USE OF REFERRING EXPRESSIONS BY AUTISTIC CHILDREN IN SPONTANEOUS CONVERSATIONS: DOES IMPAIRED METAREPRESENTATIONAL ABILITY AFFECT REFERENCE PRODUCTION?

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Dedication

To Hank.

There are no words to describe the joy you bring to your mother and me.

Abstract

References that speakers make can include both *conceptual information*, which contributes to explicatures, and *procedural information*, which constrains explicatures (Wilson & Sperber 1993). The current study compares the references made by autistic and typically developing children in naturally occurring conversational settings, with an understanding of pronouns and determiners (following Gundel et al. 1993) as procedural markers of an intended referent's cognitive status in the minds of listeners. The result is an exploration of how the metarepresentational impairment associated with autism affects procedural and conceptual aspects of reference production in an unstructured context that many researchers recommend to better observe how autistic children handle the pragmatic challenges presented in everyday life.

Results support a hypothesis that most day-to-day uses of pronouns and determiners do not involve metarepresentational consideration of the mental states of one's listeners. However, analysis of references to entities judged to be in the current focus of listener attention suggests that autistic children are impaired in recognizing what information regarding cognitive status and conceptual content listeners require. Possible explanations are considered, including: impaired metarepresentational mindreading ability limits appreciation of listener needs; early joint attention impairment interferes with recognition of references as intentional acts and subsequent acquisition of pronouns and determiners as procedural markers of referent cognitive status; and as a connectivity disorder, impairment in autism is most manifest when the need for high-level integrative processing is greatest. Monitoring relevant reference information in unstructured social situations strains the integrative processing ability of autistic children, resulting in tendencies toward over- and underspecification.

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Chapter 1 Introduction

1.1 The Problem

1.1.1 How much and in what ways do speakers consider the mental states of their listeners when making references in everyday conversational settings?

Much of pragmatics research investigates how listeners understand speakers, given that linguistic information in everyday utterances is often open to multiple interpretations and that the meaning of everyday utterances often goes beyond simply what linguistically encoded information it contains (Sperber and Wilson 1986/1995). Wilson and Sperber (1993) describe how listeners construct hypotheses about the explicit content of utterances by using linguistically encoded *conceptual* information to form mental representations and linguistically encoded *procedural* information to manipulate those representations. These hypotheses are then mentally enriched until an interpretation that satisfies a presumption of relevance is reached (Sperber and Wilson 1986/1995).[1] Gundel, Hedberg, and Zacharski (1993) explore how references are understood, given that a variety of forms can refer to the same thing and that specific forms can to refer to many different things. They describe how information (which Gundel (2011, 2009) describes as procedural) encoded in pronouns and determiners constrains how listeners mentally access intended referents, and how, in certain contexts, this information interacts with pragmatic principles to communicate additional, extra-linguistic information.

[1] Sperber and Wilson's Relevance Theory will discussed in more detail in section 3.4.2.

It is widely accepted that speakers tailor references to meet the needs of listeners, but what cognitive processes are involved? Does this tailoring require conscious assessment, or metarepresentation, of the mental states of listeners? Consider the following example:[2]

Example 1

01 A dog walked into my yard last night, and **it** proceeded to dig up my rose bushes.

Assuming there are no relevant preceding utterances, any English speaker reading this sentence will infer with certainty that "it" refers to the dog introduced in the previous clause. Yet the personal pronoun *it* can refer to an infinite number of things; how is it that we know exactly what it refers to here? Gundel et al. (1993) posit that pronouns and determiners (*he/him, she/her, they/them, it, this/these, that/those, the,* and *a(n)*) have information encoded in their conventional meanings that listeners use to infer what the speaker is referring to. In the case of personal pronouns such as *it,* the information instructs the listener to associate with the linguistic form a mental representation of an entity in the current focus of attention. In processing an utterance, a listener is able to immediately narrow the infinite set of possible entities to which *it* could refer to the thing or small set of things in her current focus of attention. In the case of example (1), the listener infers with minimal processing effort that "it" refers to the dog that walked into the speaker's yard. Now consider example (2):

Example 2

02 Johnny, we're going to the park. Bring **the leather football**, will you?

[2] Relevant references are in **bold** in all examples. Underlined references indicate relevant speaker stress.

Let us assume that the speaker in this example is Johnny's mother, and further, let us assume that a good deal of relevant shared background information with her son has influenced her utterance. She knows that her son has two footballs, a small rubber one that he has had for a year and a new leather one that is more like a regulation football. She knows that Johnny likes to throw the rubber one and that he is very good at it. She also knows that he has been struggling to learn how to throw the larger, heavier leather ball that he recently got, and that he needs to master that one if he is going to succeed in this summer's flag football league. She anticipates that if she tells him simply to bring "*the* football" with him, either he will ask which one she means, or he will assume it does not matter and he will bring the yellow one because it is more fun and less work. Furthermore, if she tells him to bring "*a* football" with him, she will give him the impression that any football is fine, in which case he is also likely to bring the yellow one. However, practicing throws with the leather ball is what she has in mind, so she includes extra conceptual information that explicitly indicates which football she is referring to.

Do the speakers in these examples take significantly different processing steps to formulate their references? Plausibility requires that they do. The speaker in example (1) is aware that the dog should be in the listener's focus of attention and thus likely expends no processing effort considering whether uttering "it" is the optimal way to refer to the dog. On the other hand, given the background information we have assumed, the speaker in example (2) must evaluate what information her listener will need in order to infer which ball she wants him to bring, which almost certainly involves more processing effort than the use of a personal pronoun for an in-focus entity.

On the other side of the interaction, is it safe to assume that the speakers' reference choices have processing repercussions for the listeners? Certainly. The listeners in these examples are

not managing equal cognitive loads, as more explicit information costs listeners more processing effort (Wilson 2000). The listener in (1) needs only to process the procedural information "associate the focus of attention with the form *it*" to infer that the speaker is referring to the dog, while the listener in (2) must process the conceptual content in "leather football" as well as the procedural information encoded in "the," which instructs the listener to associate a unique representation with "leather football."

Thus it is uncontroversial to suggest that different reference choices in different contexts involve varying amounts of processing load for both speakers and listeners. But the question remains as to how much consideration speakers give their listeners in the countless references they utter every day. Gundel (2011, 2009) suggests that a personal pronoun reference to an in-focus entity like that in example (1) is an implicit, relatively automatic choice that requires merely an awareness of a listener's attention, not a conscious proposition about a listener's epistemic state. In contrast, it would appear that the speaker in the scenario depicted in example (2) makes a conscious consideration of the listener's unique knowledge and desires. How frequently must referring speakers consider such propositions? Are they required of all explicit references (i.e. references with conceptual content)? Or consider the demonstrative determiner *that*, which, as we will see, does not require that the intended referent be in the focus of listener attention, but merely that the listener has knowledge in memory of the noun phrase that follows. Does any appropriate use of *that* require the thought "my listener knows/remembers that . . ."? The participants in this study have been chosen in an attempt to answer these questions.

1.1.2 Does impairment in autistic children's ability to assess the mental states of others—to form metarepresentations—result in atypical reference production in spontaneous conversations?

One way to explore the degree to which speakers making references rely on conscious assessment of the thoughts of their listeners is to look at a population with limited ability to make metarepresentational comparisons. One such population is children under the age of 4, who, absent a fully developed representational mind, lack the ability to assess the differences between their own knowledge and beliefs and those of the others around them. Research shows that typical 3-year-old children exhibit competent use of the full range of determiners and pronouns available for references (Bennett-Kastor 1983; Bittner 2002, 2007; Hernandez-Pina 1994), and given their underdeveloped ability to mentally represent the mental states of others, the performance of 3-year-olds suggests that appropriate use of pronouns and determiners does not involve consciously assessing the mental states of one's listeners (Gundel 2011, 2009). In light of the analysis above, example (1) is consistent with this suggestion, while the determination of what information to include when referring to the football in example (2) appears to require some conscious thought (though an implicit choice of the definite article *the* in such a context seems plausible).

Another population relevant to this discussion comprises people diagnosed with Autism Spectrum Disorder, whose impaired ability to consider others' mental states is well documented. To whatever extent speakers use "theory of mind" (as the ability to form mental representations about mental representations is often called)[3] to assist in making references in

[3] Theory of mind is discussed at length in chapter 2.

everyday conversation, it is reasonable to expect that verbal autistic individuals will exhibit some atypicality in their reference production. By comparing the references of 5-6-year-old autistic children with 5-6-year-old typically developing children (who can be assumed to have a fully developed theory of mind), we can examine to what extent impairment in assessing the knowledge and beliefs of others affects the manner in which conversational references are made while we simultaneously look through a new lens at the difficulties autistic children experience communicating in social situations.

1.2 Predictions

In light of the above discussion of reference and theory of mind, I expect the study to reveal the following:

1. Given that young children's use of referring expressions suggests that competent use of the procedural information in pronouns and determiners is not dependent on a metarepresentational mind, the autistic children will perform comparably to typically developing children in using forms that are consistent with the memory and attention state of the intended referents in the minds of their listeners at the moment of utterance.

2. In contexts when conscious assessment of the mental states of listeners would inform a speaker's determination of which and how much conceptual information is relevant, the autistic children's impaired awareness of others' mental states will lead to atypical references. This would include tendencies to provide conceptual information in contexts where a pronoun would be appropriate or to use pronouns in contexts when listeners need some conceptual content to identify the intended referent.

3. The autistic children will exhibit atypicality in their use of demonstratives. As I will describe in chapter 3, pragmatically appropriate use of demonstratives (*this*, *that*) requires not just the ability to assess a referent's cognitive status (which is expected to be unimpaired), but also awareness of when the cognitive status information they convey is relevant to the listener. Impaired mindreading ability is expected to interfere with assessing the relevance of this information.

1.3 Terminology

A few comments about some of the terms used in this dissertation with respect to autism are in order before we go any further. Consider how the National Institute of Health describes autism:

> *"Different people with autism can have very different symptoms. Health care providers think of autism as a "spectrum" disorder, a group of disorders with similar features. One person may have mild symptoms, while another may have serious symptoms. But they both have an autism spectrum disorder. Currently, the autism spectrum disorder category includes Autistic disorder (also called "classic" autism), Asperger syndrome, and Pervasive Developmental Disorder Not Otherwise Specified (or atypical autism). In some cases, health care providers use a broader term,* pervasive developmental disorder*, to describe autism. This category includes the autism spectrum disorders above, plus Childhood Disintegrative Disorder and Rett syndrome."* (National Institute of Child Health and Human Development)

Like the NIH, I will use *autism* and *ASD* to refer to Autistic disorder, Asperger syndrome, and Pervasive Developmental Disorder Not Otherwise Specified. I will not be discussing Childhood Disintegrative Disorder and Rett Syndrome. Asperger syndrome is sometimes referred to as *Asperger's* in the literature, and I occasionally do so as well for the sake of brevity. Another common classification referred to in autism research is *High Functioning Autism* (HFA). There is no clinical definition for HFA; it is often used to refer to persons diagnosed with Asperger syndrome, but it may also refer to anyone with an autism diagnosis who is verbal and has a near

normal (or higher) IQ level. I avoid the use of HFA for the most part in this dissertation, since it is not a clinical diagnosis, and since in my research I am interested in the reference production of all autistics with sound structural language capacity, regardless of what factors influenced the specific autism diagnoses.

My use of the terms *autistic person(s)* and *autistic(s)* in this dissertation is a deliberate decision, as it reflects my opinion with respect to an ongoing discussion that takes place among people whose lives are intertwined with autism. Many people prefer person-first language (e.g. "person with autism") emphasizing that the person is not defined by a disability. Many autistic adults, however, self-identify as autistic, seeing autism as an inseparable part of themselves, as something they *are*, not something they *have*. Essays listed in the bibliography by Jim Sinclair and Jean Winegardner offer insight into this issue. As the father of an 8-year-old boy diagnosed with Asperger's, I agree with Sinclair and Winegardner in that I see my son as autistic. Autism is part of him, it describes how his brain functions, and it is equally intertwined with the atypical characteristics that make life in society uniquely challenging to him but at the same time provide him with a unique experience of life.

The terms *neurotypical* and *typically developing* are used to refer to non-autistic individuals. This allows avoidance of terms loaded with implications, such as *normal* and its implication of *abnormal*.

Finally, regarding theory of mind: As we will see in Chapter 2, Premack and Woodruff (1978) coined this phrase to refer to the unique human ability to impute mental states to oneself and others. This ability, also referred to as *mindreading* or *mentalizing*, is considered metarepresentational because it involves the construction of mental representations about mental representations (e.g. "I know that John thinks that . . ."). In the years since Premack and

Woodruff (1978), many scholars have come to see theory of mind's development actually beginning shortly after birth, with metarepresentational thought emerging around age 4. *Theory of mind* and *mindreading* are commonly used to refer to this cognitive system that develops in the first four years of life, though theory of mind is also very often used to refer specifically to the metarepresentational ability achieved when the system is (arguably) complete. In an effort to employ these terms with clarity and minimal contrast with the researchers whose papers I will review, I will use *mindreading* to refer generally to what is occurring at any point in the system's development, metarepresentational or not, and I will restrict *theory of mind* to specifically metarepresentational activity. Thus, discussions of a subject's theory of mind ability or performance on a theory of mind test refer to the subject's ability to display evidence of metarepresentational thought.

1.4 Conclusion

It is worth emphasizing that the purpose of this research is not to investigate a disease in need of a cure; nor is it my intent, on the other hand, to take lightly the myriad struggles and challenges faced by autistic persons across the spectrum and the families who love and support them. Rather, in this investigation of linguistic performance in naturalistic settings, I endeavor to improve our understanding of the autistic mind and learn more about language and cognition in general. In addition to contributing to society's appreciation of the autistic mind, it is my hope that improved understanding of autistic cognition might identify specific cognitive differences that help autistics understand why and how they differ from neurotypical people. The adolescent with an Asperger's diagnosis quoted in Carrington and Graham (2001) expresses the kind of sentiment that such tangible information might address:

"I really do feel like an alien sometimes because I'm in my own world and all of you people aren't doing what you should be doing in my world."

The study described here is an exploration of what can be learned about autism and the role of metarepresentation in referential communication by comparing the way autistic children and neurotypical children use referring forms in unstructured conversational settings. In chapter 2, I provide background on autism, theory of mind, and the evidence that theory of mind impairment is a core factor in autistic behavior. Research on the role of theory of mind in language use will be reviewed, as well. In chapter 3, I describe the Givenness Hierarchy theory (Gundel et al. 1993), which attempts to explain how speakers choose referring forms and listeners infer their meanings. The Givenness Hierarchy and its interaction with pragmatic principles makes up the theoretical framework that underlies this investigation of the relation between language and other cognitive systems. In chapter 4, I review literature reporting on reference production in autism and consider the motivation for investigating autistic reference in unstructured settings. Chapter 5 details this study and the findings, and in chapter 6, I write up my conclusions and suggestions for further research.

Chapter 2 Autism and Theory of Mind

2.1 Introduction

In this chapter I discuss Autism Spectrum Disorder, the concept known as theory of mind, and the evidence for theory of mind impairment in autism. I also review research exploring the relationship between theory of mind and language in both autistic and neurotypical individuals.

2.2 Autism Spectrum Disorder

Autism spectrum disorders (ASD) are a group of developmental disorders featuring atypical development in socialization, behavior, and communication. Autistic disorder (i.e. "classic" autism), Asperger syndrome, and pervasive developmental disorder – not otherwise specified (PDD-NOS) are currently considered ASDs (CDC 2009). People receiving an ASD diagnosis show a qualitative impairment in *social interaction*, which encompasses non-verbal behaviors, peer relationships, sharing interests with others, and social or emotional reciprocity; restricted repetitive and stereotyped *patterns of behavior*, interests, or activities; and qualitative impairments in *communication*, both linguistic and non-linguistic. Specific to communication, people with ASDs have shown a delay in or lack of spoken language development (without attempts at compensation via gestures, mime, etc.); marked impairment in initiating or sustaining conversation with others; stereotyped, repetitive, or idiosyncratic use of language; and/or a lack of varied spontaneous make-believe play (APA 1994).[4]

[4] Diagnoses are typically made using a standardized instrument designed to assess different levels of the child's cognitive development, such as the Vineland Adaptive Behavior Scales, the Childhood Autism Rating Scale (CARS), the Autism Diagnostic Interview-Revised (ADI-R), or the Autism Diagnostic

However, a significant minority of those diagnosed with ASDs do not exhibit such extreme communication impairments. These persons have relatively intact core language abilities (i.e. syntax, semantics, phonology) (Pijnacker et al. 2009) and perform in the near normal IQ range. For this reason, these individuals are often referred to as having "high functioning autism" (HFA), though HFA is neither a medical term nor a diagnosis.[5] Autistic children who showed or are showing a significant delay in language development that is not extreme enough to preclude observation of near normal IQ are typically diagnosed with PDD-NOS. Autistic children of average or higher IQ who do not show a delay in language development are likely to receive a diagnosis of Asperger syndrome (American Psychiatric Association 1994).[6] Children with Asperger syndrome are often diagnosed later in life than other autistic children, since their apparently normal early language development allows them to blend in with neurotypical children longer (Seung 2007: 248).[7]

The behavioral abnormalities exhibited by people with HFA are much more subtle than those of lower functioning people on the autism spectrum. Typical communication peculiarities

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Observation Score (ADOS). A child's score is based on parent interviews and the evaluator's observations.

[5] HFA children typically have normal or near-normal IQ scores. Seung (2007) writes that 20% of persons with autism function within the normal range on IQ tests, while Sigman, Dissanayake, Arbelle, and Rusking (1997) report that 70% - 80% of autistic individuals achieve IQ scores in the mentally retarded range (249). The CDC's most recent numbers, based on six states with sufficient data, found about 41% of autistic children were cognitively impaired (IQ of 70 and below), but that number approached 70% when borderline IQs (85 and below) were included (Rice 2006). Perhaps a very rough breakdown would estimate half of children receiving an ASD diagnosis have IQs in the mentally retarded range, one quarter are in the near normal range, and another quarter have normal or higher IQs.

[6] The DSM IV describes children with Asperger syndrome as lacking a "clinically significant general delay in language."

[7] This is a highly qualitative diagnostic distinction that is far from controlled and standardized. My own son was diagnosed with PDD-NOS shortly after his third birthday, but his diagnosis was changed to Asperger syndrome a year later when his increased familiarity with the testing environment reduced his level of social anxiety enough for him to more readily display his advanced language skills.

include overly formal or pedantic word choices, obliviousness to listeners' indications of interest level, a penchant for producing intense monologues as if trying to persuade, and difficulties maintaining an ongoing topic of discourse (Colle et al. 2008: 29). Such atypical communication characteristics contribute to the widely accepted observation that all persons on the autism spectrum exhibit difficulties with the pragmatic nature of language (Chevallier et al. 2010, Happé 1995b, Bartlett et al. 2005, Adams et al. 2002, Nadig et al. 2009, Jolliffe and Baron-Cohen 1999**,** among others). That is, regardless of syntactic, phonological, semantic, and general intellectual abilities, all persons with an ASD exhibit impairments in the processes involved with using language socially and appropriately in a given context (Arnold et al. 2009, Tager-Flusberg 2001). To fully understand the pragmatic impairments associated with the autism spectrum, one needs a familiarity with the large body of research documenting the impaired ability to attribute mental states to others exhibited by persons with an ASD.

2.3 Autism and Theory of Mind

With the publication of "Does the autistic child have a 'theory of mind'?" Baron-Cohen, Leslie, and Frith (1985) introduced to autism research "a new model of metarepresentational development" specifying that a theory of mind underlies "a crucial aspect of social skills, namely being able to conceive of mental states: specifically, knowing that other people know, want, feel, or believe things . . ." (38). Premack and Woodruff (1978) coined the phrase *theory of mind* in a paper exploring whether chimpanzees can infer others' states of mind the way humans do. An individual, they write, has a theory of mind if he imputes mental states to himself and others. Humans impute a number of mental states, such as belief, knowledge, preference, doubt, guessing, and pretending, but Premack and Woodruff assert that purpose/intention is

unquestionably the state we impute most widely. They view this inference of mental states as a theory since mental states are not directly observable, and because the inferences can be used to make predictions about the behavior of others (515). It is the *metarepresentational* aspect (Pylyshyn 1978) that allows such predictions. Pylyshyn dubs the process metarepresentational because a person employing a theory of mind has a representation about a state of affairs (e.g. history class is cancelled today), stands in relationships to the representation (e.g. *be aware* that class is cancelled today), *and explicitly represents the relationships* (e.g. "I know that class is cancelled today, as does Bill, but Mary does not"). That is, the person has a representation about a representation. With explicit representations of one's own awareness that class is cancelled today and a friend's expectation that class will be held as usual, an individual can predict the friend's actions. Using the contrasting representations this way—as a frame of reference for anticipating and interpreting the actions of others—is the practical importance of representing someone's wrong beliefs (Wimmer and Perner 1983, Baron-Cohen et al. 1985).

Sperber (2000) identifies four categories of metarepresentation:

- Mental representations of mental representations
    - E.g. the thought "John believes it will rain."
- Mental representations of public representations
    - E.g. the thought "John said it will rain."
- Public representations of mental representations
    - E.g. the utterance "John believes it will rain."
- Public representations of public representations
    - E.g. the utterance "John said it will rain."

Mental representations of mental representations are the class of metarepresentation that theory of mind researchers are typically interested in. One way to be certain a person, e.g. Mary, is capable of such a metarepresentation is to show that Mary is aware that another person, e.g. John, believes something that she does not believe or that she knows to be false. Mary cannot express such an awareness without the ability to contrast John's belief with her own; i.e. the ability to make a mental representation of a mental representation. Wimmer and Perner (1983) tested for the ability to express this awareness by telling children a false belief story like that depicted in figure 2.1. The experimenter introduces two dolls, Sally and Anne, to the child and asks a naming question to check that the child knows which doll is which. The child then watches Sally place the marble in her basket and leave the room. Anne then moves the marble to her box while Sally is away. When Sally returns, the experimenter asks the critical belief question, "Where will Sally look for her marble?" Children who point to Sally's basket pass the belief question and those who point to Anne's box fail. Those who pass answer correctly because they are able to compare mental representations of Sally's (false) belief about the marble's location with their own knowledge of

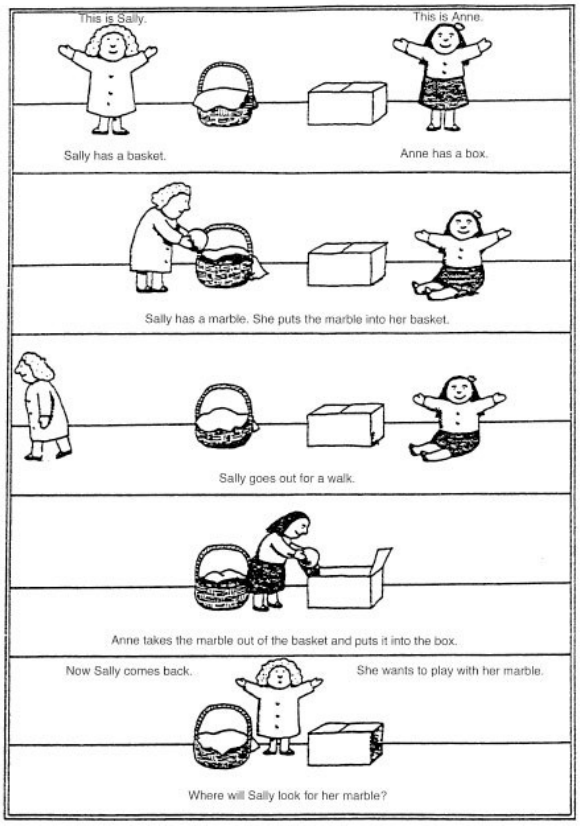

Figure 2.1 Sally – Anne Test for False Belief

where it really is. Those who fail are unable to verbally demonstrate this ability. Children who pass the belief question are then asked two control questions: a reality question, "Where is the marble really?" and a memory question, "Where was the marble in the beginning?" By confirming that the child has knowledge of the true current location of the marble and an accurate memory of its previous location, researchers are satisfied that the child's answer to the belief question was not influenced by an error in comprehension or memory.

Wimmer and Perner found that most children before age 4 are unable to verbally attribute to others beliefs different from their own, and that it is between age 4 and 6 that children develop the ability to represent the relationship between two or more persons' epistemic states (126). This is the time when a child moves from a transparent view, that people simply believe what is the case, to an opaque view wherein they distinguish between what is the case and what people believe to be the case. The emergence of this representational thinking is what allows most 4-year-olds to answer the "Where will Sally look?" question correctly while most 3-year-olds cannot. A correct answer requires an awareness that Sally does not know that Anne moved her ball. This is considered a demonstration of 1st order theory of mind: the ability to make inferences about the beliefs and desires of other people. As children continue to develop, 2nd order theory of mind emerges, allowing inferences about a belief about a belief (e.g. "John believes that Mary believes the ice cream truck is in its original location"), followed by 3rd order, allowing inferences about a belief about a belief about a belief, etc. Wimmer and Perner (1985) use a task similar to the Sally-Anne test in order to test for 2nd order theory of mind. This features a story where the two characters are separately, independently informed that the ice cream truck has moved to a new location. Both characters know where the truck was and where it is now, but each thinks that the other thinks the truck is still in the old place. Wimmer and

Perner found that typical children between age 5 and 7 begin to successfully articulate where John will look for Mary based on his false belief that Mary thinks the truck is in the original spot. Finally, as we will see in the coming sections, numerous publications have supported Wimmer and Perner's conviction that false belief tasks are a legitimate measurement of a subject's ability to employ a theory of mind.

Baron-Cohen et al. (1985) administered the Sally-Anne test to 20 children with autism, 14 with Down syndrome, and 27 clinically normal preschoolers. The autistic children were considered relatively high functioning, with an average IQ of 82, while the Down's children had an IQ average of 64. Examining the results, the researchers found that 85% of the control children and 86% of the children with Down syndrome passed the test, while only 20% of the autistic children passed. This was consistent with the hypothesis that children with autism fail to employ a theory of mind, and Baron-Cohen et al. hypothesized that an inability to represent mental states explains this failure, concluding that this inability constitutes a deficit specific to autism. "We wish to explain this failure as an inability to represent mental states. As a result of this the autistic subjects are unable to impute beliefs to others and are thus at a grave disadvantage when having to predict the behavior of other people" (43).

The hypothesis that autistic persons cannot represent mental states motivated extensive research to replicate Baron-Cohen et al.'s (1985) findings and to explore how such a deficit might explain the behavior of people on the autism spectrum. A table from Happé (1995) is included in Appendix B that identifies the key findings of 26 studies published in the decade following Baron-Cohen et al. (1985). A significantly impaired ability to solve false belief tasks proved to be a very robust result among autistic subjects, and many researchers acknowledged the possibility that an underlying inability to represent mental states was the key explanation for

the behavioral impairments in autism. In section 2.4, we look at some of the research on how theory of mind operates cognitively. In section 2.5, we look at ongoing research on how theory of mind impairment might explain the behavior of autistic persons.

2.4 Models of Theory of Mind

2.4.1 Baron-Cohen (1995)

In his essay *Mindblindness* (1995), Simon Baron-Cohen explores how evolutionary psychology might explain theory of mind, and in the process he posits developmental steps between birth and the acquisition of a representational understanding of mind that culminates around age 4. Evolutionary psychology endeavors to account for the functioning of specific cognitive mechanisms, and Baron-Cohen identifies one specific adaptive problem he is interested in: the rapid comprehension and prediction of another organism's behavior (12). In order to account for the emergence of this ability, Baron-Cohen breaks down the human mindreading system into four components. He proposes that the first two, the intentionality detector and the eye direction detector, emerge early in infancy.

The *intentionality detector*, "the first basic mechanism humans need to get into the mindreading game," is a perceptual device that interprets motion stimuli in terms of the primitive volitional mental states of goal and desire. It is activated whenever there is any perceptual input that might identify something as an agent. The *eye direction detector* observes the presence of eyes, computes where the eyes are directed, and infers that if another animal's eyes are directed at something, then that animal sees that thing. Baron-Cohen describes how the intentionality and eye direction detectors are used together in the first year of life to make

dyadic representations that specify the intentional relation between the self and some other agent, or the agent and some object. The two together are not enough, however, to allow a child to represent that she and someone else are both attending to the same thing. This requires one more component.

The third component of Baron-Cohen's mindreading system is the *shared attention mechanism*, which emerges between 9 and 18 months. Through this mechanism children experience a sense of sharing the world with others by comparing some other agent's perceptual state with their own current perceptual state. This produces a triadic representation, in that they now have the added awareness that they and the agent are attending to the same object. The shared attention mechanism relies mostly on the eye direction detector, as the agent and self are often related via "see," "notice," or "attend to." Baron-Cohen does point out that the shared attention mechanism can work with the intentionality detector, too, when, for instance, children relate their perception to an agent's perception via intentionality concepts such as "want" or "has goal." In fact, Baron-Cohen believes the shared attention mechanism allows children to interpret a person's intention to refer to something as a goal to pick something out, as in *Agent has goal to pick out X/refer to X*. With the emergence of the shared attention mechanism, children at this stage can now read behavior in terms of volitional states (belief and desire) and perceptual states (e.g. see). However, Baron-Cohen notes that they are not yet able represent the full set of epistemic states, which includes pretending, thinking, knowing, imagining, dreaming, guessing, and deceiving; nor are they able to tie volitional, perceptual, and epistemic mental state concepts together in an understanding of how mental states and actions are related. He suggests that children at this stage can represent mental

states dealing with two properties of intentionality: *aboutness*, about things other than themselves, and *aspectuality*, about specific aspects of things.

Baron-Cohen's fourth component is the *theory of mind mechanism*, which begins to develop around 18 months with the emergence of pretend play, and is complete around age 4 when a child can represent the full set of epistemic states. Baron-Cohen writes that children now understand a third property of intentionality, *referential opacity*, or the possibility for misrepresentation. At this point a child understands that the embedded proposition in a sentence may or may not have the same truth value as the sentence itself. It is this representational understanding of mind that allows children to pass false belief tasks like the Sally-Anne task that Baron-Cohen et al. (1985) used. The theory of mind mechanism allows children to consider the truth values of the two propositions in a sentence like "Sally thinks that her marble is in the basket." With the newly developed understanding of epistemic mental states added to the earlier developed understanding of volition and perception, children at this point are able to use the mechanisms together to understand how mental states and actions are related. The theory of mind mechanism's function is to turn all the newly-acquired mentalistic knowledge into a theory of reasoning that allows predictions about action and behavior.

In summary, Baron-Cohen posits three phases of development that encompass the emergence of the four components of the human mindreading system, culminating in theory of mind ability:

1. 0–9 months, in which the *intentionality* and *eye direction detectors* emerge
2. 9–18 months, in which the *shared attention mechanism* emerges
3. 18–48 months, in which pretend play emerges and culminates in the *theory of mind mechanism*

2.4.2 Tager-Flusberg (2001)

In a chapter of *The development of autism: Perspectives from theory and research* (Burack, Charman, and Zelazo, eds.), Tager-Flusberg (2001) also describes a componential model of theory of mind that starts developing in infancy and leads to a representational understanding of mind around age 4. She cites research on newborns' ability to imitate facial expressions and orient themselves to social stimuli, on 6-month-olds' interpretations of human actions as goal-directed or intentional, and on older infants' own intentional actions including pointing, early language, and social referencing (161). This suggests that the early foundation of theory of mind is in place by the second year of life (161). The development continues with the emergence of the ability to interpret desire, emotion, and perception by age 3, followed by the representational mind at age 4.

Tager-Flusberg posits that the different components of theory of mind are associated with distinct underlying mechanisms for processing different aspects of social information (163). She emphasizes a distinction between basic social-perceptual and social-cognitive components of theory of mind. The *social-perceptual component* explains how we use information available in faces, voices, and posture/movement to make on-line real-time judgments about the mental states of others. "The developing ability to interpret mental-state information from these stimuli is based on the interaction of these innately specified mechanisms with social information in the world, obtained through interactions with other people" (Tager-Flusberg and Joseph 2005: 310). This component emerges first, building on innate preferences of infants to attend to human social stimuli, "especially faces and voices" (Tager-Flusberg 2001: 163); during the latter half of their first year, children begin to use this perceptual information to interpret others' emotions and intentional states. This capacity continues to develop for years, culminating in the adult

ability for making sophisticated judgments from just the eye region of the face. Tager-Flusberg speculates that the social-perceptual component is not related to other cognitive systems, including language, but she makes it clear that such speculation has not been systematically investigated.

