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1. Introduction

People in their everyday life communicate. A successful communication involves various aspects, among others cognitive and language aspects. In this paper I want to investigate if and how these aspects are connected and influence one another. However, one could say, cognitive and language aspects are infinite especially when considering their connection. Thus, I chose as a cognitive aspect Theory of Mind, henceforth ToM, and as a language aspect pragmatics, specifically irony and implicature comprehension. Theory of Mind is the ability to attribute mental states to self and others (Glatzeder, 2010). Pragmatics on the other hand is the functional use of language. Since this paper aims to connect two complex and broad topics, Chapter 2, Chapter 3 and Chapter 4 provide the reader with basic concepts, theories and testing material about ToM and pragmatic. The following chapter, namely, Chapter 5 will present a first taste of the connection between those skills.

The broad research questions of this paper are if and how Theory of Mind and pragmatics are connected and if and how they influence one another. In order to build an argument for this opinion, I chose to investigate Aphasia, presented under Chapter 6 and to propose an experiment designed for Aphasia, presented under Chapter 8. This part creates the sub questions of this thesis, namely if patients with Wernicke's Aphasia have pragmatic and/or ToM impairments and how these impairments are connected. Chapter 7 presents information and previous findings regarding three clinical populations, Aphasia, Schizophrenia and patients after a Right Hemisphere Damage, henceforth RHD. Aiming to strengthen the proposal of a connection between Theory of Mind and pragmatics, Schizophrenia and RHD are chosen since these disorders display impairments in both skills. This chapter will present results of previous research on their ToM and pragmatic abilities taking into consideration ToM tasks, and pragmatic tasks on irony and implicature comprehension. Moreover, the proposed experiment in Chapter 8 is based on previous findings presented in Chapter 7. The reason Aphasia has been chosen is because some patients have pragmatic impairments (Kasher et al., 1999, Giora et al., 2000, Cutica et al., 2006, Zaidel et al., 2002), although, findings on their ToM abilities are controversial. The majority of papers argue that people with Aphasia have unimpaired ToM abilities (Varley &

Siegal, 2000, Stuss et al., 2001, Surian & Siegal, 2001), whereas only two papers argue that they have impaired ToM abilities (Samson et al., 2004, Apperly et al.2004).

On the other hand considering Schizophrenia and RHD patients, the proposal of a connection between ToM and pragmatics is strengthened since both groups show impairments in both skills. Due to this, previous findings in Aphasia seem to be “suspicious”. The question arising is “how can both, Schizophrenia and RHD display impairments in both skills, whereas Aphasia only in one?”. This paper will try to make some assumptions and shed more light on that question.

The main question of the paper as mentioned above is if and how ToM and pragmatics are connected and influence one another. In order to propose a connection the designed experiment, aims to investigate if the ability to solve a first order false belief task is connected or influences the ability to comprehend an irony or implicature task. If participants show impairments in both tasks the connection between ToM and pragmatics will be strengthened. It is argued that ToM skills are vital for implicature comprehension. Thus, impairments in both skills will also reinforce the vitality of ToM in pragmatic comprehension.

Back to the sub questions of this thesis, namely if people with Wernicke's Aphasia have a ToM or a pragmatic impairment and if yes, where the connection between these skills is. The hypothesis is that patients will display a pragmatic and Theory of Mind impairment, not only due to previous findings, but also due to the argumentation that implicature comprehension needs ToM ability. The goal of the proposed experiment is to propose a way to investigate, if patients with Wernicke's Aphasia have a deficit on these skills. Since this paper is not conducting an experiment, the results can only be hypothesized. Thus, the hypothesis is that if participants show impairment on both tasks the assumption of ToM being vital for implicature understanding will be supported.

Chapter 9 provides a discussion about the expected results of the experiment based on previous findings, proposing an answer on all of my research questions. Chapter 10 offers a conclusion of this thesis, pointing out the most important findings and assumptions as well as proposing some ideas for further research.

2. Theory of Mind

2.1 Introduction

Many articles and books from various fields like 'philosophy of mind', developmental psychology, cognitive neuroscience (Goldman, 2012) and linguistics try to understand human's actions, behaviors and interaction. In order to understand it, it is presumed that human beings are equipped with a mind and mental states. The skills of producing, conceptualizing and reasoning about mental states is called Theory of Mind (Malle, 2002). ToM is very often defined as the ability to attribute mental states to self and others (Glatzeder et al., 2010). It is also known as "commonsense psychology", "naïve psychology", "folk psychology", "mind-reading" and "mentalizing" (Goldman, 2012) and allows people to understand what knowledge, intentions, beliefs and desires another person has, thus, being able to interact (Kern, 2005). With its origin in folk psychology the term "theory of mind", as it is nowadays used, was first introduced by Premack and Woodruff (1978) (Povinelli & Preuss, 1995). Since then, developmentalists try to solve the puzzle of how and when children develop this ability.

Theory of mind is based on a representational-functional conception of mind, which has a complex cognitive capacity and is important in social cognition and communication as well as for human social skills. A developed ToM involves a developed concept of "self" and "other" together with perspective taking and awareness of different mental representations and states someone has (Höfler, 2011).

A lot of research has focused on theory of mind development and found that it can be influenced by various aspects like executive function, language competence, linguistic socialization and socio-cultural factors (Kern, 2005). Although theory of mind development has been a hot topic in the research field the past years, this paper will discuss functional theory of mind, specific pragmatics in adult language disorders where the development is not under focus. However, research began to investigate the connection between theory of mind and language through development. As we will see in this paper theory of mind theories are discussed and built up on findings and assumptions about language development and theory of mind development. Some of the theories focus more on the developmental aspect, whereas some don't. This does not mean that theories cannot be applied in a functional theory of mind setting. Since most ToM theories have been discussed under a developmental framework, it is hard to differentiate

completely developmental from functional theory of mind, especially when considering the theoretical frameworks of theory of mind.

When talking about cognition, which includes Theory of Mind ability, the question if it is *domain-general* or *domain-specific* arises. These two frameworks have been investigated and broadly discussed, proposing how learning processes take place. The *domain-specific* view argues that mental activities appear in a restricted area of domains or in specific domains, whereas the domain-general account argues that mental activities appear in multiple domains (Kaniel, 2010). Research tends to embrace more the domain-specific framework, since it is linked in some aspects with modularity which is a beloved framework in recent years. Domain-specificity has often been linked with modularity, innateness and brain localization (Khalidi, 2010). Modularity is indeed very close to the domain-specific account since Fodor's (1983) modularity theory is defined, among others, by domain-specificity. However, innateness in domain-specificity, has often been questioned, due to the simple fact that some domain-specific abilities are innate, whereas others not. For example, chess playing is a domain-specific abilities, but is not innate. Similarly, brain regions can speak for a domain-specific account, however, one ability may activate various brain regions (Khalidi, 2010). Thus, Khalidi (2010), proposes that a domain-specific system should be in principle generalized, although not meaning that domains are generalized. Thus, he proposes a concept of domain specific rules or principles instead of domain specific capacities. He argues that a domain is originally designed to deal with the abilities it includes. The domain-specific framework has been embraced in research for typically developing children, evolutionary psychology, neurodevelopmental disorders in children as well as for neuropsychological, brain-damaged patients in which neuropsychologists tend to divide the brain into modules according to their function like semantics, syntax etc. (Karmiloff-Smith, 2015)

Although, the question if ToM as well as other cognitive functions are domain-specific or domain-general is still under discussion, the domain-specific framework may be more suitable to explain why some abilities can be intact while others impaired. The domain-specific framework tends to be more suitable, due to the fact that impairments, seen in neurodevelopmental disorders as well as in acquired language disorders, are specific. For example in autism the claim is that the theory of mind module is impaired, whereas other modules like mathematics may be impaired. Moreover, considering brain damaged patients, the domain-specific module seems also more suitable since patients with aphasia may have severe syntax impairment while their theory of

mind ability is intact (Karmiloff-Smith, 2015). Thus, this paper also follows the domain-specific framework. These two frameworks, also play a role in the theories about ToM discussed below since theory-theory, modularity and Theory of Mind Mechanism are based on domain-specific frameworks (Goldman, 2012) whereas the simulation theory leans towards a domain-general account. As mentioned above, this paper leans toward a domain-specific account, thus, someone could ask himself why the simulation theory is being mentioned in this paper.

This chapter intends to introduce the reader with the basics of theory of mind as well as the basics of pragmatics, so he or she can be able to follow up while reading this paper. In order to do so, core ideas as well as theories of theory of mind should be mentioned. Since simulation theory is a largely discussed theory it could not be missing from an introductory chapter on theory of mind theories. Simulation theory will be briefly discussed, because of space reasons as well as the fact that this paper is not leaning towards a domain-general framework.

Additionally, ToM skills can be divided into two other groups, the affective and the cognitive ToM. The affective theory of mind concerns the knowledge about emotion, is tested via faux pas and irony tasks which require an empathic appreciation of the addressee's emotional state. On the other hand, cognitive theory of mind, tested via false belief tasks, concerns the knowledge about beliefs, this meaning having the ability to differentiate between one's from another's knowledge (Kalbe, 2010).

Moreover, ToM reasoning has been divided into two groups, the **implicit** and the **explicit** ToM reasoning, which has been investigated a lot in the ToM development but is important also for people's general ToM ability. In a few words, implicit ToM is about the spontaneous ability of deriving others mental states without necessarily reflecting on them while explicit ToM includes reasoning of another person's mental state in order to explain a behavior (Sodian et al., 2015). As mentioned above, the term ToM entered the science field in the late 1970's and up to now various theoretical approaches have been introduced in order to explain and examine ToM. The most dominant ones are the theory-theory approach, the simulation theory, the modularity theory and then the theory of mind mechanism. (Glatzeder et al., 2010, Hale et al., 2003, Lillard, 1999).

2.2 Theoretical Approaches

❖ *Theory-theory*

The concept of this theory has its roots in folk psychology and got embraced by developmental psychologists afterwards. In the field of philosophy of mind there are differences among philosophers (Goldman, 2012), however, they share the assumption that a theory is understood as a set of laws like generalizations. The generalizations include “(1) Observable inputs to certain mental states (2) certain mental states to other mental states (3) mental states to observable outputs” (Goldman, 2012:3). Applying the laws the illustration of each generalization is, (1) if someone has not drunk and did sport he will be thirsty, (2) the tendency of people in pain is the desire to relieve the pain and lastly (3) the tendency of people who are angry is to frown. In other words, when attributing mental states to others one has to observe a behavior, a stimulus and previous mental states so one can draw law-guided inferences (Goldman, 2012)

In the developmental framework of theory-theory the approach supports that ToM relies on a theory-like cognitive mechanism and is based on theoretical knowledge. In other words, in our everyday life we experience actions and outcomes and we try to explain these actions using mental states. So when a child observes another child dropping its ice cream and crying, it theorizes that losing a treasured object drives to sadness (Györi, 2003). Theory-theory enables the child that various processes may inform its theory, like introspection might create a connection between crying and sadness (Lillard, 1999)

This approach, focusing on the maturing and developing ToM, targets the changes which happen in performance during the pre-school years and claims that conceptual change is conceived in terms of theory formation, in which belief concept changes (Goldman, 2012). The core idea is that concepts are organized in intuitive theories and that these concepts are inter-defined, mutually supportive, coherent and domain-specific. Studies in this field have shown that the change of performance is due to exposure to new information. Theory-theory hypothesizes that the child's representational ToM is not a set of single concepts, but an intuitive theory (Hale & Tager-Flusberg, 2003).

Theory-theory could explain the very first findings about ToM development in children, namely that at the age of 4 children develop ToM. These findings were based on the Sally-Anne test and the Smarties test which were the first tests about false belief understanding. So theory-theory

very conveniently explained that children still haven't developed the skill of ToM (Goldman, 2012).

However, theory-theory was found in a difficult position when in 2005, Onishi and Baillargeon showed that 15-month-old children have an understanding of false belief when another task is used.

❖ *Modularity Theory*

In the 1980s the modularity-nativist approach entered the research field, proposing something very different as his predecessor (Goldman, 2012). Modularity theory, as its name suggests, argues that people's mental domain is equipped with one or more domain specific modules for their representative and computational skills. It is a nativist theory that proposes an innate cognitive structure for those modules which mature throughout time. Modularity theory argues that people's mentalizing ability is present at any time, but must be triggered (Colombo, 2013). Thus, the nativist modular theories suggest that very young children are actually equipped with a metarepresentational concept of belief, but lack other cognitive structures, which are necessary for the false belief tasks (Hale & Tiger-Flusberg, 2003). These cognitive structures mature throughout time, but are not acquired via learning, so mentalizing is innate and triggered when the environmental factors allow it (Goldman, 2012). In other words, children understand the concept of belief but fail false belief tasks because of their poor computational resources, which are necessary to solve this complex task (Fodor, 1992).

❖ *Theory of Mind Mechanism (ToMM)*

Building up on the modularity approach Leslie (1992) proposed the "Theory of Mind Mechanism (ToMM)", an innate cognitive module which is domain specific, has a representative and computational specialization, is fast, informationally encapsulated and essential for mentalizing. Leslie (1992) argues that the human brain has two different mechanisms, one for comprehending mental states (mental representations) and one for comprehending non-mental representations. Thus, representation understanding can develop differently according to the mental nature. This argument is difficult to be strengthened by investigating typically developing children. However, when investigating developmental disorders, such as autism, the differentiation of mechanisms seems plausible. Literature has shown that children with autistic

spectrum disorder display differences in their understanding of mental versus non-mental representations. The former being impaired and the latter unimpaired. Thus, Leslie (1992) argues that mentalizing ability (theory of mind) is indeed domain specific. ToMM uses a representational system that characterizes propositional attitudes and a mechanism that forms the basis to the ability of acquiring ToM, which is damaged in autism. Theory of mind mechanism acts conjointly with a general cognitive mechanism, the selection processor (SP), in order to solve false belief tasks. The SP was proposed in order to answer the question “Why do children younger than 4 fail false-belief tasks?”. Leslie (1992) argued that children fail at this task not because the absence of theory of mind or ToMM, but because of the lack on inhibitory control. Thus, the executive control mechanism named “selection processor” was proposed (Maraffa, 2011). At this point Leslie (1992), considering Fodor’s (1983) theory, argues that ToMM is more a “vertical component”, whereas the SP more a “horizontal” component.

Fodor (1983) introduced the terms “horizontal” and “vertical” faculties. According to him, horizontal faculties include all of cognition, whereas vertical specific skills. For example, a horizontal module could be the memory skill, since a person with good memory can remember things across domains. A vertical module could be mathematic skills since this skill does not influence other skills, like language skills (Bryson, 2005). ToMM argues that there is a central system that is both input and output, in which input is the information about past and present behaviors that will drive one to understanding one’s psychological state. The outputs are agent-centered descriptions of behavior, namely the metarepresentations or M-representation (Maraffa, 2011).

At this point, Chomsky’s position to language should be mentioned, since it is a linguistic parallel to ToMM. Chomsky argued that language is an input and an output system, and that the output system correlates with the input system, thus suggesting that language is central (Smith, 1999). Hauser, Chomsky and Fitch (2002) argue that language is modular. They propose the “faculty of language” which is divided into a broad and a narrow sense. The language faculty in the broad sense, henceforth FLB, includes abilities vital for language but not restricted to language. According to them, the FLB consists of a sensory-motor and a conceptual-intentional system as well as the computational mechanisms for recursion (Hauser et al., 2002). The recursive mechanism includes three properties, namely computability, definition by induction and mathematical induction. Moreover, they point out the fact that recursion represents the mechanism and not patterns in its outputs (Hauser et al., 2014).

In their paper, Hauser et al. (2014), note: *“The computable function must be defined by a form of induction: outputs must be carried forward and returned as inputs to generate a hierarchical structure over which can be defined complex relations”* (Hauser et al, 2014:3). This idea has gained a lot of interest but has also been criticized since it does not incorporate other language aspects which are not recursive (Pinker & Jackendoff, 2005). Evidence against Hauser’s Chomsky’s and Fitch’s (2002) argument, came from patients with severe grammar impairment that could solve mathematic tasks that required recursion (de Smedt, 2009). Moreover, Pinker and Jackendoff (2005), argued that the claims by Hauser et al. (2002), may be due to the influence they have from syntax, and specifically the Minimalist approach.

❖ *Simulation theory*

Simulation theory or empathy theory, presented in the mid1980s suggests that if someone is able to answer the question “What would I do in **that** person’s situation” then he can predict another person’s behavior as well as understand another person’s mental state. In other words, we put ourselves in other’s shoes, we simulate our mental state to this of the other’s. Thus, the observer generates mental states which are simulated to those of the person who is doing the action. For example, when I see someone looking for his keys standing in front of his locker, I simulate my mental state, “what would I do in that person’s situation?” I would like to open my locker. Thus by simulating the other’s mental state I am able to understand the intentions of another person (Goldman, 2012). However, theory theorists argue against this theory on the level of theory existence. They argue that the observer must have knowledge about the person doing the action and that this knowledge must be organized in a theory. In simulation theory, through the procedure of simulating, empathizing, feeling with, re-experiencing other’s mental states no theoretical mechanism is needed, thus, they are questioning if this proposal should fall under the umbrella of theories (Goldman, 2012).

Apart from these theories there are others trying to explain ToM. Due to this wide range of different theories and ideas Flavell (2004) proposed to standardize ToM theories by suggesting three primitives. Specifically that ToM is an innate or early developing mentalistic ability, the knowledge about mental processes is an informal theory and lastly that skills of processing information and language support ToM development. The theories discussed above were dominant until the middle of the 1990's and the next step for the research field showed more

interest in the relationship ToM may have with language and if language is crucial in order for ToM to develop. This topic will be discussed in this paper focusing on the pragmatic aspect of language (Höfler, 2011).

2.3 Non-verbal Theory of Mind Tasks

ToM has been investigated by a plethora of different tasks. These tasks can be divided in two big categories the verbal and non-verbal ToM tasks. In this paper the focus will be on the non-verbal tasks since people with Aphasia may perform worse when verbal language is included. The non-verbal tasks include mental comprehension in understanding thought and intentions, first and second order false-belief tasks, attribution of intentions and the windows task. A brief overview of research on these tasks will follow.

