detail in its own section below, with a corresponding table for each (see Table 1, 2, 3). The tables depict three crucial factors gleaned from the interviews that were seen to affect clinical thinking: a) knowledge concerning the neurological basis of strokes; b) good patient interaction; and c) accurate observation of the physiological and psychological aspects of music therapy. Within each theme there are five categories (so 15 in total), with an example from the data given for each category.

Although standard music therapy training and education were seen to be adequate enough to meet entry-level professional requirements, therapists who worked consistently with patients suffering from one particular kind of neurological impairment, such as stroke, felt the need to gain more specific knowledge and specialist training about the particular disabilities that a stroke entails. By discussing among themselves new techniques that they had discovered in therapy sessions when, for example drumming, they could figure out

what was best for their patients. And it is precisely these kinds of technique, developed by music therapists in practice that this research wants to shed more light on.

Theme 1: Knowledge of Neurology and Neuropsychology

Clinical, as well as functionally oriented music therapy training had provided the music therapists with a basic neurological understanding of the kind of disability they were facing, and how they might help their clients by drumming. But most of them only gained the really relevant and specific neurological knowledge required once they started actually working with stroke patients and training themselves therein. The Orff approach has not only been used as a way to teach music, but as a form of therapy to help with memory, dexterity, and agility in elderly individuals who often become weak with old age (Bitcon & Hampton, 1976). This approach also contributed significantly to the models that were used in the MT-STROKE project. The Orff approach, where all the concepts are learned by drawing out a person's inherent affinities for rhythm and melody and allowing these to develop in natural ways, seemed to be very useful for the stroke patients, and thus for the therapists. One reason given, was that this approach addresses not only the praxial concepts of music, like rhythm and tempo, but also its aesthetic qualities (Estrella, 2012).

The clinical model for active music therapy in the MT-STROKE project was based on a combination of structured musical exercises, pitched at various levels of difficulty; dynamically rhythmic playing, with sequences of movement that changed; interactive clinical improvisation; music-assisted relaxation; and therapeutic discussion. The training that this project provided, helped music therapists understand the neurological importance of certain techniques, such as being in the right position when drumming. It also helped them to see more global consequences, such as how important it is in rehearsals to motivate patients to play to the best of their ability.

By reflecting upon their way of working through the use of real-time observation and supervision, therapists also got a better understanding of the problems facing each patient and could provide more effective rehabilitation. During the specialist training that MT-STROKE provided, music therapists also learned to pay particular attention to a phenomenon that occurred quite often with stroke patients, when they sometimes got stuck doing one particular movement. The training required them to start the same action all over again from the beginning, with music therapists giving both verbal and musical hints, as well as intervening, if necessary, to help and motivate patients to progress with their drum playing. The important thing was not to learn and adopt patterns and models that could in the long-term prove neurologically detrimental, as one therapist describes here:

At first it was difficult for me to stop the clients, when I noticed that the patient was using a model of drumming that was less beneficial. I learned that in a neurological way it is important not to learn such models, so that's why I stopped the drumming immediately and we did the exercise all over again in a more neurologically rewarding way.

The drumming was interrupted only if patients were losing the intended drumming model, and were stuck playing in a position that was creating difficulties for their hand or otherwise. In the video, the different techniques the therapist used to encourage optimal drumming positions could be seen, and all of these examples were explained from a neurological perspective.

TABLE 1 Knowledge of neurology and neuropsychology

Clinical music therapy training	**Functionally-Oriented music therapy training**	**The Orff approach**	**Stroke-training**	**Supervision**
In Clinical music therapy training we were given some background knowledge in neurology, but not that much. This kind of stroke-training could be very useful to add in clinical music therapy training, too.	Functionally-Oriented music therapy models are a good basis for building-up sessions with patients. For me it was easy to learn codes for playing, but some music therapists found them difficult	With Orff approach we build up drumming sessions, that could be used directly in rehabilitation. The Orff approach was very useful and easy to learn	Stroke-training has been very useful. The neurological information it provided has been especially important. The lectures and advice that we got from neuropsychologists proved very important: they explained in a clear and understandable way, the kind of symptoms and difficulties patients might have. It is very usual, that stroke patients get stuck doing one particular movement. Then I have to get them to want to move on by helping them understand why it is important to do the rehearsal in a right way.	I am hoping there will be more supervision in the future, because, with these patients, it feels very important. At first it was difficult for me to stop the clients, when I noticed that the patient was using a model of drumming that was less beneficial, I learned that in a neurological way it is important not to learn such models and that's why I stopped the drumming immediately and we did the rehearsal all over again in a more neurologically rewarding way.