The *social-cognitive component* includes a representational understanding of mind; it builds on the perceptual component, beginning in the pre-school years when children begin to talk and reason about epistemic states.[8] It is responsible for our ability to make complex inferences about the content of mental states via the integration of information across time and events. Tager-Flusberg links this component closely to other cognitive or information processing systems, suggesting that working memory and language may play a significant role in its development (164). The component is typically in place by age 4, when children have the metarepresentational capacity to pass false belief tasks, but it continues to develop for years to come, using reasoning and inferencing skills to integrate constructs like belief and intention. As we mature, our social-perceptual and social-cognitive capacities "function in a complex interconnected way such that our mental state judgments, inferences, and reasoning entail both components" (164). This seems consistent with Baron-Cohen's view of the theory of mind mechanism developing mentalistic knowledge into a theory for predicting behavior.

In summary, Tager-Flusberg posits two components to theory of mind that begin shortly after birth:

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[8] Epistemic relations typically emerge in speech by 30 months, when children begin constructing sentences with a matrix clause subject expressing certainty or uncertainty about the state of affairs in the subordinate clause (Bloom, Lahey, Hood, Lifter, and Fiess 1980), e.g. "I think that he will sit down." As we will see in section 2.5, researchers suggest that at this stage of development, children talk about mental states without the ability to represent others' states of mind. That is, for a time they use the syntactic structure without fully recognizing the contexts in which it is appropriate to do so.

1. *Social-Perceptual Component*: Emerges first, building on innate preferences of infants to attend to human social stimuli. During the latter half of their first year, children begin to use this perceptual information to interpret others' emotions and intentional states.

2. *Social-Cognitive Component*: Includes representational understanding of mind; builds on the perceptual component, beginning in the pre-school years when children begin to talk and reason about epistemic states. Responsible for our ability to make complex inferences about the content of mental states via the integration of information across time and events. In place by age 4, but continues to develop for years after.

2.5 Relation of Language to Theory of Mind

A good deal of research has investigated the association between language and theory of mind ability and a possible causal direction between the two. In the introduction to *Why Language Matters for Theory of Mind* (2005), Astington and Baird offer a nice summary of the body of research, crediting Chris Moore (2002) for succinctly identifying that the underlying question is "whether there is anything special about theory of mind that requires language and, relatedly, whether there is anything special about language that allows theory of mind to develop" (8). Astington and Baird identify several perspectives that include no recognition of a special role for language:

- Theory of mind is innately specified, but it is simply not evident until a level of linguistic and cognitive development is achieved. (Fodor 1992)

- The role of language is merely superficial—because most tasks that endeavor to measure theory of mind are verbal tasks, success on these tasks requires a level of

linguistic development. (Chandler, Fritz, and Hala 1989)

- Theory of mind abilities rely on general cognitive operations that require language for their implementation. (Frye, Zelazo, and Palfai 1995)

- Language is simply the natural way of providing children with the information they need to construct a theory of mind. (Gopnick and Wellman 1994; Perner 2000)

Astington and Baird also identify several positions in support of language's special role in theory of mind; the book is organized into sections according to the linguistic focuses researchers have taken.

2.5.1 Conversational Pragmatics

Children's participation in conversation is seen as critical to theory of mind development. The experience of information exchange brings children discoveries that others know things they do not know and they know things others do not. This leads to an understanding of "people as epistemic subjects and an awareness that there are different points of view on the same material world" (9). The social world can be seen as a community of minds in which children participate more and more as language develops. Through language children gain access to the mental world that allows them to acquire social understanding.

2.5.2 Lexical Semantics

It is in conversation that children acquire the concepts of mental states like belief, desire, and intention. But these mentalistic notions do not stand in one-to-one relations with specific behavioral patterns. Conversation may provide children with a means of "abstracting the

underlying mental-state concepts because the concepts are encoded semantically in the language of the culture." Some believe children use the mental-state terms before they fully understand them, and their increasing use of the terms facilitates their ability to reflect on and label their (and eventually others') mental states. "Language allows for a level of abstraction that can support concepts about unobservable mental states" (9).

2.5.3 Complementation Syntax

Some researchers suggest that the understanding of mental states and perspectives that develops in children as they participate in conversation is not sufficient for the metarepresentational interpretations of behavior that are required to pass a false belief task. Researchers such as Jill and Peter de Villiers (de Villiers, J. 2000; de Villiers, J. 2005; de Villiers, P. 2005) point out that solving a false belief task requires the syntactic structure of a full clause complement. To answer "Where will Sally look for the marble?" a child must be able to form a sentence with an attitude (*Sally thinks*) about a proposition (*that the marble is in the basket*). Thus de Villiers and de Villiers suggest that the understanding of referential opacity that Baron-Cohen identifies as emerging at age 4 with the theory of mind mechanism crucially depends on mastering the syntax of sentential complementation.

Children first learn the syntax of sentential complements as they begin to use verbs of communication and, in turn, learn that the embedded clause in such sentences need not be true. Consider the painful lesson the toddler in his car seat is learning in this example:

Example 3

03 Honey, I said **that we could get some ice cream on the way home**, but I'm afraid we're not going to be able to.

Jill de Villiers (2005) suggests that children bootstrap the understanding of such false complements in communication verbs to mental state verbs—well before they have a full understanding of those verbs. That is, children gain an understanding of the syntax and possible truth values of sentences like example (3) because they are overt and can be checked against facts. With this syntactic tool in their possession, children start applying the same structures to verbs like *think* or *believe*. Importantly, it is the syntactic structure that provides the necessary format for "the representation of mental attitudes toward mental contents" (Astington and Baird 2005: 17). Olson (1988) suggests that in this way the acquisition of language gives a child the metalanguage to talk about mental states and eventually represent others' states of mind. Because children initially apply sentential complements to mental state verbs by analogy, they do so before such representational reasoning has developed (de Villiers 2000). Thus for a time, children use the structure without fully recognizing in which contexts it is appropriate to do so. The complement structure invites speakers and listeners to enter a different world, to suspend their usual procedures of checking truth. Once children have gained this understanding, they have the skills to pass a false belief task. At the point of mastery, de Villiers (2000) posits that a feature is set in the grammar to indicate that complements of non-factive communication verbs[9] or mental-state verbs *can be false.* In summary, de Villiers argues that children's syntactic development facilitates mental state reasoning. "Thus only the syntax of natural languages normally provides the anchor around which the concept of the propositional contents of other

[9] Verbs that take sentential complements are categorized as *factive* if they presuppose the truth of their complements (e.g. *know, realize, regret*) or *non-factive* if they have no such presupposition (e.g. *say, remember, think*) (Karttunen 1971).

minds can coalesce" (de Villiers 2000: 90). We will look at some findings regarding complementation and false belief task performance in autistic subjects in section 2.6.2.

Research supports a strong correlation between language and theory of mind abilities. Astington and Jenkins (1995) concluded that language leads the way to passing false belief tasks in a clear developmental relationship; de Villiers and Pyers (1997) found that mastery of complement structures in comprehension and production was the best predictor of false belief reasoning; and de Villiers (2000) reports that orally taught deaf children—considered to be developing normally except for their delayed language—failed false belief tasks, possibly because they had not learned complement structures. Slade and Ruffman (2005) found that general language skill is strongly correlated with theory of mind, but they did not find evidence for syntax having a stronger correlation than semantics. Consistent with previous research, they found that children's general language ability directly contributes to their later theory of mind and that, in certain conditions, language is a more consistent predictor of false belief understanding than vice versa. However, Slade and Ruffman's findings challenge previous suggestions that theory of mind does not contribute to later language development. They suggest that task sensitivity may mask the role of theory of mind in language development (133).[10] The suggestion that theory of mind ability influences language skills is consistent with the view that joint attention, an early manifestation of developing mindreading (Baron-Cohen 1995), entails understanding others as intentional agents, and that acquiring a language requires

[10] Slade and Ruffman (2005) initially found that language ability, as measured by a large number of items, predicts later theory of mind, but not vice versa. However, they then reduced the language measure to equate the range of scores with the range possible on the theory of mind measure. Under this analysis, they found that false belief performance had a significant effect on later language.

the interpretation that words and gestures are intentional acts (cf. Tomasello 1995; Baldwin 1993, 1995).

2.5.4 Relevance Theory Interpretation Strategies

Sperber (1994) identifies three on-line interpretation strategies—naive optimism, cautious optimism, and sophisticated optimism—that can be used to move beyond "the ambiguous and incomplete linguistic senses" (9) of an utterance to comprehending the speaker's intention. Sperber (2000b) suggests these strategies may be the domain of distinct metarepresentational abilities that humans may have evolved in addition to theory of mind, including a comprehension module aimed at the on-line interpretation of utterances. Sperber (1994) describes the strategies within the Relevance Theory framework he and Deirdre Wilson developed (1986/1995), wherein the search for an utterance's relevance is seen to be the cognitive force driving human communication. We will look at Relevance Theory in detail in the next chapter, but for now let us just note that Sperber and Wilson contend that when a speaker wishes to communicate something *and makes this intention clear to a listener*, such "ostensive-inferential" communication creates presumptions of relevance (cf. *Communicative Principle of Relevance*, section 3.4.2), and this "underpins the working of a special-purpose inferential comprehension device" (Wilson and Sperber 2004: 625). They see the comprehension process as the domain of a dedicated inferential mechanism "that automatically computes a hypothesis about the speaker's meaning on the basis of the linguistic and other evidence provided. This approach allows for varying degrees of sophistication in the hearer's expectations of relevance" (625). Just as children are born with a substantial innate ability to acquire language, Sperber and Wilson suggest that children are also born with an innate endowment allowing for the

emergence of ostensive-inferential communication. It is in this light that Sperber (1994) suggests three strategies for interpreting a speaker's utterance, each of which involves following the path of least processing effort in constructing an interpretation of a speaker's behavior and stopping when interpretation is relevant enough. Since each comprehension strategy is more sophisticated than the preceding one, each requiring one more layer of metarepresentation than the one before, Wilson (2000) suggests that the strategies may represent stages that correspond with broader theory of mind development. They are as follows:

NAIVE OPTIMISM: The naive language user assumes speakers are benevolent and competent. A listener trying to determine a speaker's intended meaning looks for an interpretation that seems relevant enough for the context. If the listener finds one, he assumes it is the one the speaker intended, and he attributes it as the meaning of the utterance. In concluding that an interpretation must be what the speaker intended, the listener thinks about the speaker's thoughts, of course, which is the only metarepresentation required of a naively optimistic listener.

CAUTIOUS OPTIMISM: A cautiously optimistic listener allows for the possibility that the speaker might have misjudged what would be the most accessible and relevant interpretation to the listener. That is, a listener at this level still assumes speakers are benevolent, but he is aware that they may not always be competent. In this strategy the listener attributes to the speaker an interpretation that the speaker might have thought would be relevant enough and most easily accessed, even if that interpretation does not actually happen to be the most accessible relevant interpretation. That is, in determining speaker intention, the listener stops not at the first sufficiently relevant interpretation but at the first interpretation that the speaker might have

thought would be relevant enough. After forming a possible interpretation, the listener asks himself, Could the speaker have expected this interpretation to occur to me? Would the speaker have seen this interpretation as relevant enough for me? At this level, metarepresentations serve as premises toward conclusions, not just conclusions. The extra level of metarepresentation assists in avoiding misunderstanding in two types of context where the naively optimistic listener would fail:

- accidental relevance, where the first interpretation that seems relevant enough is not actually the intended one; and

- accidental irrelevance, where the speaker misspeaks, leaving the naively optimistic listener unable to ask himself what the speaker might have intended to say.

SOPHISTICATED UNDERSTANDING: The sophisticated listener assumes a speaker is necessarily neither competent nor benevolent. Such a listener can ask himself, Under what interpretation might the speaker have thought I would think that her utterance was relevant enough? To identify a speaker's intended interpretation, the listener must metarepresent the speaker's thoughts about his (the listener's) thoughts. A listener at this level has the capacity to recognize deception, because he is aware that speakers use communication to pursue their own ends, which will correspond to the listener's ends in some ways and differ in other ways.

Sperber (2000b) and Wilson (2000) speculate that on-line interpretations of utterances may involve metarepresentational abilities that are in addition to the mindreading ability considered the domain of theory of mind. Both suggest that such "metacommunication" ability may be a specialized subpart of theory of mind. Wilson (2000) suggests that a child's move from naive optimism to cautious optimism in comprehending speakers coincides with the acquisition of a

1st order theory of mind. In other words, a listener's ability to ask herself whether a speaker might have thought a particular interpretation would be relevant enough overlaps with or may stem from the same ability utilized when representing a contrast between one's beliefs and the beliefs of others. This would correspond developmentally with the emergence of Baron-Cohen's theory of mind mechanism, while perhaps Sperber's sophisticated understanding strategy develops during the years in which Tager-Flusberg (2001) suggests children grow more skilled in their ability to use their mentalistic knowledge to predict behavior.

2.5.5 Summary

In summary, Astington and Baird (2005) describe the body of language and theory of mind research as a whole that is greater than the sum of its parts; the possible explanations should not be seen as being in competition, but rather as part of a broad explanation of why language matters for theory of mind. "Pragmatic ability allows children to participate in communicative exchanges, where they hear mental terms used with sentential complements. From this experience, they acquire awareness of points of view, concepts of mental states, and mastery of the syntax for representing false beliefs. Both the social environment that provides this cultural input and the child's own cognitive resources that make use of it are needed for the child's theory of mind to develop" (11). "We argue that language matters for false belief understanding (and thus, theory of mind) because language supports the metarepresentational model that underlies this understanding" (16).

Given the body of evidence that connects early socialization, language acquisition, and theory of mind, it is not surprising that researchers began looking for unique correlations between the communication and theory of mind impairments in autism.

2.6 Language and Theory of Mind in Autism

As evidence of a theory of mind impairment in autism mounted, researchers were motivated to explore how the impairment was manifest beyond struggles with false belief tasks. Among the most compelling aspects of the theory of mind hypothesis of autism was how well it seemed to explain communication difficulties observed among autistic persons. Recall that even the highest functioning verbal autistic persons produce structurally adequate language while often showing poor understanding of how to use it properly in social context; thus researchers began investigating whether impaired theory of mind ability could explain poor pragmatic linguistic skills.

2.6.1 Literature Review: Language and Theory of Mind in Autism

Using Relevance Theory as a framework for understanding language comprehension, Happé (1993) looked at how performance on false belief tasks correlated with comprehension of simile (e.g. "Jeff's like a vulture out there, isn't he?"), metaphor (e.g. "Jeff's a vulture out there, isn't he?"), and irony (e.g. "Jeff's not waiting ominously out there at all, is he?"). Because impaired ability to represent the mental state of one's partner in conversation will impair one's awareness of mutually known contextual information, Relevance Theory predicts that impaired theory of mind in one of the interlocutors should interfere with successful communication.[11] Happé reasoned that figurative language utterances should be particularly troublesome to autistic people because of the extent to which a speaker's attitude needs to be taken into

[11] I am setting aside here Sperber's (2000b) and Wilson's (2000) hypotheses regarding a metarepresentational mechanism distinctly adapted for use in the interpretations of speaker utterances ("metacommunication").

account in order to interpret figurative language beyond its literal meaning. Happé predicted that performance on false belief tasks would correlate with understanding of metaphor and irony but not of simile, which requires only linguistic decoding of the literal meaning of the sentence. She describes how there is little difference in a listener's task of processing "He was like a lion" versus "He was like his father" in that both merely require a determination of how the referents are similar (103). Happé asserts that metaphor, in contrast, requires a 1st order theory of mind, i.e. attributing belief to others ("Mary doesn't know that . . ."), because "the propositional form of the utterance is a more or less loose interpretation of the speaker's thought. . . . Just as in the false belief situation (but not the true belief case) the actor's mental state is crucial, and reality alone is no guide to action, so in metaphor (but not simile) the speaker's mental state (intention) is vital, and working with 'reality' in the form of the literal meaning of the utterance is not sufficient for comprehension" (104). Irony, Happé continues, is more demanding still, as it requires a 2nd order theory of mind, i.e. beliefs about attributed beliefs ("Mary knows that John does not know . . ."). She cites Sperber and Wilson's (1986/1995) view of ironic utterances as references to attributed thoughts; e.g. in making a comment like "Well that was clever," a speaker expresses a possible thought and simultaneously a (mocking) attitude toward that thought (104). A listener must recognize something in the sentence's context that allows her to infer that the speaker is mocking the literal meaning of his sentence.

Happé chose her subjects from a large group on whom she had previously conducted a thorough assessment of theory of mind. She chose participants who fell into one of four groups:[12]

[12] Refer back to section 2.3 for discussion of 1st, 2nd, and 3rd order theory of mind.

1. 6 autistic subjects who failed the false belief tasks (the "no-ToM" subjects)
    a. age 10 – 28 (*m* = 18)
    b. Verbal IQ = 52 – 76 (*m* = 62)

2. 6 autistic subjects who passed the 1st order false belief task but failed the 2nd order (the "1st-ToM" subjects)
    a. age 9 – 25 (*m* = 16)
    b. Verbal IQ = 64 – 100 (*m* = 82)

3. 6 autistic subjects who performed "most successfully" on 2nd order false belief tasks, scoring at least 6/8 on performance questions (the "2nd-ToM" subjects)
    a. age 11 – 26 (*m* = 18)
    b. Verbal IQ = 58 – 100 (*m* = 90)

4. 14 non-autistic participants with moderate learning difficulties (MLD) who passed both the 1st and 2nd order false belief tasks
    a. age 12 – 38 (*m* = 20)
    b. Verbal IQ = 40 – 89 (*m* = 56)[13]

The subjects participated in two experiments. The first was a sentence completion task in which they had to choose a word or phrase from a list of six choices. The sentences featured synonym (control), simile, or metaphor.[14] The no-ToM group performed worse than the MLD subjects and the other autistic subjects on all three conditions, but the difference was significant only with the metaphors. This supports Happé's prediction; she concludes that it is "only when an utterance *must* be understood as an expression of a *thought* that autistic subjects without theory of mind are at a disadvantage compared with other, non-autistic, mentally handicapped individuals" (108, author's emphasis).

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[13] Happé notes that the MLD group was matched with the no-theory-of-mind autistic subjects for VIQ, so intellectual impairment would not be a likely explanation for any difference between the groups.

[14] Sentences with simile and metaphor differed only in the key phrases "was like" and "really was."

In the second experiment, characters in stories uttered metaphors and ironies, and the subjects had to explain what the characters meant by their utterances and answer forced-choice questions about the meanings. Consistent with her predictions, Happé found that the no-ToM autistics performed much worse than the other autistic groups on both metaphor and irony, the 1st order group performed nearly perfectly on metaphor but poorly on irony, and the 2nd order group got perfect scores on both.

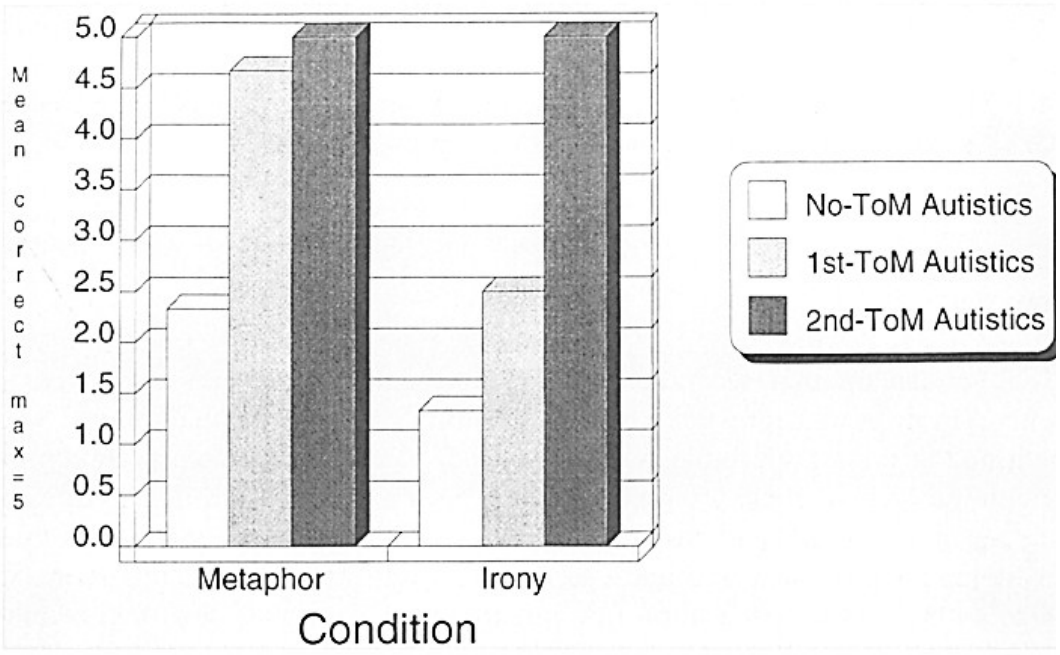

Figure 2.2 Happé (1993) Experiment 1

Interestingly, the MLD group, not included in the chart, had mean scores of 4.71 on metaphor and 4.36 on irony. This supports Happé's assessment of the role of theory of mind in understanding metaphor and irony: despite significantly lower verbal IQ scores, the MLD subjects (all of whom passed both levels of theory of mind tasks) performed statistically just as well as the 2nd order autistics in irony.

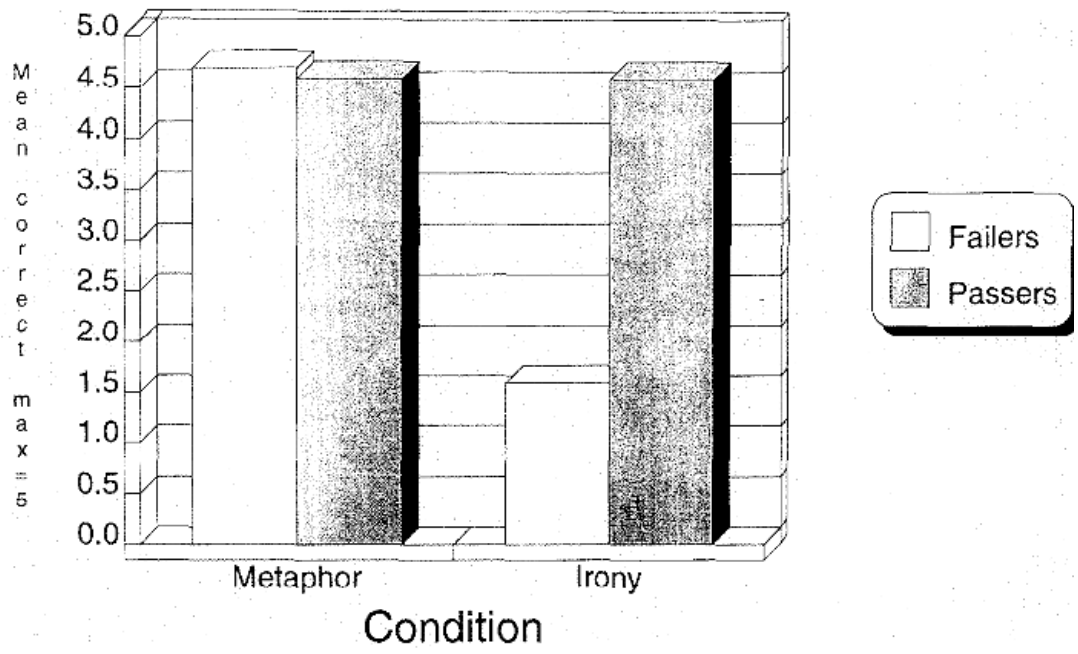

Figure 2.3 Happé (1993) Experiment 2

Finally, Happé followed these tests with an assessment of two groups of typically developing children (mean ages 5:4 and 5:3); both groups passed a 1st order false belief task, while only one group passed a 2nd order task. Happé got similar results: the 2nd order group was nearly perfect with both metaphor and irony, while the 1st order group did equally well on metaphor but quite poorly on irony. Happé notes that efforts had been made to find children of the same age for both groups and developmentally the children were probably all just before or just after a turning point in metarepresentational ability. The results paint a remarkable picture of the impact of 2nd order theory of mind on irony comprehension.

Happé concludes by emphasizing how well Relevance Theory explains impaired communication abilities in autism: "theory of mind, and specifically the ability to represent intentions, may be vital for normal ostensive-inferential communication." Happé's results show how *degree* of metarepresentational ability relates to *degree* of communicative ability "in a

quite specific way" (115, author's emphasis). Happé raises the question of how these results contribute to our understanding of how the minority of autistic persons who pass false belief tasks go about doing so. In a later paper she describes two responses researchers have had to this question. Success on false belief tasks by high functioning autistic subjects could be proof of their possessing a theory of mind, in which case the handicaps of autistic persons (including high functioning) could be due to "a gross delay in acquisition" or some other additional cognitive impairment (Happé 1994: 130). Alternatively, false belief task success could stem not from theory of mind ability but rather from the ability of some autistics to devise a non-mentalizing strategy to solve the problem. This, Happé writes, could explain why such subjects are socially handicapped despite passing a test that suggests they have a working theory of mind. That is, the strategies that allow false belief task success for some autistics may not be so effective in the unstructured, spontaneous interactions that are common in everyday life. Regardless, Happé points out that whatever it is that distinguishes the autistic subjects in the three different theory of mind groups, it has "a direct and particular association with the comprehension of figurative language" (116). Happé says the results suggest there is a real difference among the groups in underlying theory of mind performance—i.e. more than just a difference in ability to devise a non-mentalizing strategy to solve a false belief task. "The obvious question for future research, then, must be to explain the persisting social and non-social impairments seen in even those autistic subjects who appear to have developed the ability to think about thoughts" (116).

More research has explored the question of how some autistic subjects solve false belief tasks, but first let's look at another paper that used Relevance Theory to study cognition in autism, focusing on whether autistic children "have an ability to derive an answer from context" (1050). Loukusa, Leinonen, Kuusikko, Jussila, Mattila, Ryder, Ebeling, and Moilanen (2007)

selected two groups of autistic children, one age 7–9 and another age 10–12, to compare to a group of typically developing children age 7–9. The autistic children were all considered high functioning, testing at or above normal in full-scale IQ, and neuropsychological assessments were administered to verify that "difficulties in linguistic understanding and auditive memory problems did not affect" their performance (1051). Controls were chosen from the same age range as the younger autistic group to ensure that none of the control children had more experiences than the autistic children that "could affect their answers to pragmatic questions" (1052). Typically developing 8- and 9-year-olds had performed "near the ceiling level" when answering the same questions in Loukusa et al.'s pilot study, so the researchers felt there was no need for older control children.

Loukusa et al. investigated how the children would perform answering "contextually demanding" questions and explaining their answers, hypothesizing that performance would be worse among the younger autistic group than the other two groups.[15] They used pictures and short stories to ask the subjects questions that were designed to investigate "contextual operations" they had identified that a listener must process in order to comprehend an utterance. The operations they focused on were reference assignment, "enrichment" of incomplete sentences via contextual and world knowledge, and inference of meanings, known as "implicatures" that go beyond what is strictly entailed by the linguistic meaning directly encoded in an utterance.[16] Loukusa et al. considered the reference questions to be the easiest and the implicature questions to be the most difficult. Judging from the example they give, it

[15] Loukusa et al. do not explain why they expected the younger autistics to perform worse than the older autistics, but presumably they expect inferential impairment to be more acute in younger autistics due to developmental delay.

[16] We will look at implicatures at length, beginning in section 3.4.1.

appears the reference task required only the most basic understanding of reference. The examples are verbatim from the appendix:

Example 4

An Example of a Reference Assignment Question:

Best Clothes

Description of the picture:
There is a mother and a girl in the picture. The girl has a dress on and she is running. There are muddy puddles on the road. The girl has just stepped in the puddle and the picture shows the mud splashing.

Verbal information and the question:
The girl with her best clothes on is running on the dirty road. Who is running on the road?

An example of a correct answer (almost all children gave this answer):
"A girl."

Example 5

An Example of a Basic Implicature Question:

Rain

Description of the picture:
The picture shows a village, there are two ice-cream kiosks and a church. It is raining. There are cars driving on the road and cyclists are cycling on a path. A boy is walking and holding a book over his head. There are two girls, one with an umbrella and one with a raincoat (the hood is up).

Verbal information and the question:
Here is a picture of a village on a rainy day. There are many cars driving on the road. A boy is walking over the zebra crossing. (point to the boy) Why is the boy holding a book over his head? (basic question)

An example of a correct answer and explanation (normally developing 7-year-old girl):
"So he does not get wet."

How do you know that?

"His book works as an umbrella."

An example of an incorrect answer (11-year-old girl with AS):
"He returns it to the library."

Loukusa et al. hypothesized that both autistic groups would do worse than controls on the more difficult questions, and overall, they found that in both answering the questions and explaining their answers, the controls did better than the older autistic group, who did better than the younger autistic group, except for the reference questions, on which all children performed near the ceiling. "Results supported the central viewpoint of Relevance Theory that language skills are not sufficient for understanding utterance meaning, but the interpretation of an utterance demands an ability to go beyond linguistically given meaning by using and connecting relevant contextual information. As the contextual comprehension of high-functioning children with AS or HFA develops later compared to typically developing children, important developmental stages may be missed, and therefore pragmatic context use may remain lacking or fragile. This may result in a breakdown of pragmatic comprehension if the situation is demanding, e.g. when comprehension demands interpretation of subtle contextual clues or the combination of many contextual things via deduction" (1055).

Returning to the question of what explains the success some autistic subjects have on false belief tasks, Happé (1994) reasoned that if those who pass false belief tasks do so via a "non-theory of mind strategy," settings with a less rigid structure than a controlled setting false belief task might prove too challenging to such a strategy. A non-theory of mind strategy "might be flexible enough to be applied successfully to slightly different surface forms of the same task, or might succeed only if the elements of visual access and information are spelled out (as they are in the false belief and deception tasks, but not in life)." Thus Happé designed this experiment

"to extend the range of tasks involving theory of mind to a more contextually embedded and realistic form, which might be expected to trip up even those subjects who succeeded on the previous simplified tasks" (130). Happé (1993) reasoned that whatever ability the autistic children were exploiting to solve false belief tasks—theory of mind or not—it was associated with comprehension of metaphor and irony. By attempting to present more naturalistic and challenging tasks involving theory of mind, Happé (1994) investigates a method to further tease out how autistic subjects' performance on false belief tasks and figurative language tasks like those administered in Happé (1993) correlates with their ability to employ a theory of mind in everyday life.

Happé once again grouped autistic participants by performance on theory of mind tasks, though this time she also included a large "able" autistic group comprising all the autistic subjects who at least passed one of the false belief tasks.