A very important human interaction for studying ToM is deception because of its association with false-belief tasks (Frith & Frith, 2005). False-belief tasks (first- and second- order) are the most extensively used method for a metarepresentational theory of mind. According to Dennet (1978) the capacity to recognize that a person holds false beliefs is a good criterion for measuring ToM since it shows the ability of a person to understand another's mind. False-belief tasks examine if a person can differentiate one's own from another person's beliefs and mental states. A well-known example of a first-order false belief task is the Sally-Anne test by Baron-Cohen and his colleagues (1985). This psychological test has as main characters two girls, Sally and Anne. The story goes as follows, Sally puts a marble in her basket in a room and then leaves the room. During this time the second character, Anne, moves the marble into a box. The task of the participants is to answer where Sally will look for her marble when she comes back. Participants have to answer successfully on control questions, and then the ToM question. Children who answered the control questions correctly and give the correct answer on the ToM question, namely „in the basket“ successfully solved the task, whereas the children who answer „in the box“ unsuccessfully. Participants who solved it correctly have a ToM ability since they can recognize that Sally holds a false belief, as well as they understand that their knowledge is different from Sally's knowledge, thus being able to differentiate their own mental states from others (Bloom & German, 2000). False belief tasks, has been observed, are successfully solved after the age of three to five years (Millgan et al., 2007).

Although literature has designed various non-verbal tasks, presented below just a minority are strictly non-verbal. Strictly non-verbal tasks can also be questioned on their verbal nature since the experiment must be explained and participants are asked to do something. So the question arises is how do experimenters present an unknown experiment to the participants without using any language. Designing a strictly non-verbal task may be likely, although it may have a few limitations. In order to design a strictly non-verbal test the participants are asked to find the solution all by themselves, without given instructions. This may cause confusion, ultimately resulting in insignificant results. Moreover, it is risky for research not to explicitly explain the experiment to a participant for various reasons. Firstly, the participants should undergo much more test trials, which is time as well as money costly. It may lead to insignificant results through confusion and it may lead to lack of attention when a participant does not understand the experiment. From the above reasons, limited time as well as funding researches have, conducting such a strictly non-verbal tasks may be kind of utopic. Thus, when talking about a non-verbal tasks someone should address what he or she is asking for and how much verbal language is included in an experiment. Thus, it may be beneficial to address the non-verbal tasks into limited language tasks or little language used in a task. Moreover, the distinction if language is used in a tasks is of vital importance, since when talking about a non-verbal task the material used should not include language at all. However, the experimenter may ask questions after the presentation of the material using simplified language. To sum up, in this paper when talking about a non-verbal task, the material as well as the answer expected from the participants will not include any language at all. This not meaning that the experimenter will not ask questions or will not give directions about the experiment. The papers presented below fall under the umbrella of non-verbal or limited-simplified language. From the presented papers, one that fits or is easily adapted to a non-verbal test (as defined above) will be chosen for the experimental proposal. A collection of theory of mind tasks using little or simplified language is presented below.

✓ Mental state comprehension, understanding thoughts and intentions:

Adapted from a verbal test designed by Happé et al. (1999), Balaban et al. (2016) created a non-verbal cartoon story:

“In one (A) a viciously smiling shark in the water is holding out a stick that looks like a hand waving for help, while a man standing on a nearby rock is getting ready to jump in. In the second cartoon (B), a rooster is strangling a hen and next to them a small elephant is hatching from an egg. First, we asked the participants to describe what they saw in each picture. Then we asked what they thought the cartoon was about and if they found it funny in any way. For the first cartoon, an appropriate description would be one that mentioned the shark’s intentions to lure the man to jump in the water. For the second cartoon, an appropriate answer would be one that referred to the rooster’s understanding that his partner cheated on him” (Balaban et al. 2016:10)

✓ Second-order false belief (FB) task

Kobayashi and colleagues (2010) in their research used a non-comic story with a second-order false belief story with the question to be addressed being „what is he thinking?“ and the process being “x thinks that y ...”. The story consisted of 5 story slides and the 6th slide presented two different outcomes, e.g. (1st) John and Paul are watching a soccer game between France and USA, (2nd) France is winning by a lot, (3rd) Paul goes to the bathroom, (4th) USA wins the game, (5th) Paul comes back when the game is finished. The 6th slide has John's thinking bubble in which there are 2 thinking bubbles of Paul thinking (1) France won (2) USA won so successful ToM is to point at the bubble (1) . (Kobayashi et al., 2007). However, some of their stories are very complex (see watermelon story) and the participant may be very confused with their complexity.

✓ First-order False belief task

In the first-order false belief test the most well-known test is the Sally and Anne test which is a hiding-finding task. Research has been based on this task-model and made adjustments on it in order to work as a nonverbal task by making the set-up interactive in which the participant observes the hiding and finding story by the Call and Tomasello (1999) live (Call & Tomasello, 1999, Colle et al., 2007) or with a picture sequencing task (Langdon et al., 2006). Langdon et al. (2006) used a non-verbal false belief task using 4 pictures presenting a story, asking the participants to put them into the correct order. Moreover, a first-order false belief test has been used for the first time in an eye-tracking research in 2009 (Senju, 2009) following more research in this field. In this test, the participant's eye movements are tested when the character holding

a false belief comes back to the room. The eye-tracking test measures anticipation of the following event, so eye-movements will indicate an implicit ToM reasoning (Sodian et al., 2015).

✓ Attribution of intentions

Some scholars use the comic strip or animated video stories examining attribution of intentions. Attribution of intentions expects the participants to suppose the intention of the character in order to find the logical answer, thus, attributing intentions of the character. An example of a story would be: in the first picture someone is in jail trying to break the window bars, in the second picture he removes the bars and in the third picture he stands in front of his bed. The next step is to present three logical ending pictures, one in which he makes a rope with his sheets, one in which he shouts and the last one in which he sleeps. The correct response is the first picture, thus, the participant should infer that the character wants to escape and that he is going to do it by using a long rope throwing it out of the window so he can climb down (Brunet et al., 2000, Völlm et al., 2006).

✓ Windows task

In the windows task the participants are presented with two boxes, each of the boxes has a window so the participant can see the interior of the box. One box has a treasured object and the other one is empty. Through the experiment another person takes part and the participant is asked to point at the box the person should open. The participant must infer that he has to point at the empty box so that the other person does not get the box with the treasured object. Thus, the participant has to infer the rule „point to the empty box“. (Bloom & German 2000).

All of the above tasks, can be defined as non-verbal tasks, if we consider the definition of non-verbal tasks given earlier. All tasks, do not include materials in which verbal language is used. Verbal language is used only during the instruction phase and at the final question.

3. Theory of Mind and language

Research for connecting theory of mind and language during its first steps focused on developmental theory of mind as well as on language development. Since the goal of this paper is to strengthen the connection between Theory of mind and pragmatics, an introduction on the connection between theory of mind and language would be very useful. Thus, a small introduction of arguments speaking for this connection will be presented. Up to now the exact interface between language and ToM is not clear. It is still an open question if language is causally related to ToM or if ToM aspects are causally related to language acquisition (de Villiers, 2007). Three possible explanations have been given and investigated the connection ToM has with language. Those are, that language precedes ToM, ToM precedes language and lastly that the two capacities co-exist and co-arise. The claim of language preceding ToM can be supported by the fact that some theory of mind related skills appear in the early years, like imitation, eye gaze tracking and detecting self-propelled motion. These abilities, however, do not show reasoning of mind, but can be precursors of mental state inference. Supporters of ToM preceding language argue that the skill of inferring communication intentions of others is a precondition for language. What holds against this idea is that metarepresentation is perhaps dependent on language (Malle, 2002), also taking into consideration de Villiers (2000) work, advancements in language cause advancements in ToM. The view that language and ToM co-exist and co-arise is the most dominant. This view is supported by parallels in characteristics and developmental time frames which are noticed between language and ToM. Developmental ToM and its connection with language will be shortly discussed throughout this paper since it was and still is a very important topic when trying to connect language with theory of mind. Thus, it will be discussed in order to strengthen the view of a connection between those skills. However, as this paper unwraps, the developmental view will fade away and focus is given on the functional aspect.

3.1 Aspects of language involved

The relationship between language and ToM has been investigated in different language fields, which are lexical semantics, syntax and pragmatics.

In the field of **lexical semantics** the allegation is that concepts of mental states are acquired by children in conversation (Höfler, 2011). This is believed due to the fact that language encodes

mental state concepts semantically and children are able to abstract them out of conversations. This is achieved through care givers which are describing and explaining the child's own and other people's experiences and behaviors (Hale & Tager-Flusberg, 2003). This leads the child to be able to map personal experiences and mental states to other people. The connection between semantics and theory of mind has never really been under focus in the linguistic field since not much research is evident. However, it has been shown that when children with autism spectrum disorders (ASD) are asked to comprehend a sentence with a semantic common sense, they are able to do it without difficulty, whereas they lack theory of mind reasoning (Mika & Kikuo, 2004).

In the framework of **syntax** linguistic determinism played a big role. Linguistic determinism claims that the ability to formulate embedded propositions, like sentential complements, is necessary in order to communicate different points of view using mental terms. They seem to be also crucial for ToM acquisition (de Villiers & Pyers 2002, Nixon 2005). Using as a measurement of ToM acquisition false belief tasks, it is observed that children can solve those tasks successfully when they have mastered sentential complement. Sentential complements are necessary in complex sentences with a mental state verb like 'think' as a main verb, which has as a subordinate clause as its grammatical object, the sentential complement (Fernandez, 2013). An example of this syntactic structure is given in de Villiers (2000) „The girl thought (that) she saw a pink frog,, and this example is supposed to be the key syntactic structure a child must acquire in order to successfully solve a false belief task. This sentence structure consists of a matrix sentence „The girl thought,, and an embedded sentential complement „(that) she saw a pink frog“. Its structure is quite special concerning its syntactic build-up and not common since it only appears with communication and mental state verbs. Moreover, the fact that children mastering specific syntactic skills is connected to performance in false-belief tasks can also be claimed by Hale & Tager-Flusberg (2003) who trained preschoolers (36-58 months) on the use of sentential complements and those children gained syntactic knowledge and improved their ToM skills. The syntax framework for connecting ToM and language was a big wave when research started looking for the link between language and ToM. However, focus on this field has faded out after a lot of research and counterarguments. From the developmental side, Frank (2010) argued against linguistic determinism because most of the studies deal with the English language and do not examine the sentential complement and its relation with false belief tasks in other languages. De Villiers (2005) argued that the performance in false belief tasks of oral deaf children and American Sign Language-learning deaf children, the performance of the

complement comprehension task is a predictor for the performance in standard and low-verbal false belief tasks. Looking closer at the results it was observed that their vocabulary is a stronger predictor for their false belief performance and not the complement clauses. It has been argued that linguistic determinism cannot be the most important factor relating language with ToM taking into account a meta-analysis which shows that semantics, syntax, vocabulary and general language, predict ToM reasoning (Millgan et al., 2007). Furthermore, it is claimed that English speaking children first solve false-desire tasks and later false-belief tasks. (Frank, 2010). De Villiers (2005) argued that this phenomenon happens because the false-desire task needs the 'to + competence', whereas, the false-belief task the 'that + competence'. However, a study conducted with German-speaking children found that this is not the case since in German both false-desire and false-belief sentences take the "that + competence". The study showed that although both sentences need the "that + competence" children still solve the false-desire tasks earlier than the false-belief tasks (Perner et al., 2005). These results prove de Villiers (2005) argumentation was incorrect. Frank (2010) continues to argue against the assumption that linguistic determinism is the only factor which matters in ToM compared balanced bilingual children (L1 Japanese, L2 English) and examined the mastery of center embedded sentences, which are harder to parse. In Japanese the center embedded sentences are of vital importance in order to process a false-belief sentence as well as a second order false-belief sentence. He hypothesized that if the false-complement structure has an effect on understanding false-belief sentences, children would perform worse in Japanese than in English. However, results showed that language did not have an impact on their performance. Thus, the claim that the 'that + complement' has to be acquired for false-belief understanding does not seem to be as important as it was believed to be. Similar results are found in German speaking children too. In the research field most studies focus on one language aspect, where through, it is hard to understand if Semantics, Syntax and pragmatics are independent or interdependent (Fernandez, 2013). However, Ruffman and collaborators (2003) investigated semantics and syntax simultaneously. They actually found that a general language ability is related with ToM and not individual language domains. Moreover, in acquired language disorders such as Aphasia and specifically agrammatic aphasia, which means a severe impairment in grammar ToM has been found to be unimpaired. This being one more strong argument against the syntax framework (Varley & Siegal 2000, Apperly et al. 2006).

Pragmatics, specifically conversational pragmatics and non-literal language have been investigated. This aspect of language is believed to be important for ToM development and maybe even more relevant compared to syntax and vocabulary (Davies & Stone, 2003, Harris, 2005). Pragmatics will be theoretically discussed under chapter 4 and research on adult language disorders under Chapter 7.

Pragmatics need linguistic and extra-linguistic communication in context, such as the skill of featuring mental states to others, understanding non-verbal communication and recognizing how to answer and act depending on the question and situation respectively. Moreover, in order to understand metaphor, deception, irony and humor one has to have a well-developed ToM (Fernandez, 2013). More evidence regarding the connection between pragmatics and theory of mind, from children as well as from adult populations, will be discussed under chapters 5 and 7, strengthening the argument of a connection between theory of mind and pragmatics.

4. Pragmatics

Pragmatics is a very large field that deals with the use and function of language. Pragmatics can be divided in three main categories, the theoretical, empirical and sociological pragmatics (Cummings, 2014). Theoretical approaches discussed below are based on theoretical concepts, like non-literal language, context, speech acts and implicatures. The theoretical approaches described here as well as the core concepts do not reflect to the plethora of theories and ideas discussed throughout the years in theoretical pragmatics because of space reasons. However, the most important concepts, mentioned above will be discussed in the following section.

Empirical pragmatics is based on theoretical pragmatics. This is due to the fact that empirical pragmatics study language in use, in contexts like an interview, spontaneous speech, comprehension of a story and various other ways. The data collected are then linked and explained using a pragmatic theoretical framework. Clinical pragmatics fall under empirical pragmatics and study pragmatics in clinical populations. Theories about clinical pragmatics have been discussed throughout the years and the most dominant cognitive-pragmatic theories will be briefly discussed in this paper. Due to the fact that this paper aims to propose an experimental design using clinical population a theoretical background about clinical pragmatics will be helpful

(Cummings, 2014). Sociological pragmatics deals with all forms of language, meaning also those that do not fall under the formal linguistic theories (Horn & Ward, 2004).

In this chapter the main pragmatic concepts will be discussed and in upcoming chapters of this thesis empirical pragmatics will also be mentioned in atypical conditions. Theoretical approaches as well as empirical pragmatics have narrowed their focus on an inferential model. Implicature theory and Relevance theory deal with inferences (Horn & Ward, 2004). In my thesis I will focus on implicature understanding and the proposed pragmatic task in the experiment deals with a non-verbal implicature task. The theoretical background focuses more on implicatures and inferential abilities.

4.1 Theoretical Pragmatics

Theoretical pragmatics consist of some core concepts, essential for forming theories. All concepts of theoretical pragmatics will not be mentioned in the following section due to space reasons and vital concepts for this paper will be discussed. These concepts are: context, non-literal language, implicature and speech acts.

Firstly, context is based on a mutual knowledge, beliefs, assumptions and other attitudes. Context may be linguistic, physical, social and/or epistemic, although, the epistemic context should include the other three. An epistemic context refers to that participants of a conversation have knowledge of the world. The linguistic context refers to the way utterances are presented, whereas the physical context refers to the setting a conversation takes place. Lastly, the social context refers to the social relationship the participants of a conversation have. Pragmatic deficits are often accompanied with deficits in context understanding (Cummings, 2014).

Non-literal language as its name suggests are utterances that their meaning goes beyond the literal meaning of their words. Non-literal language includes a variety of pragmatic phenomena like irony, proverbs, idioms, metaphors, hyperbole and understatement. Non-literal language has been investigated and sometimes found to be impaired in various pragmatic disorders. (Cummings, 2014).

A very important concept in pragmatics are implicatures. Grice was the first to introduce the term implicature with his goal being the differentiation of pragmatic implicature and the term of implication in logic and semantics. Grice was also the first to argue that intentions play a central

role in communication. According to him an implicature is defined by “what is said”. However, this definition is too broad since then anything with a pragmatic input can be characterized as an implicature (Haugh, 2002). Grice was also the first that focused on intentions and differentiates between natural and non-natural meaning. According to his theory the essence of a non-natural meaning are the intentions between speaker and hearer. Grice was the first, to argue that intentions play a central role in communication (Cummings, 2014).

Conversational implicatures according to Grice fall under 4 categories these of quantity, quality, manner and relation and the violation of maxims is called “flouting” (Haugh, 2002). Grice's conversational implicature theory includes the cooperative principle which says, *„Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged „* (Grice, 1975:45). Grice also mentions cognitive and communicative principles. The cognitive principles are about how our mind works and the communicative principles are about how we interpret intentional communicative behavior. Moreover, he mentions four maxims, which make communication easier and effective. These Maxims are:

- Maxim of quality: say something that is true and specific
- Maxim of relation: say something relevant
- Maxim of quantity: do not say more than needed
- Maxim of manner: do not say something ambiguous

Through the cooperative principle and the maxims the human mind picks the most relevant information. Theory of Mind is based on mechanisms used for inference and prediction formation about intentional actions. These inferences and predictions should be reliable and done quickly (Bloom & German, 2000). Grice's theory which argues that knowledge comes first is against the Sapir-Whorf „linguistic determinism“ in which the idea is that language comes first. (Azabdaftari, 2012).

Grice's implicature theory was embraced by relevance theory arguing against the cooperative principle and the maxims Grice suggested. Relevance theorists take Gricean theory into a more cognitive level by adapting his theory. Relevance theory will be discussed under the Chapter 4.2.1.

Lastly, speech act theory was first introduced by Austin (1956) and became popular through Searle (1969). According to this theory a speech act may be a constative or a performative utterance, which describes a true/false situation or which cannot be said as true or false respectively. Speech acts are divided by Austin in three groups, the locutionary, illocutionary and perlocutionary acts.

Locutionary act: making a grammatical utterance

Illocutionary act: “doing something in saying something”, this act has a force, it can be a question or a warning

Perlocutionary act: “doing something by saying something” this act does not appear every time like the above two, it can be inspiring or persuading someone and is an act that has an effect (Oishi, 2006)

Searle builds up on Austin’s concept proposing the propositional act. The main difference to Austin is that in order to have an illocutionary act it has to go through the propositional act, which one could say serves the classification of illocutionary forces. This classification is divided in five groups, the representative or assertive, commissive, directive, declaratory and expressive content.

