Music Therapy for Aphasia

How Can Music Help People with Aphasia Reclaim Speech?

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Abstract

For hundreds of years, it has been observed that people with aphasia can sing words fluently, even though they cannot speak. This thesis will investigate how this observation has led to therapy methods, the goals of which are to facilitate propositional speech using music, and how and why these show good results. Various kinds of literature relating to this area will be presented, as well as interviews with music therapists having experience with aphasic patients, an interview with a former aphasic patient who was a musician prior to the impairment and who used music during rehabilitation, as well as an observation by a music therapy group session on clients with speech impairments. The findings are that music therapeutic methods seem to yield good results, and observations, vocal output measurements as well as brain imaging show changes following therapy. Which are the mechanisms that music provides that facilitate the changes are being debated, and there is no formal agreement about this at this juncture; there is, for instance, debate whether the left or the right hemisphere takes over the processing of language. Music does motivate rehabilitation and reduce mood impairments, if applied properly. Aspects of music therapy—other than music itself—may also be important for the positive outcomes, such as the tradition of the therapy in contrast with other therapies, since music therapy is more method-oriented than problem-oriented, and depends on the intensity of the therapy that is suggested.
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1 Introduction

- Where words fail, music speaks
  (H.C. Andersen)

Approximately five years ago, I watched a music therapist’s presentation about music therapy and why she got into the field. She told a story about her grandmother, who was in a nursery home and had not spoken in several years. She said that she played her grandmother some psalms that both she and her grandmother knew well, when her grandmother suddenly started singing along. The old woman, who had not said a word for many years, was suddenly singing words! The music therapist explained that this had something to do with the brain hemispheres; briefly, she said that music is in the right hemisphere and language in the left hemisphere. This marked the beginning of a growing interest of music therapy and speech for me.

In the following years, I heard about aphasic patients who sang often during rehabilitation and who impressed doctors and the health-care system by recovering quickly. Perhaps there is a connection between use of song and music and recovery?

In hundreds of years, the relationship between singing and speaking has been discussed. It was reported already in the last half of the sixteenth century that people who had lost their ability to speak after sustaining brain damage to the left hemisphere were still able to sing (Merrett, Peretz and Wilson 2014).

Could music be used more systematically as a rehabilitation method? The answer is yes. Several music-therapeutic methods exist that use music as a tool in speech rehabilitation for aphasic clients. Some of these methods will be presented in this thesis.

This introductory chapter, chapter 1, gives an overview of this thesis, presents the research questions, identifies limitations, and offers explanations of terms. Chapter 2 presents the methods I have used and offers an introduction to the interview form and to the interviewees and participants in the observation that was conducted. It also contains information about the whole interview process: i.e., about how I found interviewees, how data was collected from
them, the interview guide, and how I chose to categorize the information. Chapter 3 provides a theoretical introduction in which I give a short instruction to the workings of the brain, as some of the literature that is presented in chapter 4 focuses on neurology. Chapter 3 also presents aphasia: what it is, what it is caused by, how it is categorized, etc. Finally, a short introduction to music therapy is given. Chapter 4 is a literature review; it covers literature on music therapeutic methods for aphasia and outcome studies on music therapy for aphasia. First, I present some music-therapeutic methods used on aphasia, then some studies that investigate the mechanisms of music therapy for aphasic patients, and last studies on the efficiency of music-therapeutic methods and techniques for people with aphasia. Chapter 5 is the qualitative study. It presents findings from the observation of the music-therapy group session, the interview with a former aphasic patient who is a musician and who often sang during rehabilitation, and interviews with music therapists. Chapter 6 is where the discussion, literature review, and qualitative study will be linked together in this thesis.

The research questions for this thesis are the following:

How can music help non-fluent aphasic people reclaim their speech?

Do music-therapeutic methods and techniques work for non-fluent aphasia, and if so, how?

During this study, I spent one semester at the Music-Therapy Master Program at the University of Jyväskylä, Finland. The University of Jyväskylä provided me with relevant courses for this thesis and provided experience with the clinical observation of music-therapy sessions.

1.1 Limitations

There are several impairments and problems that accompany aphasia following a stroke or traumatic brain injury. In this thesis, I will first and foremost focus on aphasia. There are different types of aphasia. I have chosen to focus primarily on non-fluent aphasia, because the literature shows that music and music therapy yield better outcomes with non-fluent aphasia than with fluent aphasia, and to prevent this thesis from becoming too comprehensive. Fluent aphasia will however be mentioned. The literature mostly presents methods that involve singing rather than musical instruments, so the use of singing is naturally discussed more than other approaches. The Former Aphasic Patient interviewed for this thesis had non-fluent aphasia.
1.2 Explanation of terms

Client, patient and student

The person that received music therapy is typically called one of three different terms in this thesis: patient, client and student. All of these terms are used in the literature and the qualitative study in this thesis, and they always refer to the person who is a recipient of music therapy. Different terminology is used partly because of the situations in which the therapy is provided. If the therapy is given in a hospital, the right term would be patient. Clients are found in individual therapy, in which the treatment is non-medical. The term students is used when a school institution, such as adult education, is mentioned in this thesis. Client is often used instead of patient with the aim to break down the stigma of being “weak” for needing help with the situation (Bruscia 1989:32). It may also depend on the tradition of the country in which the therapy is applied. For instance, when I studied in Finland, client was the most used term for therapy recipients.

Classification of aphasia

There are two main types of aphasia: fluent and non-fluent aphasia. There are several subgroups of fluent aphasia, which is associated with problems in speech comprehension. People with fluent aphasia can often speak fluently, but their sentences do not make sense. People with non-fluent aphasia have problems with speech comprehension. A more thorough presentation of aphasia and the subgroups will be given in the chapter 3 entitled, “Theoretical Introduction” under point 3.2.

Music-therapeutic techniques and methods

Different types of music-therapeutic approaches will be considered in this thesis: for instance, music-therapeutic methods and techniques for aphasia. The term music-therapeutic methods suggests a whole procedure of a clinical period over an amount of time with music therapy and a fundament of what a therapist may do. Melodic Intonation Therapy (MIT), for example, suggests what a therapist is doing in relation to how the client is doing. MIT also suggests when the therapy is done. A music-therapeutic technique is smaller, like a trick a therapist can do in therapy—for instance, singing familiar songs. Singing familiar song or tapping out a rhythm with the hand does not provide a whole procedure of therapy over an amount of time. Most music-therapeutic approaches are eclectic; they are made of different elements from different sources and traditions, and are depending on the aims of the therapy and the abilities of the receiver of therapy.
2 Method

This thesis constitutes both a literature study and a qualitative study. The literature study includes a presentation of formal music-therapeutic techniques that are used on aphasia patients, of theories about why it works, and of outcome studies done on music therapy with aphasia patients. The outcome studies presented in this thesis include case studies, studies with language tests as a measurement of recovery, and neuroimaging studies on recovery. The studies that include brain imaging are mostly combined with language testing to identify links between recovery and changes in brain tissue. The qualitative study includes qualitative interviews with therapists who have experience using music-therapeutic techniques with aphasia patients, and with a person who have suffered from aphasia who have used music as a tool to rehabilitate herself. The qualitative study also includes one clinical observation of a group music-therapy session with clients with aphasia and other speech problems.

2.1 Literature studies

I also wrote about music therapy and aphasia in my bachelor thesis, so I started collecting literature already at that time. I started by contacting my recent music-therapy teacher to ask her if she knew of some literature. She then gave me people to contact who know more about these things, so I also received some literature tips from them. I also used a Master thesis on the same theme and found some literature from the author’s literature list. My current supervisor also provided some literature tips. Other professors and fellow students have given me literature tips as well. I found a lot of new literature in the references of the literature I had already found. I obtained some literature via a course I took in Finland.

Search in databases

I performed searches with keywords in several databases: Google Scholar, PubMed, Brage/Bibsys, RefWorks, PsycINFO, EMBASE and Oria. The keywords I used were, “music therapy aphasia,” “music aphasia,” “music therapy non fluent aphasia,” “music therapy Broca’s aphasia,” “music therapy Broca’s aphasia,” “music therapy Wernicke’s aphasia,” “music therapy sensory aphasia” and “music therapy receptive aphasia.” I also performed searches on relevant music-therapeutic methods; “aphasia Melodic Intonation Therapy,” “Melodic Intonation Therapy,” “aphasia SIPARI,” “SIPARI,” “aphasia speech music therapy for aphasia,” “speech music therapy,” “aphasia therapeutic singing,” “aphasia musical speech
stimulation,” “musical speech stimulation,” “aphasia Modified Melodic Intonation Therapy,” “Modified Melodic Intonation Therapy.” When I was specifically looking for studies that include brain imaging, I would use keywords like “brain imaging” combined with the name of a music therapeutic method: for instance, “brain imaging MIT.” When I was familiar with authors, I would specifically perform searches for their name: for instance, “Shlaug,” “Thaut,” or “Tomaino” in combination with “music therapy” to obtain most relevant results. Since I needed literature about stroke, I used the keyword, “Stroke.”

Sometimes google.com provided me with better results than for instance scholar.google.com. Google.com was sometimes able to find websites of the authors, for instance, which contain useful information and publication lists.

Citation style
The citation style I use is primarily from Odd Skåberg’s Oppgaveskriving (2005), mixed with some elements of the APA-style. This is a style I have developed through five years of academic studies. Larger books and articles are cited along with the page numbers where the information was found, but I refer to short articles without page numbers. The book Rhythm, Music, and the Brain by Micheal H. Thaut (2005) is a Kindle DX version book, and this version does not contain page numbers. It is therefore referred to without page numbers.

2.2 Qualitative studies

Interviews
Six persons were interviewed. One had a stroke at a young age: thirty years old. Her lesion was quite bad, but she is now functioning well. Soon after her stroke, she started singing in her choir, as she had done before the stroke occurred. Four interviewees are music therapists who have experience working with aphasia. Three work as music therapists in Norway, one in Finland. I also interviewed one music-therapy student from The Netherlands who worked with aphasia patients during his internship. I did personal interviews and recorded them to transcribe them later.

Each interview was a semi-structural, qualitative interview, so I either met with the interviewees at a café or at their work place. One interview was conducted over Skype, because we were not able to meet. I used a type of interview is called the “research interview” technique proposed in Kvale and Brinkmann (2012:22), which builds, according to them, on daily and professional conversation about an issue that both persons are interested in. The interview was semi-structured and used either open conversation or a closed questionnaire,
but a mix of these two (ibid.:47). The interviews went as a conversation rather than me asking questions, although I had an interview guide with me—mostly as a reminder or suggestion of what questions I wanted answered—but sometimes the interviewees answered the question before I posed it. I had one separate interview guide for the clinicians and one for the aphasic patient. This is the one I used on the therapists:

- How much have you worked with clients with non-fluent aphasia?
- What kind of music-therapeutic methods or techniques did you use?
- Did you find any particular method best, or does it depend on the client?
- How severe was the damage/how was their speech when you saw them?
- What age group were your non-fluent aphasia clients?
- What were the results after therapy?
- Did you target any symptoms other than speech problems, such as depression and frustration/bad life quality?
- Do you have any particular memories of working with this client group?

This is the interview guide I used to interview a former aphasic patient.

- What kind of damage led to your aphasia?
- How does it feel to have missing language?
- What kind of treatment/rehabilitation did you get?
- Was music used during the rehabilitation?
- How did you relate to music privately during the rehabilitation?

Since the therapist is educated, I did not need to make it more oral and understandable, but I did use more “daily life” language with the former aphasic patient, and asked, “Can you tell me about what it was like being ill?” and, “Can you tell me about what it was like to lose your speech?” I started the interviews with a question such as that mentioned above, or something such as “So, you have experience with working with aphasic clients?” Then the conversation usually went on, as the interviewees were prepared for the theme of the interview. These guides had more of a reminder function, and on several occasions most of the themes were covered without me asking the questions; the interview then passed more as a conversation about a theme we both were interested in.
Recordings and transcriptions

I recorded the interviews and transcribed them afterwards. I used my iPhone for recording, as it worked well enough for the purpose. I always made sure I had enough battery capacity and memory available on the device before the interview. I also checked to see if the recording app was working in advance of the interview. Before one interview, the interviewee wanted to meet at a café in the city Centre in the rush hour. I was afraid it would be too noisy around, so the day before the appointment I went to the café and tried to record speech to make sure it was hearable. I also received some tips from people that have more knowledge about recording. They suggested that I put the recording device on something soft, like a fabric, so as not to not pick up too much vibration from the hard surface it was placed on. I also made sure that the microphone on the phone was pointed so that it would pick up both the interviewee and me.

In the transcription, I wrote down only what is relevant to the thesis because we sometimes spoke about other things for a while during the interview. When this happened, I just let it pass by itself instead of cutting it off and going back to the interview question. I think it was wise to keep the atmosphere relaxed and safe, as this is crucial to get good and honest answers, giving the interviewees time to remember episodes from their earlier experiences. One of the interviewees gave me feedback. She said that she felt very calm being interviewed by me, so it seems that my hypothesis was a good one.

Some of the interviews were done in English, and some in Norwegian. This means that, when inserting quotes into the text, I sometimes had to translate Norwegian to English. Since vocal and written language are different, direct written vocal language can look a bit odd. Sentences are often incoherent or do not end properly, and the grammar may be wrong. Therefore, I gave preference to citations—both from the English and Norwegian transcription—that are suitable as written language in terms of grammar, sentence structure, context and translated oral language. To leave the spoken text as it was given would be to run the risk of making intelligent and wise professionals look less intelligent and wise than they really are. I made sure to retain the meaning and the message of what they were saying. I regard this practice as beneficial for both readers and interviewees.

Clinical observation

One group music-therapy session was observed. This group was comprised of five members over seventy, all of whom suffered from speech damage, three of who were aphasic. The session lasted one and a half hours. I had an assistant role during this session, but I also
managed to take some notes. This group session was conducted by one of the interviewees; thus, the data from this session was collected via notes and via interviews with the music therapist. This session was located in Norway.

I did not interview these clients because their speech was too poor. Some of them could not form words at all; some could use only basic words, like *yes* and *no*. One had quite good speech; she could talk about how she and her husband were doing, but she got “out of breath” and tired while talking. These clients would not have been able to give me much information. Even the one who could speak did not speak well enough for a good interview, and I did not want to make her speak so much that she became tired. The music therapist who was conducting the group gave me information about the backgrounds of the participants, such as what damage they have and when they sustained it.

**Consent in participation**

I sent notification of my project to Norsk Samfunnsvitenskapelig Datatjeneste AS (Data Protection Official for Research in English) approximately a year and a half before I planned to complete the thesis. They gave me some guidelines, such as how to treat confidential data when the informants were to be anonymous and how to write a consent-in-participation form. All interviewees received written information\(^1\) in advance, and participants who were observed were informed by their music therapist in advance of my arrival. All participants in the study—the interviewees and the clients who were observed—signed that they consented. They were free to withdraw from the studies at any time if they changed their minds. Norsk Samfunnsvitenskapelig Datatjeneste AS approved the project\(^2\). Because observation was not listed as a method in the original notification, I notified them again when observation became a part of the method.

**Finding interviewees**

To find interviewees, my supervisor suggested that I contact the aphasia association in Norway: Afasiforbundet. I sent them an email to ask whether they knew of people who work with music-therapeutic methods in Norway, and they connected me with a more professionally competent person. She suggested that I write an advertisement to invite people to participate in my Master’s project. I wanted to talk to both therapists who had worked with aphasia and people who had suffered from aphasia who had received music therapy or used music as a tool themselves. This advertisement was placed on the aphasia association website,

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\(^1\) See Appendix 2
\(^2\) See Appendix 1.
It was also sent out to the association for speech therapists in Norway. I also put an advertisement on the Facebook page for music therapy in Norway. My contact information was attached in the advertisement so that people who wanted to participate could contact me.

Some of the interviewees were found through mutual acquaintances. I contacted them and asked if they wanted to participate in this project. When I went to Finland on exchange to study music therapy, I came in touch with music therapist teachers and students who had experience with aphasia patients, and I then asked if I could interview them.

I had contact with some informants who said they would participate, but who stopped answering after a while despite my attempts to make contact again. After a certain time, I gave up trying to contact them, because time was running out.

Analyzing interviews
I used meaning coding to analyses and categorize the interviews. I used the question themes from the interview guides, and I made a list of color-coded themes. I used those colored markers to mark places in the transcriptions that were found to be relevant to the themes. The coding is inspired by grounded theory, which is a theory about coding in qualitative research that was introduced by Glaser and Strauss (Kvale & Brinkmann 2012:209). Grounded theory is a systematic strategy for theory development without a theoretical framework. It uses conceptualization to bind facts together rather than inferences and hypothesis testing (ibid.:323). Coding in grounded theory is qualitative coding in relation to other codes, contexts or consequences of actions. Open coding in grounded theory refers to analysis, examination, categorizing and conceptualizing of data. Grounded theory does not challenge other theories, except to develop an inductive theory. The codes are supposed to define the experiences or actions the interviewee describes. I then used the colored coding to find relevant quotes more easily, so that I could later use them or write about them in the thesis. Since it was a semi-structured interview, thus an conversation and not a questionnaire, this required some time, as I had to look for the relevant replies to the question. Relevant replies to the same question or regarding the same category could for instance be found several different places in the transcription.
3 Theoretical introduction
To prepare the reader, this chapter provides a basic overview of brain anatomy and physiology. Some brain imaging methods will be presented. There will also be given an overview of language in the brain, and music in the brain. Then an explanation of aphasia will be given, such as classification and causes of the lesion. At the end, a presentation of what music therapy is will be given, with focus on music therapy in rehabilitation and neurologic music therapy.

3.1 Brain
Because brain-imaging studies play an important role in several of the clinical investigations that are discussed in this thesis, I discuss some basic brain anatomy and physiology and some brain-imaging methods in what follows.

The nervous system consists of nerve cells, neurons, and supporting cells or glial cells (Brodal 2010:5). The neurons are responsible for the functions that are unique to the nervous system, whereas the glial cells are non-neuronal and primarily protect and support the neurons.

Neurons
A neuron is composed of a cell body, called a soma, and of several processes of varying length and number that extend from the cell body. There are two main kinds of such neuronal “outgrowths”: dendrites and axons. Dendrites are the neuron’s input fiber; they are multiple, and are the receiving surface of the neuron. The dendrites often branch out to form “trees” with large surfaces that receive signals from other neurons. The size of a neuron tree is related to the number of contacts the cell can receive from other nerve cells. Dendrites often have spikes, or “spines,” which are sites of contact with other neurons (ibid.:6). A neuron has only one axon, which is the neuron’s output fiber; it conducts nerve impulses from the cell body to other cells. The axon may have many ramifications that enable it to affect several other cells (ibid.:5). The external branches of the axons have club-shaped enlargements that are called boutons. The boutons lie close to the surface membrane of other cells, usually in contact with dendrites or cell bodies (soma). This site of close contact is called a synapse, and the synapse is where information is transmitted from one neuron to the other. Signal transmission does not
happen directly through cell contact, but through the signal molecules that influence the other cells. This signal molecule is called a neurotransmitter. The neurotransmitter is (at least partly) located in small vesicles in the boutons. Neurons are separate entities (ibid.:7). Repeated transmissions between the same neurons change the function of the synapse, so the transmission “glides” more easily. Repetition or exercise leads to “easier” transmission, which happens, for instance, when someone learns how to play an instrument, a game or a sport. This also regards for instance the memorization of the multiplication table, a poem and other cognitive skills. Then the learner knows how to perform the actions (Borchgrevink 2008:191). There are two types of synaptic potential: excitatory postsynaptic potential, in which the probability of cell firing is larger; and inhibitory postsynaptic potential, in which the probability of firing is diminished (Brodal 2010:40). When the cells “fires,” electro-chemical signals are transformed.

Neurons depend on oxygen, and are very sensitive to the interruption of their oxygen supply. Only a few minutes without oxygen can cause neural death (Brodal 2010:104).

White and grey matter
Brain tissue displays different shades of white and grey when it is cut. This is called white and grey matter. The white matter consists mainly of myelinated axons, in which myelin is responsible for the color. The grey matter contains cell bodies, dendrites, and axons that pass to and from the neurons (ibid.:11).

Nucleus and tracts
Neuronal cell bodies are collected in groups called nuclei. Neurons that are collected like this share connections with other nuclei to establish functional units. Therefore, the neurons in a nucleus receive the same kind of information and act on the same target. Axons from neurons that form a nucleus often have the same target; they send signals gathered, and form what is called a tract. The tracts can be seen as the roads of the nervous system, with an enormous number of bigger highways and smaller pathways. The spread of impulses is normally highly ordered (ibid.:11-12).

Structures
The brain consists of a number of different structures. The main structures are the brain stem, which is a continuation of the spinal cord, the cerebellum and the cerebrum, which consists of two cerebral hemispheres, the left and the right hemispheres (ibid.:72). The cerebrum and
Cerebellum together account for most of the human brain and contain the more advanced functions, including those that are specific to humans. Respiration, circulation, sleep, wakefulness and eye movements are controlled in the brain stem. The thalamus is almost an extension of the brain stem; it transfers sensory information to the cerebral cortex and the hypothalamus, which controls the automatic and endocrine functions, such as circulation, digestion and temperature (ibid.:72-73). The cerebellum is responsible to coordinate voluntary movements by acting on motor neurons in the cerebral cortex, the brain stem, and the spinal cord. The Basal Ganglia contribute to the control of movements and influence cognitive functions (ibid.:73). As the brain develops, it folds and produces deep fissures, called sulci. The rounded parts in between are called gyri (ibid.:91).

The cerebrum fills up most of the cranial cavity. It is almost completely divided into two pieces to make the cerebral hemispheres. A layer of grey matter covers the surface of the hemispheres, which is the cerebral cortex. The cerebral cortex consists of sulci, gyri and fissures. The corpus callosum is a fiber tract that enables cooperation between the hemispheres. The hemisphere can be divided into four lobes. These are the frontal lobe, the temporal lobe, the parietal lobe and the occipital lobe as illustrated in the image below (ibid.:89-91).
The cerebrum is the most advanced part of the brain. It is involved in sensory processes, thinking, learning, emotions, consciousness and voluntary movement (Passer & Smith et al. 2011:110). The cerebral cortex is important for us to function as humans, but we can survive without it. People who are born without the cerebral cortex have basic functions, such as sleep, hunger, some emotion, and some movements (ibid.:113). The symmetrical hemispheres control the musculature on the contralateral side of the body and respond to sensory stimulation from the opposite sides of the body. This peculiar phenomenon is called decussation (Kolb & Wishaw 2003:70).

**Brain imaging**

A CT or CAT-scan (computerized axial tomography) is a brain-imaging method that uses x-rays to shoot several narrow photos. The photos are then analyzed by a computer that makes a pictures of the brain that can be shown from several different angles. This can be used to locate lesions or impairments and to see them in relation to psychological functions. CT-scans are a hundred times more precise than normal x-rays (Passer & Smith 2011:108).