1. 6 autistic subjects who failed the false belief tasks (the "no-ToM" subjects)
    a. age 14 – 28 (*m* = 18)
    b. Verbal IQ = 52 – 76 (*m* = 62)

2. 6 autistic subjects who passed the 1st order false belief task but failed the 2nd order (the "1st-ToM" subjects)
    a. age 9 – 25 (*m* = 17)
    b. Verbal IQ = 65 – 100 (*m* = 82)

3. 6 autistic subjects who performed "consistently well" on 2nd order false belief tasks (the "2nd-ToM" subjects)
    a. age 12 – 26 (*m* = 18)
    b. Verbal IQ = 90 – 101 (*m* = 96)

4. 18 "able" autistic subjects who passed at least one false belief task
    a. age 9 – 45 (*m* = 21)

b. Verbal IQ = 64 – 101 (*m* = 87)

5. 11 mentally handicapped (MH) non-autistic participants who passed both the 1st and 2nd order false belief tasks plus 2 more MH subjects "who did not score perfectly on 1st order false belief tasks but who performed well otherwise across the battery"
    a. age 12 – 38 (*m* = 19)
    b. Verbal IQ = 40 – 89 (*m* = 56)

6. 26 typically developing children who passed both 1st order and 2nd order false belief tasks
    a. age 6 – 10 (*m* = 8)
    b. Verbal IQ = N/A

7. 10 normal adults
    a. age 15 – 24 (*m* = 21)
    b. Verbal IQ = N/A

In order to present a "more naturalistic challenge to the subjects than did the acted out theory of mind battery of tasks," Happé presented subjects with stories "about everyday situations where people say things they do not literally mean" (130). All the participants were given a series of twelve *Strange Stories* designed to explore twelve different motivations that could be behind everyday utterances that are not literally true: lie, white lie, joke, pretend, misunderstanding, persuade, appearance/reality, figure of speech, sarcasm, forget, double bluff, and contrary emotions. The participants were instructed to listen to each story carefully and help the storyteller with the questions at the end. Each story was accompanied by a picture and two questions: a comprehension question, "Was it true, what X said?" and a justification question, "Why did X say that?" Answers to the justification questions were rated as correct or incorrect, with incorrect answers involving errors about the details of the story or inferences

that were inappropriate as reasons for the story character's utterance. Justifications were also scored as either involving physical states (e.g. the boy called his dog an elephant because "the dog is big like an elephant") or mental states (e.g. the boy did so because "he was joking").

Looking at the results, Happé first compares all subjects with at least 1st false belief task success. The able autistic group did just as well as all controls when there was an appropriate physical state justification to the character's utterance, e.g. the character pretended the banana was a phone because they have the same shape. However, when the justification depended on a mental state, the able autistics did significantly worse than all other groups, and since most of the stories required a mental state justification, the able autistic group's overall scores were the lowest. Like the Happé (1993) results, the scores (out of a possible 24 points) illustrate the ability of subjects with very low IQ scores to perform comparably to normal subjects and significantly better than autistic subjects with much higher IQ scores.

1. Normal adults = 23.7
2. Normal children = 21.0
3. MH controls = 21.4
4. Able autistics = 15.7

In analyzing the performance of the autistic subjects by theory of mind scores, Happé describes the obvious correlation between the two tests as a strong indication that the various false belief tasks measure the same underlying competence in attributing mental states that the Strange Stories do (146).

1. Normal adults = 23.7
2. Normal children = 21.0
3. MH controls = 21.4
4. 2nd-ToM autistics = 20.0

5. 1st-ToM autistics = 12.8
6. No-ToM autistics = 7.5

Note that even the 2nd order ToM group scored significantly lower than the normal adults and was unable to outperform the MH group. Happé speculates that this could be because the non-autistic subjects actually employed some 3rd order understanding the autistic subjects were not capable of, such as thinking "he knows they think he will lie" in the double bluff story. Alternatively, it may just be that the battery of Strange Stories are "a more sensitive and naturalistic test of theory of mind ability than the relatively artificial and simplified false belief and deception tasks of the theory of mind battery" (144). Happé suggests that the more naturalistic format and the absence of questions highlighting salient elements (such as the questions that are part of false belief tasks) might reveal difficulties that "even the most able autistic individuals appear to have in *applying* what social knowledge they may have in everyday life" (146, author's emphasis). That is, the impairment could be not so much an inability to represent the mental states of others as an inability to put theory of mind to use. Happé suggests that perhaps weak central coherence (cf. Frith 1989, Frith and Frith 2000, Jolliffe and Baron-Cohen 1999) may be a more universal impairment in autism than difficulty representing mental states. Frith (1989) first characterized autism this way, hypothesizing that central coherence is a cognitive system that integrates various sources of information in context in order to establish higher meaning. Less structured tasks requiring on-line integration of a variety of relevant information would be particularly difficult for such individuals. The theory that weak central coherence is a more fundamental impairment in autism than theory of mind supports the same prediction as the theory that autistic subjects solve false belief tasks via non-theory of

mind strategies: both explanations would predict autistic subjects would be more successful in the slow-paced structured contexts of false belief tasks than the ever-changing unpredictable contexts of real life.

Continuing the investigation of alternative measures of mentalizing ability in autism, Frith, Happé, and Siddons (1994) looked at how autistic participants' performance on false belief tasks correlated with their performance on everyday life skills the authors considered dependent on assessing mental states. If autistic subjects who pass false belief tasks do so by hacking out a solution without employing a theory of mind, they should not show insightful social behavior in real life,[17] as their winning strategy would likely be too narrow to generalize beyond the restricted setting of the false belief experiment (Frith, Morton, and Leslie 1991). If instead autistic false belief task passers truly mentalize, Frith et al. (1994) posited that at least some autistic people acquire the ability to represent mental states and thus should enjoy more success in everyday life than those who fail false belief tasks.

For three groups of children—typically developing (TD), moderately learning disabled (MLD), and autistic—Frith et al. administered two false belief tasks for theory of mind measurement and the British Picture Vocabulary Scales (Dunn et al. 1982) for a measurement of Verbal Mental Age (VMA). Comparing the subjects who passed the false belief tasks to those who failed in each group, Frith et al. found no significant differences for the TD and MLD groups, but the autistic passers had significantly higher VMA than the autistic children that failed the tasks. Citing Tomasello's (1988) research that language acquisition is dependent on joint attention, orientation to ostension, and recognition of speaker intention, Frith et al. speculate that

[17] Frith et al. give empathy and deception as examples of such behavior.

measures of VMA may inadvertently serve, to some extent, as measures of autistic children's ability to mentalize (118). This is not only consistent with Tomasello (1988) but also with Slade and Ruffman's (2005) assertion that theory of mind ability predicts later language ability.

The researchers also administered the Vineland Adaptive Behavior Scales (VABS) (Sparrow et al. 1984), which have been used in differentiating autistic and non-autistic learning disabled people "in terms of the nature of their social impairment" (109). Consistent with previous studies, the autistic children showed a characteristic dip in their Socialization domain scores compared to their scores in the Communication and Daily Living Skills domains (120). It is noteworthy, however, that when the individual scores were analyzed, Frith et al. found that the dip in Socialization scores was only significant for the autistic children who failed the false belief tasks.

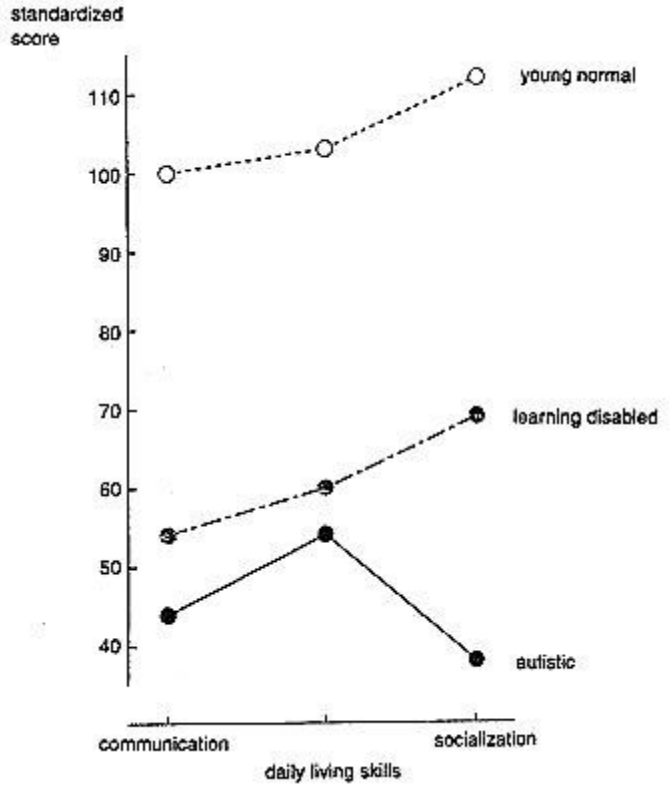

Figure 2.4 Frith et al. (1994) Profile of VABS scores for 3 groups

For a further measure, the researchers identified those items on the VABS that understanding mental states; they grouped these into an Interactive Sociability score. They also identified items that they concluded were possible without an understanding of mental states,

grouping these into an Active Sociability score. Comparing these scores, they found that the autistic passers exceeded the autistic failers on the Interactive Sociability scores but not on the Active Sociability scores.[18] The researchers concluded that the autistic subjects who passed false belief tasks "showed more everyday social insight but not more simple sociability than those who failed" (117). This is evidence that autistic children who pass false belief tasks do indeed have at least a limited ability to represent mental states. However, when Frith et al. compared the individual scores of the eight autistic passers, they found that only three of them scored significantly higher on the Interactive Sociability measures than those who failed; the other five passers did not exhibit any better interactive ability than the autistic failers. Returning to their original question of how some autistic children pass false belief tasks, this suggests that *both* mentalizing and alternative strategies are viable explanations for their success. Here is a summary of Frith et al.'s findings:

- Language competence and theory of mind seem to be closely linked in development (118).
    - Autistic persons appear to require a significantly higher VMA to pass a false belief task.
    - All the autistic children with a VMA below 5 years 5 months failed the false belief tasks. In contrast, all TDs who failed the false belief tasks had VMA of 3:3 or below and MLDs of 3:7 or below.
- Among autistic children who pass false belief tasks, *it appears some do so by truly mentalizing*, while others appear to adopt a local strategy that does not transfer to

[18] Frith et al. find no evidence that the autistic failers showed any of the behaviors they included in their Interactive Sociability score, which provides support for their determination of specific behaviors on the VABS that require mentalizing.

other aspects of life that require an understanding of others' mental states.

- Three of eight passers had significantly higher Interactive Sociability scores than those who failed.

- Five of eight passers scored no better on Interactive Sociability measures than those who failed.

Happé (1995) also found an important correlation in autism between language ability and ability to pass a false belief task. Looking at data from 70 autistic subjects, 34 mentally handicapped subjects, and 70 normal subjects, Happé reported that only 20% of subjects in the autistic group passed both theory of mind tasks administered, compared to 58% of the mentally handicapped group and 56% of the control group. Comparing those who passed, Happé found that the young autistic subjects required a much higher verbal ability than the other groups in order to pass. All the control children with a VMA under 2 years 10 months failed at least one task, while all those above 6 years 9 months passed both. In the autistic group, all those under 5:6 failed at least one, with all above 11:7 passing both. Happé concludes that either VMA over 11:7 is sufficient for theory of mind, or VMA above 11:7 is impossible to achieve without a theory of mind (851). She repeats Frith et al.'s observation that impaired ability to mind-read may hamper word learning by interrupting the processes of joint attention, reference, and ostension, thus making vocabulary measures indirect measures of theory of mind in autistic children. The result is that only those autistic subjects who passed false belief tasks were able to achieve VMA scores over 11:7 (851).

The question this raises for Happé is just why autistic children require so much greater verbal ability to pass false belief tests. She offers the possibility that standard language tests

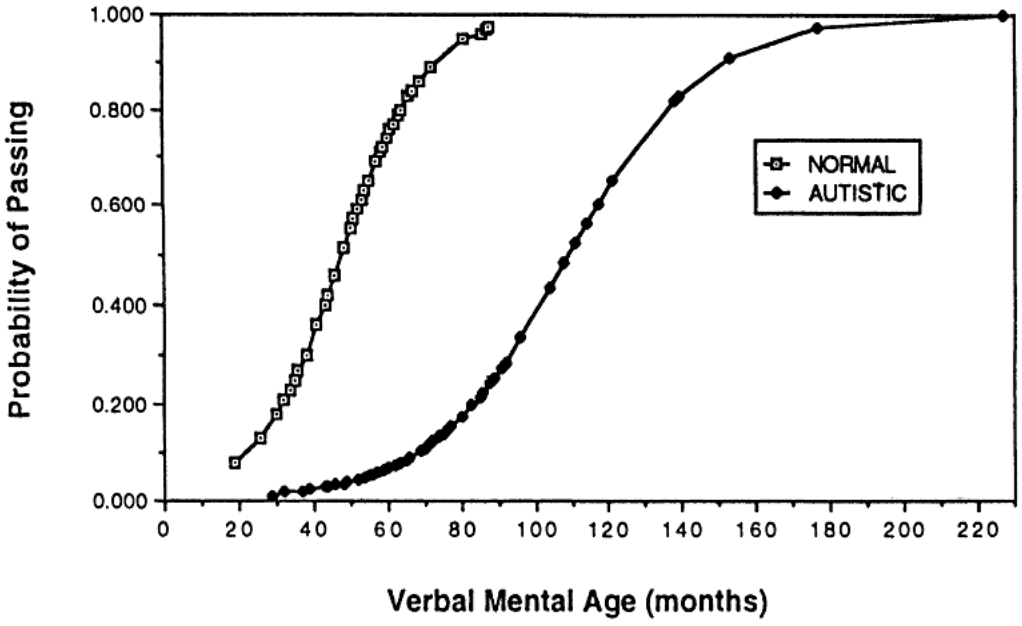

Figure 2.5 Frith et al. (1994) VMA correlation with passing false belief tasks

may present different problems to autistic children compared to neurotypical children, but she points out that the autistic children who failed the false belief tasks had higher VMAs than the young normal children who passed. Another possibility is that VMA may be acting as a measure of general ability in autistic children, and thus the correlation is mediated by general intelligence. However, previous studies have not shown a correlation between performance on theory of mind tasks and measures of nonverbal ability. Two other possibilities Happé suggests are that some other factor might underlie mindreading performance and verbal performance in autistic children, or that some autistic children might simply benefit from better teaching or motivation than others. But Happé feels the most interesting explanation is that perhaps autistic children employ a cognitive strategy to solve false belief tasks in a verbally mediated fashion (852). Such an explanation is consistent with Happé's (1991) finding that autistic children who passed 2nd order theory of mind tasks could verbally justify their answers, while the neurotypical

and mentally handicapped children passed numerous such tests without being able to give any justification for their answers. It is also consistent with Frith et al.'s (1994) conclusion that some autistic children pass false belief tasks with strategies not involving mindreading, as well as with other researchers' observations that autistic subjects solve the tests "in an unusually conscious and logical way," perhaps using cognitive strategies in a variety of social situations that neurotypical children navigate with little effort (852).

Happé makes clear that she does not consider the suggestion that autistic children employ a conscious, verbally mediated strategy to solve false belief tasks the same as proposing that they "are in fact incapable of representing mental states, that they have 'hacked out' a solution to the tasks which does not involve any appreciation of minds" (853). Others have suggested that autistic false belief task success is artifactual (Frith et al. 1991), the product of compensatory strategies that allow appropriate responses without necessarily understanding the situation fully (Eisenmajer and Prior 1991). Happé does not dispute those possibilities, but emphasizes instead that to suggest that autistic success is verbally mediated is to make a claim "about the *way* in which these subjects have developed some ability to represent mental states" (853, author's emphasis). Given the correlation between autistic false belief success and understanding of utterances of simile, metaphor, irony, white lie, persuasion, etc. (Happé 1993, 1994), Happé concludes that the competence underlying success on false belief tasks by some autistic subjects, whatever it may be, "is sufficient to allow some understanding of speaker's intention in quite separate tasks."

To summarize thus far, we have seen that Relevance Theory posits that language skills alone are not sufficient for understanding the meanings of utterances; successful human communication relies on inferring speaker intention. Researchers have thus predicted that

theory of mind ability correlates with communication ability, since representing a speaker's mental state is vital to determining her intention. Finding that performance on progressively more challenging false belief tasks correlates with understanding of progressively more challenging non-literal forms of speech supports this prediction. We have seen that researchers like Frith, Happé, and Siddons have found a wide range of theory of mind impairment across the autism spectrum, as seen in the ability of some autistic children to pass 2nd order false belief tasks while most cannot pass even a 1st order task. They have shown a robust correlation between autistic children's verbal abilities and their performance on theory of mind tests, including the observation that passing a false belief task requires a much higher verbal IQ of autistic children than of typically developing children. Among autistic children who pass false belief tasks, it appears that some may employ mindreading ability in everyday life, while others do not. Those who do not may pass false belief tasks by employing verbally mediated strategies to represent mental states that are not effective in everyday life; they may have central coherence limitations that cannot be overcome outside a structured test environment; or it could be instead that they employ strategies that allow them to solve false belief tasks without representing mental states at all. In the case of the latter, perhaps such cognitive scaffolding strategies are sufficient for moderate success in some everyday life situations that appear to require mindreading. If so, then even those autistic subjects who appeared to employ mindreading ability in everyday life (Frith et al. 1994) could, in fact, just be examples of autistic individuals whose alternative strategies are the most successful at navigating social situations without mindreading ability.

2.6.2 Tager-Flusberg

In section 2.4.2 we looked at Tager-Flusberg's (2001) developmental model of theory of mind. She described this model in the context of a review of 15 years of research on autism and theory of mind, some of which has been seen here. In conclusion, Tager-Flusberg identifies various aspects of autism symptomology that the theory of mind hypothesis of autism can and cannot explain, as summarized below.

- An underlying inability to represent mental states provides a good explanation for the impairments in pretend play, socialization, and communication observed among subjects across the autism spectrum. But it fails to explain how, as we have seen, some autistic subjects pass false belief tasks, unless we are ready to accept as fact that those subjects do so via strategies not involving a representational mind.

- The theory of mind hypothesis also fails to explain why autistic children often exhibit developmental impairments well before age 4, i.e. well before any child could be said to be employing a representational theory of mind. That is, if autism is primarily a theory of mind deficit, why do autistic children behave differently from neurotypical children at an age when **no** children are thought to have a fully developed theory of mind?
    - The developmental model that Tager-Flusberg describes in the paper (see section 2.4.2) addresses this problem by positing that theory of mind begins developing long before it can be measured with a false belief task.

- The theory of mind hypothesis offers no obvious explanation for the narrowed interests and repetitive and self-stimulating behaviors included in the diagnostic criteria for autism.

- Finally, autistic subjects' failures on false belief tasks could be interpreted in terms of constructs other than theory of mind.

- Tager-Flusberg points out that failure on tasks involving theory of mind abilities may stem from fundamental deficits in executive functions or language (160).
    - Executive function refers to a set of mental processes that are categorized along three dimensions—inhibitory control, working memory, and cognitive flexibility—considered essential in flexible and goal-directed behavior (Nilsen and Graham 2009: 223).
    - A strong correlation between language ability and the ability to pass false belief tasks has been repeatedly observed. Perhaps a linguistic problem underlies the inability of most autistic subjects to pass a false belief task.

Despite these challenges, Tager-Flusberg argues that the theory of mind hypothesis offers an explanation of too many of the phenomenological features of autism to simply discard. Nonetheless, "the challenges summarized here need to be taken seriously," she writes. They offer "a guide for how we might conceptualize the place of theory of mind impairments in a more comprehensive account of the autistic syndrome" (160).

Tager-Flusberg suggests that a key misstep in theory of mind research has been the focus on the *moment of transition* from a non-representational understanding of mind to a representational understanding that occurs around age 4 in typically developing children. False belief tasks provide an excellent measure of this shift, but they do not explain how theory of mind emerges in the context of cognitive development. False belief tasks are a pass-fail measure, and by focusing on them, "we are led to believe that theory of mind is something one does or does not have—it emerges spontaneously at a single point in time" (161). The equation of performance on false belief tasks to the presence or absence of theory of mind reduces "what should be a rich, complex unfolding mentalistic conception of people to a categorical capacity"

(161). It is in this context that Tager-Flusberg lays out her view of a developmental framework for theory of mind and its impairment in autism.

As we saw in section 2.4.2, Tager-Flusberg presents a componential model for theory of mind that begins long before the emergence of a representational understanding of mind at age 4. But in contrast to Baron-Cohen (1995), Tager-Flusberg emphasizes that the transition to a representational mind is not a culmination but rather just one important milestone in a years-long process that begins with infants' interpretation of intentional action and continues through adolescents' deepening sense of morality. Four-year-olds with newly acquired representational understandings of mind still have much to learn about the mental life of themselves and others. In the subsequent years, children acquire a deeper appreciation of ambiguity; of the mind as an interpreter of knowledge; of the enduring nature of personality traits and how those traits provide information to interpret the intentions of people's actions; and of the role of intentionality in making moral judgments. Higher-order theory of mind abilities emerge in middle childhood, allowing children to begin to understand metaphor and irony, and adolescents gradually develop the capacity to read cues from people's faces about subtle emotional and cognitive states (162). This all emphasizes that development of theory of mind cannot be reduced to a single point in human development. The roots of theory of mind impairment in autism, Tager-Flusberg suggests, "may be seen in the social orienting deficits" evident in autistic infants. Such deficits correlate with inability to perceive the behavior of others as intentional, which thus hinders the development of the social-perceptual component of theory of mind (165), and as we have seen, likely hinders the development of language (Sperber and Wilson 1986/1995; Tomasello 1988, 1995).

Both Baron-Cohen and Tager-Flusberg see the autistic deficit in theory of mind beginning long before a deficit in representational understanding becomes apparent at age 4. Tager-Flusberg views autism as a disorder "defined by fundamental impairments to the neurocognitive system that serves the social-perceptual component of theory of mind." Since the impairments are present during infancy, development of the ability to make on-line judgments of intentionality is hindered. From there, the development of the social-cognitive component is severely compromised in most autistic children. Tager-Flusberg posits that structured false belief tasks diminish the need for on-line assessment of social cues to mental state and thus tap into the social-cognitive component more exclusively than the social-perceptual (164). This ignores the complex interconnected manner in which we use both the perceptual and cognitive to evaluate mental states and make inferences from them. The social-perceptual impairment in autism, then, in and of itself, is not an insurmountable problem for passing false belief tasks, since doing so does not require a strong social-perceptual component. But Tager-Flusberg points out that most autistic people have additional cognitive and linguistic deficits that impair the development of the social-cognitive component as well, and thus they fail the tasks. In contrast, autistic persons who have good language and general cognitive and information-processing skills can acquire the capacity to pass a false belief task via "these non-social cognitive routes" (167).

In summary, Tager-Flusberg (2001) concludes (1) that impaired theory of mind in autism must be viewed as a gradual development, "from the earliest emergence of social-intentional knowledge to the more complex social cognitive constructs that develop during later childhood and adolescence," and (2) that impaired theory of mind means *diminished* capacity, not *absence of* capacity (162). She suggests that researchers look at deficits in autism as differences in the

rate of developmental change compared to other populations and other cognitive domains (162). She emphasizes not just differences in theory of mind development between persons with and without autism, but also individual differences in the degree of mindreading impairment within the autistic population. Instead of using false belief tasks, she recommends that researchers look for ways to measure the cognitive components of theory of mind using continuous variables that reflect the developmental perspective she describes. To this end, she recommends "measures of discourse skills or other pragmatic abilities that depend on understanding other minds [in order to] provide more sensitive measures of individual differences among children with autism." Such measures will eliminate the all-or-nothing results of false belief tasks (165).

The research correlating theory of mind ability with language ability seems in line with Tager-Flusberg's recommendation of finding more subtle measurements of understanding of other minds. Her work is consistent with Happé (1994, 1995) and Frith et al. (1994), all of whom entertain the possibility that autistic subjects who pass false belief tasks do so via non-social, non-mentalizing routes such as language and information processing.[19] Tager-Flusberg and Joseph (2005) suggest that language becomes an artificial route to social-cognitive understanding. That is, instead of developing a conceptual understanding of mental states grounded in social-perceptual abilities, children with autism learn, via language, to reason logically through false belief tasks; it is their "sole route to understanding propositional attitudes" (312). They conclude that language is the single most predictive factor of false belief

[19] As we saw in section 2.6.1, performance on false belief tasks among autistic subjects correlates with their structural language ability, i.e. the phonological, semantic, and syntactic abilities that constitute a verbal mental age measurement. In this context, Tager-Flusberg's reference to language as a "non-social cognitive ability" is an appropriate description.

task performance among autistic subjects. Moreover, while they found that general language ability predicted theory of mind performance in autistic subjects (supporting the findings of Happé and Frith et al.), they conclude that knowledge of sentential complements is the strongest predictor. In the experiments they describe, subjects had to answer questions of both cognition verbs (e.g. "What did Mary think?") and communication verbs (e.g. "What did John say?"). The questions also varied by whether the correct answer was a true complement or a false complement. That is, if the story indicated that Mary thought the stores were closed but they were actually open, correctly answering the question "What did Mary think?" requires the false complement "(Mary thought) that the stores were closed." And if the story indicated that John ate lunch and told someone he did so, correctly answering the question "What did John say?" requires the true complement "(John said) that he ate lunch." Interestingly, while the *controls'* false belief task performances correlated with their understanding of both types of verbs (as did the subjects in de Villiers and Pyers 2002), the false belief task performance of the *autistic* children correlated only with the verbs of communication. Specifically, the crucial predictor of false belief performance for the autistic group was performance answering questions with *a false complement of a communication verb*. Tager-Flusberg and Joseph suggest that autistic persons "depend on these linguistic structures for an explicit representation of how there may be a conflict between reality and the content of what someone says, which helps them to solve tests that assess their understanding of knowledge and belief" (309). Statements about an utterance are overt representations; they may convey information about the speaker's mental state, but "they can be interpreted at a linguistic level without any mentalistic attribution" (312). Autistic children who gain proficiency in this linguistic understanding,

according to Tager-Flusberg and Joseph, use it to master tasks that tap a representational understanding of mind.

2.6.3 Connectivity Disorder

At this point we have seen a lot of evidence for theories that autistic persons who solve false belief tasks employ unconventional strategies that are not as useful in the unpredictable contexts of real life or that those who have sufficient ability to employ a theory of mind are often unable to do so outside the controlled, structured environment of a false belief task. Both theories serve to explain why success on false belief tasks is a poor predictor that autistic persons will be successful in everyday interactions. Both theories are consistent with a model that some neurologists' suggest, wherein autism is described as a "connectivity disorder" (cf. Just et al. 2004, Keller et al. 2007, and Minshew et al. 2008). Just et al. (2004) describe autism as "a cognitive and neurobiological disorder marked and caused by underfunctioning integrative circuitry that results in a deficit of integration of information at the neural and cognitive levels." The disorder disproportionately impacts higher-order processing while simple information processing remains intact, or even enhanced (Minshew et al. 2008). The more cognitive features involved, the more need for processing novel or large amounts of information, the more demands on speed of processing—in short, the more high-level integrative processing a task requires—the more an impaired integrative ability is manifest (Minshew et al. 2008: 383). Any facet of neurological or psychological function dependent on coordination and integration of brain regions is susceptible to disruption, "particularly when the computational demand of the coordination is large" (Just et al. 2004). Just et al. suggest that social interactions place large "if not the largest" demands on information integration. Thus, under this model, autistic social

abnormalities arise from an impaired ability to process various social stimuli while theory of mind processing is simultaneously trying to determine the social partner's intentions. Just et al. suggest that theory of mind impairment itself could be the outcome of impaired integrating of social and cognitive processing; i.e. the level of representation and abstraction involved in the use of theory of mind could impose a large demand on high level integration processes that are not up to the task.

This is all to say that if the autistic brain suffers from such impaired connectivity, autistic subjects would find a false belief task challenging, but less so than unstructured, real-life uses of theory of mind. That is consistent with researchers who suggest that those autistic subjects who pass false belief tasks do so in part because the confines of the experimental task setting present a manageable challenge. Moreover, if these subjects are employing an alternative strategy that features more localized skills, the task would not tax their higher level cognitive integrative capacity the way real life situations do. Under the underconnectivity model, some autistic individuals are considered so severely affected as to have "essentially no functional connectivity of neural systems" (Minshew et al. 2008: 384); nearly any task involving theory of mind may be beyond them. Others with less severity have the wherewithal to solve false belief tasks, for instance via bootstrapped linguistic knowledge that helps to minimize the amount of conceptual representation necessary to gain some level of understanding of the mental states of others. But given the processing loads presented every day by spontaneous events and interactions, it is not surprising that the bootstrapping efforts of even the highest functioning autistics often do not prevent impaired pragmatic behavior.

2.7 Conclusion

Research has shown a strong association between performance on false belief tasks and on measurements of structural language ability. Several researchers have observed that language ability is a strong predictor of theory of mind ability; this supports a view of conversational socializing as the venue in which children learn that others are intentional beings with their own points of view. Language matters for theory of mind, because language supports the metarepresentational model that theory of mind requires. Some researchers detail this further, proposing that the syntactic structure of sentences that express false propositions—sentences with false sentential complements—provides the structure necessary for children to use and eventually understand verbs of mental state and fully acquire a theory of mind.

There is also some evidence of correlation in the other direction—that theory of mind ability and performance predicts later language ability. While evidence is limited, such a correlation supports (indeed, seems essential to) claims that theory of mind precursors like early joint attention are necessary to language acquisition, in that children must gain awareness that speakers use their words intentionally before they can acquire a language.

Individuals all across the spectrum of autism exhibit awkwardness and deficiencies in communicating and socializing. It is not controversial to suggest that such behavior is related to the deficit in theory of mind ability that is also nearly universal across the spectrum. Thus it is not surprising that language and theory of mind are correlated in autism, even more so than in neurotypical persons: researchers have shown that autistic subjects require a much higher score on measures of verbal intelligence than neurotypicals in order to pass a false belief task. This is consistent with a developmental view that the foundations of theory of mind begin forming

shortly after birth. Researchers speculate that the interdependence between theory of mind and language is hampered in autistic children from the beginning, and that those with sufficient cognitive abilities develop compensatory strategies that bootstrap language onto theory of mind. Some are successful enough to pass false belief tasks.

In order to gain a better understanding of how much representational mentalizing ability autistic subjects really have, it has been suggested that we seek subtler measurements than the false belief task, such as measuring subjects' comprehension of various types of sentences involving sentential complements, analyzing their understanding of why people say things they did not literally mean, or quantifying their performance in areas of everyday life that seem to require theory of mind. In the next chapter I will make the argument that use of referring expressions is a continuous variable that may be quite useful in this endeavor, and I will review the work of researchers who have begun to explore this.

Chapter 3 Reference

3.1 Introduction

In Chapter 2, we saw that some degree of mentalizing impairment is endemic across the autism spectrum and that performance on false belief tasks, verbal IQ tests, and interactive sociability are all correlated in autistic subjects. It was suggested that while false belief tasks appear to test the ability to impute mental states to others, they are a blunt measuring tool that offers no detail beyond presence or absence of 1st order or 2nd order theory of mind. For this reason, Tager-Flusberg (2001) recommended that researchers look for ways to measure the cognitive components of theory of mind using continuous variables able to capture its long, incremental development from birth to adulthood. To this end, she recommended investigating pragmatic abilities that depend on understanding other minds. Researchers like Frith and Happé moved in this direction with their findings that false belief task performance in autism correlates with daily living skills judged to require mentalizing; with understanding of metaphor and irony; and with ability to recognize the motivation behind a story character's (literally) untrue utterance, such as lie, pretend, forget, sarcasm, etc.

A discourse skill that has recently captured the attention of some researchers in this area is reference. As we will see, the need to take into account the mental states of others when we refer to things has been long established, and, more broadly, ". . . the idea that verbal communication is a form of mindreading has been relatively uncontroversial in pragmatics for more than thirty years" (Wilson 2000: 412). Thus investigating the reference production and comprehension abilities in autistic subjects is a natural choice in the search for subtle measures of mentalizing impairment in ASD.

3.2 Reference

Reference is verbally identifying something and thereby picking it out for the addressee. Unlike other communicating animals on the planet, humans talk about things external to themselves, both in their immediate environment and displaced in time and space.[20] Hockett and Altmann (1968) identified *aboutness* as a definitive aspect of human language. An important significance of human language utterances, then, is found in the ways they correspond to facts and things in the world around us. And when we wish to refer to an entity, be it an abstract concept or a physical thing, we use a variety of phrases such as the following:

Example 6

04 Honey, there's **a red car** pulling into our driveway. Are you expecting anyone?

05 I didn't know the olive wasn't pitted. I chipped my tooth when I bit into **it**.

06 Look! **That tree** is falling!

07 You've got a license, right? The law in these parts doesn't look kindly on **driving without a license**.

Each line in example (6) features at least one referring phrase. Such expressions can introduce new referents into the conversation, as in lines 4 and 7; they can refer to something introduced in previous lines of discourse, as in line 5; or they can refer to something in the physical world around us at the time of speaking, as in line 6. The ability to help listeners understand what we are referring to in each of these examples depends to at least some degree

[20] At least one exception may the communicative dance bees use to communicate the location of food to the rest of the hive (cf. Crist 2004). Bees certainly appear to communicate information about something displaced in space and perhaps time, but clearly humans are doing far more with language in the way we talk about anything not present in the here and now. Few have been willing to call the bee dance the sort of mediation of consciousness and expression of thought that we consider exemplified in human use of language (cf. Lucast 2010).

on mindreading—we must judge our listeners' knowledge and attention in a given context (Gundel et al. 1993; Chafe 1976, 1987; Gundel 1978, 1985; Prince 1981; Grosz and Sidner 1986; Clark and Marshall 1981, inter alia). We will look at the relationship between reference and theory of mind in depth in section 3.6, but let us first look at how referring phrases are analyzed syntactically (section 3.2.1) and the theoretical framework for reference production and interpretation used in the current study (section 3.3).