- Representative/assertive: to represent how something is (assertion, claim and report)
- Commissive: to commit to do something (promise, threat and offer)
- Directive: to commit someone to do something (suggestion, command and request)
- Declaratory: declaring something (decrees and declaration)
- Expressive: expressing something (apology, complaint and thanks)

(Searle, 1976)

Literature has linked Theory of Mind with the Gricean Theory of implicatures, and communication has repeatedly been linked with Theory of Mind. The connection between ToM and Gricean Theory has been shown from the philosophical reflective reasoning point of view and that the derivation of implicatures can be connected to the “belief-desire” psychology. However, Gricean Theory is not the only pragmatic Theory that has been linked with Theory of Mind. Relevance theory is a cognitive psychological and pragmatic theory, which has also been argued to be connected to ToM and is used more often in research (Horn & Ward, 2004). Relevance theory argues that the listener has to recognize intentions, thus treating

comprehension like mind-reading. This is due to the fact that the hearer as well as the speaker have to have the skill to attribute mental states to others. Only then can one predict and understand another's behavior. Theory of mind is about the skill people have to understand intentions, beliefs, desires, behaviors and predict actions. Pragmatics, especially when considering implicatures also deal with the comprehension of intentions someone has. The key concept of connecting theory of mind and pragmatics are intentions. In relevance theory the speaker has to try to be most relevant having the intention to be understood and the hearer has to recognize the intention of the speaker. Thus, recognizing intentions is a strong link between ToM and pragmatics. Communication is successful when the speaker presents the right intention and the hearer is able to recognize the intention, thus, answering relevant leading to a successful communication (Azabdaftari, 2012).

4.2 Clinical Pragmatics

4.2.1 Clinical Pragmatics Theories

The research field of pragmatics presents plenty interesting findings. However, as Cummings (2014) points out, most research does not connect their findings to a theory of clinical pragmatics. Pragmatic theories should have a cognitive orientation, due to the fact that, the pragmatics-cognitions interface has been discussed and investigated broadly in the connection between pragmatics and cognitive operations.

Moreover, pragmatic disorders often are accompanied by cognitive impairment. Cognitive orientation is important for pragmatic theories since a pragmatic theory without a cognitive orientation would be unable to predict mental processes included in utterance interpretation. The incorporation of cognitive pragmatic theories in an experimental setup is a young method in the research field and the combination of a clinical pragmatic theory with an experimental task is not seen so often. However, they are of vital importance for understanding the reasons behind a pragmatic impairment, making clinical findings significant. In this paper the three most cognitive oriented pragmatic theories will be discussed, namely the relevance theory, cognitive pragmatic theory and modular pragmatic theory.

- Relevance Theory

Building up on the basis of the inferential model of Grice, Sperber and Wilson (1995), introduce Relevance theory. The fundamental connection between the two theories is that both agree on the vitality of expressing and recognizing *intentions* for human communication. The inferential model argues that the speaker presents his or her intentions in order to send a meaning. This meaning is inferred by the hearer according to the provided evidence he or she has. Relevance theory, although agreeing in many respects with the Gricean theory questions the co-operative principle and maxims and in lieu of them they propose the communicative principle of relevance. Moreover, relevance theory introduces the term explicature as well as two kinds of intentions. Relevance theory develops Grice's proposal to a more cognitive psychological theory (Wilson & Sperber, 2004). Relevance theory makes two assumptions, one related to cognition and one to communication, namely utterance interpretation.

The cognitive assumption of this theory argues that human cognition always looks for the most relevant utterance but not through a co-operative principle and different maxims. Relevance is defined by the cognitive effect, which can be positive or negative. Positive effects appear when one's representation of the world yields to a true conclusion, while negative cognitive effects yield to a false conclusion. Relevance theory argues that only when a cognitive effect is positive is an input relevant. This theory is based on the cognitive and communicative principle of relevance. The cognitive principle argues that, as mention above, human cognition looks for relevance. Cognitive effects fall under three categories that may support or cancel assumptions or interact with existing assumptions. Each cognitive effect comes with a processing effort which refers to the effort needed to process an input until it derives a cognitive effect. Thus, different stimuli lead to different processing effort according to their ambiguity, length or difficulty. As Allott (2013) describes, relevance theory makes two assumptions about how human cognition performs inference. One he names the computational/representational Theory of Mind (C/RTM) and the other, more specific to relevance theory, the deductive device.

The C/RTM is that "*cognition can be modelled in terms of computations performed on mental representations*" (Allott 2013:68). According to the C/RTM, processing a stimuli is determined by mental states and semantic value is preserved by the mind's syntactic operations.

The deductive device possesses elimination rules. When the deductive device is faced with an input, deductive inferences are drawn. According to this theory, the deductive device "*takes*

input of the form 'P and Q' and returns 'P' as output" (Allott 2013:69). The deductive device is important for utterance interpretation since this device plays a role in inference and specifically in non-demonstrative inferences.

Relevance theory in their communicative assumption, namely utterance interpretation, includes the ostensive-inferential communication and propose the term explicature differentiating it from implicatures. Lastly, based on their ostensive communication they propose the communicative principle of relevance.

The ostensive-inferential communication includes two kinds of intentions, the informative and the communicative intention. The informative intention is the intention of a speaker to inform the receivers, whereas the communicative intention is the intention to inform the receiver about one's own intentions (Allott 2013). Ostensive communication succeeds when the receiver recognizes the other's intentions, which means that the communicator has fulfilled his informative intention. So a communicative intention can be characterized as a second-order intention having an informative intention in its content. Thus, a communicative intention cannot work without an informative intention. However, an informative intention can succeed without a communicative intention (Csibra, 2010).

Sperber and Wilson (1995) differentiate between implicit and explicit communication, corresponding to what is implied and what is explicitly communicated. An explicature according to this theory is related to what is explicit, the semantic meaning, and is always being generated. Explicatures are characterized as the development of the logical form of a sentence (Haugh 2002). Explicature in Relevance Theory can be parallelized with "what is said" of the Gricean theory (Bertucelli-Papi, 2000). On the other hand, when a communicated assumption arises and one has to make a hypothesis of what the intended implication is an implicature has to be derived (Haugh 2002). According to relevance theory, the communicative principle is based on the ostensive stimulus. The ostensive stimulus, namely each utterance, helps in presuming the optimal relevance. This means that stimuli have to be worth processing by the receivers and the communicator has to use the most relevant and compatible stimulus (Wilson & Sperber, 2004).

Relevance theory has been linked with clinical pragmatics on spatial reasoning, selection tasks, language development and the way implicatures are derived (automatic versus not automatic) (Cummings, 2014). Moreover, relevance theory makes an effort on combining language and cognition. In its cognitive assumption ToM is already mentioned, thus, a strong connection

between relevance theory and theory of mind can be observed. Both theory of mind and relevance theory focus on one's intentions and the understanding of intentions. The core idea between theory of mind and relevance theory, thus pragmatics, is comprehension and attribution of intentions.

- Modularity Theory

Modularity theory is based on Fodor's (1983) concept of modularity of mind. This concept describes a mind architecture in which the mind is divided into modules according to their cognitive functions. Modularity theory follows a nativist framework and argues that modular cognitive systems are domain-specific, innate and autonomous. This theory disagrees at some points with the relevance theoretic and cognitive pragmatic approach since these theories do not accept that pragmatics can be captured by a module (Cummings, 2014). Kasher (1991) is based on the Fodorian modularity of mind, although he revises the terms "module" and "pragmatics". According to Kasher (1991), his suggestion of a module is given as "*We replace the notion of a 'module' as an input cognitive system of certain properties by a notion of a 'module' as a cognitive system that is independent, in several significant respects*" (Kasher 1991a: 389) and his suggestion of pragmatics is given as "*we have knowledge of basic speech act types, such as assertion and question, which is definitely part of one's knowledge of language*" (Kasher 1991a: 388). Moreover, he suggests that a modular pragmatic knowledge is divided into pure linguistic and not pure linguistic knowledge leaving the question open if this modular pragmatic knowledge is organized in one or several modules. However, he mentions that knowledge and information integrate between modules and central systems. Modular pragmatic theory has been linked to brain damaged population, schizophrenia, autism as well as to localizing pragmatic knowledge in the brain in favor of the left hemisphere (Cummings, 2014).

Modularity has been linked to the relevance theoretic approach, although Sperber and Wilson (2002) disagree at some points. Since relevance theory is a very strong cognitive approach, a question that arises from cognitive science concerns the cognitive architecture and more specifically where pragmatics is. Thus, it seems to be an overlap between relevance theory and Fodor's modularity (Carston & Powell, 2008). Fodor (1983, 2001) claims that the mind has perceptual input systems and motor output systems. He also includes non-modular central systems, which incorporate decision making and belief forming abilities. Carston and Powell

(2008) present the existing idea that since pragmatic inferences deal with beliefs, speaker's meaning and intentions, they should be categorized as central systems. Thus, communication needs a module dealing with the decoding procedure of an utterance, although the inferential phase is non-modular. Literature has taken two paths answering the question if pragmatic processes are executed by central interpretive systems. Some argue that meaning attribution, which is characterized as a kind of intention, falls under the category of attributing intentions, beliefs and mental states, which is known as theory of mind. However, Wilson and Sperber (2002) argue that pragmatic processes refer to a domain-specific comprehension module which has its specific principles and rules. They argue that the general mind-reading module might have generated this metacommunicative module. Neither do they reject the connection between modularity and relevance theory nor do they agree that pragmatic interpretation applies to Fodorian's central system or that mind-reading abilities to a communicative domain. Relevance theory and modularity seem to have some similar ideas and characteristics, although they propose a different mental architecture on pragmatic processes.

As a theory of mind framework, this paper leans towards the modularity approach. However, as a pragmatic framework, this paper leans more toward relevance theory, since this theory focuses a lot on intentions which are vital for the connection between theory of mind and pragmatics.

- Cognitive Theory

Bara (2010) discusses his very strong cognitive pragmatic theory. He argues that people process emotional and cognitive mental states at any time, which can be conscious or unconscious. He introduces the term "behavior game" which means that people taking part in a communication act construct a mental representation of this act. This theory argues that for each utterance interpretation the receiver has to follow the "behavior game". This game has to be linked to utterances and the more complex the utterance is, including inferences or not, the more complex the game becomes. I do not want to go into more detail for this theory since the debate regarding pragmatic theories is between the relevance theory and the modularity theory. Relevance theory is a very strong cognitive pragmatic theory, embraced and investigated by a plethora of research. On the other hand, modularity theory could not be missing from the debate not only because there are parallelisms between it and relevance theory but also because the theoretical

framework on theory of mind leans towards a modular approach. Thus, relevance theory and modularity theory are more discussed.

Cummings (2014) argues that in order for someone to derive an implicature he or she needs rationality, intentionality and holism.

Rationality is included in all the above mentioned clinical cognitive pragmatic theories. In modular theory it is presented via the principle of the effective means, namely that the receiver will choose the most effective and low cost action for utterance interpretation. Cognitive pragmatics explain rationality via inferencing rules (metarules in this case) each game has. In relevance theory, the principle of relevance reveals the rationality of this theory. However, the rationality of cognitive pragmatics as well as relevance theory has been criticized when examples including general world-knowledge were closely studied. Intentionality is not under focus in modular theory since the theory argues that one makes beliefs about another's mind content. In cognitive pragmatics intentionality is found in the shared belief space of the participants. In relevance theory the intentionality character is seen through the proposal of a functional central unspecialized inference process. Lastly, holism in modular theory is evident through system integrations, in relevance theory via lexical, logical and encyclopedic information and in cognitive pragmatics via functional systems, which process linguistic and extralinguistic information. The view of cognitive pragmatics could be parallelized with modules although cognitive pragmatics do not want to take that path.

Although all three points have undergone criticism, they are worth taking into consideration when conducting an experiment including pragmatics since more research can shed more light on the "correctness" of each theory, application of each theory and maybe adaptation or enrichment of each theory.

4.2.2 Non-verbal Pragmatic tasks

For the same reason as described in Chapter 2.3, namely that in the proposed experiment the use of verbal language is minimized since it might influence the results, non-verbal pragmatic tasks will be discussed. Pragmatics has been investigated a lot through the years in different populations and cultures. In literature a plethora of pragmatic tests as well as pragmatic

Batteries can be found. However, literature lacks non-verbal pragmatic tests. In relation to the amount of verbal pragmatic tests the amount of non-verbal pragmatic tests is extreme low. This is not so surprising since pragmatics is a linguistic field in which language is necessary. Research has tried to develop and propose limited language and non-verbal tasks which are of high interest.

Colle and her colleagues (2013) used the validated clinical tool “Assessment Battery of Communication” (ABaCo) designed by Sacco and colleagues (2009). ABaCo was designed for assessing pragmatic skills and consists of 5 different evaluation scales, the linguistic, extralinguistic, paralinguistic, context and conversational scales. The extralinguistic and paralinguistic scales are non-verbal.

The extralinguistic scale consists of 12 videotaped items including communicative acts, deceit and irony; each one of them is tested by 4 different videos.

- Communicative act: A boy and a girl are in a room and the boy makes a gesture meaning “Do you want coffee?”, then the girl responds by pointing to the clock meaning “It is late”. The examiner asked the participant what the girl said. The participant should then answer that the girl refused the offer or something alike.

- Irony: A boy and a girl are eating an awful soup, the boy smacks his lips meaning “delicious”. The examiner asked what the boy said or meant, if he said the truth and why he said it.

- Deceit: The boy asks, using a gesture, the girl for some candies and the girl replies, also using a gesture, with a disgusted expression. The examiner then asks what the girl said and meant, is she was telling the truth and why she answered like that.

The paralinguistic scale consists of eight items of standard communication acts, eight basic emotions and four paralinguistic contradiction items.

- Standard communication acts: The actor talks in a nonexistent language and makes a request. The examiner asks the participant if the man wanted to say something, make a request give and order or deceive.

- Basic emotion: The actor talks in a non-existent language being very sad. The examiner asks the participant what kind of emotion the actor wanted to express giving the following options: angry, ashamed, sad or happy.

- Paralinguistic contradiction: A boy has birthday, a girl comes into the room with a present, the boy opens the present and sees an ugly tie, he says with an annoyed expression “Thanks, really I needed one of those...”. The examiner asks the participant what the boy said and if he liked the tie or not.

However, this task cannot fit under the proposed terminology of a non-verbal test. Although the material does not include a verbal factor the experimenter asks the participant to answer verbally on his question. Thus, this test will not be included in the proposed experiment. Since this task is of limited language and due to the lack of non-verbal pragmatic tasks, the material is highly appreciated and worth mentioning. In the paralinguistic contradiction test of the paralinguistic scale, the nonexistent language is not mentioned and so it is unclear if it is indeed a nonverbal task or if it contains language.

Moreover, Cutica and her colleagues (2006) conducted a research testing the extralinguistic pragmatic abilities by using gestures. They adapted a test proposed by Bucciarelli et al. (2003) that consisted of 15 short videos. Different communicative acts were tested, these were direct acts, conventional indirect acts, complex standard acts, deceit and irony. For each of the communicative act three different videos were presented and the participants should identify the communicative intention. As an example a short videotape of the following story was presented: “a boy (A) and a girl (B) are walking towards a car. A opens the car door for (B)” (Cutica et al. 2006:16). After the story the participants were presented with a picture depicting the communicative gesture of the actor. Afterwards, a white balloon appeared and four different photographs each of them depicting another action. For the example mentioned above, the presented photographs were, (1) B gets into the car, (2) A gets into the car, (3) B is playing with a puppet and (4) A is calling someone. The examiner then asked the participants what the character meant, and the participant should pick the most suitable photograph of the actor’s communicative intention. This task, fits under the non-verbal terminology since the participants are not asked to say something and the story does not include verbal language. The verbal part of the experiment is the question the examiner “asked”, which is simplified and very limited language.

Kasher et al. (1999) conducted a research using verbal and non-verbal material for testing conversational implicatures on Right Brain Damaged (RBD), Left Brain Damaged (LBD) patients and on a Control Group (CG). The non-verbal material consisted of 18 pictures, the majority of

them being paintings by famous artists. Each painting presented a problem that seeks solution in order to get the true meaning. The task of interpreting the painting is parallel to deriving an implicature (for more information on this topic see Kasher (1982)). Each one of Gricean's maxims was related to a painting. As an example, they showed participants, Rene Magritte's Painting "Le Domain D' Arnheim" in which an eagle's nest/eggs are on a windowsill and in the background is a mountain on which an eagle is formed. An aphasic patient named it the eagle mountain and concluded that the mountain was looking up for the eggs safety.

This experiment is an interesting experiment since there is no relationship between a speaker and a listener, although implicatures must be derived. The nature of the implicature and the pragmatic background of this test can be questioned. However, as Kasher et al. (1982) points out in his paper, Grice (1957) already had made a parallel on deriving implicatures using paintings. Arguing against this opinion is daring, thus, it will not be further discussed in this paper.

Another interesting fact about this task is that it is not necessary of mental nature, meaning that one does not have to understand directly another's mental state. Again, this point of view can also be argued. As Cummings (2014:116) wrote: "the ability to attribute mental states to one's own mind is as important to utterance interpretation as the ability to attribute mental states to the minds of others". Taking into account what Cumming (2014) said and maybe the fact that the artist's mental state may be in the painting, the nature of this task can be much more complicated. However it is fair to conclude that the mental nature of this implicature test is not as direct as it is with other implicature tasks in which two people are exchanging utterances or gestures.

Furthermore, the tests described above concerns deriving non-verbal implicatures and not non-verbal tests. Thus, the examiner as well as the participant uses verbal language, resulting them no being strict non-verbal tests. However, to my knowledge and in my research I could not find more non-verbal pragmatic tests, for the needs of this paper these tests are a very good start.

5. Theory of Mind and Pragmatics

In the following section the connection between ToM and pragmatics will be discussed on the developmental as well as on the functional level. It is important to mention that this will not be

the end of trying to argue that this connection is strong since the following chapter aims to provide the reader with a screening on empirical findings strengthening this argumentation.