MRI (magnetic resonance imaging) gives pictures based on how atoms in living tissue respond to a magnetic pulse that is sent out from the MRI-machine. When the magnetic field is turned off, the magnetic energy absorbed by the atoms in the tissue releases a small electric tension that is sent to a computer to be analyzed. The MRI provides a color picture, and is much more precise than a CT-scan (loc.cit.).

Functional MRI or fMRI is a development of MRI, which takes photo with a faster interval. This makes it possible to shoot pictures of the blood stream in the brain. Because active brain tissue uses more oxygen than inactive brain tissue, these photos can provide information about brain activity by indicating the concentration of oxygen in the blood stream (loc.cit.).

PET scans (positron-emission tomography) measures brain activity, including metabolism, blood stream and neurotransmitter activity. Before a PET scan, the person being scanned has radioactive glucose injected to the blood. This injection travels through the bloodstream to the brain. Glucose is the main nourishment for the neurons, which consume more glucose when they are active. Thus, a PET-scan measures how much energy the radioactive glucose releases. If the person being scanned is doing tasks, it is possible to see which part of the brain is active. The data from the energy release of the radioactive glucose is shown as a color picture of the brain on a screen, and colors show where in the brain there is activity (loc.cit.).
Magnetoencephalography (MEG) records the magnetic field produced by groups of neurons at the surface of the skull. MEG provides a description of the electrical activity of the neurons and a three-dimensional localization of the cell-group. A computer displays electrical waves and can convert them into a color representation to show “the hot spot” of the stimulus (Kolb & Wishaw 2003:157).

**Brain and language**

Two main language regions were discovered in the last half of the seventeenth century. Both were discovered through clinical observation, and both were in the left hemisphere. In 1861, the French physician Paul Broca discovered loss of speech—aphasia—in the left frontal lobe just in front of the motor face area. This area is therefore called “Broca’s area,” and it is connected with speech production. In 1874, Carl Wernicke discovered a lesion in the posterior part of the superior temporal gyrus of a patient. This area is now known as “Wernicke’s area,” and it is connected to speech comprehension (Brodal 2010:509). Both of these speech areas were discovered through lesion studies. Therefore, the conclusion was made that there was a connection between which part of the brain is damaged and which functions were impaired, as in this case speech production or speech comprehension. fMRI and PET-scans show that Broca’s and Wernicke’s areas are involved during various language tests; but other parts of the cortex also participate. This may be because language depends on several different processes, such as storage of words in short-term memory, phonologic and semantic processing in relation to the long-term memory, arranging words into sentences, and issuing commands to motor areas about sound production (ibid.:510). Silent reading and repetition of words activates primarily the anterior region, thus Broca’s area. Semantics activates areas in temporal, prefrontal, and inferior parietal cortices, including Broca’s and Wernicke’s areas, primarily in the left hemisphere. Phonologic processes activate partly the same areas as semantics, and partly different areas. The locations of various networks of language processing in the brain have been proposed; memorizing happens in the temporal lobe, analyzing in the parietal lobe and synthesizing in the frontal lobe. There is further evidence of specialization in each region or area, but what we know about language in the brain today is still limited (loc.cit.). It is still uncertain whether language processing has a brain network to itself for the functions mentioned above, or if the processes share systems with other cognitive processes. While there is brain-imaging evidence that some processes are shared, there are cases of people who experience selective loss of language without any other cognitive defects and vice versa (ibid.:509). More recent brain-imaging studies show that
The left hemisphere is responsible for most of the aspects of language function for most people, even for those who are left-handed. Approximately 95% of right-handed and 70% of left-handed persons have language function in the left hemisphere; so the “dominant hand” does not show a strong correlation. Studies of split-brain patients—i.e., patients who have had the corpus callosum transected due to severe cases of epilepsy (to prevent the spread of abnormal discharges from one hemisphere to the other)—confirm that the right hemisphere is mute in most people. For example, when split-brain patients are asked to feel objects with their right hands without seeing it, they can tell what it is because the tactile information is received by the speech-dominant hemisphere. If the same thing is done with the left hand, however, the patient is unable to name the object, because the information goes to the “mute” hemisphere. The patient still shows appropriate emotional reactions to the object, so it is clear that the right hemisphere “understands” the nature of the object but cannot express it in speech. If it is very emotionally loaded, then the patient can utter some words (Brodal 2010:513). There is evidence of surprisingly good auditory comprehension of language. There is also some reading ability in the right hemisphere, but little writing ability (Kolb & Wishaw 2003:507). One aspect of speech—prosody, the melody and sound of speech—is located in the right hemisphere. Thus, some patients with damage to the right hemisphere may lose prosody. These patients may also have problems understanding the emotional aspects of speech. Brain-imaging testing of prosody shows activation in the region which corresponds to Broca’s area in the superior temporal gyrus (ibid.:514). Purves and Brannon (2013:409) summarize these types of studies by saying that the left hemisphere is specialized with respect to expression and verbal and symbolic processing whereas the right hemisphere is specialized with respect to visual and emotional information.

Recent studies show that large regions of the perisylvian frontal, temporal, and parietal cortices in the left hemisphere are involved in speech production and speech comprehension.

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3 The perisylvian cortex, also called the sylvian fissure, divides the frontal, the parietal and the temporal lobe.
The image above illustrates the perisylvian fissure and its location, and the location of the Broca’s area and Wernicke’s area.

Exactly where the speech areas are located depends on the individual, according to Purves and Brannon (2013:413). Humans do not necessarily use the same brain areas to process different languages.

In learning a second language, there is an anatomical difference if the language was learned as a child or as an adult. With respect to a second language learned in childhood, brain imaging has shown that the processing of the primary and secondary languages overlap in Broca’s area; but in people that have learned a second language as adults, the languages is processed in two separate areas in the Broca’s area (Kolb & Wishaw 2003:627). Studies also show that bilingualism may delay the onset of dementia (e.g., Craik, Bialystok and Freedman 2010).

**Music in the brain**
Several studies support the theory that music has biological roots. Humans have regions in the brain that are dedicated to music (Peretz 2003:192). There is no quick answer to where in the brain music is processed, since different components of music—such as rhythm, melody, harmony, and volume—are processed in different regions of the brain (Brust 2003:181). It was previously believed that music processing is located in the right hemisphere, but this
hypothesis is no longer supported (Altenmüller 2003:346, Baker 2000:110). It is also partly individual where in the brain music is processed. Appreciation and expression of melody has also been linked to the right hemisphere, but a study found that this is true only for non-musicians; musicians show left-hemispheric dominance. When the participants of this study were listening to rhythm, both groups showed the most activation in the left hemisphere. Left-hemispheric activation was larger when the participants were listening to the music actively and analyzing it than when they were merely listening to music as background noise (Brodal 2010:514). A PET-study found that imagining a familiar tune activates association areas around the right auditory cortex motor area. This area is important for rhythmic and sequential movements (loc.cit.). Quite recent studies have shown that pitch is processed in the temporal lobe in the right hemisphere and timing in the temporal lobe in the left hemisphere (Altenmüller 2003:347). For most humans, the auditory processing of music lies in the superior temporal gyrus. The brain’s plasticity with respect to auditory processing is very adaptable, so repeated training might lead to change in plasticity (ibid.:348-350). Clinical observation has shown that damage to the right hemisphere may lead to problem with the processing of music—mostly associated with processing of pitch—although damage to the left hemisphere may also lead to problems with the processing of music (Stewart and von Kriegstein et al. 2009:187). Pitch can be tested “locally” through simple notes and “globally” through discriminate pitches in melodies. Peretz found in a study in 1990 (ibid.:188) that participants with right-hemispheric lesions could process pitch neither locally nor globally, although participants with left-hemispheric lesion could process pitch globally. Peretz suggests that there is a hierarchal process between the hemispheres: the right hemisphere processes the pitch contour, which is elaborated by the left hemisphere. Little research has been done on timbre, though clinical observation suggests that it is processed in the right frontal lobe close to the region that processes pitch (ibid.:189). Like pitch, tempo and meter may also be processed hierarchically. Tempo is processed locally and meter globally. Observation has shown that people with left-hemispheric lesions may have difficulty processing rhythms, and a few studies show the same about meter (loc.cit).

Experiments have been done in which temporarily paralysis of the right hemisphere results in a deficit in singing while music perception and speech stayed intact. Temporarily paralysis of the left hemisphere shows that people can sing better than they can speak (Wigram, Pedersen & Bonde 2002:53). Lesions studies show that people with left-hemispheric damage have problems with rhythm and time perception (Jungblut, Huber, Mais & Schnitker 2014:2).
Only elementary physiological activates can be assigned to different parts of the brain; it is hard to localize creative activities, such as composing, because they rely on so many different activities and therefore involve different parts of the brain. Composition, performance and listening all require the senses of hearing and sight, intellectual and emotional functions, and sensory and motor activity. This tells us that these activities involve the cerebral cortex, the subcortical motor and sensory nuclei and the limbic system. Structural, mathematical and organization functions are linked to the left hemisphere, whereas the creative, emotional and “spiritual” functions are linked to the right hemisphere. Thus, damage to one part or some parts of the brain would not destroy all of the “music” in the brain; but it may destroy some elements of it (Wigram et al. 2002:53). For instance, an individual might retain the ability to sing scales but lose the ability to sing melodies. The auditory, visual, somatic motor, and sensory systems all play a role in the appreciation and performance of music. The ability to hear music in the “inner ear” is a matter of auditory imagery, and it may be highly developed in musicians, for instance, in some of the great composers. Musical memory is also well developed, and several great composers and musicians can write down music from their “inner ear” and their memory (loc.cit.).

Musicians, especially those who have played since they were children, show a more developed frontal corpus callosum, greater concentration of grey matter in some brain regions, and a more symmetric motor cortex in both hemispheres (Schlaug 2003). Piano players use both hands equally, which may explain why the corpus callosum is bigger in musicians, since the corpus callosum is what binds the two hemispheres together. Berit Vik (unpublished) found through a study that used fMRI scans on participants with traumatic brain injury who underwent music training, that there is rewiring of neural pathways after music training. The instrument played may also cause different brain structures. A string player develops finer motor skills in the left hand than a pianist, because the pianist’s left hand often works as the “accompanying” hand. Brain imaging shows differences in brain plasticity in pianists and string-players that correlate to the fine motor skills that string players have in their left hands (Schlaug 2009b).

**Similarities of music and language**

There is more to speech than just the right order of words; speech also contains inflections, intonations, tempo, sound production, rhythm and melody. In both music and language, several functions are in use at once; both include sound production, hearing, melody, and rhythm. In most languages and cultures, coherent and rule-based (Peretz 2003:194).
Language and music both depend on phonatory and articulatory mechanisms [...] on distinctly human brain mechanisms dedicated to the analysis of complex, segmented, rapidly changing stream of sound. And yet there are major differences (and some overlaps) in processing of speech and song in the brain (Sacks 2007:216).

Music and language is processed in different auditory systems according to Peretz (2003:194). Brain imaging shows that word and tones are processed auditory similar in the brain (Besson & Schön 2003:277). The same regions were activated during comprehension and listening to musical scales, auditory picture imagination, and musical representation. The supramarginal gyrus is involved in the comprehension of symbolism in language in sight reading. Broca’s area is activated while playing music, especially in rhythmical tasks (loc.cit.).

Historically, the neurological language areas were divided into Broca’s and Wernicke’s areas, which generally represented speech production and speech understanding. Later, neural imaging showed that several brain regions in various aspects of language contributes in language processing. Neuroimaging has also shown that music is processed in widely distributed neural networks, thereby proving that some of the neural networks for speech and music overlap (Tomaino 2012:312).

There is a difference between propositional, emotional, ejaculate, and automatic speech. The latter can be preserved in aphasia. Cursing, poems learned by heart or singing with lyrics learned by heart constitute examples of automatic speech. Thus, a person with aphasia may be able to curse or sing familiar songs but be unable to utter a propositional phrase (Sacks 2007:218).

### 3.2 Aphasia

Aphasia is a loss or disturbance of speech that is caused by a brain lesion (Brodal 2010:509). Aphasia refers to a disorder in language that is produced by an injury in the brain areas that are specialized for these functions; it may affect speech, writing (called agraphia), and reading (called alexia) (Kolb & Wishaw 2003:502).

**Classifications and types of aphasia**

There are many different types of aphasia. There are also disagreements among the experts concerning the number of types of aphasia, although some classifications are widely used:

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4 Supramarginal gyrus is a partion of the periable lobe, also known as Brodmann area 40.
non-fluent aphasias, fluent aphasias and pure aphasias. There are several subgroups under each of these classifications. *Pure aphasia* includes selective impairments, such as agraphia, alexia and word deafness. Another classification is *Fluent aphasia*, which is related to comprehension or input of language. One subgroup is Wernicke’s aphasia—also called sensory or receptive aphasia. Its symptoms include impairment in writing and an inability to arrange sounds into coherent speech or to comprehend words. Another subgroup is transcortical aphasia, which is also called isolation syndrome. A person with transcortical aphasia can repeat, understand, and name objects but cannot speak spontaneously or comprehend words. “Comprehension could be poor because words fail to arouse associations” (ibid.:504). Persons with conduction aphasia—which is another subtype—cannot repeat words but can speak and name objects. People with amnic aphasia, also called amnesic aphasia, cannot name objects but have no problems with comprehension, speech, and repetition. The last classification is *Non-fluent aphasia*, which is related to speech production; it is also called Broca’s aphasia, motor aphasia, and expressive aphasia. It may be severe or mild. Persons with non-fluent aphasia have good speech comprehension. Sometimes patients cannot speak at all, but they might speak in short phrases and take more pauses than usual, make sound errors, make repetitious errors in grammar, and leave out function words. They may use only keywords in conversations (loc.cit.). They typically use only single words in a telegraphic style, and the words can also be applied “wrongly.” The muscles involved in speech production are not paralyzed—the damage is only in the brain. The damage not only affects vocabulary and grammar but also rhythm of speech, which leads to this characteristically unmusical telegraphic style (Sacks 2007:215). The deficit involves switching from one sound to another rather than making sound. If the lesion is severe, the patient may not be able to speak at all; but it may also be mild, in which the symptoms will only be articulatory lacks or errors in speech. Other subgroups include transcortical aphasia—the symptoms of which are poor spontaneous speech but good repetition and articulatory speech—and global aphasia, in which both speech production and comprehension are poor (Kolb & Wishaw 2003:503-504). Non-fluent aphasia is the classification that will be described the most in the rest of this thesis.

**Localization of lesion**

In terms of localization of lesion in aphasia, there are new findings since Broca and Wernicke discovered the speech areas following observation of speech damage. The key deficit from Broca’s aphasia does not come from damage to Broca’s area, and Wernicke’s aphasia does
not come from damage to Wernicke’s area, as believed earlier. As mentioned, recent brain-imaging studies show that most of the brain participates in language because there are so many processes involved, such as production, comprehension, activation of muscles in face and tongue and memory (ibid.:505). The authors stress that the persons who provide information in form of brain imaging, often has suffered from stroke, which may vary in severity. This makes it difficult to link symptoms to damaged brain areas, because variety in severity may show damages in different brain regions. Another issue is that the symptoms would be more severe shortly after a stroke than after an amount of time has passed, so it is hard to know whether the brain tissue is dead or just temporally paralyzed (Kolb & Wishaw 2003:505). Although symptom classification was originally linked to the brain regions—e.g., Broca’s aphasia was linked to Broca’s area—recent improved anatomical analysis suggests that there are no such precise correlations (ibid.:502). The core of non-fluent aphasia deficit is called apraxia of speech. Some findings suggest that apraxia does not come from damage to Broca’s area but from damage to the insula5 (ibid.:505-506). Other symptoms of non-fluent aphasia—impairment in sentence comprehension, recurring utterances, impairment in articulation of sound, and impairment in working memory for sentences—have different neural bases (loc.cit.). As for fluent aphasia, it has been suggested that lack of comprehension comes from damage to the medial temporal lobe and underlying white matter. Damage to this area does not merely damage the local language function; it also cuts off other regions that affect language. Damage to Wernicke’s area tends to affect word rhyming and the ability to hold sentences in memory until they can be repeated (loc.cit.). There are also theories and some evidence about language processing in the subcortical regions (ibid.:507). Fibers connect the anterior speech area (Broca’s area) and the posterior speech area (Wernicke’s area); thus, damage between those areas can also lead to aphasia (Brodal 2010:510).

**Cause of aphasia**

The most common cause of aphasia is stroke; but traumatic brain injury, tumors and encephalitis may also lead to aphasia (Jungblut 2005:189). When a stroke occurs, there is an interruption of blood supply, either due to bleeding or embolism. This means that the regions that the blood does not reach would not get oxygen or glucose. This may lead to death of neurons; but the interruption of blood flow is followed by a sequence of events that progress even if the blood flow is restored. In the first seconds to minutes after a stroke occurs, there

5 The insula is a portion of the cerebral cortex folded deep within the lateral sulcus, which is the fissure separating the temporal lobe from the parietal and frontal lobes. The insula exists in both hemispheres, and is also called insular cortex, insulary cortex and insular lobe.
are changes in the ionic balance of the affected regions. These include changes in the pH level and properties of the cell membrane. Ionic changes leads to a variety of pathological changes: for instance, prolonged opening of calcium channels. This event allows toxic levels of calcium to enter the cell. The tissues become inflamed and swollen in the affected area and even in cells around the area that are relatively far from the site of injury, all of which may lead to death of the cells. A form of neural shock may subsequently occur, as a consequence of which the areas related to the injured region do not get any input, which may lead to a temporally loss of functions. This depressed function might come back after some time, and thus difficult to know whether function is lost temporally or permanently following the lesion. (Sacks 2007:218). A stroke may also lead to changes in metabolism that may injure the brain tissue (Kolb & Wishaw 2003:680-681).

**Recovery from aphasia**

Rehabilitation after a brain injury does not mean that damaged brain tissue heals, but that the brain finds way to compensate to regain the functions of the damaged area (Kolb & Wishaw 2003:679-680).

Kertesz (in ibid.:682) reviewed the prospect of recovery from aphasia by using the case histories of his own patients. He found that aphasic patients with brain injury had more successful recoveries than those with stroke. When recovery first occurred, the progress of recovery of the patients was similar. The most recovery occurred in the first three months, and gradually less recovery occurred after that.

After a study of reorganization of language in the brain, Rasmussen and Milner (ibid.:631) conclude that speech has a strong affinity to the left hemisphere and will not abandon the hemisphere unless the entire speech Centre is destroyed..

The neural processes that underlie language recovery following a stroke remain largely unknown. Only a few studies have investigated it. These studies tend to focus on spontaneous recovery, hence natural recovery. Just a few have studied brain imaging before and after the application of therapy. There is a general consensus that small lesions lead to more activity in the left hemisphere while there is activation in the homologous speech areas in the right hemisphere if the lesion is large. Thus, recovery from speech damage may be through undamaged portions of the left hemisphere or through homologous speech areas in the right hemisphere (Schlaug, Marchina and Norton 2008:2). A recovery through the undamaged portions of the left hemisphere seems to result in a more complete and faster recovery than through the homologous speech areas in the right hemisphere. Persistent
recovery through the right hemisphere seems to indicate slow and incomplete recovery (Jungblut et al. 2014:1).

**Age and Recovery from aphasia**

Keretz (in Kolb and Wishaw 2003:682) found evidence that younger patients show better recovery than older patients. Several studies on childhood aphasia show that children who have difficulty speaking, reading, and writing recover quickly compared to adults with aphasia. Alajouanine and Lhermitte (in Kolb and Wishaw 2003:628) observed complete recovery of spontaneous language in three of thirty-two cases and significant improvements in all of their other participants after six months. After one year, twenty-four had normal language. Hécaen (loc.cit.) followed post-injury recovery from aphasia in fifteen children. Five showed complete recovery within six weeks. After investigating early postnatal brain damage using siblings as controls, Wood and Teuber (ibid.:629) concluded that language survives after early left-hemispheric brain injury and that this survival seems to be related to a potential language zone in the right hemisphere. Children younger than one year are prone to more severe overall impairments than older children. Children between one and five years old have the ability to recover completely (ibid.:626,629). There is evidence that children can recover language after removal of the entire left hemisphere, which means that there is linguistic potential in the right hemisphere (Sacks 2007:220-221). Rasmussen and Milner (Kolb & Wishaw 2003:631) found that a hemispheric shift of language is rare after the age of five. After that age, an intrahemispheric reorganization is more likely, possibly with intact surrounding zones acquiring some control over speech.

**Assessment of aphasia**

Some standardized tests are available for the assessment of aphasia. They typically include tests for auditory and visual comprehension, oral and written expression, and conversational speech. These are used both, “to provide standardized clinical description of patients and to facilitate comparison of population in neuropsychological research” (Kolb & Wishaw 2003:510). The *Halstead-Wepman aphasia Screening Test* and the *Token Test* are two examples of test batteries that include a number of subtests (loc.cit.). These tests may be useful for classifying the status of aphasia patients, although some criticisms have been made of this type of testing because it does not focus on individual differences and because poor scores in certain tasks may not be due to speech impairment (it might also be that the patient does not know the name of the object used in the test) (ibid.:511). Some have suggested that too little information is given about the naming tasks and about what poor naming may mean.
Aphasia and dignity
It must be extremely frustrating to have aphasia. We are such linguistic beings; we express ourselves verbally. To lose the ability to express oneself through language must be unbearably frustrating and isolating. Some are treated like “idiots” or non-persons because they cannot speak or cannot speak properly (Sacks 2007:215). It is as if people forget that their cognitive abilities usually work well. Nevertheless, it is understandable that people act like that around aphasic patients. The sounds aphasic patients make when the try to speak are both odd and reminiscent of the sounds that mentally disabled people make. With some mentally disabled people, depending on severity, it is necessary to adjust speech to ensure comprehension. With aphasic patients, especially those with non-fluent aphasia, the speech comprehension is still most often intact. Another issue is that some aphasic patient do not have control over their facial muscles, due to lesions in the brain; therefore, it might be hard for dependents or third parties to see any kind of reaction from the aphasic patient.

Impairments related to aphasia
Some of the studies of aphasia describe other impairments that often come hand in hand with aphasia. These include a whole array of cognitive impairments, just a few of which will be mentioned here. Some patients who have had a stroke, traumatic brain injury or something else that has led to damage in the language area may also get hemiplegia or hemiparesis. This usually occurs on the right side if the damage is to the left side of the brain, due to decussation. There is also dysarthria, or in severe cases, anarthria, which is paralysis or incoordination of the musculature of the mouth (Kolb & Wishaw 2003:502). These impairments may accompany aphasia and thereby complicate the study of it. Depression is also normal following a brain damage. It may result from loss of ability or it might be affected by the brain damage. There is evidence for the hypothesis that depression is related to the location of the lesion, and that left hemisphere lesions lead to depression more often than right-hemispheric lesions (Carson, MacHale & Lawrie 2000:122). Amusia is an impairment that affects the capacity of musical activity. There are two main classifications of amusia: sensory and motor amusia. Sensory amusia involves the inability to hear, read or understand music, while motor amusia involves difficulties in singing, instrument performance or writing music (Wigram et al. 2002:52).
3.3 Music therapy

Defining music therapy

It is not easy to define music therapy. In fact, when I was an exchange student in a music-therapy program in Finland, we had an entire lecture on the problem of explaining what music therapy is to others. When people ask me what it is, I answer that it is a way to use music to promote health. That answer does not give everyone closure, however; some ask for more concrete definitions, which I always find it hard to provide. Then, they ask questions about particular cases. Can you use it with mentally disabled people? Can you use it with children? Can you use it with depression? I often find myself answering “yes” to all of these examples.