3.2.1 Determiner Phrases

Referring phrases are analyzed using the syntactic framework that noun phrases are embedded within determiner phrases, serving as complements to the determiner that is the phrase head. English definite determiners are the definite article *the* and the demonstrative determiners *this/these* and *that/those*. The English indefinite determiner is *a(n).* The term *pronoun* is used to describe the English personal pronouns *he/him*, *she/her*, *they/them*, and *it* and demonstrative pronouns *this/these* and *that/those*. This is an oversimplification, to be sure, as there is disagreement on exactly what syntactic position pronouns hold in determiner phrases. For instance, demonstratives can all be analyzed as determiners, some with an overt complement in the noun phrase (e.g. "*that ball* is red") and some without (e.g. "*that* is red"). Given the focus of this dissertation, however, for simplicity we can proceed with the understanding that demonstratives with no overt noun phrase complement will be considered demonstrative pronouns.

3.3 The Givenness Hierarchy

Gundel, Hedberg, and Zacharski (1993) pose the following research question: "What do

speakers/writers know that enables them to choose an appropriate form to refer to a particular object, and what do hearers/readers know that enables them to identify correctly the intended referent of a particular form?" (274). In keeping with established research that shows that the form a speaker/writer uses depends on the assumed memory and attention status of the referent in the listener's mind, Gundel et al. propose six cognitive statuses relevant to the forms of referring expressions used in natural language discourse. They suggest that a speaker makes assumptions about the listener's memory and attention state in the current context and chooses a referring expression that includes information about the cognitive status of the referent for the addressee. Gundel et al. arrange the cognitive statuses in an entailment scale called the Givenness Hierarchy.

in focus	>	activated	>	familiar	>	uniquely identifiable	>	referential	>	type identifiable
it		*that* *this* *this* NP		*that* NP		*the* NP		indefinite *this* NP		*a* NP

Table 3.1 The Givenness Hierarchy with associated English forms

The Givenness Hierarchy is a hierarchy of cognitive statuses that can be encoded by a language. For English, Gundel et al. identify eight pronouns and determiners that encode cognitive status as part of their conventional meaning (table 3.1). That is, each form encodes information that serves as an instruction about where and how to mentally access the intended referent. A speaker choosing one of these forms guides the listener's comprehension by restricting the possible entities the form may refer to. The specific form signals the assumption that the cognitive status for that form is met for the listener, along with all lower statuses (those

to the right of the chosen form). Because of this unidirectional entailment relationship, any form on the Givenness Hierarchy can be used for referents that meet the form's minimal required status and can also be used for referents with higher statuses. For example, in saying "It came from over there," a speaker explicitly signals to the listener that he is talking about whatever is the focus of the listener's attention at the moment of speaking, and is thereby restricting possible referents to those that have in-focus status for the listener. "The car is waiting outside," on the other hand, signals that the listener can at least associate a unique representation of the car referred to, but the car may actually have familiar, activated, or in-focus status at the moment of utterance, since anything familiar, activated, or in focus is also uniquely identifiable.

3.3.1 The Cognitive Statuses on the Givenness Hierarchy

Here is a summary of how Gundel et al. (1993: 276–280) characterize the individual statuses:

TYPE IDENTIFIABLE: The addressee is able to access a representation of the type of object described by the expression. This status is necessary for appropriate use of any nominal expression; it is sufficient for use of the indefinite article *a(n)* in English. For instance, in order to use *a* in example (7), the speaker only assumes the addressee knows the meaning of the word *fox*, and thus knows what type of thing "a fox" describes.

Example 7

08 **A fox** was in the yard last night.

REFERENTIAL: When a speaker intends to refer to a particular object (i.e. when the interpretation of the phrase is referential), she expects the addressee to associate a unique representation with the intended referent. To do this, the listener can retrieve an existing representation of the referent, construct a new representation from the information in the nominal phrase, or construct a new representation by the time the sentence has been processed based on the other information conveyed in the sentence. Referential status is necessary for appropriate use of all definite expressions, and it is sufficient for appropriate use of indefinite *this* in colloquial English.[21] Whereas the speaker in (7) may or may not be talking about a specific fox, the speaker in (8) must have a specific fox in mind for the sentence to be appropriate, and by the time the sentence is processed, the addressee is expected to have a representation of it:

Example 8

09 **This fox** was in the yard last night.

UNIQUELY IDENTIFIABLE: A uniquely identifiable referent is one with which a listener can associate a unique representation by the time the nominal expression is processed. The speaker assumes the addressee is able to either access a unique representation of the referent from memory or create a unique representation by processing the descriptive content in the nominal phrase. Uniquely identifiable status is necessary for the definite determiner *the*. When speakers/writers refer to a particular thing the addressee has no previous knowledge of, they can only appropriately use *the* if there is enough descriptive content in the phrase for creation of a unique new representation. (This is distinguished from the referential status of "this fox" above,

[21] Indefinite *this* will not be considered a demonstrative in this dissertation, and thus it is not included in discussions of and references to demonstratives henceforth.

which allows the addressee to construct a new representation from the entire sentence.) Gundel et al. give “the dog next door” in (9) as an example of a phrase that is adequately descriptive to allow the addressee to associate a unique representation without having any previous knowledge of the dog, whereas “the dog” would be sufficient if there was previous knowledge in memory.

Example 9

10 I couldn’t sleep last night. **The dog (next door)** kept me awake.

Gundel et al. also explain that some phrases allow construction of a unique representation by way of a bridging inference to a recently activated entity. In example (10), “the alpha male” is sufficient for the listener to create a unique representation because the listener holds the knowledge in memory that wolf packs feature a male leader known as the alpha.

Example 10

11 We saw a pack of wolves trotting single file behind **the alpha male** on the drive home last night.

FAMILIAR: Referents with familiar cognitive status are those the addressee can uniquely identify due to an already existing representation in memory (long- or short-term). In English, familiar status is necessary for appropriate use of all personal pronouns and demonstratives, and it is sufficient for appropriate use of the demonstrative determiner *that*. A reference to “that alpha male” is not licensed above in example (10) because, while the activation of a wolf pack would likely evoke the addressee’s knowledge of pack hierarchy, it would not motivate a mental representation of that particular pack’s alpha male. In contrast, if the addressee in example (9)

has adequate previous knowledge of the neighbor's dog, using a demonstrative determiner, as in (11), is perfectly appropriate.

Example 11

12 I couldn't sleep last night. **That dog (next door)** kept me awake.

ACTIVATED: Activated referents are represented in current short-term (working) memory. Activated status is necessary and sufficient for appropriate use of the English demonstrative pronouns *that* and *this*, the demonstrative determiner *this,* and for stressed personal pronouns. If the neighbor's dog is currently barking or its barking has just been discussed, example (12) represents an appropriate use of the pronoun *that* as a reference to the barking.

Example 12

13 **That** kept me awake all night.

IN FOCUS: When a referent is not only in short-term memory, but also at the current center of attention, it is in focus. A referent must be in focus for appropriate use of zero and unstressed pronominals. The speaker is able to refer to the shirt as "it" in (13) because he has brought it into focus in the preceding sentence.

Example 13

14 Look at that shirt. **It**'s so blue!

3.4 Inference of Intended Meaning

In asking how it is that speakers consistently make references that allow listeners to successfully identify the intended referent, Gundel et al. (1993) note that speakers can use

different forms to refer to the same thing, and the same form can be used to refer to many different things (274). The following examples can all be used to mean the same thing, and a speaker's assessment of his listener's knowledge and attention can influence which of the bold-face expressions is best for the context:

Example 14

15 **A red car** just drove by. It was gorgeous.
16 **The red car that just drove by** was gorgeous.
17 **That red car** was gorgeous!
18 **That car** was gorgeous!
19 **That** was gorgeous!

The same multitude of linguistic options available for any given referent is available at every level of syntactic structure. An intended meaning can be expressed in an infinite number of ways, and an utterance can always be interpreted in more than one way. A listener often needs to consider more than just the encoded linguistic meaning in order to understand a speaker's intended meaning (i.e. the actual referent). Describing the principles by which listeners incorporate contextual factors to make inferences about speaker meaning is at the core of pragmatics research. Gundel et al. (1993) suggest that determiners and pronouns encode information about the listener's attention and knowledge of the entity referred to, but this information is still not always sufficient to narrow possibilities to a single interpretation. How do listeners further use information about cognitive status to determine what the speaker is referring to?

3.4.1 Grice: Implicatures and the Cooperative Principle

An important framework for describing the inferential process in language interpretation was introduced by Grice (1975). Consider one of Grice's examples:

Example 15

20 Speaker A: How is C doing at his new job?

21 Speaker B: Oh quite well, I think. He likes his colleagues, and he hasn't been to prison yet.

Grice has this to say about the interaction: "At this point, A might well inquire what B was implying, what he was suggesting, or even what he meant by saying that C had not yet been to prison. The answer might be any one of such things as that C is the sort of person likely to yield to the temptation provided by his occupation, that C's colleagues are really very unpleasant and treacherous people, and so forth" (43). Grice adds that, on the other hand, A might not need to ask for any clarification at all; in the context, the speaker's meaning might be perfectly clear. Regardless, Grice's point is that whatever it is that B means to communicate, it is distinct from what B literally says. Grice calls such communicated meanings—meanings that go beyond what is strictly entailed by the linguistic meaning directly encoded in an utterance—*conversational implicatures.* He proposed that these inferences arise when interlocutors observe what he called the **Cooperative Principle:**

> *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. (45)*

Grice describes human communication as a rational activity in which speakers cooperate to an accepted purpose. In order to do this, he contends that speakers adhere to four

conversational maxims that yield interactions in accordance with the Cooperative Principle:

> **Maxim of Quantity**
> **Q1**: Make your contribution as informative as required (for the current purposes of the exchange).
> **Q2**: Do not make your contribution more informative than is required.
>
> **Maxim of Quality**
> Do not say what you believe to be false.
> Do not say that for which you lack adequate evidence.
>
> **Maxim of Relation**
> Be relevant.
>
> **Maxim of Manner**
> Be perspicuous.
> Avoid obscurity of expression.
> Avoid ambiguity.
> Be brief.
> Be orderly.

In the case of example (15), a Gricean analysis might say that if A does not ask for clarification, it will be because he infers B's meaning via the maxim of Relation. That is, B said that C has not been to prison yet, which, given that A's question was how C is doing at his new job, seems completely irrelevant. But if A assumes B is a cooperative speaker who honors the maxim of Relation, he will conclude that B's prison observation must be relevant. Speaker A might then reflect on the knowledge that A and B share regarding C and/or his new job, such as his employment history, the likelihood of him committing criminal acts, details about C's new employer or colleagues, or anything that might be relevant. If B is being cooperative, A should not have trouble making an inference about what B is intending to communicate. If he knows that C was led out of his previous place of work in handcuffs, for instance, A will have no problem understanding B's statement.

On the other hand, perhaps B mistakenly thinks that he and A share some knowledge that would allow A to infer his meaning. In that case, unlike the above analysis, A might make come up short in his mental inventory of their shared knowledge, failing to arrive upon a satisfactory meaning for B's utterance. At that point, A might decide that B has violated the maxim of Quantity; if he still assumes B is a cooperative speaker, he would likely conclude that the violation was unintentional, that B inadvertently failed to make his utterance as informative as required. Speaker A would then likely ask for clarification as to B's meaning. Another possibility is that B *wants* A to ask for clarification, that B knows his comment about prison will be puzzlingly irrelevant or under-informative to A. In that case B could be seen as intentionally violating the maxim of Relation in order to pique A's curiosity, in order to get A to ask him what he means.

Sometimes speakers violate maxims not as sly conversational bait to tempt a listener's interest, but rather as a convention for the listener to recognize as intentional. Grice wrote that this form of conversational contribution, which he dubbed *flouting*, occurs when a speaker so blatantly violates a maxim (any maxim) that the listener must consider how the utterance can be reconciled with the supposition that the speaker is observing the Cooperative Principle. In response, the listener infers unspoken meaning from the violation itself (49). Consider example (16):

Example 16

22 Speaker A: How was it going to church while you were visiting your family?
23 Speaker B: I've never been so miserable in my life.
24 Speaker A: Ha! That's awful! What was so bad about it?

Speaker A reacts with interest to speaker B's assertion of misery, but A shows more amusement than sympathy and seems indifferent to the level of misery B says he experienced. Within Grice's framework this would be explained as follows: A assumes B honors the maxim of Quality, to be truthful. A could take B at face value, and ask what occurred to make the event the most miserable he ever experienced. However, given A's life knowledge and experience regarding misery, A instead infers that B is obviously violating the maxim of Quality, seeking to convey extra meaning through a sarcastic statement. B is grossly exaggerating the truth and intends for A to realize this. Thus, A infers that B did indeed have a bad time, but any claims of life-changing misery can be ignored.

Finally, let us look at example (17) for an illustration of how the maxim of Manner also gives rise to conversational implicatures:

Example 17

25 Speaker A: What did you do with Cheryl last night?

26 Speaker B: Oh, you know, dinner and a movie. Actually, we went to an early show first and had a nice long dinner afterward that went well into the evening.

A Gricean analysis proposes that speaker B's restating of events in his second sentence is not redundant because the conjunction *and* conversationally implicates "and then," even though there is no sequential order logically entailed in its meaning. This is due to the influence of the maxim of Manner, which relates to *how* a speaker says what he intends to say. If a speaker is to be cooperative, he must honor the Manner maxim, which requires that he make his contributions orderly. Thus, if his listeners assume him cooperative, they will assume any series of sequential events that he describes will be listed in the order in which they occurred, unless perhaps context renders that order utterly irrelevant. It is the prevalence of the inference

of order that motivates B to restate his description. He realizes he conveyed that they went to dinner first, when, given the long, late dinner they had, it was actually relevant that they went to the movie first.

3.4.2 Relevance Theory

Relevance Theory is another framework for explaining how hearers determine a speaker's intended meaning given that the intended meaning frequently goes beyond the meaning that is linguistically encoded in the sentence. Dan Sperber and Deirdre Wilson (Sperber and Wilson 1986/1995; Sperber 2000, 2000b, 1994; Wilson and Sperber 2004, 1993; Wilson 2000) posit a *Cognitive Principle of Relevance*, that human cognition is geared to the maximization of relevance; and it is the pursuit of relevance that drives human communication. Human cognition evolved under constant pressure to increase efficiency, resulting in a system wherein perceptual mechanisms pick out potentially relevant stimuli, memory retrieval mechanisms activate potentially relevant assumptions, and inferential mechanisms process them in the most productive way. This hard-wired propensity to pay attention to that which is relevant is the cognitive background underlying all inferential communication (2004).

According to Relevance Theory, human communication exploits the human ability to attribute intention to one another. Listeners in conversation recover a sentence's linguistically encoded meaning and then enrich the sentence using relevant contextual information to construct a hypothesis about the speaker's informative intentions. A sentence's context comprises the set of premises used in its interpretation as well as all internal representations (such as a person's knowledge of the world) and external stimuli (including linguistic and paralinguistic signals) that provide information that the listener considers relevant. While any

sentence has multiple possible interpretations, they are not all equally accessible in the given context in which the sentence was uttered. Relevance is a function of balancing effort and effect; listeners follow a path of least processing effort when accessing contextual information and stop when they arrive at an interpretation that meets their expectation of relevance. An interpretation is considered relevant if it connects with its context to yield conclusions that matter to the listener. Sperber and Wilson call such conclusions *Positive Cognitive Effects*; such effects contribute worthwhile differences to the listener's representation of the world.

Sperber and Wilson describe an *informative intention* as the intention to inform an audience of something, and a *communicative intention* as the intention to inform the audience of one's informative intention. A bar patron's intention is informative when she places her empty glass in a prominent position with the hope an attentive bartender will pour her another drink. Her intention is communicative when, catching the bartender's eye, she holds her empty glass up for him to see. A communicative intention, then, is one's intention to make one's informative intention mutually manifest. This is performed by using ostensive stimuli to attract an addressee's attention and convince him that one's communicative intention is worth processing. Sperber and Wilson define ostension as behavior that makes manifest an intention to make something manifest, and, according to the *Communicative Principle of Relevance*, ostension comes with a tacit guarantee of relevance. A speaker's utterances should be relevant, worth processing, and clear enough to make the intended meaning understood. Speakers with a communicative intention are signaling to their listeners that paying attention to their utterance will be worthwhile. Ostension provides two layers of information to be processed: the information pointed out and the information that the first layer of information has been intentionally pointed out. If the hearer is to be sure of recovering that meaning, Sperber and

Wilson contend that every item of contextual information used in interpreting the utterance must be not only known by both speaker and hearer, but *mutually known.* Speaker and hearer must know that they each know what they know.

In determining a speaker's meaning, the greater the positive cognitive effects achieved from processing an input, the greater its relevance; the greater the processing effort required, the less its relevance. Thus a listener is challenged with processing enough relevant information to infer a speaker's intended meaning while not expending effort processing more information than necessary to make that inference. To do this, the listener tests possible interpretations of the speaker's intended meaning in order of accessibility. As soon as the listener deems an interpretation adequately relevant—that it produces a satisfactorily positive cognitive effect—he stops processing any more possible interpretations.

Sperber and Wilson describe how hearers test possible interpretations of speaker meaning via simultaneous pragmatic subtasks that continue until an interpretation satisfies the hearer's expectation of relevance. In order to reach this satisfactory interpretation, hearers construct appropriate hypotheses about the explicit content, the intended contextual assumptions (implicated premises), and the intended contextual implications (implicated conclusions). Hypothesizing about the explicit content requires filling in ellipsis, lexical narrowing of words with more than one meaning, resolving ambiguities, and identifying referents. Such enrichment of the explicit linguistic content should be adequate to form a determinate proposition, which Sperber and Wilson call an *explicature.* Consider how the listener in the following example might assign a referent to "the dog" on her way to forming an explicature of the sentence.

Example 18

27 I asked my neighbor to keep his dog tied up, but I looked out the window this morning, and sure enough, there's **the dog** in my yard again.

Wilson and Sperber (1993) write in detail about how a listener processes information in the search for the speaker's intended meaning. They specify two types of linguistically encoded information that provide input to the inferential phase of comprehension: conceptual information concerns the representations to be manipulated, and procedural information gives instruction on how to manipulate those representations. Conceptual representations can be brought to consciousness, while procedures cannot; we do not have direct access to the information encoded in procedural markers. Wilson and Sperber contend that procedural information *constrains* the inference of explicatures and conceptual information *contributes* to explicatures. Conceptual information in example (18) includes the representation "dog," and, in Givenness Hierarchy terms, accompanying procedural information provided by the determiner instructs the hearer to associate a unique representation with dog; this serves to limit the possible entities the phrase "the dog" could refer to. Wilson and Sperber offer no analysis of how determiners are processed, but they do (1993) describe some aspects of pronoun processing. They describe pronouns as comprising character and content: the character of a pronoun is a rule to determine its content, and the content is the entity it refers to. In this sense, pronouns are both procedural, in that they narrow the hypothesis space the hearer must consider in order to fill in the content, and truth conditional, in that the hearer cannot identify the proposition the utterance expresses without assigning a representation of an entity to the pronoun. In other words, pronouns are not propositional, but they are procedural rules to help

determine referents, and referents, of course, are part of the propositional content of any referential utterance.

Now, if we apply a similar analysis to determiners, *the* in "the dog" instructs the hearer to assign a uniquely identifiable dog to "the dog." The path of least effort is to associate "the dog" with the dog the speaker introduced in the previous sentence with the DP "his dog." And given that there is no other dog even uniquely identifiable at that moment, the hearer should not consider any other entity as a possible referent for the phrase. In the quest to construct an appropriate hypothesis about the explicit content, resolution of "the dog" is handled quite simply. The combination of procedural information encoded by the determiner *the*, conceptual information encoded by the noun *dog*, and the relevance-driven inclination to choose the first interpretation that provides adequate cognitive effects for minimal processing effort limits the hypothesis space the hearer must search to just one possible entity. Thus the view that pronouns and determiners are procedural markers of the cognitive status of the intended referent is perfectly compatible with Relevance Theory, under which they can be seen as constraints on reference resolution, which is necessary to construct an explicature of the utterance.

3.5 Scalar Implicatures and the Givenness Hierarchy

Listeners inferring speaker meaning must also be aware of implicatures that arise in some contexts due to the interaction of general pragmatic principles with the place some words occupy in implicational scales. Consider example (19):

Example 19

28 Speaker A: How long have you lived in Minneapolis?

29 Speaker B: I've lived here four years.

When speaker A hears speaker B say he's lived four years in Minneapolis, A infers B means four years and four years only. A Gricean analysis would explain that the first part of the Quantity maxim (*make your contribution as informative as required*) motivates this inference; B says he has lived here four years, and if B has lived here for even longer, B would have said so. This is an implicature because the logically entailed meaning of *four* is "at least four," not "four and only four." Consider example (20):

Example 20

30 Williams: Due to budget cuts, we need to cancel all classes that don't have ten registered students. I'm afraid you'll have to give your pragmatics students the bad news, Johnson.

31 Johnson: What? No, I don't need to cancel; I have ten students. In fact, I have twelve as of this afternoon.

Numbers form a scale, with each larger number entailing all smaller numbers. But a number does not entail "not a larger number." Other sets of words form implicational scales, too. Consider the word *some*; it is part of the implicational scale {all > most > many > some} where each "stronger" form entails the "weaker" forms to its right. So *all* entails "some," but *some* does not entail "not all." The implicatures derived from scales are strongly engrained in language users; when a speaker uses a scalar term, she often intends to convey "not the stronger term." Consider example (21):

Example 21

32 Ed: Where's the leftover pizza?

33 Ron: Uh, it's gone.

34 Ed: What?!

35 Ron: I thought you said we could have some.

36 Ed: I did! But I didn't say you could eat it all!

It can be difficult to accept that "not the stronger term" is not entailed in the weaker term of an implicational scale; Ed certainly thought he made that clear. Such is the ubiquity of the scalar inference we all draw from implicational scales. But consider how Ed's irritation would have been avoided if the friends' earlier conversation had gone like this:

Example 22

37 Ed: There's leftover pizza in the fridge. You're welcome to some of it if you get hungry.

38 Ron: Cool. Should I make sure to leave you some?

39 Yeah, please do. I'll probably be hungry by the time I get home.

The reason Ron's question on line 38 is perfectly ordinary and acceptable in this context, even though *some* does not implicate "not all," is that *some* is perfectly consistent with "all," i.e. it does not entail "not all." If it did, Ron's question would have been unnecessary and odd.

Scalar implicatures can be seen as inferred via the maxim of Quantity. Given a term on an implicational scale, listeners assuming the speaker is being cooperative assume the speaker would have used a stronger term if it applied and it was relevant to do so, since Q1 requires adequate detail and Q2 requires omission of unnecessary detail. A Relevance Theory explanation is similar: a speaker's utterance is seen as relevant via the Communicative Principle of Relevance, which supports an interpretation of a weaker scalar term where the stronger form

is contrary or irrelevant to the speaker's meaning. Thus, in most contexts, the speaker in example (19) is pragmatically obligated to utter the highest truthful number, because it would be relevant if he had in fact lived more than four years in Minneapolis. In contrast, in example (20), it was unnecessary for Johnson to specify exactly how many students were registered for his class (though he did offer the precise number in his follow-up statement) because having a minimum of ten students was the relevant point.

Gundel et al. (1993) describe how the linguistic forms on the Givenness Hierarchy and the information they encode also form an implicational scale. A cognitive status entails all the statuses to its right on the hierarchy. For example, demonstrative pronouns explicitly signal activated status, so referents of demonstrative pronouns are therefore also familiar, uniquely identifiable, referential, and type identifiable. But activated entities do not require a demonstrative. A speaker referring to something in his listener's current active memory is licensed to use pronominal *this* or *that*; however, phrases headed by determiners *this, that*, *the,* indefinite *this,* or *a(n)* are all logically appropriate references as well. In fact, if the speaker judges that this activated entity is actually the focus of his listener's current attention, the speaker can use any form on the hierarchy. And since the hierarchy forms the unidirectional entailment scale {in focus > activated > familiar > uniquely identifiable > referential > type identifiable}, the same entailment relationships hold between the forms as we saw in the scale {all > most > many > some}; i.e. each form encodes a cognitive status, but each form does *not* encode that the statuses to the left are *not met*. So e.g., the phrase "the car" entails that the referent is uniquely identifiable, but it does not entail that it is not familiar, activated, or in

focus. Gundel et al. illustrate this in presenting findings that the definite article is actually used to modify referents in memory more often than demonstrative determiners are.[22]

Gundel et al. explain how pragmatic principles interact with the unidirectional entailment relationships in the Givenness Hierarchy in the same way they interact with other implicational scales. This gives rise to implicatures that further restrict the appropriate use of the forms and their possible referents. In certain contexts, weaker (entailed) forms conversationally implicate that stronger (entailing) forms do not obtain, and in other contexts, weaker (entailed) forms implicate stronger (entailing) forms. For instance, in certain contexts, demonstrative pronouns not only entail "activated" but implicate "not in focus," and the indefinite article *a(n)* entails "at least type identifiable" but implicates "not uniquely identifiable." Speakers using the forms on the Givenness Hierarchy must honor the Quantity 1 requirement to be sufficiently informative while not violating Q2 with more information than necessary. For example, using a personal pronoun for an in-focus referent satisfies Q1, as it provides the maximum amount of information about the referent's cognitive status. Gundel et al. observe that signaling the same referent's identifiability with the definite article also satisfies Q1, as the definite article typically encodes sufficient information about cognitive status to allow the addressee to use the conceptual information in the phrase to assign a unique representation to the referent. A demonstrative determiner, on the other hand, provides a listener with more information about cognitive status than the definite article, as a demonstrative restricts possible referents to those that are at least familiar, in the case of the determiner *that*, and at least activated, in the case of

[22] Of 246 English noun phrases Gundel et al. judged to be in focus, 214 were unstressed personal pronouns and 30 were nominals with the definite determiner *the*. Of 150 noun phrases judged to be activated, 95 featured the definite determiner *the.* And of 54 judged familiar, 47 featured *the* (p. 291).

determiner *this*. In most cases, this additional information about cognitive status is unnecessary given the conceptual content encoded in the phrase and would thus constitute a Q2 violation. Thus, Gundel et al. argue that the applications of Q1 for personal pronouns and Q2 for definite determiners conspire to minimize the use of demonstratives, which gives rise to a "not in focus" implicature in many contexts for both demonstrative pronouns and demonstrative determiners. This encourages speakers to use a demonstrative only when it is relevant to specifically encode the status familiar or activated. The result is a relatively low cross-linguistic frequency of demonstratives in natural language discourse. Personal pronouns and the definite article are frequently used for referents that are in focus, while demonstrative pronouns and determiners tend to be reserved for contexts where the speaker considers it important to signal to the addressee that the referent is in memory *but not in focus*. This "not in focus" implicature is particularly useful to signal a shift in focus, as in Gundel et al.'s examples, where "that" in (23) refers to the closet, and "it" in (24) refers to the kitchen.

Example 23

40 Anyway, going on back from the kitchen then is a little hallway leading to a window, and across from the kitchen is a big walk-through closet. On the other side of **that** is another little hallway leading to a window. . . .

Example 24

41 Anyway, going on back from the kitchen then is a little hallway leading to a window, and across from the kitchen is a big walk-through closet. On the other side of **it** is another little hallway leading to a window. . . .

While the Givenness Hierarchy is not the only model for how speakers choose the particular referring expressions they use, researchers generally agree that these choices are constrained at

least partially by the speaker's assessment of the addressee's memory and attention state at the point in the discourse when the form is used. And the ability to assess the memory of others requires an awareness that others have memories separate from one's own. Thus, appropriate reference production must rely, at least in part, on the same mechanism used to ascribe mental states to others. This could be a linguistic use of general theory of mind abilities, or it could be the distinct comprehension module aimed at the on-line interpretation of utterances that Sperber and Wilson hypothesize. So what do we know about the relationship between the development of theory of mind in children and their acquisition of appropriate reference production?

3.6 Reference and Theory of Mind

As mentioned above, making references that our listeners understand depends to some extent on theory of mind, as our assessments of a listener's knowledge and attention inform the referring phrases we construct. Gundel (2009, 2011) details two ways in which the appropriate use of referring expressions involves the ability to take into account the mental states of others: *identifying a referent's cognitive status in the mind of a listener* and *determining how much information is necessary and relevant for the listener.* The latter act is considered metarepresentational while the former is not.

3.6.1 Implicit, Non-representational Assessment of Cognitive Status

A speaker making a reference requires the linguistic knowledge of the information encoded in pronouns and determiners as well as the non-linguistic ability to assess what cognitive status the intended interpretation has in the listener's mind at that moment in the conversation. Since

various studies (Bennett-Kastor 1983; Bittner 2002, 2007; Hernandez-Pina 1994) document 3-year-old children using the full range of pronouns and determiners appropriately (which presumes some awareness of their listeners' attention and memory with respect to the entities they refer to), it is safe to assume that some aspect of mindreading must be present early in development, that to some extent "children are aware of and sensitive to the mental states of others before the age of 3" (Gundel 2009: 91). This is noteworthy given that the presence of metarepresentational ability is typically confirmed only when a child can pass a false belief task, and very few children can do so before age 4. Thus Gundel (2009) asks the question:

> *In what ways, then, is the kind of mindreading ability involved in use of referring forms more like mindreading abilities, such as joint attention, that have been shown to develop before age 4 (and even before age 2) and less like the kind of mindreading ability involved in false belief tasks, which typically develops after age 4? (92)*

Gundel suggests that the answer may be found in the kind of information that pronouns and determiners encode and how that information is processed. As seen in section 3.4.2, Sperber and Wilson (1993) specify two types of linguistically encoded information that provide input to the inferential phase of comprehension: conceptual information concerns the representations to be manipulated, and procedural information gives instruction on how to manipulate those representations. Conceptual representations can be brought to consciousness, while procedures cannot; we do not have direct access to the information encoded in procedural markers. Matsui, Yamamoto, and McCagg (2006) provide evidence for this distinction in their finding that Japanese children were better able to make use of information about evidentiality (i.e. a speaker's degree of certainty regarding the expressed proposition) when it was encoded by sentence ending particles than when it was conveyed by epistemic verbs such as *know* and

believe. They note that closed-class items[23] such as these particles typically encode procedural, non-representational information that "manipulates representational (i.e. conceptual) information, and as such, are not accessible to consciousness" (162). Like the Japanese particles, pronouns and determiners are also closed-class items, and consistent with Matsui et al. (2006) and Sperber and Wilson (1993), Gundel (2009) asserts that they are procedural markers that constrain listener processing options in determining referents by providing information about the cognitive status of intended referents in the minds of listeners. Development of appropriate use of pronouns and determiners thus requires the linguistic knowledge of the procedural information that each pronoun and determiner encodes. And since procedural information is not consciously represented, it is not surprising that children are able to acquire this linguistic knowledge well before the emergence of metarepresentational thought.