Knowledge of neurology and neuropsychology was therefore important in a very practical way in these music therapy sessions. But as we have glimpsed already, it was perhaps even more important that music therapists should develop first and foremost a good relationship with their patients, as without suitable motivation, no such knowledge would be implemented.

Theme 2: Interaction with Patients

Music therapists found the actual interaction with patients to be the most important factor in keeping the sessions therapeutic, encouraging and positive. And, according to feedback, the patients shared this opinion. Music therapists therefore built up a warm relationship with their clients, as can be seen in the next data excerpt:

It is very important, that the patient feels that I am here just for him - that I totally concentrate on him here and now. I was actually quite surprised that the interaction with the patient was so intimate. I tried to listen to him and encourage him in every possible way I could, and in an emotional way too, so that the positive feeling would last all the while we were working together.

Because the rehabilitation programme lasted a full 20 sessions, music therapists had every opportunity to build up a good relationship. Music therapists were there for their clients, looking out for them, listening to them, empathising with them, encouraging them to do their best, to practise and to discuss the situations they found themselves in. For example, one client who was one of the most badly injured, nevertheless had a great sense of humour and so the session was correspondingly geared to his humour as much as the music therapy itself. Good interaction with the client was essential to enable this.

A very important part of each 60-minute session was therefore the start, when they had a discussion about the things that had happened since the last meeting, and how the patients had been doing in other contexts (i.e., at hospital or at home). The therapist could ascertain at this point what mood the client was in for the day and therefore at what pace to set the activities - for example, if the patient was in an aggressive mood the therapist would slow things down; or if the client was in a curious mood, the therapist would explain why they were putting the drum in a particular position for them. Different clients would require very different ways of communicating, particularly as an essential part of music is fun and therefore quite subjective. During the session the patients were not just left to play, but the level of interaction was maintained by encouraging and helping them to play to the very best of their abilities. At the end of each session there was also a moment to listen to music, reflect, and to give global feedback about the whole recovery process, and talk about how they felt the stroke rehabilitation was progressing. This also gave the therapist a chance to step back and reassess how the interaction with each client was progressing, and what things if any, needed changing for the next session.

TABLE 2 Interaction with patients

Playing	Listening and sharing	Discussion	Reflection
When I think how difficult and big a thing the stroke must be for my patient, it seems natural to want to encourage him each time he manages to overcome his difficulties and play well. I am a little bit concerned about the huge proportion of time we spend drumming. I wanted to give him a rehearsal that could help him to use his wrist in a better way, as I noticed he could do it.	As a music therapist I was surprised at how intense and empathic the relationship with the patient was. The whole time I tried to listen to the patients needs, while also encouraging him in both physical and mental ways to pick up on the positive feeling. I want to be intuitive with my patient, if there is something he needs to rehearsal more or talk about. It is very important to build up a confidential relationship with patient, because we only meet 20 times	... It is therefore very important that the actual moments of interaction and contact are good between us, and that there's a confidential atmosphere when we work together. I wanted to make my music therapy sessions very human, so that there was always the possibility for example, to stop and talk about things. At the end of the session we always have a nice conversation while listening to music. The only place for discussion is at the beginning and at the end. I don't think it´s really enough.	I think that the interaction and relationship are very important: here is someone who has had an acute stroke which has probably turned his world upside down. He doesn't know what the future holds, or where this will lead him. He doesn't know if he is going to get any better or perhaps if he will ever be able to move one side of his body again. There could be all sorts of thoughts occurring to him… And then there is me, a new music therapist, who is a total stranger to him

Theme 3: Physiological and Psychological Observations

The music therapists all mentioned how important and challenging it was, to continuously be paying attention to each of their clients while simultaneously conducting the sessions:

As a music therapist I have to think more and more about the context I am working in with each patient: what kind of person they are, and what they need at that precise moment. It´s as if I had four canoes and had to jump from one to another continually.

The sort of things they were looking out for was each client's motivation; their body language; what motor functions were particularly difficult; any changes in mood; their cognitive performance; and those things that clients were able to cope with well, and not so well. The music therapists were well aware of the fact that one of their greatest challenges was to successfully observe all these aspects at the same time in their stroke patients. As one of the therapists succinctly put it:

Observing and acting upon many things at the same time - what happens in a patient´s mind; how his body is functioning; which direction I should move the drums for him; and how to improve his motivation - all that has been very challenging.