One of the major problems with defining music therapy comes from the fact that it is transdisciplinary: “music therapy is not a single, isolated discipline with clearly defined and unchanging boundaries. Rather it is a dynamic combination of many disciplines around two main areas: music and therapy” (Bruscia 1989:7). Music therapy is a relatively new profession, which has emerged over the last fifty years from different professional disciplines.

A general definition will always evade us, though Wigram offers an attempt: “The use of music in clinical, educational and social situations to treats clients or patients with medical, educational, social or psychological needs” (Wigram et al. 2002:29). The World Federation of Music Therapy uses this definition:

Music therapy is the professional use of music and its elements as an intervention in medical, educational, and everyday environments with individuals, groups, families, or communities who seek to optimize their quality of life and improve their physical, social, communicative, emotional, intellectual, and spiritual health and wellbeing. Research, practice, education, and clinical training in music therapy are based on professional standards according to cultural, social, and political contexts (WFMT, 2011).

A general definition of music therapy will always be inclusive. It will vary with the client population, the professional background of the practitioners, the needs of the client, and the approach of treatment. It also varies with the culture in different countries (Wigram et al. 2002:29-30, 35).

Music therapy grows from several different traditions: for example, psychotherapy, special education, medicine, general psychology and music education (Bruscia 1989:7-8, Wigram et al. 2002:30). It is used in all of these traditions, but the approaches and goals differ in each.
Music therapy is method-orientated

Music therapy is more method-orientated than problem-orientated. It relies on music as the modality and main method of treatment rather than on the clinical problem (Bruscia 1989:37). Thus, music therapy has different goals that depend on the setting. Most music-therapeutic methods presented here aim to aid in speech rehabilitation.

Music therapy in rehabilitation and Neurologic Music Therapy (NMT)

Music therapy in rehabilitation is aimed to help clients who have suffered from trauma, illness or injury to regain previous as high a level of functioning as possible. This type of therapy addresses both emotional and adaptational needs. It is an intensive form of treatment, and may be used as or in therapy. The relationship between therapist and client is crucial for therapeutic change (Bruscia 1989:141). Some authors and some of the music therapists interviewed for this thesis also focus on improving the quality of life and wellbeing of the clients. Some of the methods that will be presented here also go by the name, Neurologic Music Therapy (NMT), which may be a little more problem-orientated than other music-therapeutic approaches. NMT is a system of therapeutic techniques that have been developed from neurological evidence (Thaut & Hoemberg 2014:2). NMT aims to use music to establish new neural links for patients with neurologic dysfunctions. It is a therapeutic use of music for patients who have cognitive, affective, sensory, language or/and motor problems that are due to disease or injury to the nervous system. The clinical core of NMT consists of twenty techniques that are defined by the treatment goals and by the use of music to achieve them. NMT is interdisciplinary, so non-music therapists who are trained in allied health professions can adapt materials and principals of NMT to their own work. Collaboration between music therapists and other trained health professionals may also be beneficial, and is quite common. An overall plan for treatment may be obtained when music therapists work with other health professionals, such as doctors, nurses, psychologists and speech therapist.

Many music therapists find that their approach is to improve general health of the patient, to work with specific disorders and problems, and to maintain quality of life and stability in the chronic population (Wigram et al. 2002:33).

The role of the music therapist

It is important that music therapists have knowledge about music psychology. This knowledge concerns the basic processes of the ear and the brain, because these processes are the psychological preconditions of music perception, music experience, and music preferences (Wigram et al. 2002:45). A question often raised against music therapy is the
need of the therapist, and why you cannot just put on some music and call it music therapy. A therapist is needed to create a mutual relationship between the client and the therapist, where the therapist provides expertise to the relationship (Bruscia 1989:34-35). In terms of music therapy for aphasia, Sacks 2007:219) claims that the relationship between client and music therapist in aphasia rehabilitation is important because of the intimacy rehabilitation requires. It involves musical and vocal interaction, but also physical contact, gesture, imitation of movement and prosody. The therapist supports and encourages and leads the patient into increasingly complex speech
4 Literature studies

Music begins were the possibilities of language end (Jean Sibelius).

This chapter presents music-therapeutic methods and techniques for aphasia, outcome studies that include these methods and techniques, and studies that investigate the mechanisms of the methods and techniques.

Several studies report that non-fluent aphasic patients do better with music therapy than with sensory or fluent aphasia (e.g., Sacks 2007:216). Upon using the keywords, “music therapy fluent aphasia,” “music therapy Wernicke’s aphasia,” “music therapy receptive aphasia,” and “music therapy sensory aphasia,” no literature on music therapy for fluent aphasia was found in Google Scholar, PubMed, Oria, Brage/Bybsis and Refworks.

There is no universally accepted method for treating non-fluent aphasia. Nor are there any established criteria for treatment efficacy, although there is informal agreement among therapists that success is shown by an improvement in speech output that is generalized to untrained language structures and contexts. Interventions in the sub-acute phase are conducted by a speech therapist to evaluate the patient’s individual needs and to find a technique that is suited (Schlaug et al. 2008:2).

4.1 Music-therapeutic methods and techniques for aphasia

This part-chapter presents some of the best known music-therapeutic methods for aphasia. The methods are Melodic Intonation Therapy (MIT), Modified Melodic Intonation Therapy (MMIT), SIPARI, Speech Music Therapy for Aphasia (SMTA), Musical Speech Stimulation (MUSTIM) and Therapeutic Singing (TS). These methods are used in the research papers presented later in this thesis. They are also the methods that the music therapists I interviewed use or are inspired by in their work.
Melodic Intonation Therapy (MIT)

Melodic Intonation therapy is the most common and best known of music-based speech therapies (Tomaino 2012:312, Hurkmans et al. 2012:2). It is also the most-researched of the music-therapeutic methods for speech production problems (e.g. Schlaug et al. 2008, Schlaug, Marchina & Norton 2009a, Zumbansen et al. 2014, Naeser & Helm-Estabrooks 1985). MIT is listed as one of the twenty neurological music-therapy techniques in the Handbook of Neurologic Music Therapy (Thaut & Hoemberg 2014).

When applied properly to an appropriate client group, such as non-fluent aphasia patients, MIT is a powerful technique that is used to facilitate speech production, and, to a smaller extent, developmental apraxia (Thaut 2005). MIT aims to re-route speech pathways from the damaged left-hemispheric speech area to language-capable right-hemispheric areas. There is brain-imaging evidence for this possibility (e.g., Schlaug et al. 2009a) and evidence that long-term MIT can reactivate areas that control speech production in the left hemisphere (Thaut, Thaut & McIntosh 2014:142). I elaborate upon this evidence later in the thesis. The developers of MIT—Martin L. Albert, Robert W. Sparks, and Nancy A. Helm—first proposed the hemispheric shift in 1973. They developed the method on the observation that many people with non-fluent aphasia could sing words perfectly even though they could not speak at all. Albert et al. originally thought that MIT might lead to a takeover of the homologous speech areas in the right hemisphere. The fact that children who had their entire left hemisphere removed could completely recover language and speech function was an inspiration, for it suggests that the right hemisphere has linguistic ability. Since this could happen to children, Albert and his colleagues thought that adults might also be able to recover from speech impairments (Sacks 2007:220-221). In the early 70s it was thought that the use of melody and singing triggered re-routing in the brain; newer research has shown, however, that the element of rhythm in MIT is equally or perhaps even more important than melody (Thaut, Thaut and McIntosh 2014:142, Stahl, Kotz, Henseler, Turner & Geyer. 2011).

MIT uses melodic and rhythmic elements to intonate, or sing, phrases, and it uses words to assist with the recovery from aphasia. The method is highly structured. The original MIT protocol consisted of four progressive levels. In the first level, the therapist hums the melody of the intoned utterance, which is a short phrase or a word, while aiding the patient by tapping the left hand to the rhythm of the syllables. The hand tapping continues throughout level two, and the client joins in on the humming. Then the therapist presents the phrase and invites the client to join in subsequent steps. After some time, the therapist fades out of the humming so that the client is almost humming alone. After fading out, the therapist intones
the stimulus phrases and cues the client to repeat them. Level three is almost the same as level two except that the client is required to wait some seconds before repeating. At the last step of level three, the therapist intonates a question that fits the phrase they already have practiced, so the therapist can ask a question and the client can answer. At level 4, the intoned singing should become speech in stepwise transition via *sprechgesang* (speech singing). Hand tapping is also progressively faded out. At the end, the therapist should ask the question without intonation and the client should be able to answer by speaking. An appropriate question, for instance, might be, “What would you like to drink?” The client might answer, “I would like a cup of tea” (Thaut et al. 2014:142). Usually only two pitches are used; the higher pitch represents the syllable that would naturally be stressed. The MIT treatment starts with words or short phrases and works on making them longer as the client improves (Schlaug et al. 2008:2). Another important aspect of MIT is that it should be applied intensively, preferably 1.5 hours a day, five days a week until the patients has mastered all levels of MIT (ibid.:3).

There are several mechanisms included in MIT that are meant to engage the right-hemispheric networks for speech production. MIT provides reduction of speech. Melodic-rhythmic intonation of verbal output is considered slower than when spoken because syllables are lengthened, chunked and patterned in singing. Syllable lengthening makes it easier to distinguish individual phonemes that form words and phrases. The right hemisphere is better suited for processing slower modulated signals; thus, a good way to activate the right-hemispheric language networks is to translate spoken language into musical prosody. MIT provides syllable “chunking,” which involves prosodic features such as intonation, syllabic stress and change in pitch, which may help patients group syllables into words and phrases (Patel 2008 in Thaut et al. 2014, Schlaug et al. 2008:6). Music engages right-hemispheric networks, thus helping to bypass damaged areas in the left hemisphere (Seger et al. 2013 in Thaut et al. 2014). Rhythmic pacing and entrainment predominantly engage right-hemispheric networks in the auditory, prefrontal, and parietal regions (Stephan et al. 2002 in ibid.) Left hand tapping activates right language-hemispheric networks because spoken language and arm gestures are controlled by the same motor control network (Gentilucci and Dalla Volta 2008 in Thaut et al. 2014). This may in turn engage verbal output (Schlaug et al. 2008:6). Whether MIT really does engage expressive languages areas in the right hemisphere is not yet proven (ibid.:3).

Good candidates for MIT include people with left-side lesions in Broca’s area (which is responsible for encoding speech production) or lesions that interrupt the nervous connection between Broca’s and Wernicke’s areas (Thaut 2005). To be an appropriate
candidate for MIT, the patient must have good auditory comprehension, a facility for self-correction, significantly limited verbal output, a reasonably functional attention span, and emotional stability (Thaut et al. 2014:140). Patients with speech-comprehension problems—for instance, those with Wernicke’s aphasia (receptive aphasia), transcortical aphasia or conduction aphasia—are poor candidates for MIT (Thaut 2005, Thaut et al. 2014:140). A study that includes CT-scans of aphasia patients with a good and poor response to MIT showed that the good-response subjects had lesions in Broca’s area while the poor-response subjects had lesions in Wernicke’s temporal isthmus or in the right hemisphere (Naeser & Helm-Estabrooks 1985). It is not necessary to be musical to benefit from MIT (Thaut 2005).

**Modified Melodic Intonation Therapy (MMIT)**

Modified Melodic Intonation Therapy (MMIT) was developed by Felicity Baker in 1995. It is designed for patients who have severe non-fluent aphasia but do not benefit from MIT due to the severity of the lesion. Like MIT, MMIT is based on repetition of phrases that are set to musical structures. However, MMIT is more melodic than the *sprechgesang* that is applied in MIT, and the structure of the phrases is more musical than prosody-like. MMIT aims to make music function as a mnemonic aid instead of engaging and increasing the interaction between music networks and speech networks in the brain. The program aims to internalize musical phrases to trigger verbal language so that the phrases are encoded in memory and can be retrieved on request. Whereas MIT often uses only two pitches, MMIT uses more than four to make it more melodic but still easy enough for the patient to be sing the phrases. MIT focuses on whole sentences—for instance, “I would like a cup of tea”—whereas in MMIT only the word “tea” would be practiced because it is the main point of the sentence and the only thing understanding requires. The phrases are new compositions and not familiar melodies, and each phrase should be different in melody and rhythm so that the patient will not confuse the different phrases.

When MMIT is applied, several steps of the program are followed. At first it may be beneficial to engage the client by singing familiar songs. This may give clients positive feedback and show them that verbal output is actually still possible, albeit not functional. This provides motivation. The second step involves presenting a number of meaningful phrases. The therapist sings these a couple of times accompanied by an instrument while the client listens. The client is then directed to join when he or she feels comfortable and receives a tape with those phrases to practice at home. After practicing these phrases for a number of sessions, the therapist gradually withdraws participation so that the client can sing the phrases
unaided. Familiar songs are sung at intervals at this point for distraction, so the client can be tested to see if he or she is able to generate the phrases individually. The final step involves the use of target words in normal conversation. The therapist asks questions and the client answers with phrases he or she has learned. (Baker 2000:110-112).

SIPARI
SIPARI stands for singing, intonation, prosody, breathing (German: Atmung), rhythm and improvisation, which are the essential elements of this method. Monika Jungblut developed SIPARI in cooperation with the Medical Faculty of the University of Witten-Hedecke. The method aims to activate the remaining right-hemispheric speech abilities. It also includes “inner singing,” which makes the patient mentally prepare, and it expands on the concept of melody or intoning in MIT. It has breathing exercises, because breath is very important for any utterance that is being prepared for phonation. The rhythmic exercises aim to support the phonological and segmental capabilities of the left hemisphere. Improvisation enables the patient to practice communication on a nonverbal level. SIPARI will improve linguistic, motor, and cognitive functions and thereby support speech-motor processes and speech-systematic processes that encourage planning and sequencing performance. The SIPARI-method requires additional training for therapists (Jungblut 2009:1-2).

The singing aims to use the remaining vocal resource and consists of singing of familiar songs, ritual songs, songs newly composed by the therapist and clients, voice-training exercises and vocal improvisation. The intonation part focuses on the metric development of the right-hemispheric component and consists of “internal singing” (which means the mental preparation of sound-word imagination). The intonation part also consists of initiation of vocal-sound exercises, transition exercises, and intonation exercises. The prosody part aims to develop various component of prosody—such as vocalization, temporal structure, and melody line—with a focus on the transition from melodic-metric to rhythmic temporal processes. It consists of accentuation exercises, vocalization exercises, group-forming exercises, and rhythmic singing and speaking with increasing tempo. The breathing part aims to encourage elementary vital processes as the basis of body feeling and vocal utterance. It consists of raising awareness of respiration, exercises in prolonging and regulating respiration, exercises to support articulation, and exercises to coordinate respiration and phonation. The rhythm part aims to develop metric and rhythmic grouping to support phonological and segmental abilities and to enhance impaired sequencing. In consists of exercises in changes and types of meter, awareness of rest, changes in tempo, and rhythmic alterations. The improvisation part aims to
promote the ability to communicate on a non-verbal level to improve cognitive functions, social abilities, and emotional abilities. It consists of musical role-play, thematic improvisation, associative improvisation and musical arrangement of text written by the patient (ibid.).

The therapy will be applied in individual therapy for people who have speech-comprehension problems and in group sessions for patients who have speech-production problems. The group setting helps them end social isolation caused by poor speech and communication. The music is motivating, and therapy in groups facilitates verbal communication and cognitive functions such as memory and attention (Jungblut 2009:3).

Speech Music Therapy for Aphasia (SMTA)

STMA consists of two interwoven lines of therapy: speech therapy and music therapy. These two therapists work together at the same time in the same room, but they have naturally different tasks and the two lines of treatment can be explained separately. The speech therapy consists of three levels: phonemes (including syllables), words, and sentences. The phoneme training always targets the word-level, and phonemes much used in common words or names will be trained, from which the client would benefit. Vowels can be trained in isolation, but consonants are trained in syllables, because to train consonants in isolation may obstruct airflow and therefore limit speech fluency. The practiced words are chosen to be personally relevant to the clients—e.g., names of people close to them—and they are practiced words that are frequently used in daily life, like hello. The sentences are also supposed to be relevant to the client. In selecting these target sentences, the content of the sentence is more important than correct grammar; for example, “sit inside or outside” rather than, “would you prefer to sit inside or outside?” The speech therapist uses various cuing strategies such as phonetic cuing, visual cuing, and gestures. Phonetic cuing includes the auditory presentation of a syllable, word or sentence. Visual cuing is involved when the speech therapist shows a mouth reference. Gestures include waving when the sentence is, “good bye!” (Hurkmans et al. 2015: 942-943).

The musical line of the treatment follows a structure that progresses from singing to rhythmical chanting to speaking. The musical interventions are designed to support the speech exercises with music; they therefore share the same structural compositions from phoneme level to word and sentence level. At the phoneme level, the music therapist uses scales or parts of scales, because they are easy and familiar to clients. At the word and sentence level, the music therapist composes new melodies. SMTA does not use familiar melodies, because
the language output in familiar songs is known to be automatically generated. Using tempo, meter, rhythm, and dynamic parameters, the music therapist is able to support the melody to closely follow the prosodic features of the spoken speech production. For example, the music therapist selects a 4/4 or 3/4 beat according to the stress pattern of the spoken-word production (ibid.:943). Though MIT uses just melody and rhythm, SMTA uses all of the musical elements: e.g., melody, rhythm, meter, tempo, and dynamics. Moreover, MIT uses two notes and two durations whereas SMTA maximizes the spectra of melody and rhythm (ibid.:942). A music therapist must be present to use the SMTA as a method. According to the authors, it is beneficial to combine speech therapy with a music therapy that uses all musical elements because the resulting method then includes both specific knowledge of neurological speech disorders, the cueing strategies of the speech therapist, the knowledge of musical parameters, and the specific compositional skills of the music therapist (loc.cit.).

**Musical Speech Stimulation (MUSTIM)**

Music speech stimulation is an NMT-method that utilizes musical material such as songs, rhymes, chants and musical phrases to trigger automatic speech and to stimulate prosodic speech. In several patients with aphasia, the non-propositional reflexive speech is still intact, and overlearned songs or musical phrases are used to stimulate spontaneous speech output (Thaut 2005, Thaut 2014:146). The aim of this method is to trigger non-propositional, automatic speech and to gradually build it into a more voluntarily propositional speech, which is the kind of speech people rely on to express their ideas in daily life. There is no guaranty that this will happen, but Thaut (2005) claims that non-propositional speech activates part of the total neural speech circuitry and can therefore involve and reactivate more and more parts of the neural system.

MUSTIM can be an appropriate technique for those who do not meet the criteria for MIT due to dementia-related primary progressive aphasia or decreased cognition or due to difficulties related Alzheimer disease. Alzheimer patients may have difficulty following the complexity of MIT. MUSTIM can also be beneficial as a follow up for clients who have received MIT, have shown progress, and could benefit from training in spontaneous vocal output. In this way, MUSTIM can be a good compensatory strategy to stimulate spontaneous function words or phrase utterance. MUSTIM can be applied at many different levels of complexity depending on the function of the client/patient and the goals that are set. The therapist may start by singing a familiar song with the goal of triggering reflexive joining from the client. The therapist may also play some familiar songs instrumentally in the hope of
that the client will join in singing the lyrics (Thaut 2005). If the therapist begins by singing familiar songs, one way to continue is to sing a familiar song and leave the last word for the patient. For instance, the therapist could sing “My Bonnie lies over the ___” and allow the patient to sing “ocean.” This method can also be implemented into phrases: i.e., the therapist sings one phrase of a familiar song, and the patient sings the second. A second application of MUSTIM is to overlearn common sentences in daily life with an obvious completion. For instance, the therapist can sing, “How are ___” and the patient can fill in “you?” The goal is for the patients to be able to sing whole sentences alone. Another application is to have the patient learn two types of response to a question, like “I do want ___” or “I don’t want __.” Then the therapist can ask a question such as, “Do you want something to drink?” and the patient can choose from those two sentences to answer whether they do or do not want something to drink (Thaut 2014:147-148).

**Therapeutic singing (TS)**

Therapeutic singing is considered an NMT-method. It is a more general method than the other NMT-methods, which use general singing to facilitate a broad variety of therapeutic mechanisms and purposes. Therapeutic singing can be applied in groups or individually with all different kinds of diagnoses and age groups. Songs incorporate musical elements that are also found in language, such as melody, rhythm, tempo and dynamic. This link is one reason why therapeutic singing is beneficial for patient with difficulties with speech. Singing songs can improve voice prosody, and the rhythm in songs makes it easier to “chunk” syllables. Singing can also improve breathing at the “right places,” which is important in speech. As we have seen, language and music share some hemispheric processing, which also makes singing a beneficial technique in aphasia rehabilitation (Johnson 2014:185-189). In TS, the therapist must address both the “musical logic” and the “therapeutic logic” of their song choices to achieve success in the therapy. They must also make the songs flexible in terms of tempo, and the rhythm should facilitate the rhythm in speech, because rhythm is an important element in speech. If the song has temporal flexibility, the therapist can tailor it for the clients to get a maximal response. It is the perceptive musical choices combined with aesthetic facilitation that elevates TS above a “sing along” and makes it an effective music-therapeutic technique (ibid.:194).