Returning to the claim at the beginning of this section, in addition to the linguistic knowledge of pronouns and determiners as procedural markers of cognitive status, their appropriate use also requires the non-linguistic ability to determine a referent's cognitive status in the minds of listeners. Given that children are able to do so before age 4, it appears that such determinations are implicit, relatively automatic assessments of listener attention and memory that correspond to the earlier stages of mindreading that develop before metarepresentational comparisons of mental states can be conducted and acted upon (Gundel 2009, 2011). Baron-Cohen (1995) theorizes that children are aware of others as separate intentional beings with

[23] In linguistic theory, lexical items are divided in to open and closed items: Nouns, verbs, adjectives, and adverbs are open class, and new words in these categories are coined all the time. Prepositions (e.g. *to, with, from, around*), conjunctions (e.g. *or, but, and*), complementizers (e.g. *that*) and auxiliaries/modals (e.g. *will, have , can, must*) pronouns, and determiners are closed class. Compared to the thousands of open class words in a language, the number of closed class words in a language is quite small, and new coinages are rare (Carnie 2002).

unique volitional and perceptual states by 18 months (shared attention mechanism), while the ability to represent epistemic states develops slowly over the next 2 – 3 years, culminating in the fully developed theory of mind mechanism around age 4. A reasonable conclusion is that children have learned to associate the different pronouns and determiners with listener attention around age 2, and that only the most preliminary awareness of others' epistemic states is required for assessing the cognitive status of referents in listener minds.

3.6.2 Representational Assessment of Relevant Information

In addition to assessing a referent's cognitive status, appropriate use of referring expressions requires mindreading skills in order to also assess how much information is sufficient for the addressee to infer the speaker's intended interpretation. This includes information about cognitive status as well as information about conceptual content.

Regarding conceptual content, consider these examples of under- and overspecification:

A woman looking out a second floor window hollers to her brother downstairs, "Go get the plate number of the car out there." The brother will likely be surprised if he goes outside and finds there are actually several cars parked on the street. This, of course, is because his sister did not specify which car is of interest. The determiner *the* instructs the brother to associate a unique representation with "car out there," but in this context, the brother requires more conceptual content to form that representation. A Gricean analysis would consider this a violation of the first part of the Quantity maxim (*be informative enough*) that leaves the listener uncertain of the speaker's intention because the speaker did not provide as much conceptual information as was necessary. A Relevance Theory analysis is similar, wherein the woman would be seen as failing to honor the Communicative Principle of Relevance by not providing enough

information to make her intended meaning understood. Given the context, the brother cannot form a relevant interpretation and achieve a Positive Cognitive Effect.

In contrast, if instead the woman shouts "Go get the plate number of the two-tone four-door sedan out there with a vinyl roof," the brother might be surprised if he finds only one car in sight. In this case, the sister's statement could be seen as a violation of the second part of Grice's Quantity maxim (*avoid being over-informative*), thus leading her brother to expect to find more than one car. Nevertheless, the violation is pretty benign in this case, since an errant inference—such as *Using the descriptive information 'two-tone four-door sedan with a vinyl roof', I need to distinguish a specific car from some amount of other cars out there*—would probably interfere little with the speedy outcome the sister intended. However, this example illustrates an advantage to Relevance Theory over Grice: even though the disruption caused by the errant inference was likely minimal or even non-existent (if, for instance, the brother immediately saw the intended car and failed to note that there were no other cars around), a Relevance Theory analysis would acknowledge that the sister's failure to recognize that such extensive detail was irrelevant cost the brother some unnecessary effort processing her utterance.

One example of research on how speakers consider the needs of their listeners is the referential communication task Nadig and Sedivy (2002) devised to evaluate 5- and 6-year-olds' production and comprehension of conceptual information when their visual perspective contrasted with their listeners. The children were asked to instruct an adult investigator to pick up an object from an array of four objects, all of which were visible to the subject but some of which were in some cases not visible to the investigator. Nadig and Sedivy observed that the children were more likely to use a descriptive adjective when more than one object of the same

type (e.g. a big glass and a small glass) was visible to the addressee than when they could see that one of those objects was blocked from the addressee's view. When the task was reversed, so that the investigator made the references, the children only requested more descriptive information when both objects were visible to the speaker, and eye tracking showed that eye movements to the second object were rare when it was not visible to the speaker. The results offer evidence of 5-6-year-old children making mental comparisons of their own perspectives with those of their listeners in order to determine what conceptual information is relevant in producing and interpreting references. Given the metarepresentational nature of such comparisons, it is reasonable to assume that subjects under age 4 would not exhibit such sensitivity to relevant conceptual information, nor would, presumably, 5-6-year-old autistic children. In chapter 4 we will discuss a follow-up study Nadig, Vivanti, and Ozonoff (2009) performed in order to test that presumption regarding autistic children.

Regarding cognitive status information, after a speaker has made an (implicit) assessment of a referent's cognitive status in the mind of a listener, the speaker must still determine what procedural marker of cognitive status is the relevant choice in the context. As stated in the previous section, the appropriate use of pronouns and determiners observed in 3-year-olds suggests that assessments of cognitive status are procedural, non-representational assessments. Children's performance also suggests that perhaps many or most references do not require conscious consideration of which procedural marker is relevant and sufficient to be understood; i.e. neither the assessment of an entity's cognitive status nor the assignment of a pronoun or determiner to refer to it typically requires a mental representation. But recall from section 3.5 that adult speakers' uses of personal pronouns and definite and indefinite article DPs far outweigh uses of demonstratives in languages that have a definite article, and recall also that

Gundel et al. (1993) suggest that a speaker's cooperative obligation to provide only necessary and relevant cognitive status information is what explains this usage pattern. A speaker referring to an entity in the current focus of listener attention is licensed to use any pronoun or determiner desired, and because personal pronouns offer the most precise cognitive status information without requiring any processing of conceptual content, speakers use personal pronouns for the vast majority of all in-focus references. And in those instances when a speaker refers to an in-focus entity with an explicit DP (i.e. including conceptual content), since the definite article *the* typically encodes sufficient information about cognitive status to allow the addressee to use the conceptual information in the phrase to assign a unique representation to the referent, the definite article is almost always used in those contexts. As a result, demonstratives tend to be reserved for contexts where a referent's familiar or activated cognitive status is relevant, and listeners tend to infer from demonstratives that the referent is not in focus, since a personal pronoun or a definite article phrase would usually be a more appropriate choice if the referent were in focus. It is reasonable to suggest that decisions to use demonstratives may involve a representational consideration of relevance not involved in use of other pronouns and determiners.

In summary, comparing use of pronouns and determiners by adults to that of typically developing 3-year-olds suggests that children acquire the linguistic knowledge of the cognitive status information encoded by pronouns and determiners and the non-linguistic ability to assess cognitive status before pragmatic inferences begin to influence their reference choices (Gundel 2009: 85). That is, they develop an understanding of the procedural content of closed-class items before understanding how much information is relevant in a given context. And given that most references 3-year-olds make are not only appropriate for procedural information about

cognitive status but are also pragmatically appropriate for specificity of conceptual and cognitive status content, the reference production of such young children also suggests that in most contexts, an implicit assessment of cognitive status is adequate for appropriate use of pronouns and determiners. That is, it suggests that a conscious consideration of relevant information about cognitive status and conceptual content is often not required. Research is needed to verify this suspicion, and this dissertation is one contribution toward that goal.

3.7 Conclusion

The forms of referring expression speakers use depends on theory of mind to different degrees, depending on the context. Determiners and pronouns encode procedural information regarding the cognitive status the referent holds in an addressee's mind at the moment of utterance. Assessing an addressee's attention and memory to determine a referent's cognitive status is implicit, relatively automatic, and non-representational. It is grounded in the awareness of others as separate intentional beings with unique volitional and perceptual states that emerges in the early stages of theory of mind development. Much of the references people make in everyday conversations may require no greater mindreading sophistication than that.

The use of referring phrases also requires determining what and how much information is sufficient and relevant. A speaker must decide how explicitly to signal a referent's cognitive status, such as whether it is relevant to communicate specifically that the referent is familiar or activated, as opposed to in focus or uniquely identifiable. In some contexts, determining the most relevant cognitive status marker may require conscious consideration beyond an implicit assessment of listener attention. The speaker must also consider how much conceptual information, if any, is necessary. Weighing the relevance of descriptive content can require the

speaker to compare his knowledge and perspective with the listener's, as in contexts like those Nadig and Sedivy (2002) created for their subjects. Instances in which speakers reflect on how much information—procedural or conceptual—to include in a referring phrase are likely instances when a fully developed metarepresentational mind is required.

The relationship between reference and theory of mind has motivated some researchers to investigate how autistic subjects compare to controls in their reference production and comprehension. The next chapter will serve as a review of this research.

Chapter 4 Reference and Autism

4.1 Introduction

In chapter 2 we examined evidence of correlation between language and theory of mind and were introduced to the argument that language is important for theory of mind development because language supports the metarepresentational ability that theory of mind requires. It was suggested that pragmatic discourse skills may provide a more sensitive variable than false belief tasks in measuring theory of mind ability. In chapter 3 we looked at the Givenness Hierarchy (Gundel et al. 1993) explanation of how reference succeeds and the accompanying argument that some degree of mindreading is employed in the production and comprehension of references. In this chapter, we will review research into reference production among autistic subjects.

4.2 Literature Review: Reference and Autism

LOVELAND, TUNALI, AND MCEVOY (1989) compared the performance of autistic adolescents (mean age 16.2) and adolescents with Down syndrome (mean age 15.3) on a referential communication task that required participants to teach a partner how to play a simple board game. The investigator was looking for specific target information, e.g. "this is where you start," "this is how you win," "each player chooses a marker," etc. When adequate information was not forthcoming, the investigator gave a general verbal prompt like "I don't know how to play this game. Can you tell me how?" Prompts continued if necessary and got more specific each time, e.g. "I don't understand. Please *tell* me how to play the game," "Tell me about these things here," "Tell me where to start the game," etc. The researchers coded responses on a 5-point

scale of adequacy, ranging from *no response or irrelevant responses* to *greatly elaborated, well-produced responses.*

Loveland et al. found that the subjects with Down syndrome gave significantly more information at the first, general prompt level. Most autistic subjects required prompting all the way to the most specific level (11 of the 13 subjects), while most Down's subjects did not (only 5 of 14 subjects). Loveland et al. observed that the more specific a prompt, the more the task of selecting and organizing the necessary information was structured by the listener (i.e. the investigator), thus reducing the demand that the speaker (i.e. the subject) be aware of the listener's needs. Given the autistic subjects' struggles in the absence of the most specific prompts, the researchers concluded that this determining and organizing of information was the part of the task that was particularly difficult for the subjects. They offered theory of mind impairment as a probable explanation, suggesting that the more specific prompts may have provided perspective information the autistic subjects could not discern without the prompts (309). It seems reasonable also that the most specific prompts just eliminated the need for the listener's perspective.

PERNER, FRITH, LESLIE, AND LEEKAM (1989) administered several tasks to their subjects that measured false belief, knowledge-formation, and communication. The communication tasks were designed to measure a subject's assessment of what is relevant to tell one of the co-investigators. In each case the subject had two possible answers, one considered rather salient, one considered rather dull. When the investigator was ignorant to both answers, the more salient answer was expected to be uttered first. When the investigator already knew the more salient information, a subject with the ability to decide what is most relevant to the listener should choose the dull answer. For example, in one round the subject and investigator hid two

items in two boxes while the co-investigator was out of the room. Upon returning, the co-investigator tried to open the boxes to see what was inside. In the totally ignorant round, the co-investigator was unable to open either box; in the partially ignorant round, he successfully opened the box with the more salient object in it. In each case, he then asked the subject "What's in there," taking care to not look or gesture at either box. In another round, the child was shown a toy bee and shown how the bee can fly (flap its wings) and nod its head. In one instance, the child's partner was partially ignorant, leaving after the flapping demonstration, before the nodding demonstration. In the other instance, the partner was totally ignorant, leaving before either demonstration. In each case, the partner returned in the end and asked the child what the bee can do. Perner and Leekam (1986) had previously shown that most typically developing 3-year-olds mentioned the nodding ability first when their partner had left after the flying demonstration, while no such preference was exhibited when the partner was totally ignorant of the bee's abilities. That is, when one of the two abilities was new information, the children favored that ability; when both were new, no preference in order of mention was shown. This had suggested that children have some sensitivity to what is new and relevant to their listeners at an age when they cannot pass a false belief task.

In the knowledge-formation task, one investigator showed the subject and co-investigator three objects and told them she was going to put one of them in a cup without their seeing it. After doing so, she "let the other experimenter and the subject confirm that they could not see which object it was" (693).[24] In one round the investigator then showed the subject the object in

[24] I believe that involved asking the subject (a) if the subject could see the object and (b) if the co-investigator could see it.

the cup, making it clear to all that she would not show the co-investigator. The subject was then asked "Do you know which object I put into the cup?" and "Why do you know that?" In the other round the investigator showed the co-investigator, making it clear that she would not show the test subject. The subject was then asked if the co-investigator knows what is in the cup and why he does or does not know that.

The researchers administered the tasks to 24 autistic children, age 7:5 – 18:10 (mean = 13:6) and verbal mental age 3:1 – 12:8 (mean = 6:2). In the communication tasks, the researchers found the children overwhelmingly favored the more salient item in the total ignorance condition. In the partial ignorance condition, where the partner knew the salient item but not the dull item, the children mentioned the dull item first much more often than for the totally ignorant partner, which was seen as evidence of the autistic children taking their partner's interest into perspective. However, it was a minority of the autistic subjects who successfully favored the dull item—two-thirds still favored the salient item when the partner already knew it. Perner et al. speculated this could mean that only a third of the autistic children had the ability to make the pragmatic adjustment, in which case, the same children should be successful in a re-test using different material. The other possibility the researchers suggested is that most of the autistic children actually had the ability but only used it about a third of the time. If that was the case, they predicted the children who succeed in a re-test would comprise a third of the children who succeeded on the first round and a third of the children who failed in the first round. Perner et al. report that re-test results "strongly favored the second possibility of generally unreliable performance" and confirmed previous "reports of autistic children's difficulty in using the pragmatic distinction between old and new information" (696).

Perner et al. suggest that success on the box and toy bee tasks may not have been based on any understanding that the subject's answer should fill a gap in the partner's knowledge. They suggest this because of "an almost total lack of correlation" between a correct choice in the communication task and an adequately justified attribution of knowledge in the knowledge-formation task. In fact, Perner et al. continue, correctly adjusting to what is most relevant for the listener in the communication task "may not even be based on the ability to judge the other person's informational access." They suggest this because "there was no correlation between communicative adjustment and judgment of visual access in the knowledge-formation task." They suggest instead that the autistic children's "adjustment to old and new information may be based on very rough environmental indicators. From the child's point of view, it may be a question of verbally doing what the other failed to do, that is, calling out the name of the object in the box that the other did not open ('piece of paper')" (697).

FINE, BARTOLOMEO, SAMARITAN, AND GINSBERG (1994) interviewed autistic subjects to analyze the cohesiveness of their narratives and "ascertain if their communication is difficult to understand because of the inappropriate use of referring signals to convey meaning" (317). To measure narrative cohesion, the researchers looked at the frequency and appropriateness of the subjects' use of phoric referring forms, which they define as references that "send the listener to find information necessary to be able to understand the speaker" (320). These include pronouns dependent on antecedent information present earlier in the discourse (e.g. "I saw John; *his* house is near mine."); pronouns dependent on antecedent information in the physical world (e.g. a speaker points and says "Do *you* see *that*?"); cultural references dependent on information presumably available to any member of the culture (e.g. "*The president* was in Minnesota today"); and bridging references dependent on an inference from

antecedent information earlier in the discourse (e.g. "I saw John's new house. *The door* was painted green"). Fine et al. suggest that such references are required for true conversational reciprocity wherein two people create meaning in referring to information common to them both (325). The researchers hypothesized that, compared to controls, the autistic subjects would use less phoric references, instead relying more on explicit (non-phoric) phrases that "are completely interpretable on their own" (e.g. "*John* bought *a new car*")(320). But contrary to their prediction, they found no significant difference in the frequency of phoric expressions used by the two populations. However, they did observe more errant uses of the forms by the autistic subjects.

Fine et al. concluded that the subjects diagnosed with Asperger syndrome (average age 14.3) made more "additioning errors" than the controls (average age 13.7). That is, they made more unclear references that, lacking antecedent information, required the listener to add information to the conversation in order to make sense of it. In explaining additioning errors, Fine et al. give the example of saying "John crossed the other river," when no river has been previously mentioned. Fine et al. also judged a reference unclear if there was more than one possible antecedent for the reference, such as in their example "My father and brother are both tall. He likes basketball." However, there were no significant differences between the groups in frequency of such ambiguous reference.

Interestingly, the autistic subjects not diagnosed with Asperger syndrome[25] (average age 22.8) did not make more unclear references than controls did. Fine et al. note, however, that this group made fewer references with antecedents already introduced in the discourse;

[25] This group's IQ scores were only slightly lower than the Asperger group, and thus certainly worthy of high-functioning description.

instead, they used anaphoric expressions such as pronouns to refer to items in the physical environment more than controls did. That is, compared to controls, when the non-Asperger autistic subjects used pronominal forms they were more likely to refer to something physically present in the room and less likely to refer to something mentioned earlier in the discourse. The researchers describe the group's conversation style as "less tied to the mutually constructed verbal world," i.e. containing less reference to information established in conversation and thus common to both speaker and listener. The researchers concluded that the limited use of anaphoric forms resulted in a weaker sense of reciprocity in the non-Asperger subjects' conversations. Since an impaired or delayed onset of language development is often the determining factor preventing an Asperger syndrome diagnosis in a high functioning patient, Fine et al. suggest that perhaps the atypical avoidance of pro-forms for referents already introduced in the conversation may be associated with this developmental delay.

In conclusion, the autistic and control subjects referred to shared information equally often, but Fine et al. characterize the Asperger subjects' narrative style as using phoric links in an *unclear* way and the non-Asperger autistic subjects' as using phoric links in an *unexpected* way. A considerable amount of repeated experiments comparing Asperger and non-Asperger subjects not so divided by age (average ages were 14.3 and 22.8 in this study) would be necessary to make any firm claims about anaphora use by people of the two different ASD diagnoses. Nonetheless, the findings are noteworthy with respect to theory of mind. The atypical tendencies of the autistic groups—making references whose antecedents were unclear and avoiding anaphoric references to previously mentioned referents—could be, at least in part, the result of impaired mindreading ability hindering adherence to the Quantity maxim (i.e. make your contribution as informative as required).

VOLDEN, MULCAHY, AND HOLDGRAFER (1997) compared performance of autistic and control subjects (both groups: age range 13–24, average age 18:8) on a perspective-taking task and a referential communication task. Volden et al.'s intent was to investigate whether pragmatic language impairment in autism can be adequately explained by theory of mind deficits that impair ability to take another person's conceptual viewpoint (181). They build on Roberts and Patterson's (1983) suggestion that two levels of perspective taking are relevant to referential communication:

1. A speaker needs to understand that a listener does not necessarily share the speaker's knowledge base.

2. A speaker needs to determine what information the listener needs to know in order to interpret the speaker's intended message.

Volden et al. recall Loveland et al.'s (1989) findings that autistic subjects were successful only when prompts were specific enough to reduce or eliminate the demand to be aware of the listener's needs. They suggest that perhaps the autistic subjects understood Roberts and Patterson's (1983) level 1—that a listener's knowledge base is different from one's own—but that their level 2 perspective-taking ability was not sufficient to anticipate the listener's perspective and select the necessary and appropriate information accordingly. Thus, in choosing their subjects, Volden et al. first determined that all participants exhibited a level 1 awareness of listener perspective. This way, they were able to focus on associations between perspective taking, referential communication, and the ability to determine what the listener's needs are in a given context. Volden et al. state that the theory of mind hypothesis in autism—that mindreading impairment is at the core of communication problems in autism—"would predict

that an autistic speaker's specifically impaired ability to assess an interlocutor's conceptual perspective should lead directly to impairments in the ability to communicate a referent clearly" (193).

Each subject sat a table across from an adult listener while the investigator sat adjacent to them. The stimulus materials were pairs of identical cards, each one with two possible referents on it. The referent's variables were shape, texture, color, and position of a black dot. Each card featured two referents identical except for one of those features. The two identical cards were set down in front of the subject and the listener so that they both could see that they each had identical cards. The investigator next placed a divider between them that prevented them from seeing each other's cards, and then put a marker next to one of the referents on the subject's card, telling the subject that this was the secret one. The investigator then asked the subject "Do I know which one is secret?" "Do you know which one is secret?" "Does [the adult listener] know which one is secret?" Correct answers established that the subject had a level one perspective-taking ability—an understanding that the listener cannot see the marker indicating the secret referent. With this established, the investigator administered the two tasks.

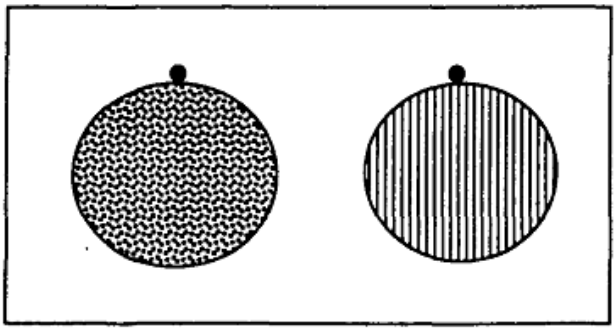

Figure 4.1 Volden et al. (1997) Stimulus card

For the referential communication task, the subject had to describe the secret referent so the listener could choose it on his own card. Descriptions were scored as

- *contrastive*: the description consisted of the distinguishing attribute;

- *redundant*: the description consisted of the distinguishing attribute and at least one other; or
- *uninformative*: the description did not include the distinguishing attribute.

For the perspective taking task, the investigator described the secret referent for the listener, adding one attribute at a time (e.g. "It's yellow," "It's yellow and dotted," etc.). After each new attribute was mentioned, the investigator asked the subject if the listener knew the referent, if the listener would be able to pick it out. In this way, the subject had to take the listener's perspective and not his own.

Volden et al. observed that both groups did very well on the perspective-taking task. The autistic subjects had no problems determining at what point the listener had been given enough information to identify the secret referent. However, the autistic subjects' performance on the referential communication task was comparatively inefficient. They were as successful as controls at distinguishing the secret referent for the listener, but they included more redundant attributes in their descriptions. Volden et al. concluded that this suggests theory of mind deficits were not responsible for the subjects' impaired reference performance. "In short, perspective-taking ability may be necessary for successful referential communication, but it does not appear to be sufficient" (195). This raises the question of why the autistic subjects performed poorly in the reference task despite exhibiting normal perspective taking skills. One possibility Volden et al. offer is that perhaps a perspective taking impairment was present earlier in the autistic subjects' lives (since impairment would, after all, be expected of autistic subjects), but subsequent development had remediated the deficiency (194). In such a case, the early mindreading deficiency may have impaired the development of expressive communication (cf.

Tager-Flusberg's 2001 account of how early deficits in one cognitive component affect subsequent development in other components).

The other possibility Volden et al. consider is that the autistic subjects may have adopted an alternative strategy to solve the perspective-taking task, such as interpreting the task as a simple comparison problem that requires helping the investigator see the difference between the two referents. Such an interpretation would ignore the listener and thus allow success regardless of any mindreading impairment the autistic subjects may have had. They find this possibility unlikely, however, as most of the autistic subjects referenced the listener in spontaneous remarks (e.g. "Okay [name of listener], there are two shapes on the page") that indicate they were aware of the listener as the discourse partner. Nonetheless, employing some form of alternative strategy would be consistent with theories that autistic individuals with sufficient cognitive resources "hack out" solutions to such tasks via non-mindreading abilities (cf. section 2.6). Given Volden et al.'s results, a noteworthy implication would be that the compensatory strategies some autistic subjects employ to solve false belief tasks are not sufficient for unimpaired reference production; i.e. analysis of reference may offer finer insight into an individual's theory of mind ability.

In summary, Volden et al. found impaired reference production as Loveland et al. (1989) had as well. The distinction is that Volden et al. observed over-informativity while Loveland et al. observed under-informativity.

COLLE, BARON-COHEN, WHEELWRIGHT, AND VAN DER LYLE (2008) analyzed the stories told by autistic and control adults as they looked through a wordless picture book. Colle et al. predicted that subtle impairments would be found in the autistic subjects' use of "referential features in language which are affected by social competence" (37). They coded references to the story

characters according to whether each reference was used to introduce, re-introduce, or maintain reference to the character. After a character, e.g. “the boy,” was introduced, any additional references to the boy were considered maintenance references unless a different character had been referred to since the most recent mention of the boy. Colle et al. looked at frequency of pronominals versus full DPs for each of the categories and evaluated each reference for grammaticality and clarity. References considered ungrammatical were incorrect uses of zero anaphora[26] or any DPs missing an article; references were labeled ambiguous when “the pragmatic context was not sufficiently clear to determine the referent [of] a pronoun or a zero anaphor.” They give one example from their data, where the errant pronoun refers to the boy’s dog instead of the frog: "And the boy opens the window, and he yells for the frog but the frog does not reply. The little boy went downstairs to check if he* was all right” (34).

Colle et al. considered maintaining reference to a character and its actions a skill that requires more sensitivity to listener needs than introducing and re-introducing characters. Thus, they were not surprised to find that the autistic subjects showed impairment when maintaining reference to characters, describing it as a “subtle but significant deficit” in autistic adults “when the listener’s needs determined the use of pronouns” (39). The autistic subjects were more likely than controls to use an explicit nominal expression (instead of a pronoun) when referring to characters that were already in focus. Colle et al. describe the resulting narrative as “less fluent and in some cases pedantic” compared to the “faster and more cohesive” narrative of the controls (37). Yet the autistic subjects also produced more ambiguous pronominal references

[26] Zero anaphora are unspoken gaps that require antecedent information just as spoken pro-forms do. For example, in each of the following sentences, the subject of “chased” refers back to the subject of “ran”: “The cat ran outside, and *he* chased the cat.” “The cat ran outside and chased the cat.”

when re-introducing characters, particularly when the character "had not been mentioned for a while" (37). Unfortunately, Colle et al. do not specify what they mean by "a while," but certainly the longer a story character goes unmentioned, the more likely a pronominal reference to it will not be conceptually specific enough for the listener to identify it. This would represent a Q1 violation in Gricean terms, in that the speaker's conversational contribution required conceptual content in order to be as informative necessary.

The authors coded demonstrative determiner phrases (e.g. "*that* boy") and definite article phrases (e.g. "*the* boy") the same, i.e. definite noun phrases. Thus we cannot know if the autistic subjects were more likely than controls to use a definite article DP, a demonstrative DP, or both. Recalling Gundel et al. (1993), speakers tend to choose definite pronouns (*he, she, it, they*) or full definite article phrases most often for in-focus referents, reserving demonstrative forms for emphasizing to the listener the familiar or activated status of the referent via the implicature "not in focus." Thus, if Colle et al.'s autistic subjects were more likely to use a *definite article DP* than controls, this would represent a (probably) subtle tendency to be more explicit in their reference production. On the other hand, if the autistic subjects were more likely than controls to use a *demonstrative DP*, this difference might be much more salient, as it might reflect a tendency to use demonstratives in contexts with no apparent reason to implicate "not in focus" to the listener. Granted, a statistically significant tendency among autistic adults to use more explicit forms than neurotypical adults to maintain a referent is noteworthy in itself, but if Colle et al. had been specific about which of the definite DPs revealed the difference in frequency, it would have provided a better picture. More frequent instances of demonstrative determiners would raise interesting questions about whether the subjects had the level of mindreading sophistication required for the understanding of scalar implicatures.

In summary, Colle et al. observed that autistic adults use more explicit DPs (conceptually overspecifying) when maintaining reference to a character already in focus and they use more ambiguous pronouns (conceptually underspecifying) to refer to characters no longer in focus.

DAHLGREN AND SANDBERG (2008) compared the performance of autistic children (average age 10.1) with that of controls (average age 9.55) on a referential communication task, wherein participants have to describe a card in a manner that allows the listener to select the card. Dahlgren and Sandberg measured the efficiency of the subjects' descriptions and looked for correlations with performance on 1st and 2nd order false belief tasks; scores on measurements of verbal, performance, and full-scale IQ; and performance on free recall memory tasks.

Participants in the Glucksberg and Krauss referential communication task (Glucksberg and Krauss 1967) look at a group of 16 cards and have the challenge of describing one of the cards in a way that will result in their partner choosing that card. Dahlgren and Sandberg identified distinguishing features among each set of cards and judged the subjects' descriptions as relevant or irrelevant accordingly. For example, each round featured cards with images of faces, and the features boy/girl, with/without a nose, happy/sad,[27] and big face/small face were considered the relevant features in round 1. Any other features described were judged irrelevant. An efficiency score was calculated by subtracting the number of irrelevant features mentioned from the number of relevant features mentioned and dividing by the maximum possible number of relevant features. Repetitions of relevant features were tallied as redundant features and were not included in the efficiency scoring.

[27] Dahlgren and Sandberg did a preliminary test of the children's ability to identify emotions from pictures so as to be sure that differences could not be explained by differences in knowledge of happy and sad.

Across trials, individual performances among the control group grew more efficient and featured fewer irrelevant mentions, while the autistic children showed no improvement from round one to two. Dahlgren and Sandberg found that the autistic children "had difficulties in conveying adequate information" in comparison with controls as seen in the lower number of relevant features they mentioned (343). Irrelevant features did not differ between the two groups, and though the autistic subjects actually mentioned fewer redundant features than controls, the authors considered the control subjects to be far more effective, fully understanding the communicative situation, if not always succeeding completely.[28]

Of all the variables Dahlgren and Sandberg analyzed, the only measurement that correlated with control group reference performances was verbal free recall, which was associated with a high number of relevant features mentioned. The correlations were myriad among the autistic children, however, with impairments in theory of mind and verbal and object free recall being the most significant (346). Particularly interesting is that the autistic subjects' 1st order theory of mind performance was strongly correlated with efficiency and number of relevant mentions, while 2nd order performance had no correlation with any scores. Also interesting is that a comparison between the autistic 1st order passers and failers showed that there were children among the passers who actually performed worse on the referential task than some of the failers. That is, for the autistic subjects, success on the theory of mind tasks did not predict success on the referential communication tasks, but failure on the theory of mind tasks guaranteed a poor reference performance. This leads Dahlgren and Sandberg to conclude that

[28] Dahlgren and Sandberg suggest that the higher instance of redundant features among controls is not evidence of a deficit in determining relevant content, but rather is indicative of good comprehension of the task and an eagerness to explain very closely (345).

theory of mind "seems to be a necessary but not sufficient component in referential communication," noting that Volden et al. (1997) reached the same conclusion (346). It is noteworthy that Volden et al. observed more redundant references from the autistic subjects, while Dahlgren and Sandberg actually observed fewer. Thus, while they all observed impairment, Dahlgren and Sandberg's results show the under-informativity that Loveland et al. observed, while only Volden et al. observed over-informativity.

Dahlgren and Sandberg offer more evidence of correlation between language skills and theory of mind ability in autism; specifically, they offer evidence that referential choices are included in the linguistic/mindreading correlation. It is noteworthy that 1st order ability correlated with referential performance, but 2nd order ability did not. That success on the Glucksberg and Krauss referential communication task would correlate with an ability to pass a false belief test is not surprising, as both require representing the mental states of others. What is interesting is that the higher level theory of mind ability that develops beyond 1st order appears unnecessary to the task.

NADIG, VIVANTI, AND OZONOFF (2009) compared how autistic (average age 11:3) and control (average age 10:8) children performed in a referential communication task where common ground information was manipulated and in a guessing game where subjects gave clues to identify an object hidden from the addressee.[29] The experiments allowed the researchers to present several communication settings with the intent of addressing some of the many contexts speakers face in everyday communication. Nadig et al. describe a variety of abilities that any given referential context may require, such as "assessing whether there are any

[29] The guessing game experiment is not immediately relevant to the focus of this dissertation and will not be reviewed.

relevant referential contrasts, assessing what information is available to the listener, and being sensitive to special communicative demands that hold in that situation" (336). Because of the complexity of referential contexts, Nadig et al. describe referential communication tasks as "a more ecologically valid way to tap a speaker's appreciation of the conversational partner's perspective" than can be achieved with false belief tasks to measure theory of mind (335).