This chapter works as an introductory chapter on the connection of these two abilities. As already mentioned throughout this paper the developmental part of ToM and pragmatics is not under investigation. However, in order to strengthen as well as introduce this connection it would be beneficial to mention some important works. Moreover, since most theories of theory of mind have been based on developmental ToM findings, it is my personal opinion, that at least some work should be mentioned.

5.1 Developmental Theory of Mind and Pragmatics

Fernandez (2013) dealt with the connection between pragmatics and ToM conducting a research with Colombian preschool and first grade children. In her research, through observing the children's narrative skills, she hypothesized that the children's ToM development is an important predictor for pragmatic skills. Fernandez (2013) investigated narrative skills because in order for children to have narrative skills the social-cognitive, semantic, syntactic, pragmatic and metacognitive knowledge has to be present. Narrative skills are important to the investigation of pragmatic skills, since they show that a child is able to start conversations, to give an appropriate response as well as understand turn-taking concept. Those pragmatic skills are necessary for understanding others' mental states. Fernandez (2013) used a wordless picture book, with which she tested if children are able to identify the characters and their mental states and if they are able to express causal relationships between events.

Fernandez (2013) found that second-order ToM scores were an important predictor. Although, pragmatic language skills are important for ToM development, syntax and semantics also play a role in ToM. Thus, she concluded that up to date we cannot argue that pragmatics is the only connection between language and ToM and that more research is needed in order to find the direction and relation between ToM and pragmatics.

Considering a neuroimaging research done by Frank (2010), it was found that pragmatic skills and not constitutive language aspects are important for ToM. Frank (2010) also argued that general language ability is important for ToM, with pragmatics being the most vital. This can be supported by other brain imaging studies that dealt with the relationship between language and

ToM. Although these studies are limited, they show that when adults are processing pragmatically coherent stories they use the medial prefrontal cortex, which is the most consistently used in ToM brain imaging studies (Ferstl & Cramon, 2002, Frith & Frith, 2003).

5.2 Theory of Mind and Pragmatics in Adult Population

Besides the interest connecting developmental ToM and pragmatics, scholars have also dealt with the connection of ToM and pragmatic skills in populations with language impairment after brain injury, brain lesions, degenerative diseases and mental disorders.

It has been seen that the left hemisphere of human brain is specialized in syntax and semantics, whereas the right hemisphere in pragmatics. Neurological evidence from previous studies shows that aphasic patients with left-hemispheric damage have good ToM, but fail syntax related tasks (Varley & Siegal, 2000). Similarly patients with left hemisphere damage (LHD) perform very well in ToM, while patients with right hemisphere damage (RHD) perform not as well as LHD patients in ToM tasks (Siegal et al., 1996). These facts already show a connection between ToM and pragmatic language skills in the brain.

Although the right hemisphere of the brain has gained a lot of interest, it is almost impossible to believe that the left hemisphere does not have anything to do with pragmatic and ToM abilities especially when considering the complex networks of the human brain. Not surprisingly a number of studies have investigated pragmatic and ToM abilities in the left hemisphere in typical and atypical populations.

Regarding pragmatics in the left hemisphere, Chapman et al. (1998) found that people with Aphasia perform worse than people with Alzheimer's disease and the control group in discourse text, including inferences and intentions interpretation. Kasher et al. (1999) found that RHD and LHD patients both perform worse than the control group in verbal and nonverbal implicature understanding. Zaidel and colleagues (2002), investigated an adaptation of "Right Hemisphere Communication Battery" in Hebrew (HRHCB) in RHD, LHD and healthy participants, the control group (CG). Their findings indicate that RHD as well as LHD patients perform worse than the CG and found that the LHD patients have more difficulties than RHD patients in indirect requests and verbal metaphor. Soroker et al. (2005) strengthened these findings, since they compared

LHD and RHD patients on speech act processing and found that both groups perform worse than the controls, while RHD patients perform better than LHD patients.

Kasher et al. (1999) and Soroker et al. (2005) argue that pragmatic processing (implicature and speech acts respectively) may function in the perisylvian cortex. Moreover, Cutica and colleagues (2006) studied the extralinguistic communication (communication via gestures). Their findings suggest that RHD patients show difficulties in standard and nonstandard communication, whereas LHD in nonstandard (irony and deceit stories). Hamel & Joannette (2007) conducted a research comparing logical and pragmatic inferences in LHD and RHD patients. The logical inferences were syllogisms following a question and the pragmatic inferences included a short story following three polar questions. Their findings showed that both groups faced difficulties with the RHD group being more affected.

Regarding pragmatics in the brain, although the right hemisphere has gained a lot of interest and is indeed very involved in pragmatic abilities, the left hemisphere also plays a role in pragmatic processes. The perisylvian cortex has been argued to include pragmatic processing abilities as well as the left inferior frontal gyrus (IFG) and the left TPJ (Li et al., 2014).

Most scholars argue that left hemisphere damaged patients do not show ToM impairments, however two studies Apperly et al. (2004) and Samson et al. (2004) found ToM deficits in Aphasic people. Moreover, the left TPJ has been argued to be involved in ToM tasks, as well as in pragmatic tasks (Li et al., 2014). Thus, pragmatic and ToM seem to be closely related.

In the following chapters pragmatic and theory of mind skills will be discussed in three adult language disorders: Schizophrenia, RHD and Aphasia. Findings indicate that when a pragmatic disorder is evident, so is a Theory of Mind deficit. Taking into consideration Schizophrenia and RHD this argumentation can be strongly supported. However, in Aphasia although pragmatic deficits are very often evident, Theory of Mind skills seem to be unimpaired. These findings may be misleading since many scholars investigating ToM abilities in people with Aphasia do not mention the location of the participants' brain damage.

Regarding the amount of research concerning ToM and language most papers focus on syntax and few of them investigate pragmatic language skills and the relation they may have with ToM. Pragmatics, however, refers to the functional use of language in social contexts and is important in order for someone to understand the intended meaning of a speaker, thus, pragmatics is of vital importance for social interaction, which needs a fairly developed ToM (Fernandez, 2013).

This subchapter presented brain overlaps as well as behavioral overlaps. Findings show a connection in the brain and on the behavioral level. More findings concerning some of the clinical populations will be discussed under chapter 7.

5.3 Summary

Through the above findings the connection between pragmatic and ToM skills is quite strong on the behavioral as well as on the theoretical part. However, more research in this field could be only but beneficial. The connection is also evident considering the definition of these two skills. Pragmatic theories dealt with the issue of making an utterance relevant to another person, which actually is understanding one's knowledge, *intentions*, beliefs and desires so that the utterance can resolve to a successful communication. Moreover, by understanding irony and humor one understands another's mind as well as the communicator understands the receivers mind. Both ToM and pragmatics deal with the terms "self" and "other", all of these parallelisms indicate the connection pragmatics and ToM have. Further evidence comes from the fact that ToM skills are important for social skills and can be influenced by socio-cultural factors (Kern, 2005) as are pragmatic skills. Lastly, through neuroscience, as mentioned in the above sections it has been seen that pragmatic as well as ToM processes have been located in the TPJ (Li et al. 2014 Mahy et al. 2014). Putting these findings all together a link between ToM and pragmatics can strongly be argued. Weed et al. (2010) mention that Theory of Mind is needed for pragmatics since they mention that an impairment on pragmatic skills may be caused due to a theory of mind impairment. This view seems to be embraced also by others like Varga et al. (2014). In their research about implicature understanding they mention the control implicatures as "*these control tasks consisted of simple dialogues which did not include any implicatures, thus their interpretation did not require ToM skills*" (Varga et al. 2014: 7). Which shows a proposal of implicature understanding including theory of mind ability.

Throughout this paper, I was wondering if there is actually a connection between pragmatics and Theory of Mind and if yes how someone can explain this connection with simple words. Of course, as we have seen till now and as we will still see in this text, there is a strong behavioral connection from clinical populations. However, even in the simplest tasks of everyday life these two skills seem to be connected. Let's take for example the following question: Michael is asking his friend Christine "Do you know what time it is?" Christine could response in two ways. First

she might look at her watch in order to tell Michael the time or she could answer with “yes or no”. The first response is an example of implicature since Christine is implicating that Michael wants to know the time as well as an example of understanding intentions. Thus, theory of mind and pragmatics have their core connection on intentions. Michael’s intention at the first moment is to know the time and then to let Christina know he wants to know the time. Christina, on the other hand, understands Michael intentions by letting Michael know what time it is. Thus, from the pragmatic perspective and by embracing relevance theory the communicative intention is Michael letting Christina understand, by inference that he wants to know the time. The part of Christina understanding the intended meaning of Michael’s utterance does not only involve pragmatic inferential abilities, but also theory of mind abilities. Christina, by attributing intentions, beliefs and mental state of Michael, is able to continue to the procedure inferring the intended meaning and answering Michael what time it is.

This example is in line with Weed (2010) and Varga et al. (2014) who argue that pragmatics and theory of mind are connected and that Theory of Mind is important for pragmatic abilities.

This connection comes from the theoretical as well as from the behavioral level. On the theoretical level, the connection is on attributing intentions, which is strongly seen in the relevance theoretic approach on pragmatics. This approach is also a strong cognitive approach with parallels to the modularity approach, an approach that has been linked with theory of mind. The theoretical level on connecting theory of mind and pragmatics has already been discussed and presented. However, the connection of ToM and pragmatics concerning intentions is still under discussion and will not be focused on this paper since it needs a deep theoretical analysis. In Chapter 7 the behavioral link will be presented since two out of three investigated adult language disorders display impairments on their theory of mind and pragmatic skills.

From the above arguments, one could ask himself if it is possible to claim that theory of mind precedes pragmatics. Since one needs theory of mind in order to understand the other person’s beliefs and then he or she is able to start the procedure of implicature. However, this is another huge topic that can undergo a lot of discussion but is not the topic of this paper.

6. Aphasia

Aphasia is an acquired language disorder and a cognitive syndrome following brain damage. Aphasia affects oral and/or written language on the utterance and/or comprehension level (Ispahany, 2012). In the literature various types of aphasia have been described and their categorization and classification occurs through the symptoms and localization of the lesion in the brain. Although between aphasias regularity and consistency of deficit patterns are evident, the level of impairment may vary.

In 1861 Pierre Paul Broca linked the posterior inferior frontal gyrus of the left hemisphere with loss of articulation. This area became known as the Broca's area. Damage in this area accompanied by language production impairment is known as Broca's aphasia. Since then, Broca's area has been localized in Brodmans areas 44 and 45 of the dominant hemisphere.

In 1874 Carl Wernicke entered the term "sensory aphasia" which occurs after a damage in the posterior first temporal gyrus. This area was named Wernicke's area and is located in the left TPJ (Hales et al. 2008). Damage in this area accompanied by language comprehension impairment is known as Wernicke's aphasia. Since then, Wernicke's area has been localized in Brodmans area 22 in the dominant hemisphere (Goodglass, 1993).

Since Broca's and Wernicke's findings, aphasia has gained a lot of interest and more types of aphasia have been described. Classifying these types is a much discussed topic since there are different approaches on how to categorize them. The most dominant classifications are the Boston Group classification and Luria's aphasia interpretation. The former being used in the US and Western Europe and the latter in Eastern Europe and Latin America. This paper will follow the classification of Adrila (2013) in which it is argued that Aphasia can be divided in three types, the primary (central), the secondary (peripheral) and the dysexecutive aphasia. His argumentation is that in central aphasia language is directly impaired, whereas in peripheral aphasia, mechanisms important for language production are impaired. Dysexecutive aphasia regards impairment of executive control, which leads to language impairments. Primary aphasia types include Wernicke's and Broca's types of aphasia, peripheral aphasia includes conduction and supplementary motor area aphasia (SMA) and dysexecutive aphasia type includes the Extra sylvian (transcortical) motor aphasia. All of these types and subtypes will be discussed briefly as follows.

❖ Primary (central) Aphasia

According to Adrila (2013), adapting Jakobson's and Halle's (1956) proposal, aphasic syndromes can be divided in two categories depending on their linguistic operations. Language ability can be impaired in the syntagmatic axis, referring to the "sequencing" linguistic operation or the paradigmatic axis, referring to the "selecting" linguistic operation. The syntagmatic axis reflects to the Broca-type aphasia, while the paradigmatic axis reflects to the Wernicke-type aphasia.

- Broca's aphasia

People with Broca's type aphasia display scarce, non-fluent and poorly articulated language while their lexical/semantic system is relatively not affected. Thus, in Broca's aphasia type it is argued that the paradigmatic axis, the selection processing, is unimpaired, while the syntagmatic axis is affected since impairments in sequencing processes appear like in morphosyntax. People with this type of aphasia have difficulties at the motor and/or at the language level. This means that they may have fluency and articulation problems, which falls under the category of apraxia of speech. At the language level grammar is affected, which is known as agrammatism (Adrila, 2010). Reading abilities are preserved, although patients are slower and need more effort compared to their abilities before the brain damage (Goodglass, 1993)

- Wernicke's Aphasia

People with Wernicke's aphasia display fluent speech production with preserved articulation and sentence structure but phoneme and word selection is impaired. Patients with Wernicke's aphasia often use neologisms which are new words they created, as well as semantic jargon thus their utterances being incomprehensible. Comprehension, reading and writing are also affected in Wernicke's aphasia, however, the severity of impairment depends on the lesion localization and type of Wernicke's Aphasia. According to Adrila (2013), anomic also known as amnesic or nominal aphasia as well as transcortical sensory aphasia are subtypes of Wernicke's aphasia. Patients with anomic aphasia have word finding difficulties, their speech is fluent and grammatical, but with substitutions mostly on nouns but also on other word categories.

Patients with transcortical (extra-sylvian) sensory aphasia have fluent speech, but with semantic jargon. This means they use inappropriate words in their utterances, thus being incomprehensible. Moreover, their comprehension is affected as well as their naming and reading abilities, although their repetition ability is unimpaired.

❖ Secondary (peripheral Aphasia)

- Conduction aphasia

Patients with conduction aphasia mainly display fluent speech, well preserved comprehension, but severe repetition impairment. Moreover, naming, reading, writing and ideomotor apraxia (difficulty on imitation of hand gestures) may be evident. Repetition impairments are found in other types of primary aphasia too, although according to Adrila (2013) conduction aphasia should be grouped under the secondary aphasia groups since this type of aphasia affects one specific aspect of language, the repetition ability, leaving knowledge of language like phonology, lexicon semantics and grammar unaffected. Strengthening his argument, that repetition is not a primary linguistic ability, although important, he mentions that, repetition cannot be acknowledged as a primary linguistic ability since animals can do it.

- Supplementary motor area aphasia (SMA)

The brain area affected in this type of aphasia is not the “language area” as in other aphasias, but the supplementary motor area, which is a premotor area is responsible for movements like initiating, maintaining, coordinating and planning sequences. It also influences reaction time as well as voluntary movements. Cognitive skills like spatial and verbal working memory, arithmetic skills, spatial mental imagery and spatial attention may also be affected in SMA aphasia. Patients with SMA aphasia during the first two to ten days post brain damage show mutism and later on incompetence initiating speech, well preserved repetition, unaffected comprehension and no echolalia. Furthermore, within weeks or months their language ability increases rapidly. Since in this type of aphasia motor abilities affect language abilities, it is argued that SMA falls under peripheral aphasias.

❖ Dysexecutive Aphasia

- Extra-Sylvian (transcortical) motor aphasia

Literature has argued that this type of aphasia can be better defined as an executive function disorder (Alexander, 2006) or as a dysexecutive syndrome. Patients with Extra-Sylvian (transcortical) motor aphasia show difficulties in initiating speech, formulating sentences and spontaneous speech. However, their repetition and comprehension skills are unaffected and in some cases naming skills are not so limited. This type of aphasia can be seen as a dysexecutive type of aphasia due to the fact that language knowledge is preserved but, verbal initiative is

affected. Comprehension is unaffected with basic linguistic processes being evident. Lastly, metacognition and not basic cognition is found in the prefrontal cortex. All in all, executive functions and metacognitive abilities and not pure linguistic ability play a role in organizing language sequences, thus, Extra-Sylvian (transcortical) motor aphasia is concerned to be a dysexecutive aphasia type and not a primary type of aphasia.

In addition to the above types of aphasia global and primary progressive aphasia (PPA) are often discussed. Patients with global aphasia show impairments in all aspects of language, their comprehension and oral ability is impaired as well as their writing skills are affected (Alexander & Loverso 1992). PPA is as its name suggest a progressive type of aphasia. Patients with PPA firstly display word finding difficulties and gradually show impairments in grammatical structures and comprehension while their memory and visual processing skills stay relatively unimpaired. (Mesulam, 2001)

From the above descriptions, we can sum up on a language profile of each type of aphasia. As mentioned above impairments and the level of impairment may vary individually, however, it can be differentiated between types, which have more or less pragmatic impairments. For my purposes the differentiation between impairments in pragmatics and other language aspects is enough since I focus on the pragmatic language aspect. Thus, from the descriptions above, interesting types of Aphasia for investigating pragmatic impairments would be aphasia types with comprehension difficulties, these types are Wernicke's aphasia, global aphasia or PPA.

I will focus on Wernicke's aphasia with brain damage in the TPJ area, excluding the other two types. Global aphasia is the most severe form of Aphasia displaying impairments in all aspects of language, thus, test results may be influenced by a variety of factors, making this type of aphasia ask for more limitation. PPA does indeed show comprehension impairment but on later stages in which other aspects of language are more impaired than comprehension (Mesulam, 2001). PPA has also been argued to be a type of dementia (Mesulam, 2003) Primary Progressive Aphasia A language Based Dementia) and the aim of this paper is to focus on an Aphasia type and connecting aphasia with pragmatic and ToM. Another argument for choosing Wernicke's Aphasia is that TPJ contains Wernicke's area (Hales et al. 2008). As we saw from the above findings in ToM and pragmatics, there is evidence that ToM and pragmatic skills activate the TPJ. Thus, seeing that all three factors are evident in one brain area it can be used as an argument for connecting them.

7. Theory of Mind and Pragmatics in Adult Language Disorders

Theory of Mind and pragmatics have been investigated in a variety of atypical conditions. Most research has dealt with one aspect at a time, although there are some others connecting Theory of Mind and pragmatics. In this paper research on Aphasic, Schizophrenic and Right Hemisphere Damaged patients will be discussed.