**The most effectual music therapeutic technique for aphasia**

Tomaino (2012:312) studied several music therapy techniques for non-fluent aphasia. The author stresses that the music therapist must focus on more than just speech. The therapist
should also address other sensory, motor and cognitive issues by using a variety of therapy
techniques. The data was collected by analyzing videotapes from therapy sessions and by
evaluating the effectiveness by music-based techniques on articulation, fluency, prosody and
breath support. Seven post-stroke non-fluent aphasia patients participated: two males and five
females. Each participant was in the chronic stage, having been aphasic from nine months to
twenty years. Each participant had eight to twelve thirty-minute sessions three times a week
for four weeks. The therapist sat facing the patient. Sixty-six videos were analyzed by two
research associates—a music therapist and a neuropsychologist—and all findings were cross
checked before they were put into a protocol of the seven most effective techniques
(ibid.:313). The first technique is to sing familiar songs. The music therapist initiates the
melody and sings along with the lyrics. The lyrics that are easiest for the patient get repeated,
and the tempo is adjusted to maximize success and to increase the chance of fluent vocal
output. It was observed that the patients could master rhythm better with singing than with
mere speaking. The second technique is to breath into single-syllables sounds. The patient
was asked to follow breathing into a vowel sound rather than into consonants or bilabials,
then into tip of tongue to tongue-based sounds. It was observed that this helped the patient
relax. The therapists suggested natural sounds, like sighing, yawning, and clearing the voice.
The technique was particularly effective when the therapists mirrored the natural breath of the
patients instead of creating a breathing pattern for them (ibid.:314). The third technique is
musically assisted speech, in which normal, everyday sentences are put to a familiar melody
for the client. For example, “Hello, how are you today?” might be put to the melody of
“Swing Low, Sweet Chariot.” The forth technique, dynamically cued singing, is introduced
with familiar song singing, but the therapist leaves out a word for the patient to fill in. This
provides a conversation-like interaction between the therapist and the patient. It also tends to
make the patient more motivated. The fifth technique is rhythmic speech cuing, which
involves tapping or clapping to the phrase that is being practiced. The technique is quite
similar to the hand tapping in MIT. The sixth technique is oral motor exercise, in which the
therapist presents a short portion of a familiar song while exaggerating manner of mouth and
tongue movements. The patient is asked to watch closely and to follow the therapist’s
movement. The last and seventh technique is vocal intonation, which includes the practice of
intonated phrases. This technique is aimed to help the patient to better convey different
meanings in daily speech, since pitch and speech melody are important for this.
4.2 Outcomes from Music Therapy for Aphasia in the Literature

Melodic Intonation Therapy is the most studied music therapeutic method for speech impairment. Consequently, there is a great amount of literature about MIT. Thus, a selected handful of outcome studies that use MIT as a method are presented in this part of the chapter. These were selected because they came up first during the search for MIT in the databases (see introduction chapter), and because other literature presents them as central for the field. Some of them contain both speech-measuring tests and neuroimaging; some are control studies, and some are case studies. A few outcome studies of Modified Music Therapy (MMIT), SIPARI and Speech Music Therapy for Aphasia (SMTA) are presented, though these methods are not studied as much as MIT. Music Speech Stimulation (MUSTIM) and Therapeutic Singing (TS) have not been studied extensively, and no concrete studies on these methods were found. There are some studies on speech and singing, however. TS is referred to as the, “unspecific use of singing activities” (Thaut 2005). Therefore, very few studies focus on its singular effectiveness (Johnson 2014:187). With respect to MUSTIM, there are studies which suggest that use of singing and intonation may trigger un-propositional speech (Thaut 2014:147). There are some studies on choral singing for post-stroke patients, both with and without aphasia (e.g., Tamplin, Baker, Jones, Way & Lee 2013, Fogg-Rogers et al. 2016).

Observations

Aphasic patients may only have the ability to sing fragments of the lyrics of a song immediately after a stroke; but it has been observed that increasing ability comes with repetition of a song. It has also been observed that patients who learn the lyrics of a song are able to recite the same lyrics without singing (Tomaino 2012:313). In light of these observations, the question is whether correct lyric singing generalizes to other word-finding abilities and whether it is correlated with the patient’s general recovery.

It has also been observed that there is an increased ability for naming tasks and word retrieval after singing familiar songs (Tomaino 2012:313).

Review studies

No studies that include MIT were included in Cochrane’s review, “Music Therapy for Acquired Brain Injury”, because the interventions in these studies were not implemented by trained music therapists or because the trials were not a controlled clinical or randomized
trials (Bradt, Magee, Dileo, Wheeler & Mcgilloway 2010:7). Only one trial that studied the effect of music therapy on speech were a SIPARI-study conducted by Jungblut in 20046.

Hurkmans et al. (2012) conducted a systematic review of music in the treatment of neurological language and speech disorders. They included only studies that measure the effect before and after intervention with adult participants. They reviewed only English, French, German, and Dutch studies. They found that in most studies, stroke was the cause of the speech disorder. The exception was Baker (2000), which is also presented in this thesis. Most of the patients in the studies were treated in the chronic phase of the recovery—more than one year post onset (Hurkmans et al. 2012:3-4). Melodic Intonation Therapy (MIT) was the most studied method (ibid.:7). After excluding all of the articles that did not meet the criteria of the study, the authors were left with fifteen articles. All studies reported good results, though the authors of the review cannot summarize the outcomes to say how many benefited from music therapy because of the different or unclear measurement methods in the studies reviewed. The methodological quality of the studies was rated as low, due to a lack of information that could have been key to exposing links to the outcomes—for instance, information about the patient or the interventions. As chronic phase of speech disorders was studied the most, the authors of the review request more studies in the sub-acute phase. The use of melody and rhythm in therapy was most studied, and the review authors think this may be due to the fact that the most studied method is MIT, melody and rhythm are the most central elements of the method (ibid.:15).

Hurkmans et al. (2012:2) ask whether MIT is a music therapeutic method on grounds that it uses only rhythm and melody or intonation as musical elements, and not tempo, meter, dynamics

Merrett et al, (2014) conducted a review study on studies investigating the mechanisms of MIT. Some studies in the review will be mentioned here, and will be presented more detailed later in this thesis.

One of the most discussed features of MIT is the role it may play in the reorganization of the brain in studies that use brain imaging. This discussion has been simplified with a disagreement about left-hemispheric and right-hemispheric facilitation (ibid.:2). Some studies

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6 This study is not included in this thesis because it is in German, which is a language I am not confident in. Other studies on SIPARI by Jungblut are although included, such as Jungblut (2005), Jungblut (2009) and Jungblut et al. (2014).
(e.g., Naeser & Helm-Estabrooks 1985, Schlaug et al. 2008, Schlaug et al. 2009a) and the early hypotheses of the developers of MIT suggest that MIT leads to right-hemispheric facilitation; others (e.g., Belin, Van Eeckhout, Zibovicus, Remy, Francois, Guillaue, Chain, Rancerul & Samson 1996, Breier, Randle, Maher & Papanicolaou 2010) suggest that MIT leads to left-hemispheric facilitation. These studies are discussed later in this thesis. Depending on what region is activated, some studies suggest that right-hemispheric activation can be helpful, while some right-hemispheric activation may lead to language disturbance. It is currently assumed that right-hemispheric activity occurs in the post-acute phase with a return to left-hemispheric after some months with language rehabilitation. At the same time, there is evidence of right-hemispheric activity in the chronic phase (e.g., Schlaug et al. 2009a). As mentioned earlier, the size of the lesion will also impact the reorganization of brain functions. Smaller lesions usually lead to left-hemispheric takeover, whereas large lesions may cause the right hemisphere to take the language functions lost. These different findings may be explained by the fact that the literature is not homogeneous because lesions come in different sizes and due to differences in genes and environmental factors. Trained musicians may, for instance, exhibit a difference in brain plasticity compared to non-musicians. There are also differences between the language tasks that are given during, prior to, and after brain imaging, and these may influence the results. Non-propositional language is usually processed in the right hemisphere, and non-propositional language tasks are often used during brain imaging with tasks such as counting or repeating everyday phrases. This may be why some brain imaging shows right-hemispheric activation, and it may therefore be a little misleading. Merrett et al. (2014) think it may be a mistake to assume that MIT contains a common neuroplastic mechanism and/or that these mechanisms are musical or linguistic in method. They think that the intensity MIT offers may be the most important factor in its efficiency. There are some theories about the importance of left-hand tapping, which provides pacing of speech and rhythmic enhancement. It might also activate right-hemispheric regions that are related to articulation through sensorimotor coupling, because speech and language are strongly linked to hand-motor control from a theoretical, neurophysiological and behavioral perspective. There is also a theory that the synchronized singing in MIT can improve articulatory singing through a mirror neuron system or through a more general perception-action integration network. Humans seems to do some actions better if they are mirroring or imitating someone else. It is important that clients and therapists sit opposite each other so they can see each other’s faces, thereby allowing the client to imitate the therapist’s cues. Some studies (e.g. Racette, Bard & Peretz 2006) have found that choral
singing leads to better word intelligibility than singing alone. There is also a theory that MIT helps because of similarities in language and music and because music and speech share some neural processes. It is thought that MIT might take advantage of these shared characteristics. This is a controversial proposal, however, since there is evidence of a clear dissociation between speech and music impairment. Some findings suggest that singing is less dependent on the left-hemispheric language network than spoken words are, which may mean that singing could activate a right-hemispheric language region to avoid a left-hemispheric lesion in the language area. There are some theories that people with previous singing expertise would benefit more from MIT (e.g., Wilson, Abbott, Lusher, Gentle & Jackkson 2010), and that MIT can promote the development of an “expert” singing network in the left hemisphere through regular practice. Some studies suggest that singing or intoning phrases may provide more time for motor planning and execution than normal speech, and that these exercises can make production more fluent and allow for less demanding rehearsals (Racette et al. 2006). The practicing of phrases with melody over a long period of time may lead to separate representation in memory, which makes the phrase easier to encode and retrieve (Wilson et al. 2006). The goal of MIT is for the client to improve generative speech; but the process consists of practicing formulaic phrases about daily life, which activates brain regions other than those responsible for generative speech. Nevertheless, this process may interact with other functions and language regions, and it will also motivate the client. That MIT provides motivation is also a theory of why it works. Singing is a non-threatening way for aphasic patients to express themselves, and it may motivate them to continue with intensive rehabilitation. There is evidence that music listening activates the brain’s reward and motivation circuitry in the form of a release of dopamine, which is a neurotransmitter associated with pleasure, motivation, and reward. The authors of the review study (Merrett et al. 2014) has from their own experienced found that aphasic patients feel highly motivated by MIT. Motivation and MIT has not been directly studied. Music has been shown to improve negative mood, which may also be the case with MIT. This is beneficial, since low mood and clinical depression are common comorbidities of stroke. Neuroplasticity is negatively influenced by stress and depression, and if MIT is able to positively influence mood, then treatment-induced neuroplasticity may also be enhanced.
Studies investigating mechanisms of music therapy for aphasia

Studies investigating effect of elements of music therapy
Tamplin et al. (2013) and Fogg-Rogers (2016) studied the effect of choral singing for post-stroke patients both in participants with and without aphasia using, among other methods, semi-structured interviews. These studies found improvement in mood, motivation, feeling of belonging, and conversation. The participants felt that they were understood better, and the study also shows improvements in breathing, loudness, and prosody. The participants with non-fluent aphasia were able to experience fluent verbal outlet while singing, which gave them more confidence when speaking. The neurological theory that music encourages functional recovery after aphasia is not studied in choral singing.

Stahl et al. (2011) conducted a study in which the aim was to investigate the importance of melody and rhythm for speech production. There were seventeen participants with non-fluent aphasia with an age span of twenty-seven to eighty years old. All were right-handed. During the experience, the participants were singing or speaking along to a playback of lyrics that were read with melodic intonation, rhythmic speech and a-rhythmic control. The lyrics were familiar lyrics for the participants and consisted of formulaic and non-formulaic lyrics. Hand-tapping was not allowed during the experiment. The utterances of the participants were analyzed by the experimenter and by two speech-language pathology students. The authors found that melodic intoning did not indicate any effect and conclude that singing may not be crucial for speech production in non-fluent aphasics. They also think that rhythm is crucial, especially for those with damage involving the basal ganglia. They also found, by comparing familiar and un-familiar lyrics, that pre-learned lyrics are easier. The authors think that this has to do with the fact that long-term memory and preserved motor-automaticy seem to mediate speech production. They think that this explains the fact that non-fluent aphasics can sing. They also found that the older participants scored higher on familiar lyrics, while the younger participants scored higher on formulaic and un-formulaic lyrics.

Zumbansen, Peretz and Hébert (2014) conducted a study in which the aim was to assess the contribution of rhythm and pitch in MIT. When the method was developed in the seventies, the original idea was that melody or intonation is most important; later theories, however, held that rhythm might be the most important element. Zumbansen et al. designed three different therapies for this study: Melodic Therapy (MT), a variant from MIT; Rhythmic
Therapy (RT), which was like MT but without the musical pitch; and Spoken Therapy (ST), which lacked pitch and rhythmic aspects. Three participants had chronic Broca’s aphasia. They had three one-hour sessions a week for six weeks per treatment. The sessions were one-to-one, conducted by a speech therapy-student. The participants and the therapists faced each other. The participants had to listen to and reproduce twenty phrases after a procedure of four steps. The phrases were uttered twice in unison with the therapist fading out half-way, once in repetition, and finally as a response to a question. The outcomes were assessed through repetition of trained and non-trained phrases and picture-description tasks that were compared to the same assessment done prior to therapy, measuring informativeness (CIUs) and syllables. The outcomes showed that MT significantly improves the informativeness of connected speech, while RT and ST do not. MT also showed an effect on trained and non-trained material. This shows that MT was most effective in the generalization of effects. The authors claim that this shows that both pitch and rhythm are valuable elements in MIT.

Tomaino (2012) conducted a study to investigate the impact of using familiar songs and rhythmic speech-motor entrainment. The study included the use of finger tapping to the melody of the songs with non-fluent aphasia patients who had been discharged from speech therapy. The participants were measured against standardized measures of expressive and receptive speech. One group had 30 minutes of one-on-one music therapy intervention for twelve weeks; the other had one-on-one picture-based conversation interventions three times a week for twelve weeks. Eighteen of the participants who received music therapy completed all twelve sessions, while only eight of those that received picture-based therapy completed. The participants were evaluated three times: once before the start of the intervention, once six weeks into the interventions, and once in a short period of time after the interventions were finished. The Western Aphasia Battery and the Test of Adult and Adolescent Word Finding were used in the evaluations. Subcategories of these tests include command following, repetition, sentence completion and naming nouns. Both groups improved, but the group that received music therapy improved the most. The author think that fact that the most of those who received music therapy completed the interventions may be because music engages and motivates patients more than picture-based therapy does. Tomaino (ibid.) concludes that music therapy provides useful tools in the speech rehabilitation of this patient group. Tempo and rhythm are important in music because of its close relation to speech. Use of pre-learned lyrics facilitates word retrieval, and melody is important to express meaning in speech. The author also emphasizes the role of the music therapist and stresses the importance of therapist
and patient facing each other. Face-to-face sessions allow therapists to give facial cues and are reminiscent of a conversation setting. Face-to-face sessions also make it easier for the therapist to see the client and to determine what the client needs.

**Studies investigating lesion localization of participants with good and poor response to MIT**

Using CT-scans Naeser and Helm-Estabrooks (1985) investigated lesion location and good and poor responses to MIT-treatment. Good and poor response following MIT-treatment were assessed with speech-characteristic ratings for phrase length and grammatical form on the Boston Diagnostic Aphasia Examination. Both groups (poor and good response) had low scores prior to MIT. Four participants with good response (GR) and four participants with poor response (PR) were examined. The researchers found that the GR cases had lesions in “Broca’s area and/or white matter deep plus large superior lesion extension into periventricular white matter deep to the lower motor cortex area for face” (ibid.:221). The GR cases had no large lesion in Wernicke’s area, in the temporal isthmus or in the right hemisphere. The PR cases had bi-lateral lesions or lesions that included Wernicke’s area or the temporal isthmus.

**Studies with brain imaging investigating changes in matter after therapy**

As mentioned, the most studied method is Melodic Intonation Therapy (MIT). It (Tomaino 2012:312) and SIPARI are the only methods that link behavioral recovery with neurological recovery.

Several studies present evidence that neuroplasticity is induced by MIT by re-routing speech pathways from the damaged left hemisphere to language-capable regions in the right hemisphere (Thaut, Thaut & McIntosh 2014:141). Among these are studies by Schlaug et al. (2009a), Belin et al. (1996) and Breier et al. (2010). These studies were performed to determine what functions change in the brain and what mechanisms in the therapy methods are most important.

Belin et al. (1996) examined mechanisms of recovery from aphasia in seven non-fluent aphasic patients who had been treated successfully with Melodic Intonation Therapy (MIT). The participants in the study were aphasia patients who had poor spontaneous recovery but who experienced a marked language improvement after receiving a French version of MIT called Thérapie Mélodique et Rytmique (TMR). The seven patients were between forty to fifty eight years old. Two of them had Broca’s aphasia and five had global aphasia. The
duration of therapy (TMR) varied from one month to nine years. The efficiency of language rehabilitation was assessed by comparing expression and comprehension scores on subtests of the French version of the Boston Diagnostic Aphasia Examination. Both the expression and comprehension subtests showed a significant improvement with TMR. Magnetic resonance (MR) and PET images was also obtained on the same day for each participant. This was done to ensure that the heads of the participants were positioned in the same way each time, and that they were investigated in the same way by the same investigator for both examinations. The participants performed four different activation tasks; thus, four different conditions were measured while cerebral blood flow (CBF) was measured. There were four action tasks. The first task was rest: the participants were asked to remain at rest. The second task was hearing: the participants were asked to listen to a list of words read by one of the investigators with a natural intonation. The third task was simple repetition: the participants were asked to repeat the words of a new list with a natural intonation. The final task was repetition with MIT: the investigators read the words with a MIT-like intonation and the participants were asked to repeat the words with the same intonation. The researchers made two main findings. First, simple passive word hearing and word-repetition tasks that are performed without MIT result in an abnormal activation of right-hemispheric structures that are homological to the structures normally activated in the intact left hemisphere and in deactivation of the left hemisphere structures. Second, word repetition performed with MIT reactivated Boca’s area and the left prefrontal cortex. The different activation patterns found with and without MIT suggest that the right and the left hemispheres were not equally involved in recovery. The authors claim that it is doubtful that the right hemisphere activation observed with usual language tasks was involved in the recovery process. They offer two main reasons for this conclusion. First, the patients remained severely aphasic during the pre-MIT period even though they had been exposed to speech therapy in their daily life. Second, no region of the left hemisphere was activated during the simple repetition tasks; Broca’s area, for instance, was conversely deactivated. The results of this study may seem unexpected because MIT is assumed to work by developing right-hemispheric language abilities and because it is based on the observation that singing abilities, which are at least partially mediated by right-hemispheric structures, are preserved in severely non-fluent aphasic patients. The authors think that the findings might be explained by the hypothesis that MIT exaggerates speech prosody more than singing does. The challenge is then to damp down the “right Broca’s area” and its hyper activity. By engaging the right-hemispheric regions in normal activity and disengage from abnormal activity, singing and melodic intonation seem to be beneficial for
this. “This process has a certain self-sustaining momentum of its own, for as the left Broca’s area is released from inhibition, it can exert a suppressant action to the ‘right Broca’s area’” (Sacks 2007:221).

Schlaug et al. (2008:3) criticize Belin et al.’s study because only two of their seven patients had Broca’s area aphasia and the rest had global aphasia. There was only one brain imaging session, which took place after therapy. In addition, analysis of brain images were done only on predefined regions of interest rather than across the entire brain.

Breier et al. (2010) conducted a study to report language-specific neurophysiological activity indexed by magnetoencephalography (MEG) in two patients who underwent two blocks of MIT. Both participants had chronic aphasia after stroke. The aim was to record language-specific brain activation obtained via MEG during a covert action-naming task. Given the findings of Belin et al. (1996), Breier et al. (2010) hypothesized that improvement in language functions would be associated with increased activation within putative premorbid language areas within the left hemisphere. This study had two participants with chronic expressive aphasia. Both were males. Patient one was fifty-five years old, had a stroke five years prior to administration of MIT, and was right handed. Patient two was forty-nine years old, had a stroke two years prior to administration of MIT, and was right-handed. Both patients incurred significant damage to frontoparietal areas and some damage to temporal-lobe areas within the left hemisphere.

Patients were presented with a simple line drawing taken from the Action Naming Test. They were told to silently name the action it depicted as quickly as possible. Stimuli consisted of 160 drawings. Correct information units were obtained for all responses as the measure of change.

Patient 1 exhibited a significant increase in CIUs (>35%) after the first block of treatment. This improvement was maintained after the break, but little additional improvement after the second block was apparent. In contrast, Patient 2 did not demonstrate substantial change on the treatment response measures after either block of MIT (ibid.:311).

As mentioned, maps of language-specific neuropsychological activity were obtained before and after therapy. Both patients showed increased activity in the left hemisphere after receiving MIT. The patient who responded positively showed decreased activation in the right hemisphere homotopic to the left-hemisphere language areas compared to baseline scans. The patient who showed a poor response to MIT exhibited increasing activity in those right-
hemispheric homotopic areas.

The authors claim that the finding, which is similar to that of Belin et al. (1996), “supports the hypothesis that MIT acts through promoting left hemisphere activation and that increased activation in the right hemisphere after therapy may have limited functionality or even act in a manner of detrimental to behavioral response” (Breier et al. 2010:313).

**Studies with brain imaging and language measurement comparison**

Schlaug et al. (2009a) conducted a research study with brain imaging before and after therapy by using MIT on six clients with moderate to severe non-fluent aphasia. The aim was to examine whether intensive intonation-based speech therapy in chronic non-fluent aphasic patients with large left-hemispheric lesions would lead to functional changes in the brain and change brain structure. At least one year had passed since they had the patients had their first and only left-hemispheric stroke. The authors tested whether intonation-based speech therapy could lead to changes in white-matter tracts, particularly the fiber tract called arcuate fasciculus (AF). The AF reciprocally connects the superior temporal lobe, which is important for auditory feedback control, to the premotor regions/posterior inferior frontal gyrus, which is important for planning and sequencing of motor actions and auditory-motor mapping, and with the primary motor cortex, which is important for executing vocal motor actions. These regions are the most likely to play a role in the recovery process, and include the Broca’s and Wernicke’s language areas. The AF is a pathway between in the dominant hemispheres. The AF is usually more developed in the left (dominant) hemisphere than in the right hemisphere.

If a stroke affects the AF and its anterior target regions, the clinical presentation is usually of a non-fluent or dys-fluent Broca’s aphasia with a greater or lesser degree of impairment to repetition but with relatively intact comprehension. The authors sought to determine whether or not the AF in the undamaged right hemisphere would show structural changes as a result of intensive and long-term MIT treatment. Behavioral assessments were done several times before therapy, after seventy-five therapy sessions, and one month after that. These assessments included measures of the number of correct information units (CIU) per minute produced during spontaneous speech, picture descriptions, and descriptions of common procedures. Secondary outcome measures included syllables per phrase and correctly named items on standard picture naming test. To detect structural changes in brain tissue, the authors used diffusion tensor imaging (DTI), which is a magnetic resonance imaging (MRI) technique that provides information about diffusion of water molecules. DTI makes it possible to study normal white-matter anatomy and structural connectivity. It also makes it possible to study
the potential remodeling of white matter tracts in stroke patients who are undergoing intense rehabilitation (loc. cit.). The authors also identified and traced another tract as a control: the corticospinal tract (CST), “to minimize possible whole-brain differences in diffusivity from timepoint to timepoint”.

The AF was successfully identified in the right hemisphere for all six patients; but it was not identified in the left hemisphere, perhaps because the stroke ruined the tract in the left hemisphere. Therefore, analysis of the results is restricted to the right-hemispheric AF. All six patients showed a significant increase in the number of fibers in the right hemisphere. One patient also had an increase in the length of the fibers in the AF and the CST. All six patients also showed significant improvement in speech-outcome measure. The more measured behavior improvement the patient exhibited, the more the AF fibers were detected after therapy.

Several of the patients underwent two separate DTI studies prior to therapy so that the researchers could examine possible scan-to-scan variability ensure that changes in structure would be because of therapy and not to variability in scans. The authors claim that there is a connection between this method and what is shown on the brain scans.