Figure 4.2 Nadig et al. (2009) Experiment

In analyzing the ability to make effective referential descriptions, Nadig et al. looked also for associations between reference production and the following variables:

- age,
- structural language ability according to Clinical Evaluation of Language Fundamentals Fourth edition (CELF-4) score (Semel, Wiig, and Secord 2003),

- performance IQ as measured using the Wechsler Abbreviated Scale of Intelligence (WASI) (Wechsler 1999),

- adaptive functioning, using the Daily Living Skills and Socialization subscales of the Vineland Adaptive Behavioral Skills-II (VABS) (Sparrow, Cicchetti, and Balla 2005), and

- autism severity according to the Autism Diagnostic Observation Schedule (ADOS) (Lord, Rutter, DiLavore, and Risi 1999).

Nadig et al.'s referential communication task compared how the children described one of several objects depending on whether all the objects were visible to the addressee (i.e. how much of the visual environment was common ground between interlocutors). The intent was to investigate how theory of mind impairment affects autistic children's awareness of *audience design*, i.e. whether they adapt their language to the knowledge base shared with their conversational partners (334). In situations where interlocutors perceptually share objects, a cooperative speaker must identify the relevant conceptual content if she is to adequately describe an object (Grice's Q1) without being more descriptive than necessary (Grice's Q2). Nadig et al. cite evidence that typically developing children demonstrate sensitivity to audience design early in communication development (Akhtar et al. 1996, O'Neill 1996) while autistic children "generally do not" (O'Neill and Happé 2000, Wetherby 2007) (334). Consistent with descriptions of pragmatic language impairment in autism, Nadig et al. describe as one of the most conspicuous traits among high-functioning autistics the "failure to adapt language by providing too little or too much information for a given situation" (334).

Nadig et al. identified two levels of audience design demands in the referential

communication task. In level 1, the speaker and the addressee see the same objects, and the speaker requires the ability to give adequate descriptions from her own perspective. The speaker must describe the target object (a cup) in a manner that distinguishes it from another visible cup.

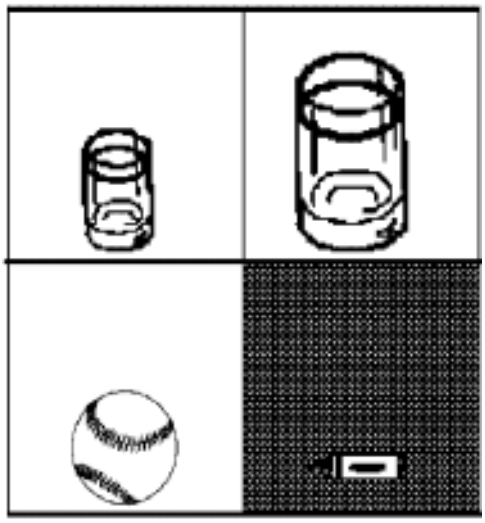

Figure 4.3 Level 1 Audience design demand

In level 2, the interlocutors have divergent visual perspectives, and the speaker must have the ability to adjust her descriptions to an addressee's perspective that differs from her own. The speaker must describe the target object (a cup) with the awareness that the second cup is not visible to the addressee. Any conceptual content that distinguishes the target cup from the second cup will be superfluous/irrelevant for the addressee.

Nadig et al. began the experiment with a baseline task, where no similar objects were present. A subject's Level 1 score was the difference between the proportion of common ground trials where a size adjective was (correctly) uttered and the proportion of the baseline trials where one was (incorrectly) uttered. A subject's Level 2 score was the difference between the proportion of common ground trials where a size adjective was (correctly) uttered and the

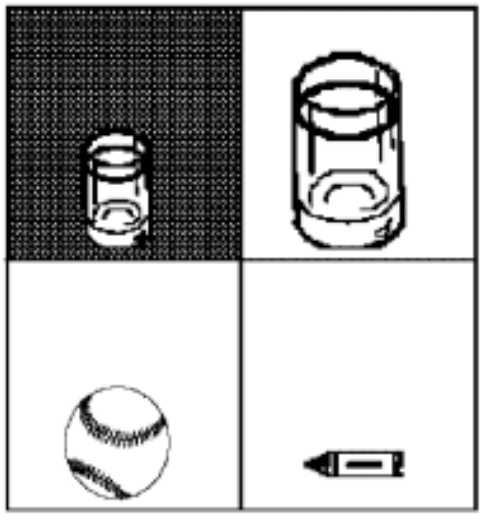

Figure 4.4 Level 2 Audience design demand

proportion of the privileged ground trials where one was (incorrectly) uttered. A perfect score on each task was 1.

The researchers found that the typically developing children performed better than the autistic children on both tasks, but the difference was statistically significant only on the level 2 task (TD median 0.8, mean 0.8; ASD median 0.6, mean 0.4). Comparing the groups' performance on the two tasks, Nadig et al. present three adaptation profiles (table 4.1). While all the TD children demonstrated both levels of adaptation, 8 of the 17 autistic children did not, with 3 of them demonstrating neither. That is, while all the TD children took their listener's perspective, nearly half the autistic children did not. The three with neither level 1 nor 2 made under-informative references that were not adequately descriptive for the listener (e.g. referring to "the cup" when two cups were visible to the listener), despite the lack of demands on perspective taking. The five without level 2 ability made over-informative references that included privileged information (e.g. referring to "the small cup" when only one cup was visible to the listener) that was irrelevant to the speaker.

Adaptation Profile	Typically Developing	Autistic
Both Levels 1 and 2	17	9
Level 1 only	0	5
Neither Level 1 nor 2	0	3
Total	17	17

Table 4.1 Audience design adaptation profiles

Nadig et al. summarize their findings as follows:

- TD performance correlated with language level (CELF-4 test score) in the level 1 task but not level 2.
    - There were no other correlations for the TD group.

- Autistic performance correlated with performance IQ in the level 1 task and language level (CELF-4 test score) in the level 2 task.
    - There were no correlations with age, autism severity, or Vineland adaptive functioning scores.

- There are adaptation profiles for audience design in autism; it is not a spectrum-wide general attenuation.
    - In contrast, there is no variation in ability among typically developing children.

- The results are consistent with previous research (Dahlgren and Dahlgren 2008):
    - One of the autistic subgroups offered under-informative descriptions.

    - Audience design ability in autistic subjects was associated with language level and performance IQ.

Nadig et al. speculate about the correlations between audience design and cognitive skills. Level 1 ability correlated with autistic performance IQ, which they suggest indicates that the autistic subjects may have succeeded by "using visual-spatial reasoning to notice referential ambiguity." In contrast, level 2 ability correlated with language level. Given the demands of referencing the addressee's perspective (not required in Level 1), Nadig et al. see the language correlation as consistent with previous findings (discussed in chapter 2) of a strong relationship between language ability and social-cognitive task performance in autism. They suggest that a broader hypothesis would focus on controlled processes and limited processing resources: "Difficulty with processing the structural aspects of language may leave an individual with less capacity to attend to and incorporate crucial aspects of contextual information" (345).

Perhaps most remarkable is that Nadig et al. found no association between audience design and autism severity (ADOS scores) or adaptive function (VABS scores). The Vineland scales have been used in assessing children for autism for years, and many consider the ADOS to be the current gold standard in autism diagnosis. Yet, consider what Nadig et al. have found: In a sophisticated measure of reference production that unequivocally depends upon each subject's ability to take a listener's perspective, nearly half the autistic subjects showed impairment, compared to none of the controls, *yet autistic performance did not correlate with measurements of autism severity*. Nadig et al. interpret this as further evidence that the performance of autistic subjects in this field of research is explained more by the ability to solve a structured task than from advanced social skills. Autistic participants "often perform well on structured tasks though the abilities demonstrated fail to generalize to more unconstrained tasks or the unpredictability of daily life" (345). This raises the question of whether language ability and/or autism severity will correlate with ability to take a listener's perspective in less structured, naturalistic settings.

ARNOLD, BENNETTO, AND DIEHL (2009) compared the reference production of a group of autistic children (average age 11.1) and a group of autistic adolescents (average age 15.1) with corresponding control groups (average ages 11.6 and 14.6). They examined how the production of pronouns and zero anaphors in a story-telling task was influenced by two categories of constraint: 1) the discourse status of the referring expression and 2) the presence of indicators that the speaker was experiencing excessive cognitive load. The researchers did not judge the cognitive status of the referents in the discourse as would be required under the Givenness Hierarchy model, but instead categorized each expression's discourse status by coding the syntactic position (i.e. subject versus non-subject) of each reference to a story character, the syntactic position of the previous reference to that character, and the number of clauses since

that previous reference. To assess the effects of processing effort, they analyzed the rates of pronouns and zeros under two conditions where cognitive load was likely at play: the presence of disfluency and particularly lengthy clauses.[30]

Participants in Arnold et al.'s study watched a Sylvester and Tweety cartoon that was divided into three 2-3 minute segments. After each segment, the subject retold the story to a researcher who pretended not to have seen it. Arnold et al. found that the pronoun/zero utterances of all participant groups were sensitive to the measures of discourse status that they were analyzing: the most pronouns/zeros were used when the referent was last mentioned in the previous clause, and all groups used explicit expressions almost exclusively when the referent had not been mentioned at all. Pronoun/zero use decreased among all groups as the number of clauses since the last mention increased, but the pattern of decrease was different for the younger autistic group. Arnold et al.

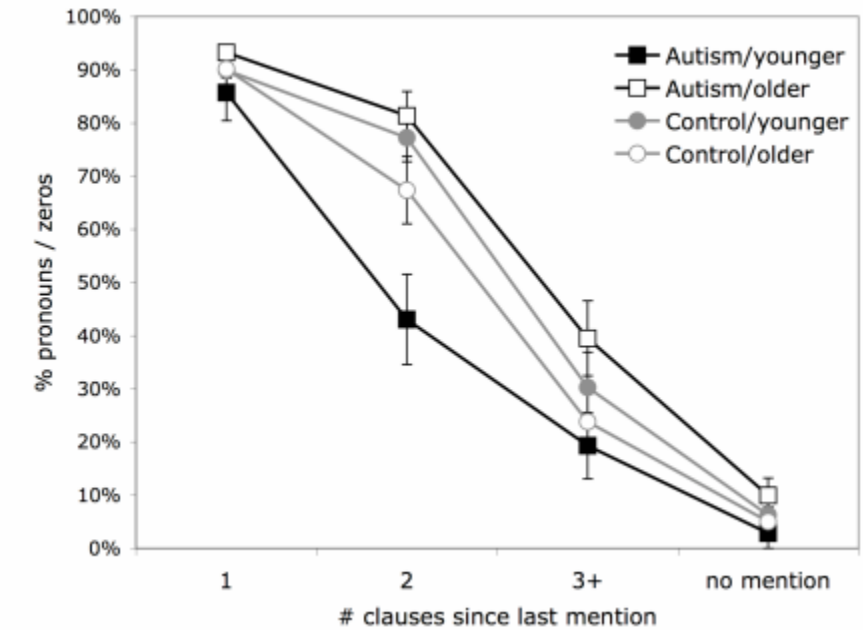

Figure 4.5 Arnold et al. (2009)
Average rate of pronoun use according to recency of last mention of referent

[30] Arnold et al. confirmed previous research that pronoun/zero use decreases under these conditions, but they found no diagnostic effect for the different subject groups. I will focus on their analysis of each referring expression's discourse status in my review.

observed that the pre-adolescent autistic children used fewer pronouns per category than the older autistic group and both control groups. This was most pronounced "in the two categories of discourse context where the choice of referring expression is not as strongly constrained (i.e. when the referent was previously mentioned, but not in the immediately preceding clause)" (23). That is, when referring to a character last mentioned two clauses ago, the younger autistic subjects were more likely to use a conceptually explicit phrase, while the other subjects were much more likely to use a pronoun.

It is interesting that the least constrained contexts produced the atypical references. A reasonable explanation may be that such contexts require additional consideration beyond the implicit processing involved in assessing cognitive status and choosing a referring form in more tightly constrained contexts. Speakers referring to previously referenced entities likely know with certainty that they are still in long-term memory, but assessing whether they remain activated or in focus for the listener may represent a gray area requiring some conscious consideration of the listener's current mental state. If so, the younger autistic group appears less confident in presuming that an entity is still in a listener's focus.

Arnold et al. offer memory impairment as a possible explanation, noting that their findings are consistent with Griffin and Arnold (2008), who found that decreases in memory capacity under conditions of memory load lead to a reduction in pronoun/zero use. This could explain the overspecification that both Arnold et al. and Colle et al. observed, and it would be consistent with the correlation between autism and low performance on memory span tasks that Bennetto et al. (1996) observed, as well as with Dahlgren and Sandberg's (2008) finding of a positive correlation between recall task performance and efficiency/relevance of referential descriptions.

In either case, whether it is impaired working memory weakening the ability to maintain focus or impaired mindreading weakening ability to judge the focus of a listener's attention, the result is that the younger autistic children exhibited a tendency to err on the side of overspecification when a story character was not mentioned in the previous clause. This could be a compensatory strategy developed in light of this impaired ability to maintain one's focus or assess someone else's.

There is some consistency between Arnold et al.'s finding and the findings of Colle et al. (2008). Both studies report a tendency for the autistic subjects to use more explicit DPs to maintain reference to a character; Arnold et al. are just more specific in describing the context in which this occurs. Where the findings of Arnold et al. differ from those of Colle et al. is that Colle et al. also observed ambiguity from conceptual underspecification (using pronouns when there was not one clear referent that could be the intended interpretation), while this was not observed by Arnold et al. That is, Arnold et al. observed overspecification from one of their autistic groups, while Colle et al. observed both overspecification and underspecification. One possible summary is that both groups of researchers observed autistic subjects struggling to match a referent's cognitive status with its appropriate form, with Arnold et al. observing overspecification and Colle et al. observing both overspecification and underspecification. However, it is difficult to reach such a firm conclusion without a clearer description of the ambiguous references Colle et al. observed. A pronominal reference could be indeterminate because it refers to something not currently in focus, like Colle et al.'s example where *he* refers to the boy's dog and not the in-focus frog: "And the boy opens the window, and he yells for the frog but the frog does not reply. The little boy went downstairs to check if he* was all right." This would be consistent with an impaired ability to assess an entity's cognitive status and

choose a referring form accordingly. However, a pronoun can also be indeterminate when there is currently more than one entity in focus that could be the referent, e.g. “Mary and Joan went to the store but she forgot her money.” In such cases, the error does not lie in the speaker’s procedural ability to identify the referent’s cognitive status in the minds of listeners, but rather in the speaker’s representational ability to assess how much conceptual information is necessary and relevant for the listener. Thus, both studies reveal *overspecification* in autistic subjects’ pronoun production compared to controls, indicating impaired procedural ability to assess cognitive status, or perhaps highlighting contexts where assessing cognitive status is less automatic, where impaired ability to assess relevant conceptual information results in a compensatory overspecification reaction. In addition, Colle et al. observed *underspecification*, though it is difficult to make inferences about what aspect of mindreading impairment might explain it.

Arnold et al. express curiosity that they did not find a greater difference between the autistic and control populations. They cite Gundel, Ntelitheos, and Kowalsky’s (2007) finding that children are sensitive enough to their listeners’ attention states and memory to make appropriate use of the full range of pronouns and determiners by age 3 as evidence that reference production may not typically require explicit representations of the addressee’s mental state, “or at least not as much as implied by the literature” (142). Notwithstanding the comment about what the literature has implied, they may be right about the amount of metarepresentational thought required in reference production (see section 3.6). However, it is hard to say whether speakers in a narrative monologue need to engage in as much mindreading as speakers engaged in a more interactive exchange that requires them to listen and observe as much as speak. It is possible Arnold et al.’s experiment provided a context that exaggerated the

frequency of references requiring only implicit assessments of cognitive status. Moreover, narratives may also have a diminishing effect on a speaker's attention to listener needs, wherein speakers are prone to ignore their listener's mental state since they are not engaged in a cooperative exchange, but rather a monologue. In any case, the differences Arnold et al. observed appear to reveal contexts where determining what information is necessary and relevant may be less automatic than in most situations: contexts where a referent's previous mention was long enough ago to place its in-focus status in doubt but not long enough ago to be obviously out of focus. As suggested above, choices of referring form in such contexts may tap into a more conscious reasoning about a listener's mental state than required in most references. The younger autistic subjects may have been erring on the side of caution when they overspecified in order to compensate for uncertainty in assessing cognitive status. Furthermore, the ability of many high functioning autistics to pass false belief tests and use language competently are precisely the kind of factors that have motivated researchers to view theory of mind as more nuanced and subtly impaired among this population than previously thought. Thus, I am not surprised by the subtlety of the impairment Arnold et al. observed, and I do not see that it calls into question our understanding of the relationship between mindreading and reference production. Moreover, to conclude from Arnold et al.'s findings that reference impairment in high-functioning autistic persons is minor and no longer present by adolescence is to ignore Colle et al.'s finding of atypical overspecification in autistic adults.

4.3 Summary

All the papers reviewed in this section report atypical and impaired reference production from autistic subjects. In general, the researchers describe autistic subjects exhibiting difficulties

making their references appropriately informative, with both under-informativity and over-informativity observed.

- Loveland et al. (1989) reported that autistic adolescents required far more prompts than Down syndrome adolescents in order to produce adequate descriptions. For most of the autistic subjects, they observed, only the most specific prompts sufficiently reduced the demand to anticipate the listener's needs.

- The autistic subjects in Perner et al.'s (1989) experiment were less likely to prioritize their references according to which referents were most relevant for the listener.
    - It is not unreasonable to see this as a different manifestation of the same impairment observed in the other studies in this list. In this case, the order of the references is atypical; in the other cases, it is the linguistic content of the references.

- Fine et al. (1994) found their autistic subjects made more "unclear" and more "unexpected" references than controls.
    - The Asperger's subjects made more references without adequate information about the intended referent, which could include under- and/or over-informative references. Their example of a reference to "the other river" when no river was previously mentioned could be seen as under-informative ambiguity or over-informative inclusion of superfluous privileged information that is not relevant to the context.

    - The non-Asperger autistic subjects' anaphoric references were more likely to refer to things in the physical environment than referents previously activated in the discourse. This could be seen as an avoidance of a linguistic tool that challenges their working memory and/or mindreading ability to judge cognitive status and relevant descriptive content for their listener.

- Volden et al. (1997) found that autistic speakers were as successful as controls at including relevant distinguishing features in their references, though they did include more redundant attributes in their descriptions. As listeners, they showed no impairment judging how much information was necessary to distinguish one referent from another.

- Colle et al. (2008) observed both under- and over-informativity with respect to conceptual content.
    - Autistic adults produced more ambiguous pronominal references when referring to characters not mentioned in a while.

    - Autistic adults were also more likely to use explicit nominal expressions when referring to characters already in focus.

- Dahlgren and Sandberg (2008) reported that autistic subjects were less likely to successfully convey adequate information in comparison with controls, as seen in the lower number of relevant features they mentioned.
    - This was consistent with Loveland et al.'s findings of under-specificity, but it contrasted with Volden et al.'s (1997) finding that autistic subjects had no trouble including the appropriate relevant descriptive features.

- Nadig et al. (2009) reported that 8 of the 17 autistic subjects in their study failed to reflect the listener's needs in their references.
    - Three were under-informative, not offering adequate descriptions.

    - Five were over-informative, referring to (superfluous) privileged information not available to the listener.

- Arnold et al. (2009) observed that pre-adolescent autistic children were more likely to use an explicit full DP in contexts where the other subjects used a pronoun.

4.4 Conclusion

The body of research on reference in the autistic population consistently demonstrates atypical production. Studies report more redundancies, less relevance, and atypical informativity; some subjects refer to more descriptive content than necessary or appropriate, some fail to be descriptive enough, and some do both. It appears that impaired ability to consider listener needs in conversation affects the reference choices autistic subjects make. Two observations suggest a deficit in their awareness of what a listener requires to successfully identify a speaker's communicative intention:

- In referential tasks that require describing something for a listener, autistics are more redundant and ambiguous than controls; they are less likely to pinpoint what conceptual information is most important and relevant for the listener.

- In narrative tasks that require telling a listener a short story, autistics make more pronominal references than controls when conceptual content is necessary and use more conceptually explicit, full DPs than controls when it is not necessary.

Most of the findings stem from referential communication experiments in contexts that require some conscious reflection about what conceptual content is necessary and relevant for a listener in light of contrasts and overlaps in speaker and listener perspectives (Loveland et al. 1989, Perner et al. 1989, Volden et al. 1997, Dahlgren and Sandberg 2008, and Nadig et al. 2009); this suggests impairment in the metarepresentational ability to compare mental states that false belief tasks assess. On the other hand, the researchers who elicited narratives (Fine et al. 1994, Colle et al. 2008, and Arnold et al. 2009) provide analysis of reference production in environments closer to naturalistic settings and feature more examples of automatic,

procedural references requiring no conscious reasoning about others' mental states. Yet the contexts in the narratives that resulted in atypical conceptually overspecific references appear to be contexts where determining how much information is relevant requires some conscious reflection about listener needs. References to previously activated entities that may or may not be in current listener focus appears to challenge some autistic subjects' ability to judge the current cognitive status of the referents in their listeners' minds, which could be due to impairment in mindreading, working memory, and/or metarepresentational ability.

Finally, in discussing their findings, numerous researchers acknowledge that the structured settings of their experiments may not adequately simulate the pragmatic challenges of everyday spontaneous interactions, and that studying younger children in different pragmatic contexts may reveal more significant differences. Here is a sample of quotes that motivate the study of naturalistic conversational data that follows in chapter 5:

Another important issue for future research will be to determine to what extent these findings apply in more naturalistic contexts, especially given that some authors have demonstrated that individuals with ASD perform differently in explicitly experimental settings and in more naturalistic situations.

Chevallier, Wilson, Happé, and Noveck (2010)

Individuals with HFA often perform well on structured tasks though the abilities demonstrated fail to generalize to more unconstrained tasks or the unpredictability of daily life.

Nadig, Vivanti, and Ozonoff (2009)

Further research in which finer micro-level social behaviors are examined in naturalistic situations with familiar peers is now required in order to determine more precisely the content and quality of the verbal and non-verbal communication displayed by children with autism and Asperger's disorder.

Macintosh and Dissanayake (2006)

Although the scope of knowledge about the pragmatic comprehension of individuals with AS or HFA is increasing all the time, there are still only few studies on children, and most of the studies have focused on a specific area of comprehension skills (e.g. humor and irony) rather than the entire pragmatic comprehension system based on context utilization. The development of pragmatic comprehension is a complex process and yet relatively little is known about how and when these abilities develop in children with AS or HFA.

Loukusa, Leinonen, Kuusikko, Jussila, Mattila, Ryder, Ebeling, and Moilanen (2007)

There is still a need for studies focusing on different aspects of pragmatic communication of children at different ages so that we can better understand the pathways of communication development of these children and direct therapeutic support more accurately to developmentally sensitive areas. . . . [B]ecause our test set-up was structured and the test questions were based on familiar situations, the context of the questions was not as complicated as it would be in natural communication situations where many challenging contextual factors must be utilized at the same time in rapidly progressing communication. Therefore, it is possible that our material was not sensitive enough to detect smaller differences between groups.

Loukusa, Leinonen, Jussila, Mattila, Ryder, Ebeling, and Moilanen (2007)

The findings suggest that in the assessment of communication development in autistic persons, emphasis should be placed on the use of language in various social contexts, rather than on only the level of verbal functioning. This approach is more useful in determining that autistic individual's effectiveness as a communicator.

Loveland, Tunali, McEvoy and Kelley (1989)

Personal accounts have also indicated that individuals with AS can take on others' perspectives, and are aware of their social difficulties . . . . However, in a real life situation, individuals with AS seem to have difficulty making or acting upon this awareness. Such reports highlight the fact that cognitive theories have attempted to explain certain characteristics of AS in terms of the individual's internal functioning (i.e., how s/he ''thinks'' or ''sees the world''). However, social context appears to be crucial in understanding how these characteristics manifest themselves in everyday interactions.

Bartlett, Armstrong, and Roberts (2005)

Thus, many of the major deficits seen in the conversational skills of speakers with ASD can be construed to relate to core indices of social disability present in the first years of life, including failures of joint attention and attention to face and voice, and to the integration of these abilities, as they develop into linguistic presuppositional skills.

Paul, Orlovski, Marcinko, and Volkmar (2009)

The study described in the following chapter is an attempt to tease out the cognitive abilities required for appropriate use of pronouns and determiners, to identify specific aspects of performance in reference production that distinguish young autistic speakers in naturalistic settings, and to suggest possible explanations for such differences.

Chapter 5 Design and Methodology

5.1 Introduction

In chapter 4 we saw evidence of a deficit in autistic awareness of what a listener requires to successfully identify a speaker's communicative intention. Experiments that require assessment of how a listener's visual perspective overlaps and/or differs with one's own provide evidence of metarepresentational mindreading impairment, as autistic subjects are less likely than controls to identify what descriptive information is most important and relevant for their listeners (Loveland et al. 1989, Perner et al. 1989, Volden et al. 1997, Dahlgren and Sandberg 2008, and Nadig et al. 2009). In contrast, narrative tasks elicit more examples of automatic, procedural references that do not require conscious reasoning about others' mental states. Some atypicality is observed in these contexts (Fine et al. 1994, Colle et al. 2008, and Arnold et al. 2009), as well, however, as the autistic subjects' more frequent conceptually under-informative pronominal references and more frequent explicit, full DPs may indicate impairment compared to controls in assessing cognitive status and/or determining what information is relevant to listeners.

5.1.1 Research Questions

Results from controlled experiments suggest that autistic subjects are fairly competent at assessing the cognitive status of a story character in the minds of their listeners, while decisions about which information is relevant to the listener produce more errant and/or atypical references compared to similar references produced by controls. This raises the following questions:

Do autistic persons show similar impairment (and lack of impairment) when making references in natural, everyday conversational interactions?

Nadig et al. (2009) designed their study to present several communication settings because of the variety of contexts speakers face in everyday communication, where any given context may require "assessing whether there are any relevant referential contrasts, assessing what information is available to the listener, and being sensitive to special communicative demands that hold in that situation" (336). Indeed, it is precisely this variety and complexity that motivates Nadig et al.'s claim that referential communication tasks are a better way to assess a speaker's appreciation of a conversational partner's perspective than how that speaker performs on a false belief task (335). So how do autistic speakers do when reference is occurring in ordinary, naturally developing, ever-changing interactions? It seems likely that the tendencies toward conceptual over- and under-informativity observed in the narrative tasks will be observed again, as there is no apparent reason to assume natural settings will offer an easier context to make references. Moreover, Happé (1994), Frith et al. (1994), and Nadig et al. (2009) have all speculated that the success that some autistic subjects exhibit in measures of mindreading may be due in some part to the structured environment of the researchers' experiments, where experimenter questions serve to highlight the salient information necessary for success. This suggests that evidence of impairment will be more apparent in unstructured naturalistic settings.

What role might compensatory strategies not involving mindreading play in reference production in naturalistic conversational settings?

The possibility was discussed in chapter 2 that autistic subjects who pass false belief tasks may do so via alternative, non-mindreading cognitive routes that may not be successful in the

less structured contexts of everyday conversation. This suggests that a comparison of naturalistic reference production by autistic and neurotypical subjects might be particularly revealing. On the one hand, alternative strategies may depend on the specific goals of structured experiments in ways that render them less useful in unstructured naturalistic settings, in which case we could expect greater evidence of impairment if a significant amount of references in such contexts require metarepresentation. On the other hand, even if the core deficit that motivates compensatory strategies is specific to insufficient metarepresentational ability, natural settings will reveal no more errant references than did the narrative tasks reviewed in chapter 4 (Fine et al. 1994, Colle et al. 2008, and Arnold et al. 2009) if the bulk of everyday conversational references do not require metarepresentational comparisons of speaker and listener mental states and perspectives.

Can we pin down a developmental trend in use of reference in autism?

Arnold et al. (2009) observed impairment in their younger autistic subjects but not in the older ones (group ages 11 and 15). Yet Colle et al. (2008) observed impairment among autistic adults in a similar study. Perhaps a younger population will allow a better chance to look at reference and mindreading before compensatory strategies have developed. In evaluating their observations of autistic ability to infer scalar implicatures, Chevallier, Wilson, Happé, and Noveck (2010) suggest that "since it is often argued that good performances in adulthood may be the result of well-developed compensatory strategies, rather than intact pragmatic competence, one could then hypothesize that testing at earlier stages in development will lead to different patterns of performance." Perhaps a group of autistic children under age 7 will

exhibit a greater difference in reference performance than the 11-year-olds in Arnold et al.'s study.

Looking at use of referring expressions in the autistic population from language onset through young adulthood could contribute to a timeline of theory of mind development in autism that helps detail how impairment in the early stages of theory of mind (cf. the stages before the emergence of metarepresentational thought hypothesized by Baron-Cohen 1995 and Tager-Flusberg 2001) affects language acquisition and early use of reference in autism. The study described below is a contribution to that endeavor. By comparing the use of pronouns and determiners by autistic 5-6-year-olds to typically developing 5-6-year-olds, we should be able to assess autistic performance in both procedural and representational aspects of reference production. Mindreading impairment is considered evident across the autism spectrum long before the emergence of a fully representational mind, and researchers suspect that those autistic subjects who pass a false belief task do not do so via a fully developed, unimpaired theory of mind. With this study we can analyze the manner in which autistic children make references from sentence to sentence in ongoing interactions, comparing the autistic children to neurotypical children as well as comparing them to each other based on false belief task performance.

5.1.2 Possible Outcomes

As discussed in section 3.6, references made by neurotypical 3-year-olds in conversations are remarkably low in errors, suggesting that reference production at that age involves predominantly procedural assessments of cognitive status and relatively little metarepresentational assessment of relevant information. How will the 5-6-year-old autistic

children compare? If the autistic children in the current study use referring expressions in spontaneous conversational situations similarly to controls, this will offer compelling evidence of the relative unimportance of metarepresentational mindreading in the bulk of our everyday conversational references, suggesting that the cognitive tools required for reference are typically in place before age 4. This is an expected outcome detailed section 1.1—that most contexts do not require a conscious consideration of which and how much information is relevant, and therefore the autistic children will exhibit a general competence using pronouns and determiners comparable to the control children.

If such competence is indeed observed—suggesting that metarepresentational assessment of relevant information is not frequently necessary—it will be of interest to look for evidence of impairment recognizing contexts when an assessment of relevant information *is* necessary. An atypical balance between personal pronouns and explicit full DPs might reflect such an impairment, as would an apparent insensitivity to the relevance of the cognitive status information encoded in demonstratives. Typically developing 5-6-year-olds consider the perspectives of their partners when using and interpreting conceptual information in references (Nadig and Sedivy 2002). If we accept that the level of mindreading sophistication required to weigh the relevance of descriptive content is akin to the sophistication necessary to weigh the relevance of cognitive status information encoded by pronouns and determiners (Gundel 2009, 2011), the 5-6-year-old control children in the current study should have a developing, if not complete mastery of how much cognitive status information is relevant. Because judgments of relevant cognitive status and conceptual information may require metarepresentation in some contexts, impairment in these areas was predicted in section 1.1.

It seems unlikely that comparable competence weighing the relevance of conceptual and cognitive status information will be observed, but it is a possibility. Chevallier et al. (2010) compared the awareness of scalar implicatures in a group of autistic adolescents with a control group by looking at how the subjects interpreted a stressed utterance of *or* in experimental settings. To the authors' surprise, there was no significant difference between groups, leading them to conclude that there is at least a subpopulation of autistic individuals "with some degree of functional pragmatic competence." Notably, however, Chevallier et al. emphasize the importance in future research "to determine to what extent these findings apply in more naturalistic contexts, especially given that some authors have demonstrated that individuals with ASD perform differently in explicit experimental settings compared to more naturalistic situations (Klin, Schultz, and Cohen 2000). In particular, it would be worth exploring whether people with autism *spontaneously* produce scalar inferences in conversational contexts" (Chevalier et al. 2010; authors' emphasis). Analyzing natural, spontaneous conversations among much younger autistic subjects than Chevalier et al.'s subjects offers an excellent opportunity to contribute to this research. For this reason, a detailed analysis of the subjects' use of demonstrative determiners and pronouns is warranted, which may reveal whether autistic children are aware of the unique contexts in which the familiar or activated status they convey is relevant to specify. The uncertainty going into the current study is how often the need to implicate or infer extra information from a demonstrative will arise.