The reason of choosing these three atypical conditions are that in Right Hemisphere Damaged patients a plethora of evidence exists in pragmatic and Theory of Mind deficits, which is strengthening the argument that these two skills are connected on the behavioral level. Moreover, research has also shown interest in Schizophrenia as Schizophrenic patients show impairments in both aspects. Aphasia is now a controversial topic and research has investigated pragmatic skills in Aphasia as well as Theory of Mind skills. However, Aphasia research on Theory of Mind lost its interest since there were findings arguing that in this condition ToM skills are well preserved. However, Apperly et al. (2004) as well as Samson et al. (2004) showed that patients with aphasia display ToM impairments.

Unfortunately, research often does not specify the location of the lesion in the brain or the type of Aphasia when talking about Aphasia and Theory of Mind or pragmatic skills, thus creating questions and limitations. By this I mean, if previous findings about Aphasia and Theory of Mind skills have been investigated in Broca's Aphasia, it cannot be generalized on all types of Aphasia. Doing a perfect research on Aphasia can be utopic since the lesion in the brain cannot be identical from one patient to the other. However, it can be similar such as between Wernicke's Patients or more specifically Aphasic patients after a brain damage in the left TPJ. After briefly describing the reasons why I chose Aphasia, Schizophrenia and RHD I will continue by presenting some interesting previous research on Theory of Mind and pragmatics in each condition. Under the subchapters discussing pragmatic abilities in those three conditions, metaphor, irony and implicature understanding are being discussed. This is due to the fact that, through my personal research these three pragmatic aspects have been investigated in varying depth in all three groups. Implicatures are important for this paper since, as Tenyi et al. (2002) argue, implicature understanding involves Theory of Mind abilities. Irony also is an interesting part since understanding of irony and sarcasm, can be argued to work also ToM free due to the "reality-based shortcut strategy" as proposed by Györi et al. (2004), which will be discussed under chapter 7.2.1. Lastly, metaphor has been broadly investigated, although only in a verbal setup.

In this section metaphor is mentioned since it has been investigated in all three disorders and strengthens the argument of pragmatic impairments in those three disorders. However, metaphor will not be included in the proposed experiment since there is no known “non-verbal” task.

7.1 Aphasia

7.1.1 Pragmatics and Aphasia

Kasher et al.'s (1999) work has already been mentioned in this paper under chapter 4.2.2. Their experiment dealt with conversational implicature processing in RHD and LHD patients. They tested 24 RBD and 16 LBD patients, 10 of them with aphasia. Under the aphasia group 3 had Wernicke's aphasia, 2 conduction aphasia and 5 anomic aphasia.

The nonverbal test has already been described (see chapter 4.22) and their results will be discussed as follows. In the verbal test the examiner tells the participant ten short stories and after each story he asks the participant questions. As an example: “I said: ‘You know, George and Mary moved out of town’ and He said: ‘I know. Too bad George left’ “. The examiner asks the patient questions, including “Do you understand what he said?” “What did he mean?” and “he said! Too bad George left and what about Mary?” (Kasher et al., 1999:573) . In the verbal test they gave one point for identification and one point for solution.

Their findings suggest that CG performed better than LHD and RHD patients and that LHD and RHD patients scored better in the identification part compared to the solution part. These groups showed similar difficulties in deriving implicatures, although they point out that these findings do not suggest that both groups process implicatures the same way. Furthermore, both groups were worse in the non-verbal task and Kasher and his colleagues (1999) noticed a high intercorrelation between verbal and nonverbal tasks in LHD patients, thus they argue that the left hemisphere may have a general “implicature processor”.

Giora and her colleagues (2000) tested 27 RHD and 31 LHD patients on understanding metaphor and sarcasm. Out of the 31 LHD participants, 24 were classified as aphasics. In the aphasic group, 4 had global aphasia, 7 Broca's aphasia, 4 Wernicke's aphasia, 2 conduction aphasia and 7 anomic aphasia. Moreover from the LHD group 24 participants had ischemic infarctions in the middle

cerebral artery (MCA), 2 in the posterior cerebral artery (PCA) and 2 in the anterior cerebral artery, the rest had a spontaneous hemorrhage in the MCA territory. Their control group consisted of 21 participants.

They conducted two experiments, the first being about sarcasm comprehension and the second about conventional metaphor comprehension. For their tests they used the adapted in Hebrew language, sarcasm and metaphor subtests of the RHCBS by Gardner and Brownell (1986) .

In their first tests the participants were asked to listen to a story and then choose one of the given answers. An example:

“A. Anne and Roger were lawyers in the same law firm. Anne hated Roger because he often teased her for defending clients who couldn’t afford to pay her fee. One day Anne was at the courthouse while Roger was defending a very wealthy man. He did a terrible job, completely mishandling what should have been a simple case. Anne said to another attorney, “Roger handled that case well.”

Questions

1. When Anne said that Roger handled the case well, Anne was:

- a. making a mistake*
- b. telling the truth*
- c. telling a lie*
- d. being sarcastic*

2. Based on what you heard in the story, which of the following is true?

- a. Roger handled the case poorly.*
- b. Roger did a good job on the case.*
- c. Roger was a tax lawyer.” (Giora et al., 2000:67)*

From the participants 24 RHD, 22 LHD and all of the control group (CG) completed the test. Their results indicate that RHD and LHD participants performed worse than CG with LHD participants performing slightly worse than RHD ones. Moreover, they compared RHD participants with non-aphasic LHD participants and found that the LHD group performed significantly better.

In their second study about conventional metaphor comprehension the same participants took part. Their test contained four clichéd metaphors. The participants were asked to describe what each metaphor meant. In this experiment 24 RHD, 16 LHD and all controls took part.

Interestingly, RHD performed as well as controls, whereas LHD participants show impairments in metaphor comprehension with the presence of aphasia not influencing the results. From their research Giora and her colleagues (2000) support that RHD and LHD patients have pragmatic impairments and that LHD patients are more impaired than RHD patients in metaphor understanding. Sarcasm comprehension seems to be better in LHD than in RHD patients. Another very interesting finding concerning sarcasm is that when they excluded the aphasic patients of the LHD group the difference between LHD and RHD became much bigger, with the LHD participants outperforming the RHD participants thus, indicating that aphasia may play a role on sarcasm comprehension. Regarding the sarcasm test, they notice that five out of six stories are sarcastic and that the results may be influenced by a response bias (Giora et al., 2000).

Cutica et al. (2006), conducted a research using a non-verbal pragmatic test already described under chapter (4.2.2), testing the extralinguistic pragmatic abilities in LHD and RHD patients compared with a CG. All participants underwent the Mini Mental State Examination (MMSE), a ToM test using the smarties test and a visuo-perceptive test. All participants passed the test.

Their findings indicated that both LHD and RHD groups performed worse than the control group in total. These results were expected since we saw already from above that these two groups display difficulties in pragmatic understanding. Moreover, they found that the RHD group performed worse than the LHD group in total. Comparing standard and non-standard communication they observed that all groups performed better in the standard communication tests. Interestingly, the comprehension of standard communication of LHD patients was as good as this of the CG. Findings regarding the non-standard communication in contrast indicate that LHD and RHD patients perform worse than controls with the RHD patients performing worse than LHD patients.

To sum up, their findings agree that when investigating pragmatic abilities in RHD and LHD patients compared to a CG, RHD and LHD patients perform worse strengthening the argument of pragmatic impairments in these groups. Thus, it is fair to conclude that both hemispheres are involved in pragmatic tasks. However, in their research they do not mention if the LHD patients had aphasia which might be considered as a limitation for this paper concerning the focus on

aphasia. Moreover, four out of nine LHD patients had a lesion in the temporo-parietal area and two of them in the frontal temporo-parietal area. Taking into consideration that pragmatics has been localized in the TPJ it would be interesting as a next step in their research to investigate how these participants responded.

As already briefly mentioned *Zaidel et al. (2002)* tested 27 RHD patients, 31 LHD patients and 21 Controls in their pragmatic skills adapting the RHCBS. From the 31 LHD patients 24 of them had aphasia, 7 had Broca's aphasia, 7 had anomic aphasia, 4 had global aphasia, 4 had Wernicke's aphasia and 2 had conduction aphasia. Not all the participants completed the entire battery, 23 RHD, 12 LHD and 21 Controls did. From the LHD group the number of aphasic patients is not given. The RHCBS consists of 11 subtests testing humor, emotion, non-literal language and integrate processes. Their findings agree with other findings that RHD and LHD patients perform worse than controls. Their results also indicated that RHD and LHD patients display the same performance, except on the indirect requests and the verbal metaphors in which RHD patients perform better. Findings regarding metaphors agree with *Cutica et al.'s findings (2006)*. Moreover, considering LHD patients they associated the inferior and middle frontal gyri with verbal humor and sarcasm, the superior and middle temporal gyri with pictorial/verbal metaphors and the anterior/posterior regions with indirect requests. In the RHD patients the localization of the lesions did not seem to influence the results except their narrative comprehension, which was linked to the junction of the superior temporal and supramarginal gyri.

7.2.2 Theory of Mind and Aphasia

As a very informative paper by *Siegal and Varley (2006)* summarizes, there is a general tendency in literature that argues against ToM deficits in LHD patients and aphasia. However, they mention *Apperly et al.'s (2004)* and *Samson et al.'s (2004)* work that speak against this tendency which are the papers discussed below.

Apperly and colleagues (2004) used a simple first-order false belief task adapted by *Call and Tomasello (1999)*. They tested 12 brain damaged patients, 7 of them had a left hemisphere damage and 5 out of them had aphasia, 3 had bilateral brain damage and 2 of them right hemisphere brain damage. The participants were presented with a video, each video could

include a false-belief (FB), working memory control, inhibition control and true belief scenario. Each video had the same setup a man, a woman and two boxes are in a room, the man allows the woman to look inside the boxes and the woman leaves the room and returns. The examiner explained the test to the participant and did some warm-up trials giving them feedback when needed. For each condition the plot changed. The participants during the experiment knew that there is a hidden object in one of the boxes, but they were unaware of which it was in.

For the false belief condition, a man entered the room while the woman was gone and swapped the boxes. As a result the woman pointed to the wrong box.

For the working memory control condition, the woman pointed at the box before leaving the room, the man then swapped the boxes and the participants should only remember at which box the lady pointed.

For the inhibition control condition, the same plot as for the FB was used, but the man additionally transferred the object from the one box to the other and the participants should inhibit that the box the woman pointed on also had the object.

For the clue-confirmation condition, the woman pointed to the box before leaving the room and then the man transferred the object from the one box to the other. This condition served as filler trials in order to show the participant that the woman was trustworthy when she knew where the object is located.

After each video the participant was prompted to point at the box he thought the object was in. They found that three patients with a lesion in the left TPJ and especially in the left superior temporal and left angular gyri displayed difficulties only on FB reasoning. A patient with a lesion in the left superior temporal gyrus, but not in the left angular gyrus did not display difficulties solely in FB reasoning. There are some very interesting findings arguing for ToM in the left hemisphere as well as for the connection between pragmatics and ToM since pragmatic skills have also been located in the TPJ. They describe the location of each patient, which is not seen so often.

Working with the same material and participants, *Samson et al.* (2004) argued that the left TPJ is not only involved in mental state processing, but necessary for it. They compared three LHD participants, two of them had aphasia, with lesion in the left TPJ and none of them answered above-chance on the FB reasoning test. They used verbal and non-verbal tests and found that aphasic patients displayed difficulties in the verbal control trials. However, when the language

factor was excluded this difficulty disappeared which did not happen in the FB reasoning task. Due to this fact they concluded that their impairment is purely on FB reasoning and therefore they strongly argue that the left TPJ is not only taking part in mental state processing but it is necessary for it.

7.2 Schizophrenia

Schizophrenic patients display an abnormal speech production. Their speech production has been linked to speech production of Aphasia or to patients with RHD. Specifically, literature has linked Wernicke's aphasia speech to that of schizophrenics which in both groups may include parahasias and their unawareness of these errors. It has been noticed that when clinicians rate schizophrenic and aphasic speech they have difficulties differentiating the two conditions (Lane et al., 2011, Kuperberg & Caplan, 2003). However, Gerson et al. (1977), who closely observed schizophrenic and aphasic language, concluded that schizophrenia displays specific parahasias, whereas in aphasia they are wider (Kuperberg & Caplan, 2003). The comparison between aphasia and schizophrenia is a much discussed topic, although an important observation is that aphasia-like symptoms in schizophrenia are not persistent, whereas in Aphasia they are present all the time (Lecours & Vanier Clément, 1976). Language after RHD has also been linked with schizophrenia, although not as close as aphasia. Literature when comparing these groups focuses more on discourse. However, this link is not based on a systematic comparison, thus in order to come to a conclusion more research is vital.

Schizophrenic language impairment is characterized by impairments in phonological awareness, receptive and expressive grammar, lexical semantic retrieval and the most dominant impairments are found in pragmatic skills (Kuperberg & Caplan, 2003). Under the field of pragmatics much studied areas are conversational implicatures, metaphor, irony, idioms and humor interpretation. Concerning Theory of Mind, schizophrenic patients exhibit impairments in this cognitive skill. Schizophrenia is a much discussed topic about ToM and a plethora of studies exist. Thus, it has been seen that ToM skills may vary among patients that have different symptoms. However, this cannot be studied closely in this paper because of limited space. Regarding schizophrenia I will present some interesting findings about their pragmatic abilities concerning inferences and especially conversational implicatures and about their ToM I will present papers dealing with false belief tasks and the hinting task.

7.2.1 Pragmatics and Schizophrenia

Corcoran (2003), Tenyi et al. (2002), Mazza et al. (2008), Vagra et al. (2014) are some studies on non-literal language concerning implicatures with the latter also involving metaphor and irony which will be presented as following.

Corcoran (2003) tested inferential skills of 39 schizophrenics and 44 controls. She used the Hinting task designed by Corcoran et al. (1995) in which the participant listens to a short story produced by the examiner. Each vignette ends with a hint like girl's A birthday is coming, A says to B "I love animals, especially dogs". The examiner asks the participant what A meant. If they understand the implied meaning they get two points. If they do not answer, the participants add an information. A says "Is the pet shop going to be open on my birthday?" and the examiner asks what A wants B to do. Their pointing system gives for a correct response one point, for an incorrect response or no response zero points.

Strengthening Corcoran et al.'s (2003) findings, *Tenyi et al. (2002)* tested 26 paranoid schizophrenic patients and 26 controls. Their pragmatic test consisted of four "question and answer" vignettes, which had a maxim violation, thus participants had to derive an implicature. The implicature they had to derive concerned a negative opinion of the speaker, for example, "a teacher of art is asked about his student's talents. His answer about the student B is: 'She has an attractive body'" (Tenyi et al. 2002:27). The participant should infer that the teacher has a negative opinion of the student's talents since he is mentioning her body, which is irrelevant with talents. Moreover, control vignettes with neutral content were presented.

Their findings show that schizophrenic patients are less able to understand the implicit meaning of the speaker and are less able to derive the implicature. Although their research is interesting, the article is very short and their findings are only briefly discussed. Moreover they do not mention what the procedure was, if the participants had to read or listen to the vignettes and how they score the participant's answers.

Partly in line with the above findings comes *Mazza et al. (2008)*, who conducted a research testing conversational implicatures in 38 schizophrenics, 34 non-psychotic relatives and 44 controls. They were asked to read "question and answer" vignettes like "how would you like your tee?" and the given answers were "in a cup" or "with milk". The participants were asked to choose the most suitable answer. Interestingly, they found that schizophrenic patients have

difficulties with implicatures against the maxims of quantity and quality, whereas relation and manner do not seem to affect them. These findings partly collide with the findings suggested by Tenyi et al. (2002) whose research showed impairments in all kinds of maxim violations. However, Mazza et al. (2008) conducted a research with much simpler implicature and language, which may have influenced the results.

In their research *Varga et al. (2014)* tested conventional and unconventional metaphors, irony and Gricean as well as control implicatures in 19 schizophrenic patients and 19 controls. Their test consisted of a total of 35 verbal tasks on an interview-like setup. Five tasks were given for each metaphor and irony condition and 20 tasks were given for the implicature condition. They scored answers from zero to two, zero for false or no answer, one point for correct answer after help and two for correct response without help. Further, they divided the schizophrenic patients in high and low IQ groups and compared their findings for these groups in each task.

For the conversational implicature condition they used Tenyi et al.'s (2002) material. They presented four tasks for each maxim violation and four tasks for control implicatures. They divided the implicature in a linguistic part and a ToM part. Regarding the control implicatures, they mention that "these control tasks consisted of simple dialogues which did not include any implicatures, thus their interpretation did not require ToM skills" (Varga et al. 2014: 7). After the examiner's presentation of the scenario, the examiner asked the participant if the utterance is strange and if yes why, which was the linguistic part. They also tested their ToM ability by asking what the speaker meant. They used one point system for ToM and another for the linguistic part of implicatures.

Consistent with previous evidence they found that schizophrenic patients have difficulties deriving conversational implicatures. Interestingly, comparing high and low IQ schizophrenics, the high IQ group showed a higher percentage of correct responses. Against the findings of Mazza et al. (2008) they found that schizophrenic patients do not show difficulties in implicatures against the maxim of quality. In general for the linguistic part of this test the participant was not asked to recognize the implied meaning of the utterance. This was asked in the ToM part in which irrespectively of the participant's IQ they displayed deficits. In their experiment about irony and metaphor they presented 5 short verbal stories for each condition based on the material proposed by Drury et al. (1998). On the irony tasks after the presentation of the story the examiner asked the participant two questions concerning the intended meaning of the speaker.

As an example of a story: “ Two men are moving out and the man A wants to pick up the wardrobe but cannot do it, then the man B says to A ‘hey you are strong’ ”. After the presentation of the story the examiner asks the participant what B really meant and if it means that A is indeed strong. They found that only lower IQ schizophrenics show an impairments. They propose that high IQ schizophrenic patients use a “reality-based shortcut strategy” as proposed by Györi et al. (2004). This is a non-ToM-based compensatory strategy in which the participant (in this case high IQ schizophrenic patients) compare the contextual reality of the given story with the literal meaning. When an irony story appears and when such a mechanism is used the two representations collide so that the participant turns the literal meaning into the opposite meaning. This is a very good hypothesis proposed by Mazza et al. (2008), especially for their needs since in the implicature task they found ToM deficits irrespectively from IQ. This can be explained because in the implicature task one cannot turn to the opposite meaning, one has to really understand the other’s mental states and intentions in order to understand the implied meaning and derive the implicature. For the metaphor condition an example for the conventional is “someone is a rabbit” (running fast), and for the unconventional “someone is like a ship without a captain” (someone cannot decide). They found that participants did not show difficulties in conventional metaphors. However, regarding unconventional metaphors, the high IQ group performed like the CG whereas the low IQ group was significantly worse. This may be due to the fact that conventional metaphors are used more often and so participants were more familiar with them. Unconventional metaphors on the other hand are more demanding.