In another study, Schlaug and colleagues measured the brain activity of eight patients who underwent MIT in seventy-five sessions of therapy. The patients showed significant changes in speech output measures. They also showed changes in the right-hemispheric fronto-temporal network while repeating simple words and phrases inside the MRI scanner (Sacks 2007:222). Sacks witnessed recordings from Schlaug’s study, and confirms the significant improvement in the patients’ speech. In the beginning, they had problems answering questions such as, “what is your address?” Some were not able to reply at all, but this improved such that by the end they could answer much more easily. The changes, both anatomically and behaviorally were obtained even several months after the treatment had ended.

Schlaug points out that most aphasia therapies have not targeted the neural process that underlies post-stroke language recovery. MIT has at least been shown to be ideally suited for facilitating the language recovery of non-fluent aphasia patients, especially those with large left-hemispheric lesions, where the only route to recovery is to engage the right hemisphere (ibid.:223).
Studies with brain imaging and control group

Schlaug et al. (2008) conducted a control study on two severely non-fluent aphasic patients. Both had impaired verbal output of naming and repetition but rather unimpaired comprehension. Both were males, forty-seven and fifty-eight years old, who had received speech therapy for over a year but were still unable to speak fluently. Their speech ability was tested twice prior to therapy to establish a stable baseline, and their ability to sing and speak the lyrics of familiar songs had been assessed. Their respective abilities to speak and sing correct lyrics had been compared. The number of CIUs was significantly lower in spoken lyrics than in sung lyrics for both participants. Both participants had brief musical backgrounds in their younger years. Both received forty sessions of therapy. One patient received Melodic Intonation Therapy (MIT), the other patient received Speech Repetition Therapy (SRT). They had a one-to-one session with the therapists for one and a half hours per day in five weeks, and they also received tasks to do at home. The outcomes were measured through behavioral tests and neuroimaging. The language tests consisted of a conversational interview that included biographical data about the patient and descriptions of complex pictures. The number of CIUs and the number of phrases and syllables were measured. The researchers used video recording to make these measurements. Sixteen disyllabic words that both participants were able to say at the baseline were used as stimuli for the fMRI-experiment. The task were to sing or speak words, with humming, phonation, and silence as control. The researchers found that the patient who received MIT improved more than the patient who received the control treatment:

The between-treatments comparison (Patient #1 MIT vs. Patient #2 SRT) made after 40 sessions showed that the MIT-treated patient had greater improvement on all outcomes than the SRT-treated patient. fMRI studies revealed that Patient #1 showed significant fMRI changes in a right-hemisphere network involving the premotor, inferior frontal, and temporal lobes, while Patient #2 had changes in a left-hemisphere network consisting of the inferior pre- and post-central gyrus and the superior temporal gyrus (Schlauv et al. 2008:6).

The authors claim that four possible mechanisms make MIT facilitate syllable and word production. MIT provides reduction of speech, because words can be articulated at a slower rate than in speaking. Reduction is dependent on the left hemisphere. The second mechanism MIT provides is syllable lengthening, which creates the opportunity to distinguish individual phonemes that form words and phrases. This together with reduction of speech can make the patient more fluent and receive greater support from the right hemisphere. The third
mechanism is syllable “chunking,” which means that prosodic features such as intonation, syllabic stress, and change in pitch may help patients group syllables into words and phrases while the “chunking” may provide more right-hemispheric support. The forth mechanism, hand tapping with the patient’s left hand on each syllable sung, engages the right hemisphere, which in turn may provide an impulse of verbal production. There may in addition be shared correlates that control both hand and articulatory movement, and the sound produced by the tapping may encourage auditory motor-coupling. The authors think that the two elements that are most likely to make the strongest contribution to recovery in MIT is the melodic intonation and the left-handed tapping. Brain imaging that targets the perception of musical components has shown that it requires a more global than local processing activity and tends to be more active in the right hemisphere than in the left. The left-hand tapping may, as mentioned, activate a right-hemispheric sensorimotor network for articulation, especially once the right temporal lobe is engaged by the melodic intonation.

Jungblut, Huber, Mais and Schnitker (2014) conducted a study with three participants who had severe non-fluent aphasia and apraxia of speech and who used fMRI procedure before and after they received therapy in form of SIPARI. Thirty healthy subjects also underwent the same procedure. The aim of the study was to explain the efficacy SIPARI has shown as a therapeutic technique for patients with non-fluent aphasia and apraxia of speech through behavioral studies that use brain imaging. Tasks of the fMRI paradigm included the repetition of vowel chants in rhythm sequences of varying complexity. Two professional musicians analyzed the recording of the chants to determine how well the participants did with repetition. Two speech therapists preformed language tests before and after therapy. They used one test that is designed to assess aphasia and another to assess apraxia. All participants showed significant improvement on the musical analysis of rhythmical vowel chants and on the aphasia assessment test. Improvement was also shown on the apraxia assessment test. One of the participants, who had Broca’s aphasia, exhibited significant left-hemispheric activation in perilesional regions. The other two participants, who had global aphasia, showed activation patterns that comprised perilesional regions and homologous areas in the right hemisphere. The neural networks these participants recruited were those used by the healthy participants who underwent the fMRI-scan. The authors believe these results suggest that changes in brain activation following the applied training might indicate specific processes of reorganization: for instance, improved temporal sequencing of sub-lexical speech components. They claim
that training that focuses on rhythmic singing while demanding the complexity of motor and
cognitive capabilities may support speech production.

**Studies investigating effectiveness of music therapy for aphasia**

**Case studies**

Sacks (2007:214) presented a story about a patient who suffered severe expressive aphasia
following a stroke in his late sixties. Despite two years of speech therapy, he was not able to
speak at all, and was listed as a “hopeless” case. But then a music therapist named Connie
Tomaino heard him sing “Ol’ Man River” and decided to meet him three times a week for
music-therapy sessions. He could only get two or three words of the song right at first; but
after a number of music-therapy sessions he could get every word right in it and in other old
ballads he liked. After two months, he was able to give brief and appropriate answers to
simple questions. In response to, “How was your weekend at home?” he could say, “Had a
great time,” and “Saw the kids.”

Felicity Baker (2000) wrote about two severely non-fluent aphasic patients who were
impaired as a result of traumatic brain injury in their early thirties: one female who was
involved in a car accident, and one male who was involved in a work accident. Both had
damage to the left hemisphere. The female was assigned to music therapy to assist the
improvement of her verbal quality. She received music therapy five days a week, where each
session lasted for thirty minutes. She also got speech therapy. At the beginning, she was
singing familiar songs in music therapy. This was not effective, so she started to receive MIT.
The female did not have any progress with MIT either—she was still unable to generate
words independently—so the music therapist decided to try MMIT. In MMIT, she was drilled
in words and phrases that were meaningful to her and her daily life, along with names of
members of her family. They started by drilling ten phrases. Within two months, she was able
to generate those phrases independently when musically cued. She received MMIT once a
week at the beginning, but this was later increased. She learned new phrases, and she also
received a tape with the musical phrases to practice at home. After two and a half years of
MMIT, the female had a functional language of 148 words/phrases, of which she could
initiate 124 independently. She could speak the remaining 24 with musical cues. She was then
able to tell a taxi driver where she wanted to go, buy public transport tickets, say family
names and ask for daily needs, such as toiletries or food. The male was initially referred to
music therapy to improve his articulation of phrases, and he did not show much progress after
speech therapy. Singing familiar songs helped him to improve his articulation. In four months, he had learned 30 words that were important and meaningful to him, including several family names. The author thinks that this male might not have been able to say anything at all if he had not received MMIT.

Albert et al. (1973) reported three cases of severe aphasic patients who had poor vocal output but intact comprehension. One sixty-seven year old man did not have any meaningful verbal output eighteen months after a stroke. He had received three months of traditional speech therapy. He started by receiving MIT, and two days later he was able to say a few words. After two weeks of MIT he had a verbal output of about hundred words. After one and a half months he was able to hold short and meaningful conversations, although the articulation remained poor and the prosody was plosive. A sixty-five year-old man had a verbal output of only five or six words, which he used repeatedly. He did not show any improvement after two months of aphasia therapy. He received MIT after being stable for fourteen months. After two weeks, he could produce verbal responses to questions—even full, grammatically correct sentences. A thirty-eight year-old woman with limited verbal output received MIT after two months of standard aphasia therapy with no improvement. She was able to produce meaningful propositional speech after only two three MIT sessions. After one and a half month she was able to have meaningful conversations about a wide range of topics. Although her sentences were short, they were grammatically correct.

**Observation studies**

After a study of nineteen participants—sixteen with non-fluent or global aphasia and three with dysarthria in the sub-acute phase—Einbu (2008:453-455) found that it is easier to sing familiar lyrics than to recite them for two thirds of aphasic participants. One third of participants get greater word output from repeating short phrases of unknown songs; some of these also achieved good results by singing familiar songs. The participants who benefited from singing had the most severe aphasia. The author believes that the fact that different outcomes were achieved while singing and reciting familiar lyrics supports the hypothesis that these activities are processed by two different systems.

Racette et al. (2006), however, found that familiar lyrics are not pronounced better when sung than when spoken by non-fluent, chronic aphasic patients. However, when the participants
were learning novel songs while singing or speaking with an auditory model, more words were recalled and repeated while singing than while speaking.

**Studies with language test as measurement**

Hurkmans et al. (2015) conducted a study using speech and language tests as a measurement on the effectiveness of Speech Music Therapy for Aphasia (SMTA) on five participants with apraxia of speech conducted by aphasia. The participants were between forty and eighty years old, four males and one female. All received twenty-four thirty-minute long SMTA-sessions twice a week. Prior to and after treatment—one time immediately after and one time 3 months after—verbal communication was tested with the Aachen Aphasia Test (AAT) and the Diagnostic Instrument for Apraxia of Speech (DIAS). For progress in articulation, participants were tested four times before the start of the treatment for baseline. The tests included the Modified Diadochokineses Test (MDT), which is related to progress of articulation. They were also tested once with a control test: the Psycholinguistic Assessment in Language Processing of Aphasia 12, which involves repetition of number series. Both tests were conducted weekly during the treatment. All participants showed significant improvement in the MDT-test and repetition of AAT. Four participants improved on the test for articulation of phonemes and on the diadochokinesis test of the DIAS. Two participants improved on articulation of words. Follow-ups showed that the improvement remained stable after treatment ended. The authors think that most of this improvement is related to the treatment, but they are unsure whether the improvement of one participant was fully related to therapy. It is important to note that the participants in this study not only had non-fluent aphasia but also global or Wernicke’s aphasia and apraxia of speech.

Monika Jungblut (2005) conducted a control study that investigated the effects of the SIPARI-method on non-fluent aphasic patients with both Broca’s aphasia and global aphasia. Seventeen patients participated; all of them were right handed and had suffered from aphasia for several years (a duration of four to twenty four years). Four females and five males were examined with SIPARI, and four females and four males were in the control group. *The Aachen Aphasia Test* was used for measurement in this study. Rhythmic-melodic voice training on the basis of the SIPARI was given over a period of seven months. All participants attended twenty group sessions once a week and ten single therapy sessions once a week for the last three months. The participants had a CD with training material from the sessions, which was frequently updated. They could take this CD home and practice with it outside the
sessions. A Mann-Whitney U test was conducted to see if the participants would improve their linguistic abilities compared to the Aachen Aphasia Test. Tests were also conducted to see if the expressive language abilities would be enhanced. The group that received rhythmic-melodic voice training showed significantly better results than the control group in both these tests.
5 Qualitative studies

Motivation is a quite amazing thing with these clients. I have always been very surprised by that, that high level of motivation they have. And they are very brave, I mean, brave in the ways that they really want to achieve something bigger. And they really don’t give up. So that’s a quite peculiar phenomenon, that they are so determined, somehow, and want to rehabilitate themselves (Music Therapist 1).

I interviewed a former aphasic patient. I have chosen to keep her anonymous, and therefore refer to her in this thesis as a Former Aphasic Patient. She did not receive music therapy for the speech problems, but worked with a music therapist on other issues while she was doing music actively during the rehabilitation. Her speech has now recovered—she is now as fluent as a healthy person—so talking to her was not problematic. Her experience provides insight into what it is like to lose speech. She thinks that the music helped her recover. This woman is Norwegian, and all of the rehabilitation happened in Norway.

I also interviewed four music therapists and one Music Therapy Student who have experience working with non-fluent aphasia patients. Three of the music therapists are Norwegian and work in Norway. One of them was educated in Denmark. The last music therapist is Finnish, and most of his experience was gained in Finland. He is now a professor in a music therapy master’s program in Finland. The Music Therapy Student is Dutch, and is studying in the Netherlands.

I observed one group session with speech impairments in which some of the clients or students had aphasia. The group session was conducted by Music Therapist 2, who is introduced below. The speech of the clients was so poor, that it would have been too difficult to impossible for them to participate in an interview. I will share both my experiences from the observation in this chapter and Music Therapist 2’s comments about the group and her clients.

I have chosen to keep the music therapists (and student) anonymous for this thesis, thus they are called “Music Therapist 1,” “Music Therapist 2,” “Music Therapist 3,” “Music Therapist 4,” and “Music Therapy Student.” Music Therapist 1 is the Finnish music therapy professor. Music Therapist 2 is a Norwegian music therapist who has worked with speech damages for about four years. Music Therapist 3 is a Norwegian music therapist, who has also worked with speech damage for approximately four years and is educated in Denmark. Music
Therapist 4 is a Norwegian music therapist who has worked with speech damage for about a year and a half. And the Music Therapy Student has some experience with a particular method from his internship. Music Therapist 1 has a broad range of experience with patients with different degrees of severity and at different stages after the damage had occurred. Music Therapist 2 mostly worked in a group setting with older people, most of whom were over seventy. Music Therapist 3 worked in different institutions, hospitals, nursery homes and adult education centers. Music Therapist 4 worked in a hospital and rehabilitation center. She reported that she applies music therapy both in groups and one on one with patients with speech impairment. The Music Therapy Student worked with aphasic patients during one of his internships with the elderly, and he used one particular method in this work. Music Therapist 2 and Music Therapist 3 worked mostly with stroke patients. Music Therapist 1 and 4 also have some experience with aphasia patients from traumatic brain injury. The symptoms from these two causes of aphasia are very similar (Music Therapist 1). The Music Therapy Student mentioned one older lady but did not report on the cause of aphasia. It is natural to think that it was caused by a stroke due to her age.

5.1 Former Aphasia Patient’s experience with music in rehabilitation

A former aphasic patient was interviewed. She unluckily had a stroke at the age of thirty and acquired severe non-fluent aphasia, among other symptoms. Prior to the stroke, she earned a bachelor degree in classical singing and played the viola. She was also an active choral singer.

She told me what happened when the stroke occurred. She said that she had a bad headache, and she did not normally get headaches very often. She and some others had been in a car for a while, and the first symptoms occurred when she was about to leave the car and say good bye to the others.

I was supposed to say “Good Bye,” but everything that came out of my mouth was only weird sounds, and neither of us understood what I said. The other woman asked me ‘What is this? Shall I drive you to the emergency room?’ We should of course have done that, but I didn’t understand what it was! My language came back after three to five minutes, so I just told her that I was going to bed. It was quite late.

She told that more strange things happened with her language the day after.

The day after I was chatting to a friend over messenger, and it started with me writing ‘Hi’, and she replied ‘hi’. And then I was supposed to write ‘How are you?’, but I wrote ‘forest’. She didn’t understand, of course, so I wrote more, which was just not existing words. She knew what had happened the day before, so she just wrote, ‘I’m coming.’
She reported that her friend brought two more people when they went to get her. The Former Aphasic Patient said she was surprised that she was able to let them in through the calling system at her apartment, considering her condition. The friends that came later told her that she acted as if she was drunk, which was not like her, so they decided to take her to the hospital. Unfortunately, they were told to take her to another hospital in the private car, which may or may not have had an impact on the outcome of the stroke. The Former Aphasic Patient said that she was also impressed that she was able to tell the hospital staff her name and her personal number. She also told them something else that did not make as much sense:

When we got there, I told them that I have three children, which is strange, because I don’t have children. And my friend told me that no, I didn’t have children. But I was really determined, and kept saying I had three children. And then they realized that I meant siblings, because I have three siblings, and that is correct. And that is what I remember from the stroke (Former Aphasic Patient).

At first she was at the hospital for five weeks. Then she was at several different rehabilitation centers. She received physiotherapy, speech therapy and sessions with a psychologist throughout this period. At the very beginning after the stroke onset, the focus and goal was to get her to walk again, since she was suffering from hemiplegia in the right side of her body.

She told that going to the speech therapist could and can be very tiring, and that she often needs to rest after a session with the speech therapist. She meant that sessions with the speech therapist were more tiring than going to physiotherapy, since sore muscles feel better than a tired head.

She received song lessons from one speech therapist, who contacted a singing teacher, since she was a singer before the stroke occurred, and one of the goals of the rehabilitation was to get her back to her old life as much as possible. She was paralyzed in half her body, including her neck, so she needed to “learn” how to sing again. After staying at the rehabilitation centers, she went to an adult education Centre where she kept getting speech therapy along with song lessons from a music therapist. The goal of these sessions was more for her to practice her singing than to regain speech, and it was called “music” rather than music therapy, although the teacher was a trained music therapist. When the first music therapist quit, she got a “piano lady,” as she puts it herself. She said that playing piano after a stroke is extremely difficult.

We figured that I could play some piano, because that is a really good exercise, because playing the piano goes really badly! It is good for your synapses, because you have to use both hands, and they have to communicate. Then a lot is happening in your brain (Former Aphasic Patient).
At one of the rehabilitation centers in the early phase after the stroke she was offered a music-session with other patients. They were supposed to bring music they liked, listen to it, and talk about it afterwards. This became too simple for the Former Aphasic Patient:

They would for instance listen to a Mozart, and they would put on a poor recording, where I would sit and listen to and wonder what the first violinist was doing, or what the singers were doing, if it was a song. I just got annoyed, because I thought that I would never be there I actually should have been. I think it is different when you are a musician yourself (Former Aphasic Patient).

She said that she did not realize how bad her speech was at the beginning:

I think that the brain is a fantastic instrument, because I didn’t realize how sick I was. It was like the brain had decided that I was supposed to do what I could to survive. I wasn’t supposed to care about if I could speak or not. The most important thing was that I ate and exercised. So I think it was very narrow what I did and what I thought about. So I didn’t realize how poor my speech was at that time before six months afterwards […] I realized it was a problem, but not how big it actually was.

At the beginning following the stroke she could not say anything besides “yes” and “no,” and she called everyone by the name of her brother.

I have been thinking about it, that I could have said, his name is “Hans Kjetil”\(^7\), which is a quite—what shall I say—more difficult name than “Ane”\(^8\) or “Tine”\(^9\), which is my mother and my sister. It would have been easier to say “Ane.” I called everyone “Hans Kjetil,” boys and girls […] I knew I said the wrong name. I knew “Mari”\(^10\) sits in front of me, and it was like “Yes, Hans Kjetil. No I mean Hans Kjetil. No, I mean…” I knew very well that it was Tine or Mari, or, that it was a girl that was there (Former Aphasic Patient).

When I met her for the interview, it was not possible to hear any signs of her former aphasia; her speech was as fluent or even more fluent than that of most people I know. She told me that she sometimes has problems finding words, and she even pointed out that this happened during the interview, but it did not strike me as any different than when non-aphasic people have trouble finding the right word—which sometimes happens when they are tired. She also told me that being unable to find words is quite similar to what it feels like to have aphasia:

Yes, it’s a little bit like that. I did of course have those problems before the stroke, like everyone else. If you get tired, then, you know well what you want to say, but you can’t find the word. It’s just like that. And that is because the brain has received a big hit! […] I remember my sister said, because we talked about aphasia, ‘I also have aphasia sometimes’. Like, everyone experiences not finding the right word. She said: ‘You just have more of it’.

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\(^7\) “Hans Kjetil” is a pseudonym to her brother’s actual name. This is done due to anonymisation.

\(^8\) “Ane” is a pseudonym to her mother’s actual name. This is done due to anonymisation.

\(^9\) “Tine” is a pseudonym to her sister’s actual name. This is done due to anonymisation.

\(^10\) “Mari” is a pseudonym to her sister’s actual name. This is done due to anonymisation.
She shared some episodes that describe what it was like to have a speech impairment and to be unable to find the right words. One time when she was at the hospital, a nurse wanted to know what she used to do before the stroke occurred. She had been working in a temporary position at a post office, but had great difficulties finding the right word to describe it:

 [...] I was not able to find the word ‘post’! Or, I couldn’t get it out. It was like something happened on the way from the head to the mouth. And it was like - I knew very well what I wanted to say. It was very frustrating.

She had a similar experience when a speech therapist tried to teach her how to tell the time:

I recognized the clockwork, and I saw that it was one o’clock, but I didn’t manage to say that it was one o’clock. I did understand that it was one o’clock, but I couldn’t say it. So I would rather say: ‘It’s two o’clock. No’. But I could see that it was one o’clock. That was extremely frustrating (Former Aphasia Patient).

Very shortly after the stroke, she was invited by the choir conductor to participate in the choir rehearsals. It is an ambitious choir that is rated as one of the best choirs in Norway. Because of symptoms that may be related to amusia, she had some problems keeping up at the beginning. She told me that she was quite good at sight reading prior to the stroke, but that she got problems with it afterwards. She told me that she was given a piece of sheet music that she had sung earlier, and that she had no problem singing the voice she had sung earlier. But then she tried to sing in another voice, the bass, and encountered a problem. She could see an interval, and knew that it was a fifth, but she was not able to sing a fifth. Despite these problems, it got better with some hard work and participation. She thinks the choir helped her recovery in several ways:

I have not thought about it in that way. For me the choir was a hobby from before the stroke occurred, but it has helped me with language, and several aphasic patients get depression following a stroke, and I haven’t got it yet, at least, and I think that has to do with the social aspect and that I could come back to the rehearsal pretty quickly (Former Aphasic Patient).

She thinks herself that being active in music has helped her, and she emphasizes the social aspect and the concentration and the number of faculties that are required to sing in a choir, although it is more difficult than before the stroke occurred:

Yes, I think so. In several ways, actually. Of course, the music for the music, as a form for therapy, to be able to sing good music. And the social aspect with the choir. It is something about having to concentrate that much, when I get a new set of sheet music, and have to sight read, I have to concentrate more now than earlier. I am getting better at sight reading, but I am not as good as I used to be yet. But when you have to concentrate that much, you have to get better eventually. Because there is a lot of thing you are supposed to do at the same time, right? You are processing lyrics, you have to think about the expression, and so on. There are several things that used to be automatically for me, but now I have to think about it, and find other method to do it [...] And when I am singing in the choir I forget that I
am actually exercising these function, and it is nice to be a little bit distracted from that and other things in life (Former Aphasic Patient).

She received a reward for the progress and hard work she made during the rehabilitation. The argumentation for the reward was that she had shown a lot of motivation to get as much back to her life back as possible and worked hard for several years to get there. She kept going to the speech therapist even though she felt that she did not improve. Because she understood that it was important, she stuck to it. She went to the speech therapist that nominated her for the prize every Friday for two hours.