5.2 Methods

5.2.1 Subjects

5.2.1.1 Autistic Subjects

Subject	Josh	Reese	Bella	Diaz	Silas	Richard
Age (yrs.: mos.)	5:8	5:4	6:9	6:3	5:8	5:10
Sex	male	male	Female	male	male	male
DSM-IV Five-Axis Diagnosis:						
Axis I	PDD-NOS	PDD-NOS	PDD-NOS	PDD-NOS	Autism	PDD-NOS
	ADHD, Combined Type			Anxiety Disorder NOS		
	Phonological Disorder			Bipolar Disorder		
	Learning Disorder NOS					
Axis II	None	None	Adaptive functioning delays	Adaptive behavior delays	Global Developmental Delay	Global Developmental Delay
Axis III	History of Seizure Disorder	None	Fetal Alcohol Spectrum Disorder	Allergies	None	Chromosome Abnormality 48, XXYY
	Sleep Apnea		Restless Leg Syndrome			
Axis IV	Social and educational difficulties	None	Safety concerns	Moved to new home	Limited social skills and safety awareness	Stresses related to diagnosis
			History of self-harmful behavior	Started kindergarten		
Axis V	GAF: 55	GAF: 30	GAF: 25	GAF: 35	GAF: 32	GAF: 45
Vineland Adaptive Behavior Scales Scores:						
Communication	72	97	74	67	72	NA
Daily Living Skills	72	77	62	60	81	NA
Socialization	55	70	55	66	72	NA
Motor Skills	61	81	88	61	75	NA
Adaptive Behavior Composite	62	78	66	61	71	NA
False Belief Test, 1st Order	pass	pass	NA	Fail	NA	pass
False Belief Test, 2nd Order	borderline	fail	NA	NA	NA	fail

Table 5.1 Characteristics of autistic participants

Autistic participants in this study are six children with autism spectrum disorder diagnoses (5 male, 1 female) between ages 5 and 7 years (range 5:4–6:9, mean 5:11) who attended the Day Treatment program at Fraser Child and Family Center, Minneapolis, in December 2009. The children were given a variety of neuropsychological tests by the practitioners making their diagnoses, including the Wechsler Preschool and Primary Scales of Intelligence 3rd Edition, the Stanford Binet 5th Edition, and the Vineland Adaptive Behavior Scales (VABS) 2nd Edition. The VABS was the only test administered to more than one of the subjects; scores were available for five of the six children. One child received an autism diagnosis and the other five were diagnosed with PDD-NOS. Co-morbid diagnoses, including bipolar disorder and fetal alcohol spectrum disorder, are noted in table 5.1.

5.2.1.2 Control Subjects

Control data come from transcripts of children's conversations recorded in the Child Language Data Exchange System (CHILDES) corpus. The transcripts feature a total of 28 children (11 male, 17 female) between ages 5 and 7 years (range 5:0–6:11, mean 5:11).

5.2.2 Data Collection

Written informed consent was obtained from the participants' parents before filming began. Footage was shot on a Fuji digital video recorder mounted to a tripod. I stayed in the room to move the tripod when necessary, as the teachers assured me they were not concerned about my presence disrupting activities. The children occasionally interacted with me, adding to the spontaneous language use being filmed. There are 8 sessions, approximately 90 minutes each.

False belief tasks were administered at Fraser in May 2010. Two of the subjects were no longer enrolled, so there are standardized theory of mind measurements on only four of the subjects. Each of the four was presented with a version of the Sally-Anne test using two stuffed animals, Kipper and Max.[31] Three of the four subjects passed this test of 1st order theory of mind.

Kipper-Max Test

This is Kipper. He has just returned from playing soccer. He comes home and sees his pal, Max. This is Max.

Kipper says: "Hi Max. I'm going to put my ball in this box."

Max says: "Okay."

Kipper puts the ball in the box.

Investigator asks naming control question: What is this doll's name? And what is this doll's name?

Kipper says to Max: "Now I'm going to go upstairs and get a drink."

Max: "Okay."

While Kipper is gone, Max takes Kipper's ball out of the box and puts it in _____. Now Max goes outside to play.

Kipper comes back after getting a drink. He wants to play with his ball again.

Test Question: ***Investigator asks 1st order ignorance question:*** Where is Kipper going to look for ball?

Investigator asks reality question: Where is the ball really?

Investigator asks memory question: Where was the ball before that?

Diaz answered the belief question incorrectly, saying Kipper would look for the ball in Max's box. He then answered the reality and memory questions correctly. Henceforth I will refer to him as the –ToM child.

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[31] Both false belief tests were altered from their original scripts in inconsequential ways to accommodate props that were available. For example, Kipper and Max stuffed animals instead of Sally and Anne dolls in the 1st order test; a skateboard birthday gift instead of a puppy in the 2nd order test, etc.

The three subjects who passed the Kipper-Max test were then given a test of 2nd order theory of mind, based on the birthday puppy test (Sullivan et al. 1994), using two action figures and a dollhouse.[32] In order to surprise her son, the mother in the story deliberately misinforms her son about what she got him for his birthday. Later, the son discovers that his mom actually got him the skateboard he was hoping for, but he keeps his discovery secret. At story's end, the boy's grandmother is talking on the phone with his mom. Grandma asks if the boy knows what he's getting for his birthday and then asks her what he thinks he's getting.

Peter's Skateboard Test

This is Peter. He is at school right now. Today is his birthday, and tonight after dinner, he is going to open birthday presents. He is really hoping he'll get a skateboard.

This is Peter's mom. She has bought a skateboard for Peter for his birthday, and she wants to surprise him. She hides it in the basement so Peter won't know about it.

Later that day, Peter gets home from school.

Peter: "Mom, how many presents did you get me?"

Mom: "Just one, but you'll really like it."

Peter: "I really hope you got me a skateboard."

Remember, Mom wants to surprise Peter with the skateboard. So instead of telling Peter she got him a skateboard, she tells him she got him something else instead: "I'm sorry Peter, I did not get you a skateboard for your birthday. But instead I got you a video game that I think you're really going to love."

Investigator asks reality control questions: Did Mom really get Peter a video game? Did Mom tell Peter she got him a video game for his birthday? Why did Mom tell Peter that she got him a video game for his birthday?

Peter: "Okay mom. I'm going out to play. I'll be home at dinner time."

On his way out, Peter goes to the basement to get his roller blades. In the basement, he sees his skateboard! Peter says to himself, "Wow, Mom didn't get me a video game; she really got me a skateboard!" Then Peter goes out to play.

Peter's mom did NOT see Peter go downstairs and find the skateboard.

Investigator asks 1st order nonlinguistic control question: Does Peter know that his mom got him a skateboard for his birthday?

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[32] Sullivan et al. found that by 5.5 years 90% of kindergartners are able to attribute 2nd order false beliefs.

Investigator asks 1st order linguistic control question: Does Peter's mom know that Peter saw the skateboard in the basement?

While Peter is out playing, Mom's phone rings and she answers it. It's Peter's grandmother calling about what time the party tonight is. Grandma asks Mom on the phone: "Does Peter know what you really got him for his birthday?"

Test Question: Investigator asks 2nd order ignorance question: What does Mom say to Grandma?

Remember, Mom does not know that Peter saw what she got him for his birthday. Now Grandma asks: "What does Peter think you got him for his birthday?"

Test Question: Investigator asks 2nd order false belief question: What does Mom say to Grandma?

Investigator asks justification question: Why does Mom say that?

Richard answered the non-linguistic control question incorrectly first, then correctly after clarification from me. He appeared unable to comprehend the linguistic control question and gave no answer. He answered the first test question "What does Mom say to Grandma?" correctly, but then answered the second test question incorrectly. His correct answer appeared to be a guess.

Reese missed an early reality control question—"Did Mom tell Peter she got him a video game for his birthday?"—but answered correctly after the question was re-stated. He had difficulty with the test questions: he responded "skateboard" to the first "What does Mom say to Grandma?" question and then changed to "video" after clarification. The mother at that point is actually answering a yes/no question, so Reese seemed to be losing comprehension at this point. He answered the next question "video," which is correct, but when asked why the mother answered as she did, Reese responded that she wanted to trick Grandma. Given this incorrect justification, there is no firm evidence for 2nd order understanding.

Josh answered all control and test questions correctly, though his response to the justification question was that Mom said "video game" to Grandma "because it's a surprise."

Without proper justification it cannot be known if Josh's answer to the final test question was just a lucky guess.

5.2.3 Data Comparison

As seen in table 5.2, the six autistic children uttered 16,647 words, producing 1573 uses of pronouns and determiners that were successfully coded; the 28 control children uttered 17,300 words, producing 1829 coded forms. Thus, the analyzed references represent 9.4% of the autistic corpus and 10.5% of the control corpus. It will be evident in the subsequent sections that the reference production of Diaz, the child who did not pass a false belief task, differed greatly both from controls and from the other autistic children. For this reason, distinctions are made between the control group, the entire group of 6 autistic children, the –ToM autistic child (Diaz), and the group of 5 autistic children, excluding Diaz. Thus, table 5.2 also shows that of the words and coded references in the autistic corpus, Diaz uttered 35% of each, with the other five autistic children producing the remaining 65% of the total words and coded references. We also see that both autistic sub-groups had roughly the same 9.4% references-to-total-words ratio observed from the entire autistic group.

The autistic group's vocabulary consisted of 1766 words, while the control group's was 1882. Their ten most frequently uttered words were similar, with each group sharing eight words. They differed in that the autistic group used *no* and *my* enough to make it into the top ten, while *this* and *that* were not top ten. However, frequency of *this* and *that* use is similar between the control children and autistic children when Diaz is removed from the totals. (Diaz's demonstrative use will be discussed at length in section 5.3.) The autistic group's ten most frequently uttered words constituted 28% of all the words they uttered, while the control

	Autistic Group	Control Group	Autistic Group (–ToM child only)	Autistic Group (excl. –ToM child)
Total Words	16647	17300	5843	10804
Percentage of Total Words			35% (5843/16647)	65% (10804/16647)
Total Coded References	1573	1829	556	1017
Percentage of Total References			35% (556/1573)	65% (1017/1573)
Total References' Percentage of Total Words	9.4% (1573/16647)	10.5% (1829/17300)	9.5% (556/5843)	9.4% (1017/10804)
Total Vocabulary	1766	1882	913	1375
Ten Most Frequently Used Words	I is a it and you the ***no*** ***my*** to	I is the it a you and to ***this*** ***that***	I is a it and no my you to have	I is a it and you the my that this
Ten Most Frequently Used Words	28% of word count	24% of word count	32% of word count	26% of word count
Words Used < 10 times	85% of vocabulary	86% of vocabulary	87% of vocabulary	86% of vocabulary
Words Used < 10 times	21% of word count	22% of word count	30% of word count	24% of word count

Table 5.2 Words and references in the corpora

group's top ten constituted 24% of their utterances. Roughly 85% of each group's vocabulary comprised words that were uttered less than ten times each. These accounted for 21% to 24% of each group's total utterances, with the notable exception of Diaz, whose least frequently uttered words represented 30% of his vocabulary.

The children in the Fraser corpus are engaged in a variety of activities, some of which feature little dialogue from the children, and some of which include many voices talking and shouting at once. Structured settings feature children answering teacher questions during socialization activities; extended dialogue and conversations are frequent. Unstructured settings comprise spontaneous interactions among the children and teachers during free-play times.

Transcripts for control data were selected if they featured children between 5 years and 6 years, 11 months of age conversing in settings similar to those filmed at Fraser. Structured settings feature 1-to-1 interactions between child and adult while playing games, playing with toys, reading books, and baking cookies. Unstructured settings feature groups of 2 – 6 children interacting with and without adults while eating lunch or playing with a doll house, action figures, and/or modeling clay.

The comparisons in this section illustrate that the control and autistic corpora are very similar. Neither group has a markedly different vocabulary, and each group's most and least frequently used words account for similar portions of total utterances and total vocabulary. The one obvious difference between the corpora is the number of subjects producing the utterances, which is discussed in the following discussion of limitations.

5.2.4 Methodological Limitations

As described, transcripts were selected from the CHILDES database to match age of subjects and approximate the settings of the Fraser data. However, one incongruity that was not avoided was the ratios of subjects-to-references between the two groups. The six children in the autistic group produced 1573 references for analysis, giving an average of 263 per subject, (sd=179, median=237). The 28 control subjects produced 1829 references for an average of 65 per subject, (sd=53, median=53). Thus, the data from the autistic group is more a reflection of the behaviors of the individual subjects than the data from the control group, as five of the six (83%) of the autistic children had at least 100 references, compared to only 18% of the control children. This discrepancy was unavoidable given the small autistic population available to study. Comparable control totals were not attainable from the CHILDES corpus without analyzing the references of many more children than autistic children.

Another limitation in this comparison is the lack of neuropsychological measurements of the control children. In order to use the CHILDES corpus as a source of control data, an assumption that the children were typically developing was necessary. A subjective effort was made, however, to watch for atypical conditions or behaviors, resulting in the discard of three transcripts mid-analysis. Two of these featured a child whose discourse behavior had no obvious unusual characteristics, but the context was a hospital room conversation between the child, his family, and the nurse who was administering pre-operative medication that could have altered his behavior for the rest of the discourse. The other discarded transcript featured a child whose conversational manner had a precocious feel that reminded me of the particular lexical skills that are often advanced in children diagnosed with Asperger's. The transcript was discarded in order to err on the side of caution.

A final limitation is that none of the 3000+ references were coded as exophoric or endophoric. That is, the analysis does not distinguish between whether the reference refers to something in the physical setting of the utterance or if it refers to something previously activated in the discourse. Demonstrative pronouns and determiners are particularly common in both such references, as they tend to refer to things that are in memory but not in focus, whether due to speaker-listener shared knowledge or to their physical presence in the setting. Since comparing the use of demonstratives by the two groups is a particularly important part of this study, failing to make an endophoric/exophoric distinction is admittedly a missed opportunity for more detailed comparison.

5.2.5 Procedure

5.2.5.1 Transcription

Video footage was transcribed using Transana version 2.41, using the Jeffersonian Transcription Notation (Jefferson 1984) (table 5.3, following page)recommended by Transana.

5.2.5.2 Reference Analysis

Transcripts were analyzed using Gate language processing system version 5.0. This included highlighting all relevant referring expressions, identifying their referents, and determining the cognitive status of each referent in the mind of the listener(s) at the moment of utterance. Cognitive statuses were judged according to the *Coding Protocol for Statuses on the Givenness*

Symbol	Name	Use
[text]	Brackets	Indicates start and end points of overlapping speech.
=	Equal Sign	Indicates the break and subsequent continuation of a single utterance.
(# of seconds)	Timed Pause	A number in parentheses indicates the time, in seconds, of a pause in speech.
(.)	Micropause	A brief pause, usually less than 0.2 seconds.
. or ↓	Period or Down Arrow	Indicates falling pitch or intonation.
? or ↑	Question Mark or Up Arrow	Indicates rising pitch or intonation.
,	Comma	Indicates a temporary rise or fall in intonation.
-	Hyphen	Indicates an abrupt halt or interruption in utterance.
>text<	Greater than/Less than symbols	Indicates that the enclosed speech was delivered more rapidly than usual for the speaker.
<text>	Less than/Greater than symbols	Indicates that the enclosed speech was delivered more slowly than usual for the speaker.
°	Degree symbol	Indicates whisper, reduced volume, or quiet speech.
ALL CAPS	Capitalized text	Indicates shouted or increased volume speech.
underline	Underlined text	Indicates the speaker is emphasizing or stressing the speech.
: : :	Colon(s)	Indicates prolongation of a sound.
(hhh)		Audible exhalation
˙ or (.hhh)	High Dot	Audible inhalation
(text)	Parentheses	Speech that is unclear or in doubt in the transcript.
((italic text))	Double Parentheses	Annotation of non-verbal activity.

Table 5.3 Jeffersonian transcription notation

Hierarchy (2007),[33] which includes a list of sufficient criteria for each cognitive status. After determining the speaker's intended interpretation, the coder starts with the most restrictive status (*In Focus*) and moves down the list all the way to the least restrictive (*Type Identifiable*) if necessary. The first criterion that is satisfied represents the highest possible cognitive status for the given referent. References were not coded if the intended referent was indeterminate, whether due to speaker error or the opaque nature of the video or transcript. Phrases repeated consecutively with no intervening discourse were coded just once. For example, if a child uttered "The car made – the car – the car crashed," the phrase *the car* was coded only once. A decision was made not to compare the frequency of indeterminate references by group due to the differences in the data media. Indeterminate utterances by the autistic children could be watched over and over again in search of extra-linguistic clues to speaker intention, whereas the CHILDES transcripts did not allow for such thoroughness.

Coding accuracy was measured by comparing my coding judgments with Dr. Gundel's on a transcript from the Fraser data featuring 113 relevant uses of pronouns and determiners. We were in agreement on 109 judgments, differing on only four (96.5% agreement). A simple proportion test showed a statistical probability (< .05) that we would agree on more than 91.7% of any coding we might compare.

5.2.6 Statistical Method

Three logistic regressions were run for various observed phenomena, one comparing the autistic group to the control group, another comparing the autistic child who failed the false

[33] Included in Appendix A.

belief task to the control group, and the final comparing the other five autistic children to the control group. All significant *p*-values (< .05) were given a Bonferroni correction for multiple comparisons. Confidence intervals (plotted in figures 5.12, 5.13, and 5.14 at the end of section 5.3.4.3.2.2.1) reveal the importance of the Bonferroni correction, as significant observations that are rendered insignificant by the correction tend to have very broad confidence ranges.

5.3 Results

As already stated, in analyzing the transcripts, the intended referents of 1829 uses of determiners and pronouns by the control children were determined with a reasonable degree of certainty, as were 1573 uses by the autistic children. The control children's references represented just over 10% of all their uttered words, while the autistic children's represented just under 10%. Because of this similarity, henceforth, patterns of use and distribution are discussed only in terms their percentage of each group's total coded references, not total utterances. The frequency of use of any of the coded forms in any particular manner with respect to each group's total coded references will always represent roughly ten times the frequency with respect to each group's total uttered words.

Various patterns of distribution are worth comparing:

- General distribution of forms:
    - How frequently was each form uttered, relative to the other forms?

- General distribution of forms by cognitive status:
    - For each form, what were the different cognitive statuses of the entities the form was used to refer to, and what was the frequency of each cognitive status relative to the others?

- Procedural competence
    - When a form was used, how frequently was it used to refer to an entity that did not meet the minimum cognitive status encoded in the form?

- Pragmatic competence
    - When forms were used appropriately with respect to the cognitive status of the referent,
        - How well was ambiguity avoided?

        - How frequently were explicit full DPs (i.e. with conceptual content) used to make in-focus references (instead of using a personal pronoun), and what forms were used in those explicit DPs?
            - In other words, how well is relevance of conceptual and procedural information assessed?

    - Does the pattern of distribution reflect a sensitivity to the scalar implicatures associated with some of the forms?

5.3.1 General Distribution of Forms

Looking at the distribution pattern of all coded references, it is apparent that the control children used the indefinite article much less than the autistic children. Determiner phrases headed by *a(n)* made up 24% of the autistic children's coded references, while only 15% of the control children's ($p < .001$ with Bonferroni correction; risk factor 1.8; confidence interval 1.5 – 2.2).[34] This could be evidence of lengthier topic maintenance among controls and more frequent introductions of new referents among the autistic children. That would also predict fewer opportunities for the autistics to use personal pronouns, but the difference between groups in

[34] Test 17, figure 5.11.

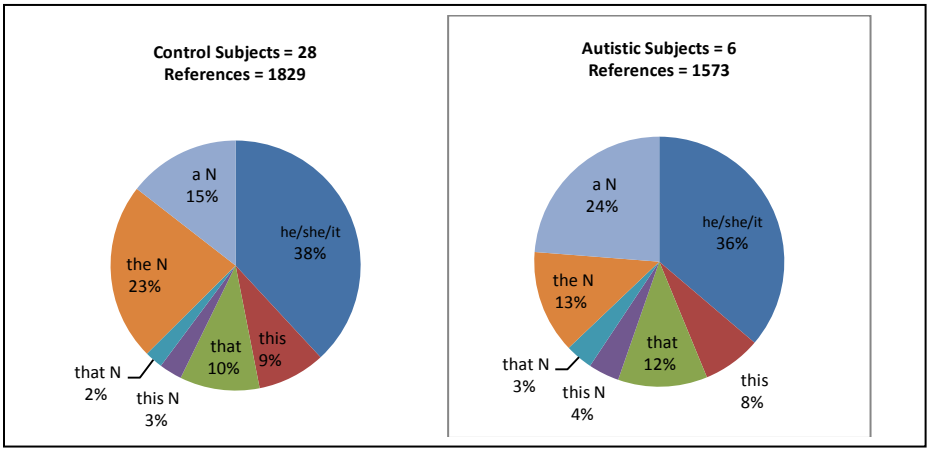

Figure 5.1 Distribution of forms used by autistic and control groups

personal pronoun use is insignificant. However, the difference becomes quite significant when the –ToM child is removed from the rest of the autistic group, as the remaining autistic children used significantly *less* personal pronouns than controls did (29% compared to 38% for controls; $p < .001$ with Bonferroni correction; risk factor .66; confidence interval .56 – .78),[35] while the –ToM child used significantly *more* personal pronouns than controls did (49% to 38%; $p < .001$ with Bonferroni correction; risk factor 1.6; confidence interval 1.3 – 1.9).[36] Diaz also differs from all subjects, autistic and control, in his reliance on these forms to the exclusion of others. Personal pronouns and indefinite article DPs represent two opposite ends of the Givenness Hierarchy, the former encoding the most procedural information about cognitive status and the latter the least. While these constituted roughly three-quarters of all Diaz's references, the control children and the other autistic children used them for only about half their total utterances. The possibility is intriguing that such a stark reliance on the two ends of the

[35] Test 3, figure 5.12.
[36] Test 17, figure 5.13.

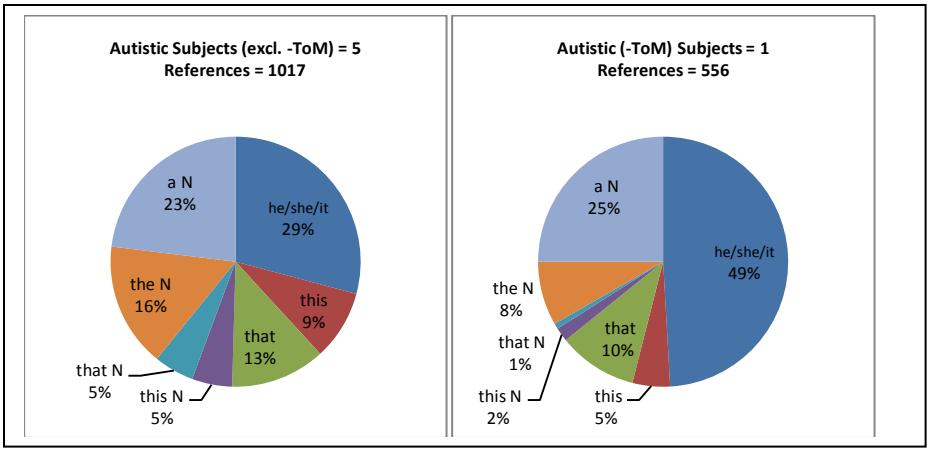

Figure 5.2 Distribution of forms by the -ToM child and the other autistic children

Givenness Hierarchy could be associated with highly verbal autistic children who cannot pass a false belief task, but obviously no conclusions can be drawn from one child. I will touch on this again in section 5.4. While the control children were much less likely to use the indefinite article, they were much *more* likely than the autistic children to use the definite article *the*. Twenty-three percent of all coded references made by controls were DPs headed by *the*, compared to only 13% of the autistic children's coded references ($p < .001$ with Bonferroni correction; risk factor 0.5; confidence interval 0.4 – 0.6).[37] The difference is particularly extreme ($p < .001$ with Bonferroni correction; risk factor 0.3; confidence interval 0.2 – 0.4)[38] between controls and the –ToM child, who used *the* only 8% of the time. Recall that the determiner *the* entails that the entity it refers to is *at least* uniquely identifiable, but that, because no conversational implicature conveying "no more than uniquely identifiable" is associated with it, and because conceptual content in the NP renders more specific cognitive status information unnecessary,

[37] Test 2, figure 5.11.
[38] Test 10, figure 5.13.

the DPs are commonly used to refer to familiar and in-focus entities as well as uniquely identifiable (cf. Gundel et al. 1993, 2001). For this reason it is also worth looking closely at *how* the groups use *the* DPs.

Table 5.4 shows the cognitive statuses of the entities the groups referred to when using definite article DPs. The autistic children used *the* a little more exclusively for referents that were at most uniquely identifiable than controls did (64% to 60%), though the difference was not statistically significant. The difference was significant, however, in how little the autistic children used the definite article to refer to things that were familiar to the listener but not currently activated (11% of *the* utterances compared to 19% by the controls; $p < .009$; risk factor 0.5; confidence interval 0.3 – 0.8).[39] Both comparisons were more contrasting when looking at just the –ToM child, who referred to something at most uniquely identifiable with 78% of his definite article utterances (compared to 60% for controls; $p < .02$; risk factor 2.4; confidence interval 1.2 – 5.2)[40] and referred to something at most familiar with only 4% of them (compared

	In Focus	Activated	Familiar	Uniquely Identifiable	Referential	Type Identifiable
Autistics	23 (11%)	25 (12%)	23 (11%)	135 (64%)	2 (1%)	2 (1%)
Controls	42 (10%)	45 (11%)	81 (19%)	252 (60%)	0	0
–ToM child	3 (7%)	5 (11%)	2 (4%)	36 (78%)	0	0
Autistics (excl. –ToM child)	20 (12%)	20 (12%)	21 (13%)	99 (60%)	2 (1%)	2 (1%)

Table 5.4 Cognitive statuses of referents of definite article DPs

[39] Test 1, figure 5.11.
[40] Test 21, figure 5.13.

to 19% for controls; $p < .03$; risk factor 0.2; confidence interval 0.03 – 0.6).[41] However, small sample size prevented any of these differences from remaining significant after a Bonferroni correction. The restricted use of the definite article could be evidence of some limitation in use of the procedural information encoded in the array of different pronouns and determiners, or it could be a result of the tendency to monologue associated with verbal autistics. I will consider these possibilities in section 5.4.

Looking again at the general distribution, there was no significant difference between the autistic and control groups' use of demonstrative pronouns and determiners, though, once again, separating the –ToM child from the group is revealing. Diaz used the pronoun *this* for only 5% of his total coded references, compared to 9% by controls ($p = .06$ with Bonferroni correction; risk factor 0.5; confidence interval 0.3 – 0.8).[42] The other autistic children used demonstrative determiners a bit more than controls, including 5% frequency of *that NP* compared to 2% for controls ($p < .003$ with Bonferroni correction; risk factor 2.2; confidence interval 1.5 – 3.4)[43] and 5% frequency of *this NP* compared to 3% for controls ($p = .05$ with Bonferroni correction; risk factor 1.0; confidence interval 0.3 – 3.9).[44]

Finally, combining into one category all references featuring a demonstrative, whether pronoun or determiner, reveals significant differences. Phrases with a demonstrative represented 18% of the –ToM child's total coded phrases and 32% of the rest of the autistic children's coded phrases. The control children used a demonstrative in 24% of their total, meaning that Diaz used significantly **less** demonstratives than controls ($p < .02$ with Bonferroni

[41] Test 7, figure 5.13.
[42] Test 11, figure 5.13.
[43] Test 13, figure 5.12.
[44] Test 6, figure 5.12.

correction; risk factor 0.7; confidence interval 0.5 – 0.8),[45] while the other five autistic children used significantly **more** demonstratives than controls (p <.0007 with Bonferroni correction; risk factor 1.4; confidence interval 1.2 – 1.7).[46] Possible explanations for these differences will be considered in section 5.4.

5.3.1.2 Summary of General Distribution of Forms

- Compared to the control group, the most striking differences are how much more the autistic group used indefinite articles and how much less they used definite articles.

- The autistic children also exhibited some variation from controls in frequency of personal pronoun and demonstrative use.
    - The –ToM child's greater use of personal pronouns and indefinite article phrases is quite marked. His use of demonstratives and the definite article, in turn, is significantly less than controls.

    - On the other hand, the other five autistic children used personal pronouns significantly less than controls, while they used demonstrative phrases significantly more than controls.

5.3.2 General Distribution: Form by Cognitive Status

When comparing the distribution by form and cognitive status of all the coded referring phrases for each group, the similarity is quite apparent. Most personal pronouns refer to

[45] Test 14, figure 5.13.
[46] Test 9, figure 5.12.

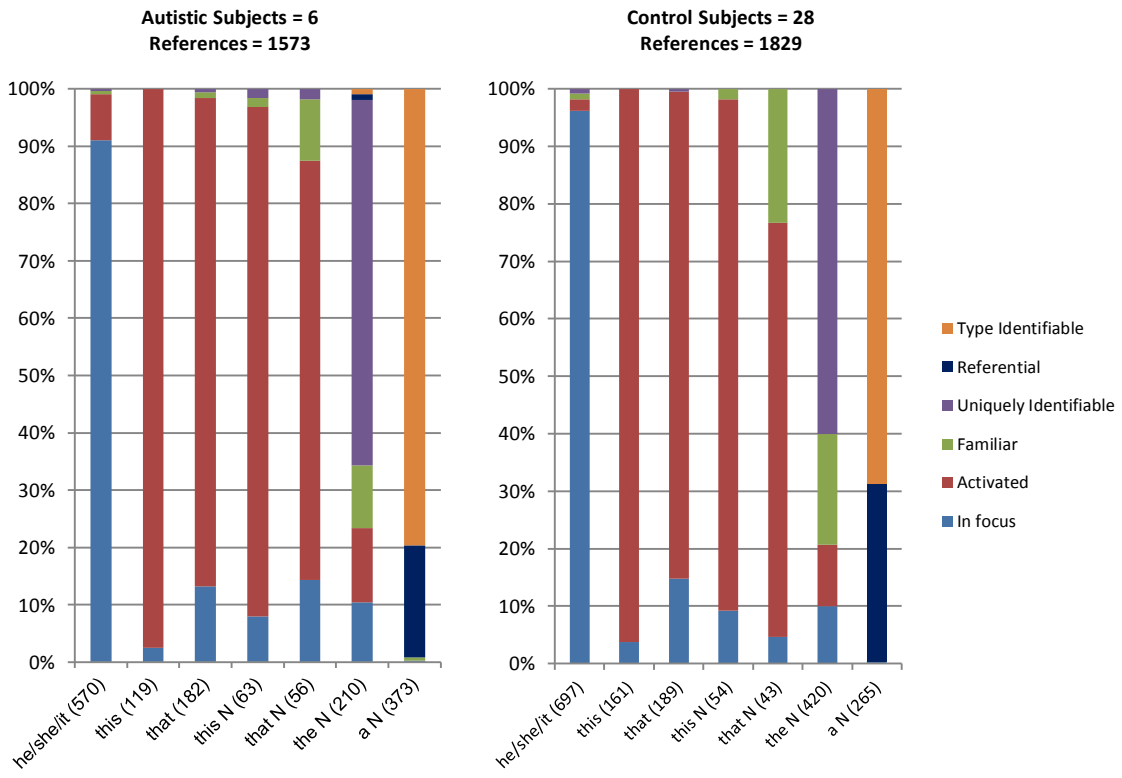

Figure 5.3 General distribution of forms by cognitive status: Autistic subjects and control subjects

entities in current focus, most demonstratives refer to at-most activated referents, and the cognitive statuses of entities referred to with definite and indefinite articles show a similar pattern: In both groups, over half the uses of *the* refer to something at-most uniquely identifiable, and the rest are divided somewhat evenly among references to at-most familiar, at-most activated, and in-focus entities. Well over half the uses of *a(n)* by both groups refer to something at-most type identifiable, with the rest predominantly at-most referential. However, several small but significant differences are apparent when looking at how the subjects' choices of referring forms reflect their abilities to assess the cognitive status of referents and to determine what information to include in references. Section 5.3.3 provides an analysis of the frequency with which the children made errors involving procedural information, i.e. how often

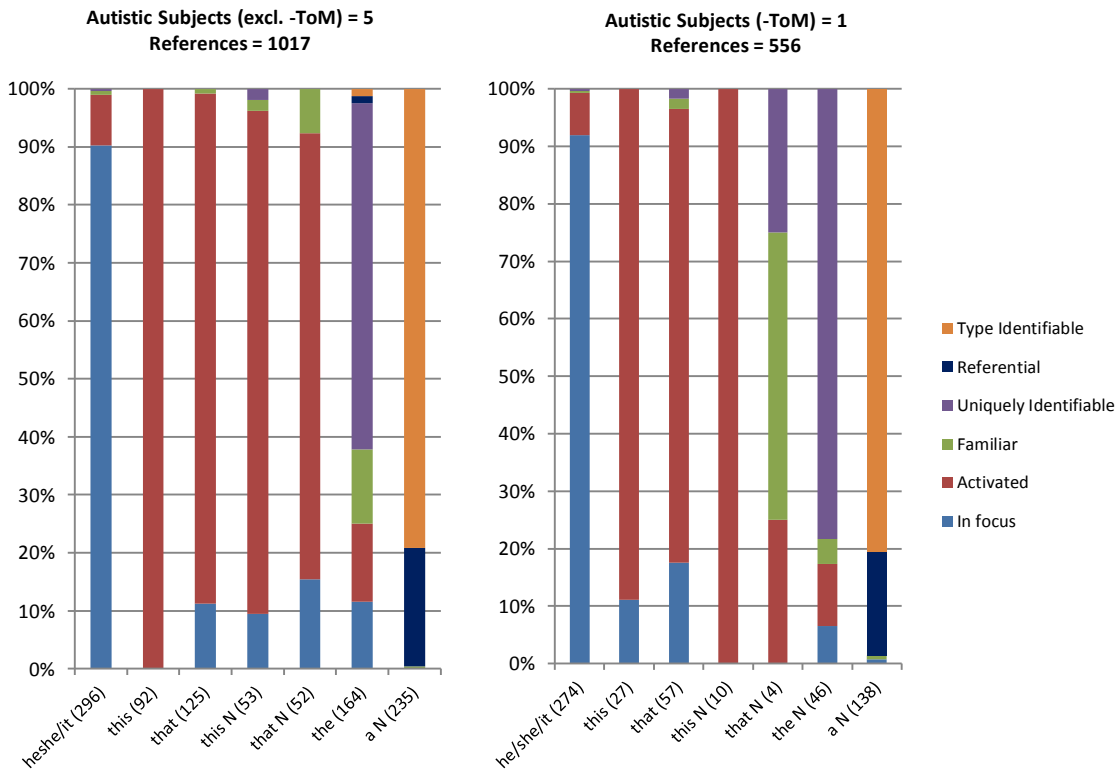

Figure 5.4 General distribution of forms by cognitive status: The two autistic sub-groups

they used a form to refer to something that did not have the minimum cognitive status encoded by the form. Section 5.3.4 looks at instances where cognitive status information encoded in the form matches the cognitive status of the entity referred to, but where the form includes information that may not be relevant.