They generally in line with all previous findings presented here, namely that schizophrenic patients display pragmatic deficits. By adding the high and low IQ factor they have some very interesting findings about what good neuro-cognitive factors can tell us about non-literal language processing. However, they note that a bigger sample of lower IQ schizophrenics, more metaphor tasks and a more homogenic sample regarding medication of the schizophrenic participants would be beneficial.

7.2.2 Theory of Mind and Schizophrenia

Langdon et al. (2006) tested 34 schizophrenics and their ToM skills using a nonverbal false belief picture sequencing task (Langdon & Coltheart, 1999). This test consisted of 16 stories of four types, the ToM false belief type and three control types namely logical reasoning, cause and effect comprehension and inhibitory control. The examiner presented cards and the participants

were asked to put the cards in the correct order. They found that schizophrenic patients, had deficits in false belief stories, cause and effect comprehension as well as inhibitory control. Strengthening their findings with another research Langdon & Ward (2009) tested 30 schizophrenic patients and 26 controls on a ToM battery. This battery consisted of the non-verbal sequencing tasks as described above, the joke appreciation task based on Happé (1999) and a verbal story comprehension task designed by Happé (1994). The joke appreciation task is partly non-verbal (test stimuli) and partly verbal (participant's response). In this task the participants looked at a video cartoon story and then were asked to describe the joke. The last test, namely the verbal story comprehension had the following setup. The participants were presented with 16 written stories, each one at a time, eight ToM stories and eight physical stories. After they read the story they turned the page and read a written question about the character's motives, which they had to answer. Schizophrenics performed, as expected, worse than controls in all three tests. They also found a strong correlation between the FB and the joke appreciation tasks, whereas no correlation was found between these task and the verbal comprehension task. These findings suggest that the verbal comprehension task may need another ToM capacity, however, more research is needed in order to draw a conclusion.

Konstantakopoulos et al. (2014) conducted a research testing 58 schizophrenic patients and 56 controls in their theory of mind abilities, using a verbal false belief task (Frith and Cornoran, 1996), a hinting task (Corcoran et al. 1995) and a faux pas recognition task (Stone et al. 1998). The first two tasks have been described in this paper. The faux pas recognition task consisted of 20 stories, 10 of them containing a social faux pas and 10 of them were control stories. As an example of a faux pas story, girl A has birthday and two days and girl B is throwing her a surprise party, one night before A's party A spills coffee on B's dress, then B says "oh no! I wanted to wear it at your party". The examiner then asks the participant if someone said something she/he should not say, what it was and why. They found that schizophrenic patients perform worse than controls in all tasks with more difficulties in the false belief and hinting tasks.

More evidence for ToM abilities in schizophrenia concerning the Hinting task comes from Varga et al. (2014). *Varga et al.'s (2014)* work has already been mentioned above concerning pragmatic abilities in schizophrenia and they describe how they tested ToM abilities by using ToM implicatures. Their findings are in line with previous ones, namely that people with schizophrenia perform worse than controls. Moreover, they found that ToM implicature processing depends on IQ since the high IQ group performed better than the low IQ group. Research on ToM and

schizophrenia is very rich. The papers presented above are some of the most popular new papers regarding schizophrenia and ToM abilities and are in line with previous studies.

Since literature is so rich on this topic, Bora et al. (2009) did a metaanalysis of previous studies on ToM and schizophrenia. They collected 36 studies that met their inclusion criteria and compared different ToM tasks. These tasks were false belief tasks, hinting task, faux pas recognition task and the “Eyes-task” (Baron-Cohen, 1997). The only task that hasn’t been mentioned until now is the “Eyes-task” in which the participants are presented with pictures of another’s eyes and they have to recognize their mental states.

Their results show that indeed schizophrenic patients perform worse in total compared to controls. Moreover they seem to be more impaired in the FB and hinting tasks and regarding FB tasks they face more difficulties in second-order false belief tasks. Furthermore, their results show that in FB and hinting tasks the answers are heterogeneous, whereas in the “Eyes-task” the answers are more homogenous.

7.3 Right Hemisphere Damage

7.3.1 Pragmatics and Right Hemisphere Damage

Right hemisphere research gained focus in the 60’s and since then a lot of research has been done investigating language, cognitive and behavioral abilities in patients after a right hemisphere damage. Findings suggest that RHD can lead to pragmatic impairment affecting metaphor, irony, sarcasm, implicature, idiom, indirect speech acts and humor comprehension. Under this subchapter inferential processing and metaphor comprehension will be discussed.

Kasher et al. (1999) tested patients with LHD and RHD on verbal and nonverbal implicature processing. Their material procedures and findings about LHD patients have been discussed throughout this paper. They tested 27 patients with LHD from which 24 completed the whole implicature battery. They found that generally identification (literal meaning) of implicatures is easier than solution of implicatures for RHD as well as for LHD patients. And that patients with RHD perform better on the verbal implicature tasks than LHD patients, while the type of implicature does not seem to affect their performance.

Continuing with research on implicatures as well as the comparison between inferential skills in RHD and LHD patients *Hatta et al.* (2004) has some interesting findings. They conducted a research testing indirect refusals and indirect requests in 20 LHD and 20 RHD patients. They used a computer based test, a Four Scenes test designed by Hasegawa et al. (2000) and Nomura & Hatta (1998). Although they included LHD patients in this test, they do not give information about their aphasia status, thus, this paper is not included in the chapter 7.1. In their study, the participants were presented via computer a total of 16 comic strip stories, each story consisting of four pictures depicting two figures and speech bubbles including their dialogues. After the story presentation the examiner read three alternative intentions the character could have, these alternatives were also visually presented. Moreover, under the three alternatives a literal meaning, an unrelated utterance and a connotation of refusal or request were presented.

An example of an indirect refusal would be:

“Two friends are hanging out, A asks B what time it is, B answers that it is one forty, A responded that he has to meet a friend (Naomi) at the station at two o’ clock and asks B if he could drive him to the station, B says that the station is five minutes away even on foot. The question following this story was:

“What’s the intention of this boy?”

A: He meets Naomi at the station (unrelated)

B: Do not want to lift him to the station (connotation of refusal)

C: He can meet Naomi even by the walk (literal)” (Hatta et al. 2004:671)

The indirect request had the same setup except that instead of the refusal implicature it involved an implicature of request. Their findings show that both LHD and RHD groups have difficulties and perform worse than the controls. Moreover, regarding the indirect refusal condition both groups performed worse than in the request condition with LHD patients being more impaired than RHD patients, whereas for the indirect request condition both groups display similar difficulties. However, the example given for the indirect refusal seems to face some limitation. First of all there are two boys taking part in the story and the experimenter asks “what is the intention of this boy?” so the participant first of all has to understand, which boy is meant. Scientist may understand that only one boy in this experiment has an intention, specifically the intention to communicate something not explicitly said, namely the connotation of refusal. However, for the participant this might not be so clear since intention, according to Cambridge

Dictionary (2017), means something that you want and plan to do. Thus, when the experimenter asks what the intention of the boy is, the participant may answer according to the intention of A. A's intention is to meet Naomi. Meeting Naomi is characterized as the unrelated answer, although it may be a possible answer if the participant gets confused. A second problematic part is that the unrelated answer includes a character of the story. According to my point of view it would be clearer and easier if they used another name, thus making it completely unrelated.

Although a lot of papers compared LHD and RHD pragmatic skills, others focus more on RHD patients. *Orjada et al. (2007)* tested implicatures with and without context according to their enriched and minimal meaning in 7 RHD patients and 16 controls. For an utterance like "I had breakfast" the enriched meaning would be "today", whereas the minimal meaning would be "someday". In order to test it they conducted two experiments, the first one including implicatures without context. In the first experiment the participants were presented with an audio recording of an utterance in the form of "It is raining. Where? Here or somewhere?" and were asked to answer where they thought it was raining. The second experiment was conducted in order to see if context changes the implicature processing, thus, participants were presented with two types of stories for each stimulus. The one story prompted the enriched meaning, whereas the other the minimal meaning. Their results in the first experiment show that three RHD participants were favoring the minimal meaning of the implicature, without context. In the second experiment three participants used the context information in order to derive the enriched implicature whereas the rest did not. However, their sample is quite small especially when comparing it with samples of other research, thus their findings need to be strengthened by further research or by testing more RHD patients.

Fornachari Ribeiro and her colleagues (2015) tested 50 patients with RHD and 75 controls in their inferential abilities using the "300 Exercises of Comprehension of Logical and pragmatic Inferences and Causal Chains". From this instrument they used the 13 pictorial stimuli leaving the 287 verbal text stimuli out. The participants were presented with a picture representing a scene after which they were presented with other pictures, one being the target picture, and were asked to choose the most suitable one. For example, first the participants looked at a picture with a boy and his mother in which the boy cried because of its toothache. After that the participants looked at a number of pictures (not given in the paper) and one of them was the target picture depicting the mother going with her son to the dentist. During the test the participants should understand the logical inferences and the pragmatic inference. For the first

step they got one point, for both they got two points and for no comprehension they got zero points. Their results are in line with the general argumentation that RHD leads to pragmatic impairment. They found that patients with RHD display difficulties in their logical and pragmatic inferential ability. Moreover, they divided their RHD group according to their lesion in the brain, but did not find any correlation between lesion type and inferential skill.

Moving away from inferential skills to metaphor and sarcasm the papers by Giora et al. (2000), Rinaldi et al. (2004) and Shamay-Tsoory (2005) will be discussed. These papers, are selected, not only because they are broadly discussed in literature, but also because they have an interesting connection. Although the papers by Giora et al. (2000) and Rinaldi et al. (2004) do not agree, Shamay-Tsoory (2005) sheds more light on their arguments by strengthening the findings by Giora and her colleagues (2000).

Giora's and colleagues experiment (2000) has already been described (see chapter 7.1.1) in which they tested 27 patients with RHD and 31 with LHD as well as 21 healthy controls. They found that RHD patients perform worse than the other groups in sarcasm comprehension whereas in metaphor comprehension they perform like the control group.

Contrary to their findings, *Rinaldi and her colleagues* (2004) tested 50 RHD patients and 38 controls in metaphor comprehension. They used a visuo-verbal and a verbal test. The visuo-verbal test consisted of 20 sentences with a metaphorical meaning and four pictures for each sentence. The participants listened to a sentence and then they were presented with four pictures, one being the metaphorical target meaning. The test was conducted in Italian, thus the translated meaning is given here, e.g., “a man is big as a shot”, this metaphor was presented with an extra clue prompting the metaphorical meaning, and namely “the man was very respected because he was a big shot”, (Rinaldi et al. 2004:481) meaning he is important and powerful. The pictures matching to this sentence were:

- Metaphorical (target) meaning: a man wearing a suit, getting out of a car while a guy opens the car door for him
- Literal meaning: a very fat man on a scale
- False metaphorical meaning: an athlete on the 1st place of a podium
- False literal meaning: a tall guy standing between two shorter guys

Regarding the verbal part, the participants were presented with a card that had a sentence with a metaphorical meaning on it. Moreover, after the experimenter read the sentence, the participants were presented with three alternatives. The participants should choose the most suitable meaning for the presented metaphor. For example, the written sentence was “in his son’s letter the father read between the lines for help” (Rinaldi et al. 2004: 490).

The given answers were:

- Metaphorical (target) meaning: The father understood that his child needs help
- Literal meaning: between two lines the father saw an explicit written request of help
- False control meaning: the father asked someone to help him read the letter

They found that RHD patients perform worse than controls in both tests and tend to choose the literal meaning more than the other alternatives in the visuo-verbal test. Moreover, in the visuo-verbal test RHD patients answered correctly about half the time with their most frequent error being the selection of the literal meaning. Regarding the verbal test, RHD patients performed much better than in the visuo-verbal test. Their error type was again the selection of the literal, but also with a very similar frequency the selection of control responses. These findings may be an evidence that pure linguistic stimuli are better processed by RHD patients than visual stimuli or the combination of linguistic and verbal stimuli. However, someone cannot come to a general conclusion since more evidence is needed in order to verify this assumption.

Shamay-Tsoory et al. (2005) shed more light on one part of Giora’s and her colleagues research (2000) by testing 41 RHD patients and 17 controls in their sarcasm comprehension skills. They divided the RHD group into two groups according to their brain lesion, 25 RHD patients with prefrontal damage and 16 RHD patients with posterior damage. They used a test designed by Ackerman (1981) consisting of 16 stimuli. The participants were presented with an auditory short story in two versions, one sarcastic and enriched with intonation and one neutral literal version with no enriched intonation. For example, a sarcastic version of a story could be in the form of: “A is going to work and he is just chilling. His boss turns to him and tells him, ‘don’t be such a hard worker’ ”. The neutral version of this story changes in the fact that instead of chilling around A is working and his bosses’ utterance is without enriched intonation. After the story presentation, the participants are asked two questions, one about the story comprehension, in this case if A worked hard and one about the meaning of the bosses’ utterance, in this case if the boss thinks A is a hard worker. They found that patients with posterior damage performed as

controls did, whereas participants with prefrontal damage had a high percentage of wrong answers in the sarcasm condition. Their study included some participants with bilateral or left frontal or prefrontal damage and suggests that participants with right prefrontal damage perform worse than participants with left prefrontal damage and left posterior damage, whereas the bilateral damage seems to have the same effect on sarcasm understanding as the right prefrontal damage has.

7.3.2 Theory of Mind and Right Hemisphere Damage

Patients after a right hemisphere damage may display ToM impairments. These impairments have been broadly investigated through the past years. Due to the big literature on ToM and RHD this chapter will present findings on ToM skills of RHD patients concerning false belief and faux pas tasks. Regarding ToM testing by using a faux pas task, the paper by Shamay-Tsoory et al. (2005) will be discussed. As already mentioned they tested right hemisphere damaged patients, dividing them into two groups according to their brain lesion localization. The faux pas test had the same setup as described in chapter 7.2.2, with the difference that the examiner, after presenting, the story auditory and written, asked the participants if and who said something inappropriate, why he or she said it and why he or she should not have said it. They also used a control comprehension of the story question like where the characters location was while the conversation took place. They found that participants with posterior damage were better than participants with prefrontal damage, although both groups were worse than controls. Moreover, contrary to their findings about sarcasm, they found that the hemisphere does not seem to interfere with the participants' ToM ability since no difference was found between right and left hemisphere damage.

Champagne-Lavau & Joannette (2009) tested 15 RHD and 15 controls in their ToM abilities using a false belief task. The participants were asked to read aloud given stories (20 in total) and as a next step to answer three questions. Questions regarding their inferential skill (Inf-Q), mental state attribution skill (Ment-Q) and a control comprehension question (Fact-Q) were asked. They used two kinds of false belief stories, namely first- and second- order false belief stories. An example of these stories and their differences is presented below:

“First-order ToM. For the Halloween party, Marie disguises herself as a witch with a dress and a black pointy hat. She meets her friend Isabelle and takes her hat off so Isabelle will recognize her. A child dressed as a ghost appears behind Marie where Marie can’t see him. Isabelle screams in terror. Marie then tells her, “Don’t worry, it’s me, Marie.” Ment-Q: *Why does Marie say this to Isabelle?*

Scoring example: Because she believes that Isabelle is afraid of her (2 pts); because she thinks that Isabelle does not recognize her (1pt).

Fact-Q: What is Marie dressed as?

Inf-Q: Why is Isabelle screaming?

Second-order ToM. Paul has invited Simon to play at his home. Simon is clumsy. He often breaks his friends’ toys. They go to Paul’s bedroom. A truck is broken, but Paul does not know it. When Paul picks up the truck, Simon says, “It wasn’t me who broke the truck.”

Ment-Q: Why does Simon say this to Paul?

Scoring example: Because he thinks that Paul believes he has broken the truck (2 pts); because they know that when Simon is here, he always breaks toys (1pt).

Fact-Q: Which child is clumsy?

Inf-Q: Whose toys are they?” (Champagne-Lavau & Joannette, 2009:425)

As expected, RHD participants performed worse than controls. They also observed if the type of question and story have an effect on their performance.

Regarding the first- order false belief task, RHD participants had more difficulties answering Ment-Q, followed by Inf-Q, whereas in the Fact-Q they did not seem to face difficulties. Moving on to the second- order false belief stories, they exhibit more difficulties answering the Ment-Q compared to first- order false belief stories. However, they do not seem to face difficulties in the Inf-Q as well as in the Fact-Q.

However, it must be mentioned that this test is of very high linguistic complexity, which is verified by the controls performance. Controls failed to answer correctly 30% for the Ment-Q in first-order, while in the second order this percentage rises up to almost 50%. Considering this fact, RHD participants had a 15% difference with controls. This percentage is not something insignificant and the linguistic complexity used by them may be a factor that does not allow us to see a bigger difference between the two groups.

Balaban et al. (2016) conducted a very interesting research investigating ToM abilities in 25 RHD patients and 14 controls using 8 different ToM tasks. They named this battery the aToMia battery and it consisted of the following tasks, first- and second- order false belief, faux pas, knowledge gaps, instruction, empathy, surprise and a cartoon story. For the needs of this paper the cartoon story they used (see chapter 2.3) and the findings on respect on these tasks will be discussed.

They found that although some of the RHD participants did not differ from the controls (TOMer participants) their total performance regardless of the task was poorer than the one of controls. Their false belief performance is in good levels with the first-order being better than the second-order. In the cartoon story they had the most difficulties compared to all other tasks. This strengthens Cutica et al.'s (2006) findings, which argue that the visual factor may negatively influence the performance on RHD participants. They also strengthen Champagne-Lavau's & Joannettes's (2009) findings, that mental state comprehension in second-order belief tasks is more impaired than first-order. However, comparing these two papers they disagree on the control group findings. Balaban et al. (2016), found a 96% of correct responses for CG whereas Champagne-Lavau & Joannette (2009) only slightly over 50%, which may be, as already mentioned, due to their complex text.