Usually patients were motivated, which made the therapy easier, but very often they also got quite exhausted in sessions. Observing this in time was very important to ensure that they did not get stuck in one particular movement. The music therapist had to watch carefully to ensure that intervention did not come too late. As mentioned above (Theme 1), the drumming would be stopped immediately, so that the patient didn't start following any detrimental models.

Another priority for observation among the therapists was each patient's mood: in other words, to be aware of how they might be coping with mood swings, since depression is a very typical symptom among stroke sufferers (Berg, Palomäki, Lehtihalmes, Lönnqvist, Kaste, 2003). In fact, some of the therapists suggested that more attention should be paid to a patient's mental health immediately after a stroke, than is currently the case.

TABLE 3 Physiological and psychological observations

Motivation	Body language	Motor function	Changes in mood	Cognitive performance	Coping skills
..how to improve his motivation has been very challenging. This patient always wanted to hear the purpose of drumming; how it affects to him. After that he concentrated better in rehearsals.	From body language I usually figure how badly stroke has affected my patient. In the end of rehabilitation you could see the improvement in body language, too.	Observing and acting upon many things at the same time - what happens in a patient's mind; how his body is functioning; which direction I should move the drums for him; has been challenging.	I have noticed that there are some differences in mood; In the beginning patients feel sad, but in the end of rehabilitation they usually feel less sad.	I have been wondering, if my client actually realise how badly he is injured. I wanted to ask him, if he thinks he is going to be all right, but I don't dare to ask, because he doesn't want to talk so much. Concentrating is difficult for my patient.	In cases where patients are depressive, more attention should be paid to their state of mind and psyche. One of the patients used humor to cope with his disabilities

DISCUSSION

The goal of the present study was to gain more insight into the skills and knowledge that music therapists feel they need to have when they work with acute stroke patients. The three aspects to this knowledge base were found to be firstly an educational background in neurology and neuropsychology; secondly careful interaction with patients; and thirdly observation that takes in both physiological and psychological factors. The discussion is therefore structured according to these aspects and related to the findings of the analysis.

Educational Aspects (Neurology and Neuropsychology)

By speaking about the specific skills required, it has become more clear what could possibly be fed back into the educational system to make training for future music therapists more effective. Indeed, this issue is becoming crucially more important, as the education and training of music therapists has been discussed and debated a lot in recent years (Goodman, 2011). According to David Luce (2006), director of Music Therapy at Chapman University in California, there is a need for much more discussion and research to explore the teaching methods and pedagogy behind the education and supervision of music therapists. Educators and clinical supervisors need to understand each student's epistemological development, and the process of learning needs to be based more on reflection and self-experiential learning (Luce, 2006). Music therapists in this study seemed to share this perspective, paying more attention to the effectiveness of learning by actually doing. They also highlighted the need for supervision and a commensurate amount of reflection after working in a new way with a patient. The findings from the interview data suggest that there is a need to look further at music therapists' clinical work and its possibilities for education.

Knowledge of neurology and neuropsychology most definitely helped music therapists during their working. And by working with methods they had learned from the Orff approach or functionally oriented therapy in stroke training, they knew how to rehabilitate stroke patients the best they could. However, there seems to be no single correct way to do music therapy in clinical work. Therapists use a variety of techniques depending on the clients involved. One thing that was common to all the interviews in this study was that their clients were the priority. The patient provided the determining factor in producing the appropriate therapeutic techniques. It was also interesting to find out how many of these techniques were seen to have been acquired through the therapists' education and how many from their work experience.

Lindvang (2010) in her study has gone further to explore the various phenomena that are the result of self-experiential learning, personal therapy and training among music therapy students in Aalborg University. Self-experiential learning was contextualised clinically and professionally, by asking qualified professional music therapists to evaluate the influence of their self-experiential training on current clinical competencies. The results showed that for those

therapists whose self-perceived ratings of clinical competence were very high, self-experiential learning had a strong and important role to play. Being conscious of their role as a music therapist and being able to handle and understand counter-transference was also seen to be very important. The current emphasis in clinical music therapy training in Finland and Denmark is nevertheless typically psychodynamic, although with further training students can focus on more specific areas of music therapy. In Denmark it seemed that meeting the client, in other words following their specific needs, was what music therapists felt most confident about, and this was confirmed in the present study.