Many people would have quit going to the speech therapists, because they are satisfied when they are able to speak in a normal situation. But I wanted to be able to take an exam, or speak when I am stressed or tired, and such situations (Former Aphasic Patient).

5.2 Observation of therapeutic group session with aphasic patients

I got received an opportunity to observe a music-therapy session with Music Therapist 2. She had a group of five clients with speech damage. Most of them had some type of aphasia. Everyone was between seventy and eighty years old. The group lasted one hour and a half, but thirty minutes of it went to help the clients with their outerwear, to help them to their places, and to make them coffee or tea. They mostly did the same exercises every time, according to Music Therapist 2. When I was present, they started by singing a familiar welcome song together, which the therapist accompanied on the guitar. Then they warmed up their voices by using a bottle of water with a straw in it. They were making sounds with their vocal chords while blowing bubbles into the water. The therapist instructed the sounds, and the clients followed. They sometimes sang triads as they did this. They also did some basic vocal exercises without the straw and water. Then they sang songs with lyrics about movement, like “up and down with your hands” while doing the movement the lyrics suggested.

As mentioned earlier, aphasia is often accompanied by other impairments—such as hemiparesis or hemiplegia—which may lead to an arm that does not work very well. The focus of a music therapist is often wider than just speech; they may combine different goals in one activity, as Music Therapist 2 does with the movement song. “I think that the physical is linked to this as well, like body and soul are linked together.” She thinks these kinds of exercises help, “loosen up,” and they get to train the “bad arm” while doing exercises with
both arms. “And I easily find how much instruction they can take and how good their body control is, and their understanding of what we are doing” (Music Therapist 2).

While listening to music—to Adele’s “Hello”—they passed around a large balloon. The rest of the session consisted of singing familiar songs that the clients liked, and the therapist accompanied them either with guitar or piano. They also had a regular goodbye song at the end. Between the exercises, there was room for them to talk a little bit if they wanted, about how they were doing and such. What they said then was obviously limited, due to their speech impairments.

During the therapy session, I had the joy of hearing a woman sing words who could not speak much, as the Music Therapist 2 told me. She had both expressive and receptive aphasia after a stroke. “Did you notice that she sang in ‘I Østen Stiger Sola?’ I figured we should sing that song because you were here and could see it yourself!” (Music Therapist 2). The fact that people who cannot talk can sing lyrics is a phenomenon that is widely discussed in the literature.

It seemed that the activities that she used worked and that the clients enjoyed it.

5.3 Music therapists’ experiences from working with aphasic patients

Experiences with music-therapeutic methods and techniques

Except for the music-therapy student, all of the music therapists told me that they do not usually follow a method very strictly but instead tailor a strategy for the particular client based on his or her state and what the client’s goals are, both in terms of speech and mental state, if the patients are referred from other institutions.

You have to choose the method or the intervention you are going to use […] depending on the goals that are relevant for that person (Music Therapist 3).

It is important to get to know the client and his or her goals and situation prior to therapy to create a good strategy.

[…] there should always be a quite thorough initial assessment before starting the therapy, getting more the whole picture of the situation and the needed therapeutic approaches and interventions. So, I would emphasize that it is crucially important to first investigate the current situation and after that start to plan the therapy itself […] and try to learn what kind of profile the client is having and what kind of therapeutic needs there are. And based on that, then you start to think about what kind of approaches might be helpful for the client (Music Therapist 1).
An usual goal is to get the client back to a functional daily life. “My focus is this: How can this person function in her daily life the best possible way, and what can I do to facilitate that?” (Music Therapist 4). Music Therapist 2 told me that she does not focus on the diagnoses the clients have: “I am not that interested in what is wrong with them (the clients); I am more concerned with the ‘here and now’ situation” (Music Therapist 2).

She told me that she does not follow any method strictly, but that she follows her intuition.

I feel, when music therapists use several methods and such, I am just fumbling a bit. But I feel that I have a good intuition, and that I have found a good arrangement for this group (Music Therapist 2).

Several of the music therapists stress how important a safe environment is for the therapy to be as effective as possible:

I think that making a safe environment and a nice moment as a foundation is very, very important. So everyone feels welcome and feels that it is socially pleasant, and that they then dare to speak or dare to try to speak (Music Therapist 2).

A safe environment is particularly crucial if the clients/patients/students are suffering from depression:

Before you start with what you intend to do, you have to facilitate to make the process good. One client I have, she is very isolated, has severe depression and anxiety that have come in the aftermath of the stroke. It’s several things, and you cannot simply start to work when the client finds it uncomfortable that you’re in the room. You have to build a relation first (Music Therapist 4).

It is clearly easier to exercise if the client has mental capacity. And if you suffer from depression, and there are several stroke patients that get some sort of depression when they have had a stroke, chemically, and then you can do something more uplifting and something you master in a different way (Music Therapist 3).

Music Therapist 2 also said that she does not want to push her clients too much but instead wants them to tell her if they need more pushing. She thinks it is crucial that the clients feel that they master something.

Music Therapist 1 stresses that it is important to carefully pay attention to the client’s behavior and performance to make sure that he or she does not get too tired during the therapy. “If they are too tired, rehabilitation doesn’t work anymore” (Music Therapist 1). He also said that it is important to follow their facial expressions for response, since they often cannot give any constructive verbal response.
Music Therapist 1 shared what he actually does when working with aphasia patients and told me which approaches he finds beneficial. Music Therapist 1 discussed the interventions he usually uses with aphasia clients and justified them:

It’s quite easy to start with just music listening, because you don’t have to do anything, and the good thing is that you don’t have to perform anything, so it is not a question about how well you do something or if you manage to do something or not. That’s also supporting the self-esteem and that kind of mental processes, which are quite important in terms of motivation and motivation to continue therapy. Motivation to move on […] (Music Therapist 1).

He thinks that all kinds of approaches can be used with aphasic clients, as long as it is tailored for the individual client. He mentions music listening, and more active approaches, such as using pre-composed music and recognizable song, because it facilitates memory. And he thinks improvisation and song writing is a good approach:

Sometimes client’s, they want to write lyrics, and then it makes it more meaningful, even that the particular song will be composed for that, to that very text they have written […] So, music listening, preferred songs, I mean following the clients preferences and those songs which help the client memorize things, working with images as well, and then this different pre-composed music, either played or sang, or both, and then improvisation in many different forms, song writing, and also vibro-acoustic therapy, can be useful. And all this can be used in a very tailored way with individual clients, following the needs of the client (Music Therapist 1).

Music Therapist 3 has used Melodic Intonation Therapy (MIT) among other methods and techniques for clients with aphasia, but did not have success with this method. She thinks the reason is lack of intensity:

It is a challenging method. One of the reasons that I don’t have, I don’t have any amazing success stories about it, and it’s because I never got enough time there, it demands quite intensive training, and the person who decides the amount of hours we get don’t prioritize that […] In the beginning I had the opportunity to do it twice a week, because I divided it, I chose to arrange the sessions that way, so the clients could come twice a week, but that was not enough, actually not enough at all. So that was actually the reason why we stopped using that method. Even if the client could learn new sentences and such, it was hard to transfer it to reality. That was too ambitious, because of the frames. I think it’s about the frames, that we didn’t have enough time and possibility to cooperate with other people (Music Therapist 3).

Music Therapist 4 does also does interventions that are inspired by MIT. She says that she does a mix of everything she knows how to do, with inspiration from different approaches. She thinks that to follow the strict regime of MIT is too mechanical and does not work in “real life.”

11 Vibroacoustic Therapy (VAT) uses sound to produce vibration that are applied directly to the body, through that the client lies on a mattress or sits in a chair with embedded speakers. This therapy is for instance used for circulatory problems and asthma (VibroacousticTherapy.com 2016).
I can’t just say; ‘we are now going through these four stages and that’s how it should be’. That doesn’t work. That’s not reality. At least that is how I see it. I think it is very mechanical to see it that way. […] I use the formal methods as an inspiration, and take some here and there, to make it fit to the specific client (Music Therapist 4).

Music Therapist 4 shared the interventions she used with one particular client with which she had one-to-one sessions that lasted twenty to forty minutes each, one to two times a week. He received a mix of training with the speech therapist and music therapy in general. She describes him as very motivated to practice.

He liked very much that we played songs he liked, and that we stopped on a word. Then it was his task to fill in that word, while the music also was there, like an echo in a way. Or that he repeated after me. Then it gets enjoyable, and it is easier to sing the words than to speak them (Music Therapist 4).

She also said that this particular client got better: “When he went home, he was able to say a few words, and make himself understood very basically on some issues” (Music Therapist 4).

The Music Therapy Student had been co-therapist within the method Speech Music Therapy for Aphasia (SMTA) during his internship. He told me about his experience with this. He said that they focused on words you use in daily life, and used the example, coffee.

And what you first do is you would make a scale, a tonal scale that is appropriate for the mood and for the specific tonality and height for the client and the patient, and you would teach that scale to them, so for instance “coffee” would be a positive thing to think about, so you’ll have for instance a major scale (Music Therapy Student).

The setting was in a nursing home and rehabilitation Centre, and the particular case they worked with was an eighty-year-old woman.

What we did was, we’d sing those scales a couple of times, while just making sure that she would pronounce the word, pronounce it right and correctly, and that’s why the speech therapist would come in and really mimic in front of the person, like give her a lot of facial feedback.

He said that they would sing “co-ffee, co-ffee” in intervals, or in up and down scales.

And after some time, if that went well, then you would progress into letting the melody slowly fade out, and then continuing singing without the piano, because we would use a piano to support our client. This all happens together with the two therapists (Music Therapy Student).

He explains what the next step might be when the client shows progress: to go from singing to speaking.

For instance what you could do if that would go very well, you would progress into having no music anymore; you get the first note and then you’ll sing it without the piano and afterwards, you would say it very staccato-like, and, for instance, afterwards you would try to smooth that over […] And again a
lot of the audio feedback and the visual feedback. And then word for word that would build into a sentence and after like, depending on the level that the patient would be in in its limitation, they would make it harder or less harder for the patient to do the exercises […] because it is focused on making as much progress as possible, it is nothing like psycho dynamic therapy (Music Therapy Student).

It seems that several music therapists, at least those I have talked to, are not very interested in focusing on only one problem when other problems accompany speech problems, such as depression and paralysis.

Some methods may be too focused on the problem, especially strict methods, it comes from another tradition that we have here. It may work well for a client that is cognitively well functioning and very motivated to practice words and manage to transfer that, then the method is perfect. But I haven’t met any of those persons. Actually, I haven’t met anyone like that. Most clients I meet do have some sort of complication, they are maybe depressed or the damage is too severe to use a method like that. Then you have to find another intervention […] If you use a method without criticism, it gets poor; you need to see the whole client in every kind of disciplines. I don’t like to think of music as a form of stimuli that is supposed to give a certain type of response, my opinion is that people need more than that. It doesn’t prevent me from using a strict method, but you need to have those other things in place first (Music Therapist 3).

Some of the therapists find that, to make the therapy intense enough, some type of “homework” in between music-therapy sessions is beneficial for this client group:

Sometimes people are motivated to do something also between the appointments, for example exercise something at home. So I would say that with these clients it would be useful for therapeutic outcomes that, in terms of therapeutic outcomes that it could be this kind of homework. Also in between the appointments (Music Therapist 1).

Some material to work on after they are discharged from therapy may also be a good idea, as Music Therapist 4 told me:

I made a list of songs that we had used, she didn’t like to sing (wife of client), but then we made a list of songs they could find on YouTube, and then they sang along. I think they appreciated it, it seemed like that, so they could work with it at home (Music Therapist 4).

Music Therapist 3 did not have the opportunity to work intensively with clients due to learning laws, economy and such. She thinks intensity is crucial for the therapy to have an effect on speech:

I really believe in that. When you see an effect immediately afterwards, you will think that there is a change in the brain, but it won’t last over time. That’s what we do when we learn something, we need repetition. That’s maybe why we have homework, because we need repetition in all learning (Music Therapist 3).

Music Therapist 4 said that she wishes she had more insensitive sessions with the clients and that she does not have any particular success stories to tell:
it’s something about the resources you have, how often a music therapist can come and help this person. It’s about the institution you work in, or economy if it’s private. I think that if I had the opportunity to work with the client six months more, to come every day or every other day – I think that would have made huge difference! I really do. Where I work now, I have a lot of patient’s during a week. I can’t focus fully on one person when there’s over a hundred other patients that need help as well (Music Therapist 4).

Music Therapist 4 brought up another interesting issue about music therapy in this setting; that many patients do not know what music therapy is and how it can be used.

I may be thinking that ‘Hello, I can help in thousand different ways!’, although just going from knowing what I can do for you to convey it to a person that maybe doesn’t know what music therapy is – only that is a big task! (Music Therapist 4).

**Interviewee’s experiences with outcomes from music therapy**

All of the therapists were asked if they found that the treatment they gave to their patients worked. The Music Therapy Student had quite a strong experience with SMTA.

When you read about it in theory, it all sounds very nice, but then you actually live and you see it – it was really cool! […] It’s a very cool and effective module, Speech Music Therapy for Aphasia; I’ve seen it work, so it was for me, during my studies in the second year really another beacon of hope for music therapy. Because I saw music therapy happen and work very directly. I’ve never seen it work that directly. Because usually it’s like the client comes in and feels depressed, and client comes out and she feels less depressed. And there’s a significant difference there, but there is not as significant as somebody who cannot speak and leaves your room and says a word. That is so much more like zero to one (Music Therapy Student).

Music Therapist 4 does think that music therapy combined with speech therapy is a good approach and believes that cooperating with a speech therapist might be a good strategy for patients with aphasia. She also thinks that music therapy does help with speech. It is not necessarily the most important thing that patients do to reclaim speech, but it definitely plays a role:

If I just think about reclaiming of speech or that part of it, I would say that yes, it is my impression that it helps. But it is not only what it helps for, it is part of a larger package. I think that the music, or the music therapy treatment is not the only thing that helps a person, but I think it plays a role. It’s not necessarily the most important for the primary treatment, but it is a very good support treatment and interdisciplinary treatment. I think you need more, you need speech therapists and the client needs to be motivated. And that’s why music is super important, and I think absolutely that music therapy treatment done the right way is great and effective to reclaim speech, I absolutely do, but it is a long process (Music Therapist 4).

Music Therapist 1 was asked if he thinks music therapy worked, and he thinks it is very individual. He said that there is much recovery to see in the acute phase. But this partly because of spontaneous recovery with help from the therapeutic approaches. He said that a
client can show improvement in therapy, but he also emphasized that it is important to think about what happens outside therapy.

And it is very important to realize that it is not some kind of improvement in therapy, and, for example in speech fluency; what is possible in therapy, but also what happens outside there and in everyday life. And quite often, people who are near to these clients, they report about the progress. And they can confirm it that there is certainly certain recovery happening and some improvement is visible out there. And it is very important to get that information as well, that it is not only happening inside the therapy. And often it goes so that first something goes positive in therapy, and in transfer effect will be seen also outside. Or, if something is possible in therapy, you can support the transfer effect to the outside (Music Therapist 1).

Music Therapist 2 told me about a so-called “plateau phase,” which means that the client or patient has reach the level of how well they can improve, according to some traditions in rehabilitation. If the client/patient/student has not improved during a period of time, it is thought that they will not improve any more. A speech therapist had “set” this stage for this particular client. Music Therapist 2 does not believe in such a stage, and talks about a client that she thinks proves this theory wrong:

I think that she also prove this wrong, because she had a stroke in year 2000, and she didn’t make much progress. I think she makes progress! One thing is that she loves music and that it is very proper for her to be in this group, but the other thing is that I think she communicatively speaks better. So I think this speech therapist had poor fantasy […] I think the plateau phase comes when you are dead, and not any earlier (Music Therapist 2).

Music Therapist 3 also had an experience in which a speech therapist did not find much to work with on a client.

I have had clients where you see that the speech therapist, for instance, doesn’t find a lot to work with, but I can say that I have gotten clients to repeat several letters and sounds, and have seen that they have kept their concentration for twenty minutes, and focus on that in music therapy you can do more than in speech therapy […] I got more out of him than the speech therapist did (Music Therapist 3).

Music therapists 1 reported that the recovery progress can be affected by when the client sees a therapist following a stroke.

You may also that results of therapy are different or the progress is different, it is slower and there will be maybe less of progress, if it would be started later on (Music Therapist 1).

All of the music therapists told me that most aphasic patients they have had are older than sixty years old, though they do have younger patients sometimes (e.g., Music Therapist 3 and 4 do). Music Therapist 1 found a link between faster recoveries for younger patients:
You could say so, that maybe the recovery process is a bit faster (for younger clients) [...] Because there is not that kind of load coming from just natural processes of being older, and senior people may have their own problems related to age already, so that kind of a comorbid thing there. Just being older [...] Those younger ones are maybe more eager to rehabilitate themselves. Trying to get back to life is maybe stronger (Music Therapist 1).

Music Therapist 4 agrees:

The brain is more plastic when you are younger, and like several other things, you can train it up better in an younger age than when you are older, although it probably also depends on motivation; younger people have the whole life in front of them (Music Therapist 4).

Music Therapist 1 thinks that singing or playing is an important way for clients to express themselves when it is hard for them to express themselves through speech. Music Therapist 1 spoke about the fact that these clients may be able to sing though they are not able to speak.

And, it’s a funny thing that how actually people, they may feel that playing some music or singing songs may be notably easy for them. So, that’s very typical for these clients, that you cannot say things that much, but you can still sing or you can use lyrics as another way or kind of a, another channel for your self-expression. Yeah, it works quite often very well. And immediately after that even being able to sing a song and, or you try to say something and then it simply doesn’t work. And sometimes it may be even so that after singing a song talking may become easier (Music Therapist 1).

Communication is more than just speech. Some of the music therapists take that into consideration in the therapy, since most therapists wish to help the client function in daily life. Music Therapist 3 addressed the fact that some patients may stop trying to speak because they are frustrated by people around them who do not understand, and thinks that music can help:

Some clients loose the desire to communicate because they may be so frustrated of not being able to say anything, and trying to explain something without words. To try to make someone understand, and you get so annoyed because people don’t understand, then you may lose all desire to try to communicate. Concerning that, I think that it is very important to provide good experiences of communicating with music (Music Therapist 3).

Music Therapist 2 also had an experience in the family with how music can help people with aphasia speak:

I had a grandmother. I made some music groups for her in a nursery home she stayed in, and she had had a stroke. She couldn’t take part in a conversation at the end. After a music session with singing some old, familiar song, she could talk to the person next to her almost as you normally do (Music Therapist 2).

Music Therapist 3 acknowledges that, even though research papers show evidence of different structures in the brain after therapy, we cannot measure whether this effect transfers to daily life, which is what the therapists like to focus on.
Ok, a difference in the brain happens, but we don’t know if there’s any difference in daily life. I have experienced that there is an instant improvement after therapy, and the client can say some words right after, and maybe during the rest of that day. Then it has some sort of transfer value (Music Therapist 3).

Even if it is not measurable, it is possible to keep track of the clients by asking people around them if they notice any difference, as Music Therapist 1 points out on page 65.

Some approaches may be wrong for the client. Music Therapist 3 experienced this with a client who was a musician prior to the speech impairment. Then it is especially important to think about what you are doing as a therapist.

You have those that can be reluctant to use music, if they for instance have been musicians before the damage. It can be hard […] you compare it to what you could do before, and you focus on the music as an achievement, and that’s not what it’s about at all when it’s about aphasia. So you’ll have to balance it. But it is possible to use music, just to use a small rhythm, it can have an effect on speech without the intervention being especially musical, and then you can add, so you can find a way they can appreciate it. If you, for instance, have played guitar before, and you have a paralyzed arm, then you shouldn’t bring a guitar into an improvisation. In a way manage to use the musical resources as strength for that client without confronting him or her with music they cannot play anymore (Music Therapist 3).

Music may provide some kind of distraction of what is happening around you, which may be beneficial in terms of depression. The strategy should although be applied in the right amount:

[...] a kind of a distraction in the ways that you can for a while think something else. So you can orientate yourself in different ways and, for example using your imagery. It can be certain kind of escapism; that you can stay for a while somewhere else […] it cannot be the only strategy (Music Therapist 1).

As mentioned, Music Therapist 3 did not have any success stories to share from her career as a music therapist. She thinks although that music therapy is a good strategy even if it does not show on vocal meaningful output:

At the same time, I don’t think that music therapy didn’t have any effect; although it didn’t have the effect you usually look for and want to measure. It has at least had a physical effect and it has increased wellbeing. It may sound like that is not important, but it is very important! (Music Therapist 3).

Music Therapist 1 shared one very special case his client group. It was an aphasic patient from traumatic brain injury, a very dramatic case, whom he worked with for three to four months.

He was not able to speak at all. And it was quite difficult to work with him because communication was very restricted, and you only could guess what is going on there and what he thought about things, because there wasn’t any understandable kind of communication.
He also said that the client’s facial expression was almost nonexistent, so it was very hard for the therapist to tell if the client was enjoying what they did together or not. He said that they played together on instruments. The client usually played a percussive instrument while Music Therapist 1 played guitar, bass or keyboards. They did this twice a week for a few months. Then the client left therapy, and went through a very intensive rehabilitation period at an institution with many specialists for his condition for approximately three months, which is a standard period. He got his speech back during this period, and then he went to see Music Therapist 1 again.

I was totally surprised when he came to me and started to talk; like ‘Oh, oh my God! What happens next?’ What he told me was how remarkable and meaningful it was for him that we played that music together before that intensive rehabilitation period. And he remembered everything there. And pointed out many, many different several occasions where we were doing something particular and he told me how important it was for him. It’s a totally moving situation when something like that kind of treasure box will be open and it was impossible to know anything about that. But afterwards when he came to me and told all those stories and linked those shared experiences to his, how important it was for him to be able to express himself through music. [...] when he told about these meaningful experiences I realized that “OK, music can even work in such situations where you really don’t see anything if it works or not.” So it was quite remarkable (Music Therapist 1).

Music Therapist 3 and Music Therapist 4 have seen that music therapy can also be helpful for clients who have speech problems that are more related to fluent aphasia or Wernicke’s aphasia. Music Therapist 3 spoke about one client who would speak uninterruptedly:

He had a type of aphasia in which he spoke ‘nonstop’, like a type of Wernicke’s aphasia, or a mixed type of aphasia. He could for instance speak very relevantly about what we did, when we made music, although he could not say concrete things like ‘this is a guitar’, but he could say what he experienced and what he felt (Music Therapist 3).

She said that this client learned to takes breaks from the uninterrupted speaking through music therapy.

Music Therapist 4 has also had experiences in which a client with a speech impairment such as fluent aphasia learns how to take breaks when she is speaking. The therapist believes that this may be because the client was able to express herself somehow through music and therefore does not have the need to constantly make sound.

I am not sure if it’s called aphasia, but the best way I can describe it is that she is rambling a lot, but it is not words, it is only sounds [...] For her to be able to take breaks is a goal with her. And when we are singing a lot together, or playing instruments, which she likes, she is able to control her sounds, and can take breaks on five or ten seconds. I feel like she has the opportunity to express something, then she is able to stop the sounds (Music Therapist 4).
Music therapists about why and how music therapy works

Some of the therapists also shared their beliefs about why and how music therapy can be so effective and powerful for this group of patients/clients/students. Music Therapist 3 is pleased with the options music therapy provides:

Music therapy is so good because you have so many different options! From using a little rhythm to make an effect to help the client find creative sides with themselves and work with identity – it’s limitless (Music Therapy 3).