7. 4 Summary

To sum up research has shown that all the above language disorders display pragmatic and ToM deficits. Specifically implicature understanding has been found to be impaired in LHD and RHD patients (Kasher et al., 1999, Orjada et al., 2007) as well as in schizophrenia (Corcoran et al., 1999, Tenyi et al., 2002, Varga et al., 2014). These conditions have also been investigated concerning their ToM abilities in varying depth. Schizophrenia and RHD patients have been closely studied, thus, a plethora of findings in different ToM tasks exists. All of them suggest that these conditions display ToM impairments. RHD patients have difficulties successfully answering to false belief and faux pas tasks (Shamay-Tsoory et al. 2014, Champagne-Lavau & Joannette, 2009) and schizophrenic patients on false belief tasks and hinting tasks (Varga et al., 2014, Rowena et al., 2015). On the other hand, a very limited amount of findings on LHD patients with Aphasia argue that Aphasic patients display ToM impairment in false belief reasoning (Apperly et al., 2004, Samson et al., 2004). The initial idea of this paper was to strengthen the argument of a connection between pragmatics and ToM. The path this paper took was focusing on the

behavioral connection of these abilities and investigating adult language disorders. Since in schizophrenic and RHD patients, impairments in both skills are, if I am aloud to say, unquestionable, considering the amount of research, in Aphasia the connection is still blurry.

Thus, this paper aims to propose an experiment that, when conducted, will hopefully shed more light on Aphasia and its ToM and pragmatics. As Samson et al. (2004) argued the left TPJ is necessary for mental state processing. Since Wernicke's Aphasia is an acquired language disorder due to a left TPJ brain damage, it is hard to believe that patients with Wernicke's Aphasia will not exhibit ToM deficits. Kasher et al. (1999) argued that the left hemisphere might have a general "implicature processor". Thus, ToM and pragmatic abilities have been localized in the left hemisphere. For these reasons, I find Aphasia a very interesting condition for investigating the connection between ToM and pragmatic abilities. Since Apperly et al. (2004) and Samson et al. (2004) found ToM deficits in Aphasic patients using a false belief task, this task will be preferred in the proposed experiment. On the theoretical connection between theory of mind and pragmatics, intentions played a big role. Thus, implicatures could not be missing from this experimental proposal since they build on understanding intentions. Except from implicatures, sarcasm understanding will also be investigated in order to see if sarcasm comprehension is also linked with ToM impairments and if it is not impaired the "reality-based shortcut strategy" will be strengthened.

All tasks will be of "non-verbal" nature, meaning that very little language will be involved. As I already mentioned under chapter 2.3, a "non-verbal" tasks in this paper is defined when the material does not include verbal language and the participant does not have to answer verbally. However, the experimenter will present verbal information as well as verbally ask the person questions using simplified and a little language.

8. Experimental Proposal

Theory of Mind and pragmatic interface can be investigated on three levels. When arguing about the interface of these skills one should take into consideration the theoretical level, the behavioral level and the interface between those levels. In other words, a scientific research should examine the connection of the theoretical framework of ToM and pragmatics via

connecting a ToM and a clinical cognitive pragmatic theory. On the behavioral level, one should design an experiment, choosing tasks and justifying the interface between those tasks. The third level is to connect a ToM theory with a ToM task as well as a pragmatic theory with a pragmatic task.

Investigating all these levels is a challenge since it requires a highly advanced knowledge on this topic. However, it would be very interesting at some point to see a work incorporating all these levels since then the argument of connecting theory of mind and pragmatics would be strengthened from all points.

This thesis will propose suitable tasks arguing the reasons of this selection. However, taking into consideration the space limit as well as personal interests and qualifications, this paper will focus on the behavioral connection of ToM and pragmatic tasks. The level of connecting theoretical frameworks of theory of mind and pragmatics as well as the theoretical framework with a specific task is a very complicated topic, which would need a large and in depth discussion and argumentation thus, this level is not being discussed in this thesis, although it would be very beneficial in further work.

The goal of this experimental proposal is to strengthen the argument of a connection between ToM and pragmatics. For the theory of Mind investigation a false belief task is proposed, whereas for the investigation of pragmatic abilities an irony and implicature task is proposed.

The hypothesis is that if a person has a ToM impairment he or she will also have a pragmatic impairment. If a person has an impairment on deriving implicatures it will be expected that he or she will fail the ToM task. This hypothesis arises from the fact that, as argued throughout the paper, ToM ability is essential for deriving implicatures.

In this chapter, after having discussed in varying depth theory of Mind and pragmatics on a theoretical and behavioral level, a design of an experiment testing these abilities will be proposed. As we can see from previous chapters, ToM and pragmatic skills seem to be impaired simultaneously in various disorders. However, in Aphasia it is strongly argued that this is not the case (Varley & Siegal, 2000, Stuss et al., 2001, Suria & Siegal, 2001), except the work by Apperly et al. (2004) and Samson et al. (2004).

The idea to focus on Aphasia was due to the fact that, literature has already argued and is leaning more and more towards the account that ToM and pragmatics are connected. However, although this link is evident in various language disorders, in Aphasia opinions conflict. This may

be firstly because of the lack of literature on ToM in aphasia when compared to other language disorders. Moreover, the lack on experimental design as well as on the type of Aphasia each experimenter investigated in the past may have influenced the results, thus being insignificant.

For the experimental design patients with Wernicke's Aphasia after a brain damage in the LTPJ will be under investigation since this type of Aphasia displays comprehension impairment. Wernicke's area is in the TPJ junction which has been argued to be activated in pragmatic as well as ToM tasks. Thus, it is more accurate to mention that this experiment will focus on Aphasic patients with a brain damage in the left TPJ.

The proposed experiment will include a ToM task as well as a pragmatic task. In the following subchapters the design and material of these tests will be described as well as the reasons why these tasks are suitable for Aphasic patients with a brain damage in the TPJ.

8.1 Theory of Mind Task

Throughout this paper, various non-verbal or limited language tests have been described. Although the more the merrier, not all of them can be investigated. Thus, the proposed experiment will limit itself on one theory of mind task. This task will be a first-order false belief test. This selection is due to the fact that since literature in Aphasia has shown that ToM ability is good preserved the test used should be of some complexity. First order false belief tasks require a higher ToM ability compared to other tests like mental state comprehension, but not as complex as a second order false belief tasks. Furthermore, taking into consideration previous findings arguing the existence of ToM deficits in patients with Aphasia, Apperly et al. (2004) and Samson et al. (2004) used a false belief task. Thus, this experimental proposal aims to strengthen their findings and maybe shed more light on this deficit. False belief tasks have been adapted and investigated using an eye-tracker. This experiment proposes a non-verbal first-order false belief task using an eye-tracker for the reasons described below.

At this point I want to go back to an experiment, briefly mentioned under the non-verbal ToM test, by Senju et al. (2009). In their experiment they used a false belief test and an eye-tracker. In the research field ToM has been broadly investigated, however, the spontaneous and implicit ToM is a newcomer in the research field and may be beneficial in order to investigate ToM in clinical populations. Senju et al. (2009) were the first using an eye-tracker and an implicit ToM

tasks. They tested a control group and patients with Asperger syndrome in explicit and implicit ToM tasks. In the explicit ToM they explicitly, verbally, asked the participants to answer the question where the character would look for the treasured object and both groups answered correctly. In the implicit ToM part of the test, using an eye-tracker the participants were presented with a video of a first-order false belief story. This part did not include language at all and the only thing under investigation was the participant's eye movements. This step revealed the big difference between controls and patients with Asperger syndrome display. The CG's eye movements showed anticipation of the location the character would look for the object, thus revealing implicit ToM ability. On the other hand, patients with Asperger syndrome showed significantly less anticipation. Their results suggest that when explicitly asked, patients with Asperger syndrome and controls do not seem to differ on their ToM abilities. However, their spontaneous mentalizing ability seems to be very different, showing impairment in patients with Asperger syndrome.

In Aphasia, concerning my personal knowledge, the implicit ability of ToM has never been investigated. Except the work of Apperly et al. (2004) and Samson et al. (2004), literature is against the claim that Aphasia includes as a characteristic a ToM impairment.

However, even if this is the case, using an eye-tracker in a false belief test would shed more light on Aphasic patients ToM ability. It may be the case that when explicitly asked they answer correctly but their spontaneous mentalizing ability may have a different profile as that of healthy controls. However, it can also be the case than when explicitly asked they answer incorrectly but their implicit theory of mind does not deviate from that of the control group. Lastly, it might also be the case that their implicit as well as explicit ToM ability is different from the one of the control group. The implicit part of ToM can be characterized as a strictly non-verbal test since Senju et al. (2009) do not mention any verbal interaction between the participant and the examiner in this part of the test. The explicit ToM will also shed more light on the investigation of ToM abilities in Aphasia since this experiment focus on Aphasia after a brain damage in the TPJ. Some of the previous papers about ToM abilities and Aphasia do not mention much about the exact brain location of the damage or do not take strictly Aphasic patients with a brain damage in the TPJ. Thus, connecting explicit and implicit ToM with a specific type of Aphasia may give us more insights about ToM ability in this specific type of Aphasia.

The ToM task used will be a non-verbal first-order false belief tasks, including an adaptation of the Sally-Anne test (Baron-Cohen et al., 1985). The test will include five videos with the same setup as (and including) an adapted (non-verbal) version of the Sally-Anne first order false belief task (see Appendix 1.). These videos will match the level of difficulty as well as the length of each story. After the participants watched the video, three pictures will be presented. For example, considering the Sally-Anne story, the picture presented will be one with the correct answer (Sally looks in the basket), one picture depicting Sally looking in the Box and one irrelevant picture Sally looking at the floor. The examiner then will ask the participant: “Where will Sally look for her marble?” and the participant will have to point at the correct picture.

Participants will sit in front of a screen-based eye-tracker throughout the procedure in order for their eye movements and fixations to be observed and maybe telling us more about their implicit as well as explicit theory of mind skills. Although Senju et al. (2009) focused on the implicit part of the false belief test, this test will provide information of both implicit and explicit theory of mind. On the one hand one can see their implicit ToM, investigating if the procedure to the correct answer is the same as that of controls via eye fixations. On the other hand, it will be tested if patients with Aphasia after a brain damage in the TPJ face difficulties on their explicit ToM, which is choosing the correct answer at the end, thus, strengthening Apperly et al.’s (2004) and Samson et al.’s (2004) findings.

8.2 Pragmatic Task

Concerning limited-verbal pragmatic tests, irony and implicatures have been investigated. Metaphor as already mentioned in this paper has not been investigated via a “non-verbal” test, up to my knowledge. However, for the needs of this paper metaphor is not so important since an implicature and an irony test will we proposed. Metaphor is not so important, due to the fact that implicature understanding is strongly argued to include a ToM ability, whereas irony may also work ToM free, considering the “reality-based shortcut strategy”. Thus, investigating metaphor is not of vital importance since the experiment will include two pragmatic tests, one needing ToM and one working also as ToM free. Metaphor understanding would be beneficial in order to drive to more conclusions.

My personal opinion is that a test should not be too long since participants might get tired throughout the test, which can influence the results. Moreover, if the test is too long and needs more appointments with the participants, it might be the case that some participants will not continue through the whole process, thus, being risky to lose them, leading to a smaller sample. Since the test for the above reasons should not be too long and since there is no known non-verbal metaphor test in the literature, metaphor can be excluded from this procedure.

The pragmatic part of the test will consist of three different parts, namely, the comprehension task which does not need ToM, the implicature task and the irony task.

Comprehension task

The idea for the comprehension test is an adaptation from the material proposed by Tenyi et al. (2002). The setup will be a short video story.

The adaptation aims to create a non-verbal test for measuring comprehension of a story without implicatures.

Participants will be presented with five stories, following the plot by Tenyi et al.'s (2002) test and being adapted on the visual cue at the end, in which three pictures are presented (see Appendix 2. for one of the stories used by Tenyi et al. (2002)). The failure of this task may imply some deficits in the video story comprehension level which would be interesting to be linked with their theory of mind and pragmatic abilities.

Implicature task

For the implicature test the test used by Cutica et al. (2006) would be beneficial (see Appendix 3. for one of their stories). This test has already been described under the non-verbal pragmatic tests. The test has the same setup as the one proposed above since the participants are asked to choose one of the alternative pictures presented.

The implicature task may need a ToM ability being crucial for the connection between ToM and pragmatics. Thus, the expected results would be that if someone faces difficulties on the ToM task he or she should also face difficulties in the implicature task. Varga et al. (2014) claim that control comprehension tasks are used because they do not require an implicature, thus, ToM.

Considering this claim we expect the connection of implicatures and ToM, thus this task should show a connection with the ToM task.

Irony task

For the irony test again the test used by Cutica et al. (2006) would be beneficial since it has already been used and showed significant results. This test has the same set up as the other tests, namely the participants are asked to choose one of the given pictures as the most suitable one for the end or the meaning of the story (see Appendix 4. for an example given by Cutica et al. (2006)). This test, is of special interest considering the proposed “reality-based shortcut strategy” by Györi et al.(2004). As mentioned above this is a ToMfree compensatory strategy. Due to this strategy the participants are able to transform the literal meaning into the opposite meaning. Moreover, taking into consideration this mechanism we can divide the pragmatic task into ToM and ToM free. However, such a generalization, namely that irony does not need a ToM, cannot be drawn since the “reality-based shortcut strategy” has not been investigated in so much depth and especially not, if not at all, in Aphasia. Thus, the results will speak for or against it, concerning Aphasia.

8.3 Methods

Regarding the participants, patients with Wernicke’s Aphasia will be chosen with a brain damage in the TPJ. Moreover, a healthy control group matching in age and IQ would be preferred. It is important to note here that it is hard to find a large population of Aphasic patients matching in age, brain damage, post onset time and rehabilitation time. Thus, these factors cannot be as strict as for the control group and some differences will exist between all participants. However, some inclusion criteria have to be drawn in order to have significant results. These are:

- First occurrence of a brain damage. Through the brain plasticity, participants should not have too long difference on their brain damage occurrence since this follows with more rehabilitation time, thus, influencing their language abilities
- Absence of any mental disorder and/or chronic disease. Another mental disorder and/or chronic disease, like for example Schizophrenia or Alzheimer respectively, may influence the

results. This paper proposes a focus on Wernicke's Aphasia after a TPJ brain damage, thus, any participant with any other disorder that might influence the results should be excluded

- Stable clinical and metabolic state in order for their answers to be more accurate. If they are not stable, their answers may differ from day to day, which may be an influential factor for the results
- Absence of visual loss. Since the tasks present visual stimuli, a participant with visual loss will not be able to see and consequently be unable to point at the correct image.
- Brain damage in the TPJ
- Diagnosed Wernicke's Aphasia since a brain damage does not necessarily lead to Aphasia

Furthermore, since the materials used will be based on visual stories, the Raven's Colored Progressive Matrices (RCPM) and specifically its visual memory part will be used in order to exclude participants displaying impairments in this task. This test is being chosen for this research since it is a fast, easy to administrate and broadly used test (Pueyo et al., 2008).

A visuo perceptive test will be administered in order to make sure that all participants can follow all object movements on a screen. This test was also used in the experiment designed by Cutica et al. (2006). The participants are asked to look at the screen and watch objects moving according to physical causality.

8.4 Procedure and Material

Participants will be presented with a total of 20 stories, five stories for each task, namely the theory of mind task, comprehension task, implicature task and irony task.

The participants will be asked to sit in front of a computer and watch a series of short videos on the screen. The test will be administered one week after the examination test that qualifies the participants to take part in the experiment.

Before moving forward to the experiment, participants will have a short training session in order to understand what they have to do. The experimenter will present videos including communication acts. After the presentation of the story 3 pictures will be displayed on the screen and the participant will be asked to choose the act which the actor wants to communicate.

This training session will use different stories from these in the experiment. Participants will watch three videos presenting a communicative act. Through this small amount of videos and the short training it is not very likely that participants will be actually trained on the experimental tasks. The training will work more as an introduction and presentation of the study. Thus, the training session is not likely to influence the results in a significant level. In order to see if such a short training session may influence results it would be beneficial to compare groups with and without training. This comparison has not been considered in this study, since it is already a big study investigating the connection between pragmatics and theory of mind and not the influence of a short training.

Participants will not undergo a specific training session for each task, they will be administered to a training session presenting communicative acts since in all tasks the actor has the intention of doing something. In the Theory of Mind part he or she will look somewhere and in the implicature as well as in the irony task the actor wants to communicate an act.

During the experimental procedure the participants will be in a quiet room looking at a computer screen. The videos will be presented in a random order. Moreover, the pictures presented after the story will also be organized so that there will not be a response bias. This means that the correct picture will not be for example, always or often the second picture.

No test session will last more than 35-40 minutes since after this time participant may be tired, thus answers may be influenced. Participants will not be asked to explain why they chose the specific answer and they will not have a time limit to answer.

Theory of Mind task

In favor of the eye tracking experiment, since anticipatory look is being measured, the participants will undergo some familiarization trials in order to see if they display correct anticipatory eye movements towards the correct location. The familiarization trials used by Senju et al. (2009) will be used in this experiment too.

For the theory of mind test the participants will be in front of a computer screen, the computer screen of the eye-tracker. The procedure will be followed as in Senju et al. (2009), although a further step will be asked. The participants after the story will be presented with three alternative pictures and will be asked to choose one of them. The pictures will be depicting where the character will look for the treasured object. This step will help us to understand the

differences between the implicit and spontaneous and the explicit ToM as well as to see if the participants can successfully pass the ToM test. For the test an example of the story would be the Sally Anne test as already described in this paper.

For the first part of the first order false belief test the anticipatory looks towards the location of the treasured object will be measured. In this case, the anticipatory looks will be measured at the point where Sally enters for the second time the room and is looking for the treasured object. If the participants look at the basket it will reveal a spontaneous, implicit ToM ability. In contrast, if the participant's eye movements will focus on the box, it will be revealed that they lack a spontaneous ToM ability.

For the second part of the test, regarding the explicit ToM ability, the participants after watching the video will be presented with three pictures. In this case, Sally looking for the treasured object in the box, Sally looking for the treasured object in the basket and lastly Sally eating a cookie. The participants are asked to choose the point at the suitable picture, depicting the end of the story. If the participants choose the first alternative it will reveal a ToM ability, if they choose the second it will reveal an absence of ToM ability. The third picture has nothing to do with the story, thus, it will be hypothesized that they did not comprehend the task. If participants point to the last picture, it would be interesting to compare their theory of mind and comprehension task results in order to see if there is a connection.