Felder and Silverman's (1988) model of learning acknowledges the fact that people handle information in a variety of ways: it depends firstly on the senses used to perceive the information; then in what proportion emotion, reason and intuition are used to reflect and act on this information; and it also depends on whether this reflection is steady or sporadic. Just as learning styles differ, so do the methods of teaching: ranging from simply lecturing to students, to demonstrating or leading students towards self-made discoveries. Some teachers might be more theoretical, others more practical; some will focus on memory, and others more on understanding (Felder & Silverman, 1988). The music therapists featured in this study all received a professional education in music therapy, but it would be instructive to know just how effective such an education is.

Langan & Athnasou (2005) attempted to measure this effectiveness with Alexander's Model of Domain Learning (1997), in which music therapy students were tested and the results compared with students of art therapy, dance therapy, counselling therapy, and music. They indicated that music therapy students indeed showed the highest levels of knowledge and interest in the domains most important for their job. The level of interest was significant, as results also suggest that specific learning occurs most effectively within the identified domains of interest or expertise (Langan & Athnasou, 2005). Another very important part of a music therapist's training is to develop self-reflection skills, which are best achieved during clinical practice by working as a music therapist under supervision. For example, Baker and Krout (2011) have reported the findings of a pilot study, where music therapy students from Australia and the USA used song writing to share their experiences in clinical training. Although students were concerned about their beginner level of competency in music therapy, they also made it clear that they had nevertheless been able to learn a great deal from their clients, which was a new finding from the educators' point of view (Baker & Krout, 2011).

As confirmed in the interviews here, from the very start of clinical training music therapists must work with all of their senses and be fully aware of the present moment. To observe, interact and utilize their neurological knowledge successfully, they have to reflect upon their way of working, and try to understand what is going on in their patient's mind at the same time. Empathy is also needed when they are building up a relationship with their patients, and yet they must also feel confident enough to intervene where necessary. This deli-

cate balancing act means, according to Bruscia (1998), that during the therapy session they must continuously move from the therapist's world into the patient's world so that they can reflect on the experience from that person's perspective, and yet they must not stray too far either side of the border between these two worlds. It is particularly important for a music therapist to understand the phenomenon of transference and countertransference when interacting with clients.

Benedikte Scheiby (2005), who has been working as an adjunct assistant professor in the music therapy program at NYU, states that the identification and management of countertransference is one of the most essential skills required by a music therapist (Scheiby, 2005). The quality of interaction with patient has been a very important theme in this interview-study. According to the findings, music therapists had good interaction skills with their patients. In both projects, music therapists were starting with the patients that were already in hospital. They treated them however, as they would treat someone outside hospital, asking about their favourite music and hobbies which, as Laitinen (2008) from the MuKu project notes, was particularly appreciated by the patients.

Interaction with Patients Using Music and Conversation

Music therapists are often asked whether it is music therapy, or just music in medicine that they are doing. According to Dileo and Bradt (2009), it is important to make a clear distinction between music interventions administered by medical professionals and those implemented by trained music therapists. This is because music therapists tailor their interventions to meet each patient's specific needs, and engage the patients also in actual music making. In order to achieve the clinical goals, there is a systematic therapeutic relationship established with the patient first, which includes assessment, treatment and evaluation.

In psychotherapy, as well as in music therapy research, there has been an increasing focus on providing evidence that only certain approaches or techniques work effectively for certain groups of clients. This is an attempt to meet all the requirements necessary to provide evidence-based practice (Ronnestad, 2008). But as a consequence of the need to provide as objective evidence as possible, which can compromise the subjective relationship between therapist and patient, some of the advantages that a therapist brings to the therapy are lost. And because a number of studies have shown that the quality of the relationship between therapist and client is indeed pivotal to the effectiveness of any therapy (Orlinsky, Ronnestad & Willutzki, 2004), this is a serious consideration that must be taken into account.

In this study, music therapists believed in the effectiveness of their work in post-stroke rehabilitation, and this was partly due to the fact that the patients themselves also appreciated the value of music therapy. One of the patients in MT-STROKE summarized his experience as follows:

This has been excellent, and I am truly grateful that I got music therapy. I have progressed a lot. In my music therapy it felt like the elements of physio-

therapy, occupational therapy and neuropsychological rehabilitation were combined successfully.