Music Therapist 4 thinks that music therapy is a good way to build a valuable relationship between therapist and client, which is very important: “Music is great, because it is easy to use it as a relation-bridge […] you kind of have an ace up your sleeve other therapists don’t have.” Music Therapist 1 thinks that music therapy, “forces you to express yourself and communicate with somebody else.” Therapist 1 also believes that music contains a social function. Music Therapist 4 thinks that singing is very releasing of emotions. Music Therapist 1 also mentions that,

[…] using music and music therapy, of course it can be helpful for the client at that point, when you get depressed and you are very insecure about your current situation, so music can be helpful when supporting, or kind of revealing that kind of difficult emotion or content. Because it is emotionally meaningful for the client (Music Therapist 1).

As seen in the literature mentioned, music is processed over large portions of the brain, which also may be why music therapy is so beneficial.

It combines many, many different brain functions during the very same activity, so that’s one of those wonderful sides of music therapy and music-therapeutic approaches, that it’s always quite a multi-sensory experience and, I guess, that’s one of those reason why it’s usually quite effective or it seems to be effective (Music Therapist 1).

Music Therapist 1 also thinks that music evokes cognitive functions because it is complex, especially when one attempts to analyze it, which also requires memory functions.

Music in all its forms contains different kinds of structures and it happens in linear time. So it must be somehow logical, like a composition or a song developed in certain ways, so it requires some memory functions and it’s also intellectually sometimes very challenging or some people may emphasize this cognitive part of music listening, they try to figure out how and what kind of arrangement it is and what kind of sound there are and what kind of structure the composition has (Music Therapist 1).

He thinks that music supports memory functions, and that music evokes these spontaneously, without the client needing to try.
Sometimes with this clients, in terms of memory functions and cognitive recovery, it’s so nice that because music kind of codes own memories, that spontaneously through music you can memorize things, so you are not like, you’re not forced to try to remember, and it happens spontaneously through music. And this kind of milestone of your experience and your past, so little by little you remember more of them, and I think you can connect things together and it makes something which makes sense. It forms a field of your experiences, which makes sense, but in the beginning, right after a stroke, you’d be just confused about everything. It’s difficult for you to express yourself and try to memorize things, so it’s a bit of a double-sided problem at that point, but through this kind of spontaneous memorizing, it’s quite a soft and gentle way to rehabilitate your cognitive side. You don’t have to do some heavy rehearsal or difficult tasks for reaching that […] it feels easier even though it is not easy (Music Therapist 1).

Music facilitates neurological and cognitive functions without the client trying; thus it does not feel like a task or exercise. The fact that music does not feel like an exercise is something that Music Therapist 3 has also experienced. “Clients I have had have told me that they looked at music therapy more as a break than a session, as in school, more like a break than the class” (Music Therapist 3). She has also experienced that music provides motivation for rehabilitation, and that music provides a form of exercising without it being tiring.

I have experienced that the motivation for rehabilitation can increase the will to participate. And also when clients are undergoing harder periods of time and having a hard time to motivate themselves to practice, they might still want to sing songs, and alluring them to exercise, in a way, without them noticing completely. Without noticing, they want to participate (Music Therapist 3).

Music also provides physical sensations, as Music Therapist 1 emphasizes. Music can give you chills, and it makes you move. Playing instruments is also physical. “You communicate through something which is physical, it’s not only relaxation.” This “forces” the client to participate (Music Therapist 1).

Music Therapist 1 also believes that music therapy provides motivation because music is touching and evokes emotions. He thinks that five elements make music therapy so powerful in rehabilitation: it evokes your emotions, it provides motivation, it supports cognitive functions, it provides physical sensations, and it provides social interaction.

I would say that maybe this is the most important thing or quality of music as therapy or music therapy as a rehabilitation form. People like it, it’s quite easy to tolerate, even for music can be irritating as well, so you can hate some music, but that’s also a reaction, and it helps you to express yourself and distract [?] your inner tension and things like that. And thinking about the recovery process; and all those phases related to that. So, there might be some very different kinds of needs coming from the client and partly just that music activates a lot, it also gives you this possibility for expressing yourself. And also those difficult emotions and difficult things, try to clarify those to yourself and maybe getting a clearer picture of the current situation (Music Therapist 1).

Music Therapist 4 notes that music therapists, especially in Norway, have great knowledge about mental health, which is something the music therapists I interviewed seem to care about. Knowledge about mental health is crucial when dealing with mood symptoms
following a stroke. Music Therapist 1 talked about the term *anasognosia*, which refers to how aware the client is about his or her current state. Anasognosia usually develops a little after a brain lesion:

> In the first place you might be just confused about the change or don’t realize that ‘ok, I cannot do things in normal ways anymore’. But then after a certain period of time, you are more aware of that, and then you are kind of paralyze also mentally […] at that point you realize ‘ok, now, I can’t do anything anymore’ (Music Therapist 1).

He says that it is good for the client to realize this stage, though it may lead to more problems, such as depression.

> And in terms of music, using music and music therapy, of course it can be helpful for the client at that point, that when you get depressed and you are very insecure about your current situation. So music can be helpful when supporting, or kind of revealing that kind of difficult emotion or content (Music Therapist 1).

The Former Aphasic Patient said that she did not realize how bad her stage was at the beginning, especially regarding her speech. Her testimony corresponds with what Music Therapist 1 described above.

**Importance of private support**

Music Therapist 2 and Music Therapist 4 described how important it is for the patients to have support from their families. The Former Aphasic Patient also talked about this. She said that her family visited her often at the hospital and rehabilitation Centre, and she stressed how important it is that someone who knew her was there, since they often knew what she was trying to say:

> It helped me a lot, that there was family that knew me from before and was there every single day. If I had only had the nurses around me, it would have been difficult to tell them what I wanted (Former Aphasic Patient).
6 Discussion

This chapter consists of a recapitulation of some of the basic brain structures involved in the studies presented earlier. This recapitulation is offered to form a link with the literature and qualitative studies, so that these three components to illuminate each other.

6.1 Localization of Language and music in the Brain

Although brain-imaging technology can provide much necessary information about the functions of different regions of the brain, the brain is still a mystery; there is much that we do not know about its functions and regions. Though the speech areas Broca’s area and Wernicke’s area were discovered in the second half of the seventeenth century, there is now agreement that language processing involves much more of the brain than these two regions. It is agreed that the left hemisphere is more involved in language than the right hemisphere, since the right hemisphere seem to be mute for most people (Brodal 2010:513). This corresponds with the fact that non-fluent aphasic participants in the studies had left-hemispheric lesions (e.g., Baker 2000, Schlaug et al. 2008, and Schlaug et al. 2009a). There seems also to be agreement that prosody is processed in the right hemisphere (Kolb & Wishaw 2003:514). According to Purves and Brannon (2013:409), the left hemisphere is specialized for verbal and symbolic processing while the right hemisphere is specialized for visual and emotional information. Recent studies show that speech production and comprehension involves regions in perisylvian frontal, temporal and parietal cortices in the left hemisphere (ibid.:413). Where language is processed in the brain also seems to differ with the individual (loc.cit.). There is no great agreement about what regions are involved in language, as newer findings keep challenging old assumptions. If language-processing areas really are individual, it will be difficult to create a standard answer for where in the brain language is processed.

There are regions in the brain that are dedicated to music (Peretz 2003:192), though like the regions dedicated to language, there is no consensus on where they are. The old assumption that music was processed only in the right hemisphere is no longer supported (Baker 2000:110, Altenmüller 2003:346). Since music contains many different components—such as melody, pitch, rhythm, tempo and timbre—it is natural to think that these are processed in different regions of the brain. Pitch is, for instance, processed in the temporal lobe in the right hemisphere, while timing is processed in the temporal lobe in the left hemisphere (Altenmüller 2003:347). Listening to or playing music requires many brain
functions, such as hearing, sight, intellectual and emotional functions, sensory, and motor activity (Wigram et al. 2002:53). Thus, it is not likely that brain damage will destroy all of the elements of music processing. Damage to the right hemisphere will often result in a deficit in singing (Wigram et al. 2002:53), while damage to the left hemisphere will often result in problems with rhythm and time perception (Jungblut 2014:2). Like language processing, music processing is individual. Processing of music also differs between musicians and non-musicians. While appreciation and expression of melody is processed in the right hemisphere by non-musicians, musicians show more activation in the left hemisphere (Brodal 2010:514). This difference might be explained with reference to the fact that analysis and “active” listening seem to show more activation in the left hemisphere, since musicians tend to listen to music more analytically.

Music and language have some similar features. For instance, both contains inflection, intonation, tempo, rhythm, melody, sound production, hearing, and, in most cultures, they are both coherent and rule based (Sacks 2007, Peretz 2003). Music and language are processed widely over the brain, and some functions do overlap (Tomaino 2012:312). For example, according to Besson and Schön (2003:277), tones and words are processed alike, and comprehension of symbolism in language and sight reading is processed in the supramarginal gyrus. Broca’s area, which is known as a speech area, is also involved in playing music—especially in rhythmical tasks. According to Peretz (2003:194) music and language are processed in different auditory systems. There is neuropsychological evidence for the modularity of two systems, with evidence of clear dissociation between language impairment and music impairment (Merrett et al. 2014). Some researchers hypothesize that Melodic Intonation Therapy and other music therapy methods are effective because they activate the shared features of music and language. This is a controversial theory, however, given the findings mentioned above.

New findings constantly challenge old assumptions, and since technology is always developing, more assumptions will likely be challenged in the future. Creative activities, such as composition, cannot be assigned to one brain region. Creativity requires several different brain functions. Future technology may make it easier to tell which parts of the brain are involved in such activity. If the processing of language and music differs per individual, a standard answer may never be found to the question of music and language localization.
6.2 Localization of aphasia and recovery

According to Kolb and Wishaw (2003:505-506), Broca’s aphasia does not necessarily involve damage to Broca’s area, as previously believed. Findings show that apraxia of speech, which is considered the core of non-fluent aphasia, comes from damage to the insula. Naeser and Helm-Estabrooks (1985) found that subjects who respond well to MIT had damage to Broca’s area and to regions close to it. These two assumptions do not quite correlate. Perhaps some patients with Broca’s aphasia (non-fluent aphasia) have lesion in the Broca’s area. It should be noted that the study of Naeser and Helm-Estabrooks is over thirty years old and that brain imaging technology and knowledge might be better now.

Schlaug et al. (2008) thinks that there are two ways to recover from non-fluent aphasia: either by activating the un-lesioned speech region in the left hemisphere, or through the homologous speech areas in the right hemisphere. Language has a strong affinity with the left hemisphere, and will not abandon the left hemisphere unless the entire speech center is destroyed (Kolb & Wishaw 2003:682). According to Jungblut (2014), recovery through the left hemisphere is more successful than through the right hemisphere. It is currently assumed that right-hemispheric activity after a left-hemispheric lesion is related to the subacute phase, while a return to left-hemispheric activity after a lesion is related to the chronic phase. Still, there is evidence of right-hemispheric activity in the chronic phase (e.g., Schlaug et al. 2009a). Such different findings might be explained with reference to the sizes of the lesions, the time since stroke occurred, genes and environmental factors in participants. An important environmental factor to consider is whether the participant has done music prior to the lesion. A study conducted by Wilson et al. (2010) found that singing expertise plays a role in neurological activation. They found that singing expertise is associated with decoupling of the singing network from the language network. Merrett et al. (2014) think these findings raise some interesting hypotheses: e.g., that MIT would be more effective on people who have already developed a specialized singing network, and that MIT may promote the development of an “expert” singing network. Some case study findings suggest that MIT is more effective with trained musicians (ibid.).

It has been observed that younger patients recover more quickly and that people with aphasia from traumatic brain injury recover faster than those with aphasia from stroke (Kolb & Wishaw 2003:682).

It has been mentioned several times that music therapy is more beneficial for non-fluent aphasic patients than for fluent aphasic patients (e.g., Sacks 2007). There has also been conducted brain imaging studies, which show that and patients with lesions in Wernicke’s
area has poor response to MIT (Naeser & Helm-Estabrooks 1985). No studies that investigate music therapy on fluent aphasic patients were found for this thesis, although both Music Therapist 3 and Music Therapist 4 said that music therapy is also beneficial for people with fluent aphasia. They each mentioned one client who was constantly making sound who was able to take breaks following therapy sessions. Music Therapist 4 thinks this is because the client felt able to express something through music and thus felt that she could take a break from making sounds. Music Therapist 3 said that her patients were able to talk more concretely about things after a music-therapy session.

6.3 The recovery of Former Aphasic Patient and music
I do not have enough knowledge to say that the nearly complete recovery of the Former Aphasic Patient is due to the use of music and song during rehabilitation. It could also have been spontaneous recovery or due to the other rehabilitation therapy she received, such as speech therapy. She did not receive music therapy targeted to help her speech, but it is possible that music helped her, given the theory presented above about music and language in the brain, and given various theories of how music therapy works.

She said herself that she got to practice vocal output, reading, and forming words at the choir rehearsals, and that the social aspect related to it was important. The social aspect can be looked upon as both meeting friends and people she knew at least once a week, but also as the socialization of making music together. Tamplin et al. (2013) and Fogg-Rogers et al. (2016) found that choral singing provides a feeling of belonging and improves conversation and that singing may give more confidence to speak to those who are able to sing words fluently. This again provides motivation (Sacks 2007). Racette et al. (2006) found that non-fluent aphasic patients pronounce words better when they are singing in unison, as in a choir. Thus, it might be possible that choral singing helped the Former Aphasic Patient to reclaim her speech more directly than just the social aspect. In addition, according to Music Therapist 1, singing and making music involves many of the mechanisms that should be practiced when recovering from aphasia, though it does not feel like exercising. This corresponds with what the Former Aphasic Patient said. She said that she did not look at the choir as an aid to her recovery at that time. It was still her hobby. But now she believes that it might have played a role. She was in the choir for the sake of making music in a choir, not to rehabilitate herself.

Since she was singing in a choir, had singing lessons and was practicing herself, she got to sing quite intensively. Intensive training is crucial if music-therapeutic methods, for
example MIT, to show results (Schlaug et al. 2008:3). Thus, the intensity of her practicing might have played a role in her recovery. This has most naturally provided her with motivation to try to get back to a normal life, since music can be uplifting and motivating. The Former Aphasic Patient said that she could sing lyrics that she knew prior to the stroke, but that it was initially hard for her to learn new words following the stroke. This corresponds with the findings in Einbu’s (2008) study: that non-fluent aphasic participants had more correct lyrics in familiar songs than in new songs.

Since her age was less than the average age for stroke, it is possible that the almost complete recovery of the Former Aphasic Patient is related to her age. The literature says that younger aphasic patients recover better than older patients (Kolb & Wishaw 2003:682). Several of the music therapists interviewed (for instance, Music Therapist 1) report that the younger aphasic patients tend to recover faster and better than older patients. The music therapists interviewed also said that the younger aphasic patients often have more motivation to work hard and recover, since they still have many years to live and are eager to return to a normal life.

The fact that the Former Aphasic Patient was a singer who had played a variety of instruments prior to her injury may have had an impact of her recovery. She was and am a singer, so as the study conducted by Wilson et al. (2011) hypothesize that singing expertise prior to the lesion my facilitate recovery, prior singing expertise may have been in her favor. It may be that people with prior singing expertise are more likely to achieve a successful recovery because brain plasticity facilitates recovery more than in aphasic patients without prior singing expertise. Little attention has been given to this possibility, and it would be an interesting issue to investigate in the future. The Former Aphasic Patient also said that she had played the violin and the viola prior to the stroke, although she was primarily a singer, and that she also played some piano with the music therapist during rehabilitation. There are, as mentioned, some differences in brain structures between musicians and non-musicians. As mentioned, musician might have slightly different brain plasticity than non-musicians, as for instance corpus callosum is more developed in musicians (Schlaug 2003). Berit Vik (unpublished) found rewiring of neural pathways in fMRI scans of participants with traumatic brain injury who underwent music training. She also included a control group without musical training. Cognitive performance was also better after music training. The study builds on evidence of shared neural pathways for music and language. The instrument played may also cause different brain structures. Brain plasticity also develops differently depending on the instrument that is played. A string player develops finer motor skills in the left hand than a
pianist, because the pianist’s left hand often works as the “accompanying” hand (Schlaug 2009b). When playing the piano, you use both hands, thus the two hemispheres has to communicate, as proposed by Former Aphasic Patient.

Music training prior to brain damage could be somehow preventive in terms of recovery from brain damage, because the brain tissue is different in musicians. Some findings show that being bilingual may also delay the onset of dementia (e.g., Craik, Bialystok and Freedman 2010), so it could be that music can have a similar effect on neurologic diseases such as aphasia. This is now only a hypothesis, but it is interesting and should be investigated further.

We will never know how much music helped this woman recover, both in terms of changes in brain plasticity and motivation. However, it might constitute at least part of an explanation of her return to a normal life and the fact that she has accomplished several achievements since the stroke. She even received an award for her determination. The music might have helped her through this process as well.

### 6.4 Music therapeutic methods and techniques

Melodic Intonation Therapy (MIT), Modified Melodic Intonation Therapy (MMIT), SIPARI, Speech Music Therapy for Aphasia (SMTA), Musical Speech Stimulation (MUSTIM) and Therapeutic Singing (TS) was presented as music therapeutic methods earlier. MIT was developed first of these methods, and several of the other methods seems quite inspired by MIT, such as SIPARI, SMTA and MMIT, that uses some elements from it. Examples of these elements are singing or intoning. However, those mentioned methods, together with MUSTIM are described as methods that can be applied if the patient does not benefit from or are suited for MIT. MMIT is for instance developed based on that MIT is too hard for some patients. This could be the case with some of the other methods as well. All mentioned methods except TS is based on singing or intoning that is faded into speech. They are all primarily based on singing instead of for instance playing instrument, although this is natural since song and speech are closely related.

Tomaino (2012) presented the five most effective music therapeutic techniques for aphasia, whish is singing of familiar songs, breathing into single-syllables sounds, musically assisted speech, dynamically cued singing and rhythmic speech cuing. All these techniques can be found in the methods mentioned above. Several of them suggest singing of familiar songs, SIPARI also focuses on breathing, and dynamically cued singing is used in MUSTIM.
Rhythmic speech cuing and musically assisted speech is very much what is used in MIT and MMIT.

Through what they told me during the interviews, I can see that Music Therapist 3 and Music Therapist 4 have both used MIT. Both of them also said that they have used the technique with the stop in singing at the last word in the phrase so that the client can “fill it in, which is the same as what Tomaino refers to as dynamically cued singing, and is also an element used in MUSTIM. Therapist 3 talked about being inspired by SIPARI and is using some elements from that method in her work. Music therapists 2, 3 and 4, and to a lesser degree 1, all talk about singing familiar songs, which may be linked to Therapeutic Singing (TS).

6.5 Music-therapeutic approaches used by music therapists in rehabilitation versus what is presented in the literature

When I interviewed the music therapists, I expected to hear what it was really like to work with music-therapeutic methods for speech rehabilitation such as Melodic Intonation Therapy, giving that it is so structured and hierarchical. However, almost every therapist told me something else. They told me that the approaches they use are often tailored to the patient because each person has different needs and often has different symptoms in addition to speech difficulties. They told me how important an assessment of the patient is. They do not seem to spend much attention towards the patient’s diagnosis but concentrate more on who the person is and on what their problems and goals are. Music therapists really seem to see the whole patient or client and give them what they need. The relationship between therapist and patient/client is crucial. Both the verbal sources (e.g. the music therapists) and the literature emphasize this (e.g., Sacks et al. 2007). This relationship is probably partly made through assessments and through the fact that the therapists see the client as a person and not only a diagnosis. Music Therapist 4 spoke about differences between the methods being used, and how they are discussed in research papers compared to what it is like to use them in “real life.”

You have to stick to your frame and be very “narrow” when doing a research project, but when you are working out in the field, you have to do what fits there and then (Music Therapist 4)

The outcome studies of music therapy for aphasia and the clinical reality of music therapy seem to be different cases. While they focus in daily life on whole patients or clients, during a research project they might measure how many words participants are able to say per minute.
and/or their brain activity during verbal tasks or use brain imaging to capture changes in brain tissue. In outcome studies, participants are chosen to fit the study. Music Therapist 3 mentioned that few are suffering from aphasia at any given time, especially in a small country such as Norway, and that those few will not neatly fit the criteria for participation in a study. In a research study, criteria are in place to include only patients that are as similar as possible. In the clinical reality of music therapy, many of the people who need help will not meet these criteria. Several studies (e.g., Belin et al. 1996) have been criticized for including people with global aphasia in a trial for non-fluent aphasic patients. It would probably be good for global aphasics if therapy would work for them as well, though it is reported that MIT is mostly beneficial for non-fluent aphasic patients. A study of a number of aphasic patients with the same problems will often not provide a very good picture of what it is like for aphasics in everyday life. Aphasia is mostly accompanied by other symptoms besides speech problems. Music Therapist 3 said that she have never met someone that only had one particular problem like that. Music Therapist 4 said that research methods are quite mechanical compared to what is needed in the clinical reality. Many outcome studies do not focus on coping in daily life, as the music therapists does. Aphasic patients have problems that are not focused on in outcome studies because they cannot be measured—for instance, motivation, quality of life, and communication without words—but music therapists nevertheless focus on these issues in daily life. There is more to communication than just words that music therapy can help with, such as communicating through playing instruments. As both literature and the experience from the interviewees have shown, music and music therapy often provide motivation by showing patients that they are still able to master something. This may occur, for instance, by showing patients that they are able to sing words though they cannot speak them. Depression is another issue that often goes hand in hand with aphasia, either due to chemical processes in the brain following the lesion, or because of the patient’s lost functions. Music therapy may also give patients a channel through which to express themselves when they are not able to express themselves through language. Even if working on depression is not directly relevant to speech, it is required if patients are to have the energy and motivation required to work on speech.

As for relating outcomes in the literature and with the experiences of music therapists, it seems that both platforms show that music therapy does help people with aphasia. Though several of the studies report “significant improvement,” none of the music therapists told that they have seen amazing improvements from therapy. All say that they have seen it help, however. The music-therapy student said that he saw how directly music therapy can work.
He said that he had seen a woman go from hardly saying anything to being able to say two words. This is an improvement that will probably serve this lady well, though two words are not much. Music Therapist 2 said that she saw improvement that the speech therapist did not see. This might not be a very big improvement, but it does not have to be a meaningless improvement. The improvement she saw might help this client in daily life. Music Therapist 4 said that she sees improvement in speech through her work. She does not think that this is due only to music; she says rather that it is due to a mix of all the therapies a patient receives plus possible spontaneous recovery. Music Therapist 1 also said that recovery is individual. He said that he often saw recovery in the sub-acute phase; but then again, it might be spontaneous recovery. Music Therapist 3 said that she does not have any success stories to tell from music therapy, although she thinks this is due to a lack of intensity in the sessions. At the same time, one might ask what this therapist would consider a success story. I choose to see “success story” as “significant improvement.”