Pragmatic task

For the pragmatic task the participants will be presented the stories in front of a computer screen. After the story ends the last scene of the story will be depicted. After the presentation of the last scene, they will be presented with four alternatives, one of them being the target picture depicting the communicative act the actor wants to communicate. For the irony as well as for the comprehension task the same material and method as used by Cutica et al. (2006) will be used (see Appendix 3. and 4. respectively). The participants will be presented with a story and after the story three pictures will be presented. The participants are then asked to choose the most suitable picture. The most suitable picture depicts what the story character wants to communicate.

9. Expected Results

The experimental design was constructed having in mind some specific outputs that will shed more light on the investigation of theory of mind and pragmatic skills in Aphasia, as well as on the connection of those skills. Previously the reasons of choosing these tasks was described and in this chapter the expected results will analyzed. Moreover, the claim of this research is that ToM and pragmatic skills are connected. Thus, the most significant expected result is that if someone has an impairment on the ToM task he or she will also show an impairment on the implicature pragmatic task if not also on the irony task. As already mentioned the irony task might not require a ToM skill so it is not necessary considered for the link of one's ToM and Pragmatic abilities. However, it is taken under consideration in order to strengthen findings about ToM involvement in irony tasks. Therefore, this experiment not only investigates ToM and pragmatic abilities in patients with Aphasia after a brain damage in the TPJ but also the connection between ToM skills and pragmatic skills.

- **Comprehension task**

The comprehension task may be also characterized like a “trap” task since patients with Wernicke's Aphasia display comprehension difficulties. But since the comprehension task may be a challenge for the Aphasic patients, a larger number of patients with Aphasia would be beneficial. The comprehension task is also a non-verbal task, thus, patients with Wernicke's aphasia may perform better than in a verbal task. Robson et al. (2010) investigated comprehension in patients with Wernicke's Aphasia and found that one third of the cases displayed a comprehension impairment. Thus, the expected result of this experiment is that some participants may fail the comprehension task but some will pass. One could argue that the failure of some participants is a desired result, since if no one fails in this task it may be supposed that it was too easy and did not correspond to the complexity of the following tasks. However, it is also kind of logical that the comprehension task will be less complex than the other tasks since the other tasks require more cognitive skills and logical thinking.

- **Theory of Mind task**

Regarding the explicit theory of mind test, previous research is controversial. Apperly et al. (2004) as well as Samson et al. (2004) argue that patients with Aphasia display theory of mind difficulties. They also used a false belief test, although not the Sally-Anne type of false belief. Nonetheless, this should not alter the results in this paper since as in Apperly et al. (2004) so the material used in this test is of a non-verbal false belief nature in order to minimize the influence complex language might have. They found that the patients with a damage in the left TPJ failed the false belief test. The proposed experiment has already argued why this type of Aphasia is under investigation, and the expected results are hypothesized to be in line with Apperly et al.'s (2004) results and strengthening their findings.

Since literature has not so much evidence that speaks in favor of a ToM deficit in Aphasia, the hypothesis that patients with Aphasia after a brain damage in the left TPJ display ToM deficits is not so strong.

Thus, this research makes a further step and investigates the implicit spontaneous ToM skills of these patients. If participants do not show any difficulty in their explicit ToM, evidence of their implicit ToM will benefit our understanding of participants' ToM skills.

However, since this has never before been investigated, it is very difficult to hypothesize what their eye fixation will reveal about their ToM processing. If the participants correctly respond to the explicit ToM task, it would be very interesting to investigate their fixations during the presentation of the video. Senju et al. (2009) examined the implicit spontaneous ToM in patients with Asperger's syndrome and found that although they do not exhibit an explicit ToM deficit their implicit ToM is different than that of the controls since their anticipatory looks do not reveal an anticipation to the correct answer.

Thus, it would be very interesting to see if patients with aphasia answer the explicit ToM task, correctly and if their anticipatory looks reveal an implicit ToM impairment but also vice versa. This means considering Apperly et al. (2004) and Samson et al. (2004), they suggest an explicit ToM impairment, and it would be very interesting to have a close look also on their implicit ToM. However, a hypothesis on this part of the test cannot be proposed since there is no previous evidence on that part.

- **Pragmatic tasks**

Regarding the pragmatic tasks a hypothesis about irony comprehension as well as implicature comprehension will be drawn. The irony comprehension task has been chosen due to the fact that previous research argues that it does not necessarily need a ToM ability. The implicature task has been chosen for the exact opposite reason (Varga et al., 2014). Thus, the implicature test will also shed more light into the question if the two skills, namely ToM and pragmatics, are connected.

- **Irony**

Taking into consideration Giora et al. (2006) who found that people with LHD, some of them with Aphasia, perform worse than controls and slightly worse than RHD patients, it could be hypothesized that in this experiment also, Aphasic patients will exhibit irony comprehension difficulties.

However, even if this is not the case, their un-impairment irony comprehension will strengthen arguments for the “reality-based shortcut strategy” by Györi et al. (2004).

- **Implicatures**

This paper, as mentioned earlier agrees with the argumentation seen in Varga et al. (2014), namely, that implicature derivation needs a ToM ability. Thus, the hypothesis on the implicature task, regarding Aphasic patients with a brain damage in their left TPJ is that they will exhibit difficulties on deriving implicatures, especially if they have impaired ToM.

Moreover, at this point the connection between ToM and pragmatics will be driven. Since this paper, claims that if there is a ToM deficit there will also be a pragmatic deficit and specifically on implicature derivation.

Literature, although not very rich at this topic, has shown that people with aphasia exhibit implicature understanding difficulties (Kasher et al. 1999, Cutica et al. 2006). These findings strengthen the current hypothesis of impaired implicature comprehension in Aphasia.

10. Conclusion

This thesis dealt with the connection between Theory of Mind and pragmatic abilities, considering a first-order false belief task regarding the Theory of Mind part and an implicature and irony comprehension task regarding pragmatics. The aim of this research is a better understanding of the two abilities in a clinical population, namely patients with Aphasia after a brain damage in the left TPJ.

In order to propose a connection between the two abilities, the thesis described a behavioral connection since this meets more my personal qualifications and interest. Another reason for focusing on the behavioral level is that in Aphasia research in this field is scarce and more evidence is beneficial. In order to argue about theoretical models one should also consider the behavioral level and findings, thus, considering the lack of information on both fields and in order to deal with theoretical models, background information on the behavioral level is of vital importance.

The connection between theory of mind and pragmatics on the behavioral level is argued via presenting adult language disorders, like Aphasia, Schizophrenia and Right Hemisphere Damaged patients, displaying impairments in both skills. Thus, a connection on the behavioral level can be seen since literature has repeatedly shown ToM and Pragmatic impairments in both groups. In Aphasia, although pragmatics is considered to be impaired, literature on ToM is controversial. Moreover, through the proposed study not only the impairment of the two skills, but also the connection of them is tested. Firstly, the experiment aims to investigate ToM and pragmatic abilities by testing participants on a ToM task and two pragmatic tasks. Secondly, it is argued that if a participant displays difficulties on the ToM task they will also display difficulties on the pragmatic test. This step will strengthen the claim that ToM and pragmatics are connected. More specifically, a lot of thought has been given in order to select the false belief task as well as the irony and implicature comprehension task. The false belief theory of mind task has been selected due to the fact that previous findings have found an impairment in this task on patients with Aphasia (Apperly et al. 2004, Samson et al. 2004). Moreover, the idea of testing implicit and explicit theory of Mind arises from the fact that, if participants do not show an impairment on this task their spontaneous ToM ability can be tested. Thus, even if they do not display the desired result (explicit ToM impairment) this research can investigate their

implicit theory of mind. This step has never been tested in Aphasia and will shed more light on how the processing of a Theory of Mind task in Aphasia looks like.

The pragmatic tasks is divided into two tasks, in order to see in more detail the connection between Theory of Mind and pragmatics. The irony task was selected in order to see if or not ToM is needed. If participants answer correctly, the proposal of the “reality-based shortcut strategy” by Györi et al. (2004) will be strengthened and if they answer wrong the connection between ToM and pragmatics will be strengthened. Regarding the implicature test and considering previous claims (Varga et al. 2014), it is argued that in order to derive an implicature theory of mind is needed. Thus, if participants show an impairment on implicature comprehension it will be supposed that they will also show a ToM impairment. By comparing the results of these three tasks the conclusion will be driven.

Theory of mind deals among others with the understanding of intentions and beliefs another person has and with the terms „self“ and „others. Pragmatics on the other hand deals with the functional use of language. Both skills, if impaired, will influence one’s life in a significant level since both skills play a big role on communication. Thus, if research links these two skills and understands more about where these two skills are connected, a better understanding of the impairment will be evident. This better understanding of an impairment might influence therapy and rehabilitation of patients with communication disorders like schizophrenia, Aphasia and RHD patients. Thus, not only science but also therapy like speech language therapy will benefit from this research.

The proposed experiment may meet some difficulties since a group of patients with Aphasia with a brain damage in the left TPJ and the proposed inclusion criteria may be very hard to find. Moreover, the test will also take place in more than one meetings, it may be the case that some patients will not continue, leading to a smaller sample.

However, the experiment proposes a good structure, arguing why each test has been chosen and how the connection of ToM and pragmatics is established as well as what the expected results are, considering previous research.

The proposed experiment, will not solve the puzzle if and how ToM and pragmatics are connected, but it will shed some light on this field as well as on the understanding of these abilities in patients with Aphasia after a brain damage in the left TPJ.

The proposed experiment, would also be very interesting if connected to neuroscience, by using neuroimaging methods and, thus linking the brain areas to each task and maybe also show a connection of ToM and pragmatics in the brain.

All in all, the reason of choosing this topic is its interdisciplinary nature since it takes the cognitive psychological field and the language field together and tries to make a connection between them. It would be beneficial for research as well as therapy to understand if the two skills are connected, in order to have a holistic view on language disorders, and not only by focusing on language on the lexical, phonological, morphological and syntax level.

All parts of language are important to be investigated as well as incorporated into therapy, especially for patients with acquired language disorders such as Aphasia.

Research will always be important on this part, in order to shed more light regarding the procedure, production and comprehension of cognitive and language abilities, as well as other abilities that affect someone's life.

Abstract

Patients with Schizophrenia or after a right hemisphere damage (RHD) display Theory of Mind (ToM) *and* pragmatic impairments. Research agrees that patients with Aphasia display pragmatic impairments, although findings on their ToM abilities are controversial, with the majority arguing for an intact ToM ability.

Literature has argued that ToM is essential for pragmatic abilities. Supporting this claim, the question arising is how patients with Aphasia have intact ToM abilities since they display pragmatic impairments. Thus, this thesis proposes an experiment designed for patients with Wernicke's Aphasia after a brain damage in the left temporoparietal junction (TPJ). The proposed experiment aims to observe, compare and link pragmatic and ToM abilities using non-verbal tests. For the ToM test a first-order false belief task is proposed. Participants will sit in front of a screen-based eye tracker in order to observe their implicit and explicit ToM ability via eye-fixations. For the pragmatic part, an implicature and irony task are proposed. It is argued that in to derive an implicature one needs a ToM ability. Thus, this task aims to strengthen the connection between ToM and pragmatic abilities. Regarding irony comprehension it is unclear if someone needs ToM. If participants answer correctly the ToM free "reality-based shortcut strategy" (Györi, 2004) will be strengthened. If participants fail, the connection between irony and ToM abilities will be strengthened.

Concluding, the hypothesis is that participants with Wernicke's Aphasia will show ToM and pragmatic deficits. However, no hypothesis can be made for the implicit part since literature has no known evidence in this field. Their explicit ToM is hypothesized to be impaired considering previous findings by Apperly et al. (2004) and Samson et al. (2004). On the implicature task it is hypothesized that if they fail on the ToM task they will also fail on the pragmatic task, strengthening the hypothesis of the vitality of ToM for deriving an implicature On the irony task, if they fail the connection between ToM and pragmatic abilities will be strengthened and if not the hypothesis of the "reality-based shortcut strategy" will be strengthened.

Zusammenfassung

Schizophrene Patienten oder Patienten nach Läsionen in der rechten Hemisphäre zeigen Theory of Mind (ToM) und pragmatische Beeinträchtigungen.

Bezüglich der pragmatischen Beeinträchtigungen stimmt die Forschung überein, bei ToM sind die Ergebnisse dagegen weniger eindeutig. Die Mehrheit argumentiert jedoch für eine intakte ToM-Fähigkeit, die wiederum für pragmatische Fähigkeiten essenziell ist. Diese These unterstützend stellt sich hier die Frage wie Patienten mit Aphasie intakte ToM-Fähigkeiten haben können, wenn sie doch pragmatische Beeinträchtigungen aufweisen. Daher präsentiert diese Arbeit ein Experiment für Patienten mit Wernicke Aphasie nach einer Läsion im temporoparietalen Übergang (TPJ). Das vorgeschlagene Experiment versucht pragmatische und ToM-Fähigkeiten mithilfe non-verbaler Tests zu beobachten, zu vergleichen und zu verbinden. Hierbei wird für den ToM-Test eine False-Belief-Aufgabe erster Ordnung vorgeschlagen. Mithilfe eines Eye Trackers werden die impliziten sowie expliziten ToM-Fähigkeiten der Teilnehmer untersucht. Für den pragmatischen Teste werden Implikatur- und Ironieaufgaben vorgeschlagen. Da für das Herleiten einer Implikatur ToM-Fähigkeiten vonnöten sind, kann eine solche Aufgabe die Verbindung zwischen ToM und pragmatischen Fähigkeiten verstärken. Das Ironieverständnis betreffend ist es jedoch unklar, ob ToM notwendig ist.

Wenn die Teilnehmer richtig antworten, so wird die "reality-based shortcut strategy" (Györi, 2004) gestärkt. Wenn die Teilnehmer aber falsch antworten, so wird die Verbindung zwischen Ironie und ToM Fähigkeiten gestärkt. In dieser Arbeit nehme ich an, dass Teilnehmer mit Wernicke-Aphasie sowohl Beeinträchtigungen bei ToM wie auch bei Pragmatik aufweisen werden.

Eine sichere Annahme für den impliziten Bereich kann jedoch nicht getroffen werden, da derzeitige Forschung diesbezüglich keine stichhaltigen Beweise liefert. Explizites ToM wird im Einklang mit Apperly et al. (2004) und Samson et al. (2004) als beeinträchtigt angesehen. Für die Implikaturaufgabe wird angenommen, dass ein schlechtes Abschneiden bei der ToM-Aufgabe mit einem eben solchen bei der pragmatischen Aufgabe korreliert, wodurch die enge Verbindung der beiden Bereiche erneut betont wird. Bei Verfehlen der Ironieaufgabe wird diese Verbindung wiederum betont, bei etwaigem Bestehen jedoch die "reality based shortcut strategy".

Appendices

Appendix 1.

Except the adapted Sally-Anne story by Baron-Cohen et al. (1985) the following video stories and pictures will be presented.

1. A man and a woman are in a room with two chairs and a table with a drawer. The man is sitting on one chair reading a book while the woman is sitting on the other chair. The man stands up, puts the book into the drawer and leaves the room. During his absence the woman takes the book and places the book behind her chair. The man enters the room looking for his book.

The three pictures presented are:

- (a) The man looks in the drawer
- (b) The man looks behind the chair
- (c) The man looks at his chair

2. Two girls are in the living room. The living room has a couch, a coffee table and a lowboy dresser. Girl A eats a chocolate. Girl A stands up and places the chocolate in a bowl on the coffee table in the living room and leaves the room. During her absence girl B takes the chocolate and puts it inside the first drawer of the lowboy dresser. Girl A comes back and looks for her chocolate.

The three pictures presented are:

- (a) Girl A looks in the bowl
- (b) Girl A looks in the drawer
- (c) Girl A looks at the floor

3. A woman and a child are eating a slice of cake in the kitchen. The child leaves the room putting his plate with the remaining cake in the oven and leaves the room. The mother, as the child is not in the room, takes the plate and puts in the fridge. The child returns and is looking for his cake.

The three pictures presented are

- (a) The child looks in the oven
- (b) The child looks in the fridge
- (c) The child looks at the kitchen counter

4. A boy and a girl are at the beach, lying on their towels under an umbrella. The boy is playing with his mobile phone. As he wants to go into the sea he leaves his mobile phone under his towel. The girl, during his absence, takes his phone and places it in his backpack. The boy returns looking for his mobile phone.

The three pictures presented are:

(a) The boy looks under his towel

(b) The boy looks in his backpack

(c) The boy looks at the umbrella

Appendix 2.

For the comprehension task, the same stories used by Tenyi et al. (2002) will be used adapted on the visual stimuli at the end of the story.

An example, taken from his experiment is:

1. "A garden has 2 trees full with fruits, one apple tree and one plum tree. At the next seen a very strong storm passes and causes all fruits to end up on the ground. "

The participant is then presented with three pictures, each of them depicting the result of a story but only one of them being the target picture.

The pictures following are:

- (a) All fruits on the tree
- (b) All fruits on the ground
- (c) Some fruits on the ground

The target picture is the second one, since it has already been depicted in the story.

2. "A fox and a bear are in front of a frozen lake. The fox is walking on the frozen lake when the ice breaks and the fox falls in the water"

The three alternative pictures are:

- (a) The ice breaks
- (b) Ice is untouched
- (c) There is no ice at all

Appendix 3.

For the irony task the same material used by Cutica et al. (2006), will be used. An example from her paper is:

„The sweets. Two girls (A and B) are sitting at a table. B has two sweets, she is eating one of them. A asks if she can have the other one. B eats the second sweet and gives A the paper. A strokes B on the back. The alternatives for A’s thought are “ (Cutica et al. 2006:23)

The participants will be presented with the following pictures and will be asked to choose the most suitable one:

„ (a) A sticks her tongue out at B

(b) A kisses B

(c) A is cooking

(d) A and B are hanging out the laundry “ (Cutica et al. 2006: 23)

Appendix 4.

For the comprehension task the same material used by Cutica et al. (2006), will be used. An example from her paper is:

„The bottle of water. Two girls (A and B) are sitting at a table. A points to the bottle for B to pass. The alternatives for A’s thought are “ (Cutica et al. 2006: 22)

The participants will be presented with the following pictures and will be asked to choose the most suitable one:

„ (a) B passes A the water

(b) B pours himself some water

(c) A eats some chips

(d) A and B play cards “ (Cutica et al. 2006: 22)

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