One thing that was common to all the therapists interviewed in this study was that their clients were the priority, and this no doubt affects the quality of patient interaction in terms of intensity and sensitivity. Indeed, it could be argued that being too objective about patients and their problems can actually hinder recovery, whereas being more personal with clients might actually improve their rehabilitation. For example, Columbia University Medical Center trains physicians, scientists, public health professionals, and nurses in this (Columbia University, n.d.). The Programme in Narrative Medicine (PNM) was established in 1996 to break down barriers in health care by providing practitioners with the clinical tools to listen, encourage patient stories, honor the intentions of their patients' and their own stories, and share thoughts and concerns. As a result, patients are treated more empathically and have the opportunity to engage more fully with their own care; understanding and articulating it beyond simply a description of physical symptoms.

This is in contrast to many prevailing methods of treatment. According to Sakalys (2000), the empiricist tradition of medicine in the West, with its accompanying objectivism, reductionism and materialism, effectively narrows medicine's focus down to the body and the physical manifestations of stroke rather than the whole individual who has suffered a stroke. This was seen in the hospital, where patients were more easily described by their particular complaint:

> the left hemiplegia in room 15
> the neglect by the window

These are systems of identification that are endemic to health care institutions in general, where it is all too easy to objectify the person who is the patient and, in so doing, dominate them quite unnecessarily and perhaps detrimentally. Understandably getting to know a person has to start somewhere, and in a hospital, the fact that all the staff knows what is wrong with a patient will of course be very important. But music listening could be helpful in these kind of situations as a counterbalance to this objectification. As mentioned before, talking about the music that the patients had listened to provided a way into a conversation for nurses with the patients who would otherwise find it hard to have a normal conversation due to being seriously ill (Laitinen, 2008). So music listening as a rehabilitative tool could also make it easier for the hospital staff to develop more constructive subjective relationships with the patients. It no longer has to be the case that sometimes, in health care, the particular physical complaint gets more attention than the whole human being, who has a history, interests and dreams for a future of their own.

Observational Techniques

The music therapists in MT-STROKE all mentioned how important and challenging it was to continuously pay attention to each of their clients while simultaneously conducting the sessions. As mentioned earlier, the sorts of things they

were looking out for was each client's motivation; their body language; what motor functions were particularly difficult; any changes in mood; their cognitive performance and the things that clients were able to cope with well, and not so well. Usually patients were motivated, which made therapy easier, but very often they also got quite exhausted in sessions. Observing this in time was very important to ensure that they did not get demotivated and stuck in one particular movement. The music therapist had to watch carefully to ensure that intervention did not come too late.

Another priority for observation among the therapists was each patient's mood, in other words, to be aware of how they might be coping with mood swings, since depression is a very typical symptom among stroke sufferers (Berg et.al. 2003). Some of the therapists suggested that, immediately after a stroke, more attention should be paid to patients' mental well being - in other words, not just the immediate physical effects of stroke, but also their state of mind. Since emotional disturbances and fatigue are frequent after the acute stroke, it is very important to observe these during the music therapy sessions (Ferro, Caeiro & Santo, 2009; Annoni, Staub, Bogousslavsky & Brioschi, 2008).

CONCLUSION

This study has provided information about music therapists' way of working with stroke patients. During the MT-STROKE project, music therapists found their specialist training very helpful, and were also of the opinion that this kind of education should form part of the training for a clinical music therapist, or at least be available to them afterwards, as and when required. They also (as did the therapists from MuKu) valued their interaction with patients very highly, and realized how important it was to be aware of both the mental as well as physical hardships their patients faced after a stroke. In their therapy sessions they observed a great many things at the same time, which was quite challenging and demanding. This study has also shown that there is a special need for multidisciplinary knowledge and multimodal training approaches. It has led the author to the conclusion that music therapy training should consist of different stages, based on the level of competence and the field of expertise required for the clinical work in question. Clinical music therapy training usually covers just the basic competencies, so when working with a specific target group, as stroke patients are, additional training would be needed, followed by extensive clinical supervision.

But perhaps the most original point that the qualitative data in this study raised was that music therapists are in fact in a better position than many think, to know how best to deal with the challenges facing stroke survivors. Their knowledge of neurology and neuropsychology, good interaction skills with patients and capacity of observing both physiological and psychological factors during session suggests that music therapy could be used to improve functional skills in a wider context, and be transferable in some capacity for use outside treatment sessions as well.

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