Music Therapist 3 thinks that methods such as MIT is very strict only works well if the client has good cognitive functions and are very motivated for training in rehabilitation. She has however never met such a person, and says that all the client she have had always have some other complication that makes following such a method - especially strictly - difficult.

As mentioned, music therapists seem to be focused on how to help people with aphasia function as well as possible in daily life, which mostly does not relate to how much they can say per minute or any similar measurements. These language measurements, which are often conducted in studies that investigate the effectiveness of music-therapeutic methods, may in some cases be of vocal output, which is formulaic and is not propositional speech. In daily life, we rely mostly on propositional speech to express our thoughts and ideas. This may mean that these vocal output measurements do not relate to daily life very well unless the clients have learned phrases as a strategy to get through in daily life, as suggested in MMIT. Baker (2000) presented a case in which woman with aphasia was able to learn enough sentences to tell a taxi driver where she was going, ask for water, etc.

Since several of the music therapists who were interviewed for this thesis think that some of the literature fails to give a picture of participants functioning in daily life, one might ask whether these studies are needed. It is hard to find participants, and sometimes they have to go through brain imaging. Methods like PET and CT cause radiation and might cause side effects. Other methods, such as fMRI, are time consuming and might be uncomfortable, because participants have to lie still for long periods and the examination is quite noisy. At
the same time, scientific studies may be important to show people that music therapy is a good approach, as some people will only rely on scientific proof.

As we have seen, music therapy is more method-oriented than problem-oriented. Speech therapy is more problem orientated, as it for instance focuses on the problem of oral communication. Music therapists, especially those considered in this thesis, seem to focus on the whole profile of the client and on the possible emotional issues he or she might have. As Thus, it seems that music therapy may have a broader reach than speech therapy alone. Both the literature and the interviewees mention the benefits that come with cooperation between different experts. For example, a speech therapist may have more competence with speech and language, while a music therapist may have more competence on music and what it does to our bodies. SMTA is, for example, based on cooperation between speech therapists and music therapists.

6.6 Music therapy may in some cases be a better approach than other therapies
Several of the music-therapist interviewees said that they were approached by patients whom the speech therapists had given up on and that music therapy seemed to help them. This was also reflected upon in some of the outcome studies—for instance, in the case studies Sacks (2007) and Albert et al. (1973) presented. This might be explained by the fact that music therapists tend to focus on whole persons with all of their symptoms. It might also be, however, that the musical element in music therapy facilitates speech on a neurophysiological level, as much of the literature suggests. If a patient suffers from poor motivation, poor attention, depression or deficits in motor timing (Tomaino 2012:313), music may seem more motivating and it might be able to catch the patient’s attention. This is because music is enjoyable. And if it catches the attention, then it might distract patients from feeling like they are exercising, as elements such as rhythm may help motor timing.

Zumbansen et al. (2014) measured “mood” in participants who underwent MIT-inspired therapies. These therapeutic methods used a standardized assessment that did not show any difference in mood prior and following the therapy. Some theories and evidence suggest that music can help with depression and improve motivation. At the same time, MIT is not very musical; it contains only the musical element of pitch and rhythm. Thus, MIT might not feel as releasing as music listening or singing.

6.7 Music therapy is not always right
Even if music therapy is very beneficial for many people, it may not be for everyone. Clients should have a relationship with music for music therapy to be beneficial. Though MIT does
not provide as many musical elements as other music-therapeutic methods and situations, musical preference is not crucial in this type of therapy. As some of the music therapists report, it is important to be careful if the client has played an instrument prior to the lesion and is not able to play it anymore. In that case, it may be important to avoid using this instrument in therapy. In some cases, it could be beneficial as well, so it is crucial that the music therapist knows the client well enough to make the best decision. It is also important to use music that the client likes.

From my experience with observing music-therapy sessions (in Finland), I found that music therapy might be more effective for people who have not done anything musical prior to therapy. This is mainly because musicians are familiar with rules and structures around music and may therefore find that free improvisation feels unfamiliar and maybe a little “unsafe.”

6.8 Validity of research studies
I have not yet read a study about music therapy for non-fluent aphasia that did not present good results. This may be a good thing, although, it is impossible to know whether studies with poor or negative outcomes are published. This is an on-going discussion in several fields. It may be that researchers decide not to publish studies with poor outcomes because their careers benefit if they publish good outcomes. Nevertheless, the empirical data collected for this thesis indicates that therapists have seen music therapy work. So does a former aphasic patient who got better and believes that it is partly thanks to music.

A Cochrane review of music therapy for acquired brain injury was included in this thesis (Bradt et al.: 2007). No MIT-studies were included in this review because they lacked the criteria required for inclusion. One SIPARI study was included. Hurkmans et al. (2012) conducted a review. Several MIT studies were included, but all of them were rated as methodologically low. Thus, most of the studies done on music therapy for aphasia, most of which are done on non-fluent aphasia, seem to exhibit deficiencies in methodology. However, some of these deficiencies relate to the illness of the participants: e.g., their lesions did not meet the criteria. The Cochrane review did not include any MIT-studies in part because some of the interventions in them were not applied by music therapists. As mentioned, MIT is an interdisciplinary approach. It may also be applied by other trained therapists, such as speech therapists.
Of the studies included in this thesis, Einbu (2008) is the only study done in the sub-
acute phase; other studies were done at the chronic stage. As Music Therapist 1 mentioned,
how long after the lesion occurred the therapy is applied is crucial for the results.

6.9 Aphasia; frustration and dignity
During the clinical observation of the music-therapy group I visited, I thought about the
dignity of the participants. It is odd to think that elderly people who have lived a life—they
may have had demanding jobs or built their own homes—have to go back to singing songs
and moving around like small children. It made me think about how severe their impairment
is and how serious the consequences of for instance a little clog in the bloodstream can be. It
seemed nevertheless that the clients enjoyed this sequence. I hope they do not feel that their
dignity is diminished by doing games that seem to be suited for small children.

Former Aphasic Patient shared her story about having aphasia and how frustrating it
was to be unable to say the word she was thinking about. All of the music therapists
interviewed, including the Music Therapy Student and Music Therapist 4, were concerned
about what it must be like to have aphasia.

That was, obviously, like one of the main problems with suffering from brain trauma, you lose all
capacity to function and autonomy your own life, and not being able to speak anymore. Like the case of
aphasia, not being able to speak fluently anymore, not being able to form the sentences and have a
correct structure while you are fully aware what you want to say. That must be the one most frustrating
thing in the world. I think so, I can imagine. So, and then giving somebody a way out, so to say a way
out, when somebody is asking you a question and you can at least answer a question (Music Therapy
Student).

“If you put yourself in the same situation, what would you have felt? It must be awful”
(Music Therapist 4). It must be very difficult to lose abilities that is likely taken for granted,
such as speech. It must be very frustrating to know what you want to say but not be able to
say it. Some aphasic patients experience being treated as “idiots,” as Sack (2007) puts it, since
people around them do not realize that it is only their speech that is gone, not their
intelligence. It is thus importance to create a therapeutic environment that does makes aphasic
clients feel as if they are being treated with dignity.

This might be a topic for further research: to interview this type of clients and ask
what it feels like. Then again, it is very challenging for some of these clients to answer such
questions, due to their speech impairments. With varying degrees and classifications of
aphasia, it might also be that some of them will answer “wrongly.” During the observation,
one of the clients answered “no” to a question when her tone sounded like a “yes,” and the
setting implied that “yes” should be the right answer. This might be like the situation in which the Former Aphasic Patient found herself when she called everyone by her brother’s name. Thus, it is difficult to study this problem. One can never be entirely sure if the answers given reflect what the patients really want to say.

6.10 Theories about why music therapy works
There is a comprehensive body of research on music therapy for aphasia, especially on MIT. I have been unable to include all of these studies. To do so would be to exceed the scope of my thesis, and literature study is only a part of the methodology of this thesis. Thus, the possibility needs to be addressed that there may be outcomes and findings that are not included in this thesis.

Several studies (e.g., Zumbansen et al. 2014, Belin et al. 1996, Breier et al. 2010, Schlaug et al. 2009a, Schlaug et al. 2008) have investigated the mechanisms in MIT that facilitate recovery in non-fluent aphasic patients. Merrett et al. (2014) conducted a review study which includes studies that investigated these mechanisms.

There is no overall agreement among the studies. Stahl et al. (2011) found that pitch does not have any effect and that rhythm is the most important element in MIT, especially for those with damage to the basal ganglia. Zumbansen et al. (2014) showed that therapies that use rhythm together with pitch achieve better outcomes than therapies that use only rhythm. It is important to address the fact that no therapy was applied in the study by Stahl et al. The mechanisms were tested in only one session, and not over time. Pitch may be more important in MIT for the therapy to be beneficial over time. Singing of familiar songs is more beneficial for severe non-fluent aphasic patients than for patients with smaller lesions (Einbu 2008).

When Albert, Sparks and Helm developed MIT in the early seventies, they thought that the therapy led to recovery through homologous speech areas in the right hemisphere. They thought that music engages the right hemisphere and thereby bypasses the damaged left hemisphere (Seger et al. 2013 in Thaut et al. 2014). Since spoken language and arm gestures are controlled by the same motor control network, they also thought that left hand tapping engages the right hemisphere (Gentilucci and Dalla Volta 2008 in Thaut et al. 2014). But Belin et al. (1996) found through a PET study on aphasic patients treated with MIT that the right hemisphere is not involved in recovery from aphasia. This study received criticism, as it reported only one brain-imaging session and focused on specific brain areas. Breier et al. (2010) did a MEG study on MIT. Their findings support Belin et al.’s findings. Schlaug et al. (2009a) tested whether MIT can lead to changes in the arcuate fasciculus (AF) in the right
The arcuate fasciculus is a white-matter fiber tract that connects areas important for auditory feedback control with areas that are important for planning and sequencing of motor actions and auditory-motor mapping and with areas that are important for the execution of vocal motor actions. All participants in the study showed both a significant number of fibers in the AF in the right hemisphere at the same time that they reported a significant improvement in speech outcome. In another study, Schlaug (in Sacks 2007) found changes in the right-hemispheric fronto-temporal network at the same time the participant showed significant improvement in speech output. In a controlled study conducted with two participants by Schlaug et al. (2008), a participant who received MIT had better outcomes on all levels than the participant who received a control therapy. fMRI scans showed that the MIT participant exhibited changes in the right-hemispheric network and that the other participant showed changes in left-hemispheric network. The authors also provide some theories on what mechanisms in MIT they think are the most effective. They think that it provides reduction of speech, as singing or intoning are slower than normal speech, which give the client more time to form sounds. It also provides syllables lengthening, which gives the client more time to distinguish between the different phonemes, as the damage of non-fluent aphasia may be related to switching one sound to another. It provides syllable chunking, including intonation, syllabic stress and changes in pitch, which may be supported by the right hemisphere. Finally they think the left hand tapping engages the right hemisphere, which again provide an impulse of verbal production.

Jungblut et al. (2014) conducted a controlled study that used SIPARI in one group and a control therapy in the other. The SIPARI-group showed significant improvement in aphasia assessment tests. One participant, who suffered from Broca’s aphasia, showed activation in the left hemisphere on the fMRI scans. The other two participants, both of whom had global aphasia, showed activation in the right hemisphere. The authors suggest that activation varies with task demand; thus the activation may differ with severity.

All of these different findings might be explicable if severity of impairment is crucial to the activation patterns in the brain. Merrett et al. (2014) think that the different findings in these studies are due to the fact that the literature is not homogeneous with respect to the size of the lesions reported, the time since the lesions occurred or genes and environmental factors. Differences in these factors may yield different results, as large lesions lead to recovery via the right hemisphere and smaller lesions lead to recovery by activating the non-lesioned parts in the left hemisphere. The kind of language task that is given during brain imaging will also
influence results, as formulaic speech activates different brain regions than propositional speech.

Some researchers hypothesize that music can help on motivation and mood. This can be beneficial, because brain damage such as stroke is often accompanied by mood impairment, such as depression. There is evidence that music listening releases dopamine, which is the neurotransmitter related to reward, motivation and pleasure, which may be why musical activities seem to be so motivating. By motivating aphasic patients, music does not help them to reclaim their speech directly; it rather motivates them to exercise to reclaim speech. Singing is a rather non-threatening way for people with aphasia to express themselves. The ability to express oneself through different channels is also something that the music therapists interviewed think is important for their clients. Sacks (2007:216) believe that it is motivating for non-fluent aphasic patients to discover that they can sing words. They thereby discover that both words and the flow of speech are still available to them.

Some findings suggest that singing to an audible model facilitates more correct word outlet than singing alone. This effect will also be accessible when singing in unison with other people, such as in a choir. A choir or a group therapy session, also provides a good social aspect for aphasic patients. It prevents isolation, and it is beneficial for some people to meet other people with the same problems who can understand what you are going through. The clients in the group session I observed seemed to enjoy their session together, and they seemed to care for each other. They were patient when someone else tried to speak, they tried to the best of their abilities to help each other speak, and they cheered each other up. A group session or a choir, or both, may be very beneficial for people with aphasia. To benefit from as many mechanisms as possible, such a group could be followed in addition to one-to-one therapy.

Music Therapist 1 thinks that music facilitates cognitive functions and evokes memory. He also think music therapy is effective because it evokes emotions, and thus attention. The fact that music is a quite physical thing, both that it provides physical reaction, such as it makes you chill, and that a lot of music activity is physical, such as playing an instrument. This also helps raising attention. Music Therapist 3 thinks music therapy is limitless in options to what you can do. Music Therapist 4 thinks that music provides an extra relation bridge, and that it provides another approach towards the client, patient or student.

Unlike speech therapy and psychotherapy, music therapy is not a problem-oriented (Bruscia 1989) but a method-oriented kind of therapy. Thus, it is not only the music that makes music therapy different from other therapies. This may be one of the reasons for the
efficiency of music therapy for people with aphasia. The fact that MIT, for instance, is a very intensive therapy may also be a reason that is not related to music, since intensive exercise facilitates change. Music Therapist 3 compared this intensive exercise with homework at school: we need repetition for information to stick. For a aphasic patient to follow such an intensive rehabilitation, however, music may be needed to maintain motivation at a high level.
Conclusion

Music therapy helps people reclaim their speech by rewiring in the brain, either via the perilesional regions in the left hemisphere or via the homogeneous speech areas in the right hemisphere. Music may also help with motivation. People with aphasia feel motivated when they are able to sing if they are not able to speak; they realize then that words are still accessible to them. Working with music during rehabilitation is often experienced as more uplifting, since music is linked to something that is done for enjoyment. It also makes the brain release dopamine. Singing is especially good for people with aphasia, and most of the music-therapeutic methods that exists today are based on the fact that non-fluent aphasic patients can often sing words. Several of the methods start with singing, but the music is faded out to leave only speech. Choral singing or just singing in unison seems to be especially good for people with aphasia, since non-fluent aphasics produce more correct lyrics than they do when they sing alone. The Former Aphasic Patient is also an active choir singer, and she had a quite successful recovery. There might be a connection.

Studies about the effectiveness of music therapy for non-fluent aphasia show positive outcomes based on vocal output measurements. These studies sometimes use neuroimaging to see the correlation between improvement in language and structures in the brain. Music therapists are more concerned with their clients’ ability to cope with everyday life, and vocal output measurements provide no insight into this. In addition, vocal output measurements are often a product of overlearned sentences. Formulaic speech uses brain mechanisms that differ from those used in propositional speech, which we rely on in daily life. Unless the sentences are learned as a strategy, as in asking for something to drink, these vocal output measurements do not give a whole impression of the patient’s profile. Music therapists see their clients as whole persons with an accompanying impairment. The music therapists I interviewed told me that they have seen music therapy work on people with aphasia, though not as significantly as the outcome studies suggest. This may be due to the lack of intensity in therapy, which is provided in the research studies. In addition, they are more concerned about the moment they are in than with how much the client improves. Most therapists, especially those I interviewed for this project, would tailor their rehabilitation programs to particular individuals. Goals for the treatment are individual, but in general it seems that patients should return to the life they had prior to the lesion as much as possible. It is not a given that changes
in brain plasticity and vocal output outcomes makes life easier for the patients. For some patients, it is beneficial just to meet in a group and sing together; for some, intensive rehabilitation is needed.

There are studies that investigate which mechanisms of music therapy make it efficient, but there is great disagreement about the results. Some studies find that rhythm is most crucial; others find that pitch is most crucial. Some find activation in the right hemisphere; others find activation in the left hemisphere. Some researchers think that success is a function of all of these mechanisms, and that they do not compete but work at different levels. Several of the studies mentioned here are rated low in method, which might account for such different findings.

Besides the effects of music itself, music therapy could be beneficial because of the tradition of the therapy, which is more method-based than problem-based, and focused more on what can be done than the impairment itself.

Most of the literature—especially the literature about MIT—suggests that music therapy works better for non-fluent aphasic patients than for fluent aphasic patients, although some of the music therapists interviewed for this thesis found music therapy to be effective with fluent aphasic patients. It was challenging to find studies that tested music therapy on fluent aphasia. Perhaps this is something that should be investigated further.

Surprisingly, there is no universally accepted therapeutic method for aphasia, although speech therapy is the most common form of therapy given for aphasic patients. Music therapists are trained to see the client as a whole person, and they have knowledge about neurological processes, mental health, and music. Thus, it may be highly beneficial for a music therapist to cooperate with a speech therapist. Though the speech therapist knows a lot about language functions, the music therapists has expertise in music and the music-therapeutic way of working. Music therapy could be used more effective with aphasic patients in cooperation with other specialists.

More information about music therapy should be provided for aphasic patients, because many people, especially in Norway, do not know what music therapy is and what it can be used for. Since findings suggest that it is quite effective, one could argue that music therapy should be
funded through the welfare system as physical therapy is. Music therapy is quite harmless, and though it is not always the right approach, it does not seem to have any side effects that will hurt the patient badly. In addition, music therapists make assessments prior to therapy to avoid this as much as possible. Clients should have a relationship with music for music therapy to be a beneficial piece to the puzzle that is the rehabilitation. Although, approaches such as MIT might nevertheless work as it is not the most musical approach.

The clinical experience of my interviewees suggests that there may be shortcomings in the research studies that investigate the effects of music therapy for aphasia. One possible reason for this shortcoming is selection criteria, as discussed by Merrett et al. (2014). The findings from the research studies might be overly optimistic. The clinical reality may lead to less promising results, as we have seen. Nonetheless, I think that clinical studies are needed to show that music therapy can work.

The differences between research studies and clinical experience might be due to the lack of intensity. In research studies therapy is given quite intensively, but this is not always possible in the clinical reality, due to frames in institutions. It may also be due to economy, either private or in terms of funding, as therapy naturally has it cost.

It must be extremely frustrating to have aphasia, to lose such a vital function as speech—a function that is effortless for most humans. To lose the ability to express one’s needs is horrible. Thus, aphasic patients should receive the best rehabilitation they can get. A good approach might be music therapy in cooperation with speech therapy, both in groups and one-to-one therapy, and to participate in a choir on the side.

As some of the shortcomings suggested by the informants are that research studies do not provide an image of how the aphasic participant is doing outside of therapy, further research should be done on the correlation between improvement in therapy and outside therapy. The method could for instance focus on language measurements as a measurement for effectiveness of therapy in addition to interviews of the people that see those aphasic participants regularly outside therapy. This may be family, spouses, health care workers etc. This could be done both during the clinical period, to see if the improvement from a therapy session still last when they get home, and at a certain time after the therapy is done, to see if the improvement lasts.
More interviews with participants should also be done, if doable, to get a picture of how the rehabilitation is experienced, which can provide insight that may lead to improvement of approaches.
References


Vik, B. Effects of Music Training on Cortical Plasticity within Cognitive Rehabilitation of TBI Patients". [Unpublished].


**Oral Sources**


Appendix 1

Receipt from Norsk Samfunnsvitenskapelig Datatjeneste AS

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

Halvgerd Aksnes
Institutt for musikkvitenskap Universitetet i Oslo
Postboks 1017 Blindern
0315 OSLO

Vår dato: 26.08.2015
Vår ref: 42709 / 3 / KH
Dens dato: 
Dens ref: 

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 10.03.2015. Meldingen gjelder prosjektet:

42709 Musikterapi og atasi – hvordan kan musikk hjelpe folk med Broca ataså å gjennom språket?
Behandlingsansvarlig Universitetet i Oslo, ved institusjonens øverste leder
Daglig ansvarlig Halvgerd Aksnes
Student Astrid Rommerud

Personvernpolitikken har vurdert prosjektet, og finner at behandlingen av personopplysninger vil være regulert av § 7-27 i personopplysningsforskriften. Personvernmeldingen tilrår at prosjektet gjennomføres.

Personvernmeldingsforordningen forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemant, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregistrerloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.


Personvernmeldingen vil ved prosjektets avslutning, 02.05.2016, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Vigdis Namtveld Kvalheim

Kjersti Haugstvedt

Kontaktperson: Kjersti Haugstvedt tlf: 55 58 29 53

Dokumentet er elektronisk produsert og godkjent ved NSD's rutiner for elektronisk godkjenning.

Appendix 2

Form for consent in participation

Request of participation in research project

"Music therapy and aphasia – how can music help people with Broca’s aphasia to reclaim speech?"

Background and purpose
The research is a master project administrated by the musicology department of University of Oslo. The thesis question is as mention in the title, “How can music help people with Boca’s aphasia reclaim speech?”

The participants as informants in this research will be people that have or are suffering from aphasia that in rehabilitation or on their own has used music as a tool to recover, and professionals that has used music therapy methods as a tool with clients with aphasia.

What does participation in this research mean?
Participation in this research will involve personal interview. The questions will be about the illness and rehabilitation, with emphasis on the relationship to music during the rehabilitation and treatment. The data will be registered in sound recordings and/or notes.

What happens to the information about you?
All personal data will be treated confidential. Only I will have access to the personal data such as name and contact information. This will be anonymous in the research. Personal data, recordings and notes will be saved in my personal devices that requires password (cell phone, laptop etc.) and in encrypted cloud services. I shall try my best not to make the informants recognisable in the published research, simultaneously as the important details comes through in the research.

The project shall be finished in May 2016 if everything goes as planned. The personal data will be deleted after the end of the project.

Voluntarily participation
It is voluntarily to participate in the research, and you can at any time withdraw your acceptance of participation in this research. If you withdraw, all the information about you will be anonymous.

If you have questions about the research, you can contact me:

Astrid Rommerud
Phone: +4795084351
Email: astrid.rommerud@gmail.com

Optionally you can contact my supervisor:
Hallgjerd Aksnes
Phone: +4722854764
Email: hallgjerd.aksnes@imv.uio.no

The research is approved by the Norwegian social science Data service.

Agreement to participation in research

I have received information about the research and I want to participate

-----------------------------------------------
(Sign by participant, date)

☐ I accept to participate in interview