5.3.3 Procedural Competence

Since the claim is that pronouns/determiners encode procedural information about the cognitive status of the intended referent, i.e. where/how it is to be mentally accessed by the addressee, the term *procedural error* will henceforth be used here to refer to any use of these forms to refer to an entity that does not meet the minimum cognitive status encoded in the

form. Sometimes procedural errors can cause a communication breakdown, e.g. if a speaker uses a pronoun that does not seem to match anything in the listener's current focus or working memory. Consider this example from the Fraser data:[47]

Example 25

42 T: All right guys we're doing balloon races. Who wants to go first? Josh and Richard? Okay. We're gonna put the balloon between our legs, by our knees, and go until I say go, okay? The first person to slap my hand wins the race. Ready, set, go! ((the boys hop to T)) Nice guys, good job! Okay Diaz and Silas can go.

43 S: I don't want Diaz with me!

44 T: Do you want to go with a different friend? Richard or Josh?

45 ((a little bit of disorganized commotion that culminates with one of the balloons being popped. T4 leaves to get a new one.))

46 T: All right guys, come sit down. Now we gotta wait for another one. Silas, buddy, you can either go with Diaz this time or you can just wait one more turn, okay?

47 Richard: **That**'s (bad/sad), Diaz.

48 T: What's sad?

Richard is referring to Silas's mean feelings toward Diaz, but by the time Richard makes his remark, much has transpired since Silas said he did not want Diaz with him in line 43. The teacher's remark to Silas that he can either go with Diaz or wait a turn appears to have re-activated for Richard the thought of Silas's mean words about Diaz. The teacher is uncertain what Richard is referring to, so she asks for clarification. At the moment of Richard's remark, it is unlikely that the event is activated for Diaz, either. In the context, the demonstrative pronoun

[47] Relevant references are in **bold** in all examples. Underlined references indicate relevant speaker stress.

that could easily be interpreted as a reference to the teacher's statement to Silas in line 46, as in the following alternative example:

Example 25b

49 R: That the teacher just told Silas that he can either go with you or wait a turn is (bad/sad), Diaz.

Example (25b) is certainly a possible interpretation of Richard's intention, and if it is accurate, perhaps the error would not be procedural (since the teacher's just-uttered ultimatum is indeed currently activated for everyone listening) but rather just a statement low in relevance. The more processing required to interpret an utterance, the less relevant is the utterance; and it would require a good deal of extra processing for Diaz to get at Richard's intended meaning, which I suggest is as follows:

Example 25c

50 That Silas said he doesn't want to play with you so the teacher had to tell Silas that he can either go with you or wait a turn is (bad/sad), Diaz.

Line 50 is the observation at the heart of Richard's statement in line 47, and that is an observation that is simply not activated for Diaz at that moment.

It is important to emphasize that "error" is used here loosely, as procedural errors are actually not terribly uncommon, and they often cause no confusion or communication disruption in the least. Context always contributes to listener interpretation of speaker intent, and some degree of extra processing effort is often enough for listeners to identify the intended referent despite a procedural error, in the same way listeners can often accommodate false starts, speech errors, or other procedural violations such as incorrect subject-verb agreement.

Nonetheless, since any use of a determiner or pronoun is a violation when it refers to something that does not meet the minimum cognitive status the form encodes, all such uses will be considered procedurally errant, regardless of whether or not they result in any observable communication disruption.

The forms that accounted for the most procedural errors were, by far, personal pronouns. This is not surprising; because they are the most restrictive forms (referring only to things in focus), they offer the most potential for misuse. While nearly all the forms were used errantly more frequently by the autistic group, the numbers are only large enough to show a significant difference in use of personal pronouns, where the autistic children made procedural errors on 9% of their utterances, compared to just 4% by the controls. Comparing the controls to the –ToM child separately from the other autistic children makes no difference; the results are the same: compared to the control group, when children in the autistic group used a personal pronoun, they were more than twice as likely as controls to refer to something that was not currently in focus ($p < .02$ with Bonferroni correction; risk factor 2.3; confidence interval 1.4 – 3.8).[48]

	Procedural Errors: Autistic	Procedural Errors: Control
he/she/it	8.9%	3.9%
this	0	0
that	1.6%	0.5%
this NP	3.2%	1.9%
that NP	1.8%	0
the NP	1.9%	0

Table 5.5 Percentage of procedural errors made with each form

[48] Test 18, figure 5.11.

Let's look at some clear examples from the Fraser footage of a personal pronoun used to refer to something not in focus:

Example 26 *Teacher and children are going over the day's weather.*

51 T2: Chris, did you want to help me? ((C nods)) What does it look like outside? Can you see? ((Holds C up to window)) What does it look like out there?

52 C: Chilly.

53 T2: Chilly? ((laughs)) It does look kinda chilly. What does the sky look like? Do you see sun or clouds?

54 C: (unclear)

55 T2: Clouds? Okay. ((puts him down)) Here, ((hands him paper clouds)) why don't you put these clouds on. ((C does it.))

56 Silas: **It** sounds like (icky) food!

57 T1: Chili is also a food, you're right.

58 S: (And then it's like) chili is like- called icky food.

In example (26), Silas uses the personal pronoun *it,* which signals to his audience to access a referent at the focus of their attention. Yet, he is referring to the word *chilly*, which is clearly not in the current focus of the conversation, as the focus was on the meaning of *chilly*, not the word itself. Furthermore, the chilliness of the weather has faded from focus anyway, as the focus at the moment Silas speaks is on the clouds in the sky and on the board. Watching the video, it is actually surprising that anyone was able to so quickly infer Silas's intended meaning. It is noteworthy that T1 is sitting off to the side, not participating, just observing. Her detached observation probably helped her infer Silas's intention, as her attention did not need to be focused so exclusively on talking about the weather with Chris. T2, on the other hand, gives no sign of understanding what Silas is talking about.

Based purely on anecdotal evidence, writing as one who has spent a great deal of time around verbal autistic children, Silas's behavior seems quintessentially autistic. Anyone, child or adult, will zone out of the conversation now and again, especially in settings like example (26) where one can choose not to be actively involved in the interactions. But much less frequently does one then speak up as if the others in the group are privy to one's daydreams. A limited awareness of those others' thoughts and attentions, however, might make such statements more likely. Yet it is important to see the distinction between such errors of distraction or self-absorption and similar errors made in the midst of active conversational participation. The latter would suggest a much more acute impairment, as it would indicate a seemingly complete blindness to the attentions of even those with whom one is directly interacting. Silas's utterance has a very autistic feel to it, but I do not know how frequently he would need to exhibit such behavior before a teacher in a non-clinical setting would take notice, as any child is probably given to an absent-minded reference like this from time to time. In identifying my expectations of what the data would reveal, I expected the autistic children would make more errors of this nature than the control children, but I expected (correctly) that nonetheless such extreme examples would be fairly infrequent. For this reason, my description of Silas's reference as quintessentially autistic is not inconsistent with my prediction in chapter 1 that there would not be a significant difference in the autistic children's ability to use forms that match the cognitive statuses of the entities they refer to.

Example 27 *Teacher and children are watching an interactive story on the computer about emotions. The boy on the computer says he feels sad when it's raining and he can't play baseball.*

59 T4: When do you guys feel sad? (2) Chris?

60 C: (inaudible)

61 T1: When it's raining?

62 J: Yeah. (2) **It**'s the same one that Chris said too.

63 T4: When it's raining?

64 J: Yeah.

In example (27), it appears that T1 is repeating what he thinks Chris said, i.e. "When it's raining?" Josh appears to miss T1's intent, apparently wishing to convey "Yeah. 'When it's raining' is the same thing that Chris said," or "What you just said is the same thing that Chris said." According to the coding protocol, speech acts, facts, and propositions are activated upon utterance, but not placed in focus. Thus, the statement "when it's raining" is activated but not in focus at the time of Josh's statement. For this reason, substituting *that* for *it* sounds more natural: "Yeah. That's the same one that Chris said, too."

Example 28

65 J: What's your favorite book?

66 T7: What's my favorite (.) book?

67 J: Yeah.

68 T7: I really like the book Where the Wild Things Are. Have you read that book?

69 Bella: Oh I have that book! at my house!

70 T7: You do?!

71 Re: Wait a second!

72 T7: What?

73 Re: I got another question.

74 T7: Okay go right ahead.

75 Re: We have **it** at Fraser.

76 T7: Have what?

77 T4: That's [a comment]

78 Re: [At Fraser.] At Fraser and even at my kindergarten school.

Early in example (28) *Where the Wild Things Are* is placed in focus, and in line 75, Reese refers to it with *it*. But at that point the book is no longer in focus, and thus T7 has to ask what he means. Admittedly, part of the confusion comes from the fact that Reese uttered a statement after declaring that he had a question to ask. It would be an interesting experiment to compare listener interpretations of example (28) with (28b):

Example 28b

79 Re: Wait a second!
80 T7: What?
81 Re: I got another question.
82 T7: Okay go right ahead.
83 Re: Do we have **it** at Fraser?

It is quite possible that T7 would have made the correct inference if Reese's utterance had actually been line 83 and not line 75. Because the context in (28) was muddled by the incongruity of Reese's utterance of a statement after announcing he had a question, T7's inferential processing broke down and she had to ask Reese what he meant. I suspect that the muddled context would not have mattered if there was an obvious potential referent in T7's focus of attention, but there was not. By saying, "Wait. I got another question," Reese removed the book from focus. Because the book was still in active memory, a clearer context would probably have allowed for smooth reference resolution with only a minor cost of processing effort.

Example 29 *Reese is up at the weather board straightening things while no one is really paying him attention; the others are doing other things. He points a finger on the board and looks at T4. He speaks loudly, as T4 is across the room playing with Chris.*

84 Re: I fixed **it** because **he** put **them** on (unclear) ((moves a cloud a bit)) like that.

85 T4: Okay.

In line 84, "it" refers to the board, which Reese is activating with his gesture, but the gesture does not place the board in focus. His utterance of "he" refers to Chris, who was at the board a few minutes earlier, and "them" refers to the clouds on the board that Reese just adjusted (while no one was watching). But neither Chris nor the clouds are in focus. As a whole, example (29) is a very autistic behavioral display from a very verbal, outgoing boy who I would describe, purely subjectively, as the most ordinary- and normal-seeming of the six children in the group. He has just spent a couple minutes by himself, doing his own thing, and then he turns to the first desirable conversation partner he sees and makes references as if she had been right there with him in the activity. It is difficult to say whether the teacher inferred the meaning of all three pronominal references after some minor processing strain or, more likely, just said "okay" because she did not deem complete reference resolution as relevant as her need to quickly acknowledge Reese and return her attention to Chris. (Of course, even that momentary deliberation would still be a processing cost resulting from Reese's breech of procedural protocol.) In any case, the ease with which the communication occurred in this example contrasts with the more salient struggles resulting from the references in examples (25, 27, and 28). As stated above, not all procedural errors are particularly costly. Indeed, what follows are examples of errant references that seem to cause no disruption to the conversational exchange at all.

Example 30 *Adult, Bobbi, brings food and serves Saasha and Nicole, then Brian. "Vir" is Virginia, the investigator, referred to as Ginny in the discourse.*

86 BOB: 0.

87 %act: comes with plates, gives saa and nic theirs first, then bri

88 NIC: girls first.

89 BRI: boys last.

90 NIC: <girls firs(t)> [//] girls first again.

91 BRI: girls first again.

92 VIR: boy.

93 VIR: that looks good.

94 VIR: andmm [= nice].

95 SAA: it is good.

96 BRI: we don't get seconds.

97 BRI: too bad.

98 SAA: we might.

99 BRI: no, we don't (.).

100 BRI: **she** doesn't give us seconds any more.

101 NIC: you mean she doesn't give us thirds.

102 BRI: seconds (.)

103 BRI: cause she'll only get [//] give us seconds if she has extra .

104 %alt: <2w> you'll

105 SAA: Bobbi's not here today .

106 %exp: bob's right behind her

107 NIC: yes, she is .

108 %exp: can see BOB easily

109 BOB: Ginny (.)

110 BOB: oh, you can't eat and write, can you ?

111 VIR: what ?

112 BOB: <I was> [?] gonna say +"/.

113 BOB: +" you wanna eat lunch .

114 BOB: but then I thought you can't eat and write .

115 %par: <aft> laughs
116 VIR: it looks delicious .
117 %par: <bef> laughs
118 SAA: Bobbi <(.) do we get seconds> [>] ?
119 NIC: <oh, that is my drink> [<] .
120 BOB: on jello and macaroni .
121 SAA: oh, goody (.) .
122 SAA: she said jello and macaroni we get seconds .

On line 100, when Brian says "she doesn't give us seconds anymore," he is referring, presumably, to Bobbi, who just served them their lunch. Since this is only a transcript, we cannot know exactly where Bobbi was standing at this moment, but we know that a moment later, she is standing right behind Saasha, apparently visible to Nicole and Brian. Saasha makes the comment on line 105 that Bobbi is not here today, which is odd, given that Bobbi just served them their lunch, but a likely explanation is that Bobbi stood behind Saasha when serving them, and Saasha didn't look to see who was serving. In any case, it is safe to say that at the moment Brian said "she doesn't give us seconds anymore," Bobbi was activated for him and Nicole, and likely an anonymous server was activated for Saasha. This is because all parties present in a discourse environment are activated. But Bobbi is not in anyone's focus at the moment of utterance, because Virginia, the investigator, has placed the food in focus in lines 92–94 by saying "boy . . . that looks good . . . mmm." Brian then shifts the focus to whether or not they get seconds on the good food, which could be argued to keep Bobbi activated by association with serving seconds, regardless of whether Bobbi's presence is immediate enough to still be activated anyway. This is because a reference to the food serving protocol could activate for listeners a representation of Bobbi (if she is their regular server, or if she was established earlier

as their specific server today) or an unspecified female server (if different women work as servers from day to day, and the identity of today's server was unknown). In the case of the latter, Brian's use of the pronoun *she* could be analyzed as non-referential, meaning he intended for his listeners to create a representation roughly no more specific than "today's female lunch server." However, given Saasha's statement "Bobbi's not here today," it seems more likely that Brian intended to refer specifically to Bobbi, who was currently activated by the discussion of serving second helpings. Gundel, Hedberg, and Zacharski (2005) describe such pronominal references to activated entities as "minor violations" of the condition that licit unstressed personal pronouns refer to entities currently in focus. Addressees easily repair such violations and identify the intended referent, as is evident in this example, as Brian's use of "she" causes no conversation breakdown, despite Bobbi not being in focus for any of the listeners at the moment of utterance.

It is possible that Brian's utterance would have cost his listeners less processing time if he had referred to Bobbi by name, though that is not necessarily the case. Referring to a person by name costs a listener more processing effort than a licit use of a personal pronoun (Wilson 2000). Which costs a listener more processing effort, associating a proper name or a personal pronoun with an activated person (provided the violation is minor, such as this case, where there is only one activated female person the personal pronoun could refer to) is an interesting question that is beyond the scope of the current study. In any case, given how easily the conversation continued to flow after Brian's pronominal reference to Bobbi, it is clear that his listeners inferred his intention without delay. Thus example (30) illustrates how, though personal pronouns carry a message for listeners to keep their attention where it is currently focused, in some contexts listeners can easily match a not-in-focus referent to a personal

pronoun, and do so without any apparent confusion as to why the speaker used the personal pronoun. Now consider another example where a personal pronoun easily refers to something not currently in focus. This one comes from the Fraser data:

Example 31

123 J: And you remember my name too (unclear) when we were playing free- when we were playing [with water]

124 W: [Ri:ght.] You::: are:

125 J: (unclear) right?

126 W: Are you Richard? ((Josh walks away))

127 Re: ((turns around and looks at W and points at Richard)) **He** is Richard.

128 W: No ((pointing)) that's Richard!

In example (31), Josh is asking me if I remember his name, though he walks away before I finish my response. Reese, who is present as well, hears me incorrectly guess that Josh is Richard. Reese turns to look at me, and points at Richard as he says "He is Richard." One could argue that Richard has been placed in focus by my guess, but given my ignorance of which child actually *is* Richard, Richard's physical body is still only activated at best, by virtue of his presence in the room. A useful illustration is to think of a similar exchange involving physical objects, such as me asking Josh "Is that your coat?" In response, it would be quite odd for Reese to interject, pointing at a different coat, "It's Josh's coat." That is because a pointing gesture activates a referent, it does not place it in focus. But in the case of people, it is perfectly acceptable to use a personal pronoun when activating someone with a gesture like a nod or a point. Indeed, Gundel et al. (1993) stipulate that *stressed* personal pronouns only require activated status, unlike unstressed uses, which require that the referent is in focus. Perhaps even the "It's Josh's coat" example could succeed pragmatically if a great deal of stress was placed on "it's." For reasons

that need not be explored here, speakers tend to take great advantage of stress to use personal pronouns for activated living beings, but almost always use a demonstrative in such contexts when the referent is inanimate. (E.g. speaker says, while pointing, “He’s the guy I was talking about” vs. speaker says, while pointing, “That’s the car I was talking about.”)

Example (31) exposes a weakness of this study. Ideally, stressed personal pronouns should be coded separately from unstressed, since stressed pronouns do not require an in-focus referent. However, given the constraints of the control data—transcripts that often do not note stress and intonation—all references with personal pronouns have been coded equally. Thus all procedural errors tallied involving personal pronouns are grouped as one phenomenon: the use of a form that encodes “in focus” in its conventional meaning to refer to something that is not in focus in the moment of utterance. This is bound to sweep up pragmatically appropriate stressed uses along with errant, unstressed ones in both groups. Yet the comparison is still valid, as neither side is coded for stress, and the presumption in this analysis is that any statistically significant difference between groups is potentially qualitatively significant. One just needs to be cautious in interpreting the comparison. If the current study concludes that the autistic population makes more procedurally errant references using personal pronouns, that may mean that they make more references that disrupt communication and/or require extra processing effort of the listener, as in examples (25 – 28), or that they simply happen to make more references that contextually allow listeners to easily infer what entity the pronoun refers to, even though it is not currently in focus, as in examples (30) and (31). The former possibility may have more interesting ramifications for the study of language, cognition, and theory of mind, but the latter would demand explanation as well.

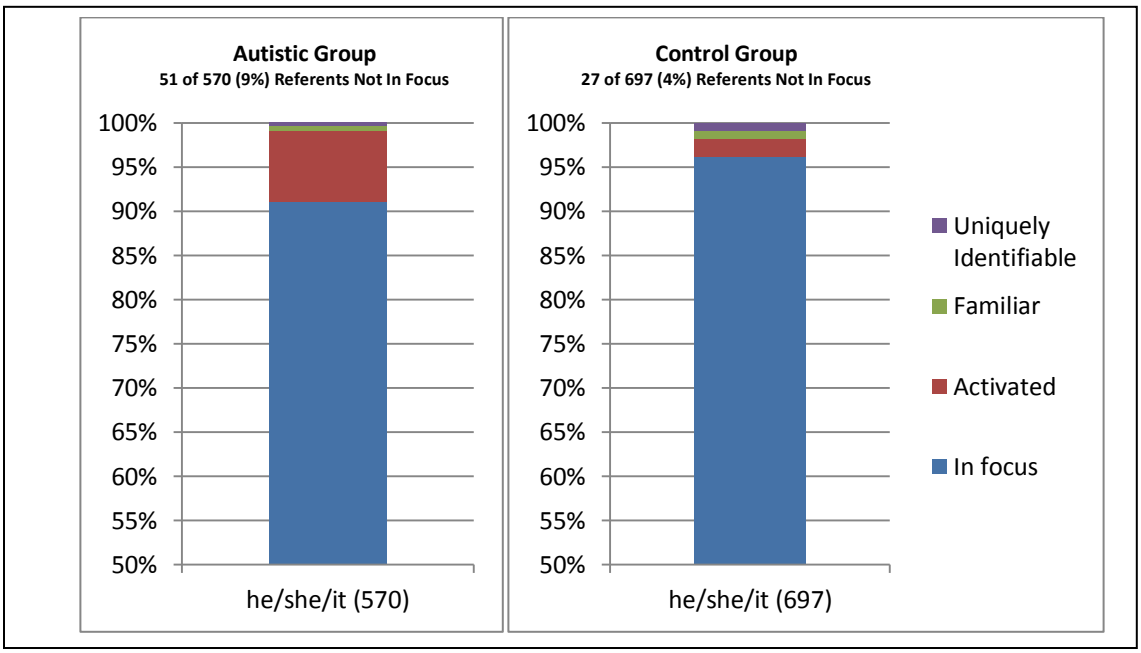

Figure 5.5 Cognitive status of personal pronoun references

5.3.3.1 Summary of Procedural Competence

The autistic children were twice as likely as controls to make a procedural error when using personal pronouns.

- The examples in this section feature pronouns that encode as part of their conventional meaning the procedural information "associate the current focus of attention with this form," but the speakers actually intend to refer to something not currently in the listener's focus.
    - Examples (25 – 29) featured obvious errors, requiring the listener to ask for clarification or expend significant processing effort in order to arrive at the correct interpretation.
        - **This is evidence of conceptual underspecification.**
    - Examples (30) and (31) illustrated that not all procedural errors cause confusion or processing strain. Such errors appear to be more easily accommodated by

listeners than under-specifying conceptually, and thus it is not too surprising that they are actually commonplace in everyday conversation.

- Such utterances can be considered *overspecific for procedural content*, i.e. overly restrictive.

Gundel et al.'s (1993) Givenness Hierarchy account of pronominal reference combined with Sperber and Wilson's model of processing relevant hypotheses of speaker intention would suggest that the least costly path to associating the correct representation with a personal pronoun is followed when a listener has a suitable referent in his current focus of attention. There are exceptions, and (30) and (31) are examples of contexts where a listener lacking focus on the intended referent likely incurs no processing cost interpreting the pronoun. There are other everyday exceptions, such as when a speaker has no intention that his listeners identify the specific entity he is referring to (e.g. "I got pulled over on the way to school this morning, but *he* let me off with just a warning"), or when the speaker himself has no specific referent in mind (e.g. "I went to the store, but *they* were out of milk").

5.3.4 Pragmatic Competence

The rest of the results will look at patterns in the groups' "procedurally appropriate" utterances. The vast majority of the subjects' utterances were uses where the information procedurally encoded about cognitive status in the form matched the cognitive status of the intended referent. Yet such references are still reflections of a speaker's decisions regarding what information is necessary and relevant to convey. For example, an explicit DP (i.e. containing conceptual information) is procedurally appropriate even when the listener would be better served with a pronoun, and opposite, using a personal pronoun for a referent that is in

focus is procedurally appropriate, but it can still be unsuccessful if, for instance, there are other referents also currently in focus. Moreover, as discussed in section 3.6, the procedural information encoded in pronouns and determiners itself also must be considered for relevance, such as when it is relevant to signal specifically that the referent is in memory, as opposed to specifying in focus or merely uniquely identifiable. Thus, to investigate the children's skill in choosing referring forms beyond just matching the cognitive status of the intended referent with a form licensed by the status, we will consider ambiguous references, choices of forms for in-focus references, and evidence of sensitivity to the relevance of the cognitive status information encoded in demonstratives and the indefinite article.

5.3.4.1 Ambiguity

Ambiguous references are one way errors can occur even when the procedural information encoded in the form is consistent with the cognitive status of the intended referent in the listener's mind at that moment. Consider example (32):

Example 32

129 Josh: Um, it's about Sponge Bob and Patrick and Bikini Bottom and **he** has a big (thing) ((gestures while saying that)) and I'll show you what it's like ((starts to get up))

Josh is talking about an episode of the Sponge Bob television show, which is the referent of the pronoun *it* in his statement. In describing what the show is about, he introduces three entities: a place (Bikini Bottom) and two male characters (Sponge Bob and Patrick). Having just been introduced in object position, the entities are probably best analyzed as activated at the moment Josh begins his second clause. If only one of the characters was male, for instance, if

Josh said "It's about Sponge Bob and Patricia and Bikini Bottom, and *he* has . . . ," the utterance would likely be just an inconsequential procedural error, similar to example (30) above. Since the listeners would have no masculine entity in current focus, and they would have only one masculine entity currently activated, they would have little trouble, given the context, associating the pronoun *he* with that masculine entity. However, the error in example (32) is more significant, since Josh refers to "he" when his listeners currently have two equally appropriate possible referents in active memory (and possibly even in focus). The distinction is that the ambiguity in (32) does not come from a procedural error, but instead from the inability to determine the intended referent without conceptual information.

Ferreira, Slevc, and Rogers (2005) describe such as ambiguities as either *non-linguistic* or *linguistic*. Non-linguistic ambiguity occurs "in contexts that include multiple instances of similar meanings, so that a single term that encompasses all of those instances is ambiguous." By this definition, the subjects in the referential communication tasks reviewed in chapter 4 were tested on their ability to avoid non-linguistic ambiguity. A reference to "the glass" when more than one glass is visible to the addressee is a non-linguistic ambiguous reference. In contrast, Ferreira et al. consider utterances *linguistically* ambiguous when two independent meanings correspond to the surface form uttered "because of some accident or limitation of linguistic encoding." Homophonous words are potential causes of linguistic ambiguity. For example, in "You better bring a fan to the game with you," because the phonological combination [fæn] corresponds to two separate words with two separate meanings, the listener will not be able to infer the speaker's intended meaning without adequate context. Ferreira et al. also identify segmentation ambiguity (e.g. *a part* vs. *apart*) and syntactic ambiguity (e.g. *the police officer shot the man with a gun*) as sources of linguistic ambiguity.

Ferreira et al.'s distinction is important, though the use of "linguistic" versus "non-linguistic" is not without problems. The linguistic ambiguities in examples like "The police officer shot the man with a gun" arise in spite of the forms being used grammatically. In a sense, then, they are also *non*-linguistically ambiguous, in that the undesired effect is a pragmatic issue, not a linguistic one. To some extent, any grammatical utterance that is ambiguous could be described not as resulting from violations of linguistic rules, but rather as a speaker's failure to adequately take into account the addressee's needs. Perhaps there is an important distinction to be made between ambiguity's cause and effect. All ambiguity is a pragmatic problem with respect to the effect, regardless of whether the cause is seen as linguistic or non-linguistic.[49] Let us, in agreement with Ferreira et al., consider linguistic ambiguity to be that which is caused in part by the grammar's lack of specificity (setting aside the speaker's role in not forming the utterance accordingly), as in the lexicon having two words with the same phonological form, or the grammar's propensity to generate grammatical sentences with more than one structural interpretation. However, let us refer to Ferreira et al.'s non-linguistic ambiguity as *pragmatic ambiguity*, since, for example, a speaker asking for "the ball" has used the determiner and noun grammatically, even if there are several balls in view. Likewise, Josh's use of the pronoun *he* to refer to a male character is grammatical with respect to the procedural information encoded in the pronoun; the problem is that there is a second male character the pronoun could refer to.[50]

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[49] This point was brought to my attention in an enlightening email discussion of this topic with Dr. Gundel.

[50] Describing the Josh's ambiguous utterance as *pragmatic* instead of *non-linguistic* is particularly appropriate, as Ferreira et al. do not consider pronouns in their discussion of language production and interpretation. They posit that non-linguistically ambiguous utterances occur less often because the similarity underlying the ambiguity is represented at the level of meaning; thus it is more easily recognized before utterance production begins. Ferreira et al. suggest, in turn, that the similarity underlying linguistically ambiguous utterances is represented only at the level of phonological form,

In each case, the speaker's utterance is grammatical, but not clear enough for the intended meaning to be inferred. The speaker did not adequately assess what the listener needed to reach the intended interpretation.

With respect to the current study, pragmatic ambiguity presented a unique obstacle in the process of coding the data. Conclusions of ambiguity were drawn only in cases where the intended referent could not be determined from the film or transcript. Such utterances were set aside as indeterminate during analysis, since a referent's cognitive status cannot be judged if the referent cannot be confidently identified. But occurrences of indeterminate references were not tallied and compared because the clues available to assist in determining a speaker's intended referent were not equal in the two sets of data. Determining an autistic child's intended meaning was assisted by careful study of the Fraser audio/video when a reference was particularly unclear, whereas the CHILDES transcripts offered no such examination when a control child's intention was unclear. A future study with film footage of all subjects could compare occurrences of pragmatic ambiguity, and, given the association of pragmatic impairment with verbal autistic persons, one might expect that the autistic subjects would produce more ambiguous pronouns.

5.3.4.2 Distribution of In-Focus References

Another way to look at pragmatic competence is to consider the forms the subjects most often selected to make in-focus references. When speakers refer to something in the listener's

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meaning that the production process has begun before the ambiguity can be recognized. Perhaps Ferreira et al. would consider a pronoun's referent to be represented at the meaning level, while the pronominal form itself would be represented later, during sentence production. However, by using the term *pragmatic ambiguity*, we can avoid consideration of these details.

current focus of attention, personal pronouns, which offer no conceptual content but offer the most specific, restrictive procedural content, account for the vast majority of those references. And in languages with a definite article, speakers not using a personal pronoun for an in-focus reference will almost always use a definite article DP (Gundel et al. 1993).[51] We will review the reasons for this in the next section, but for now let us just note that one reason for this pattern is that speakers tend not to include conceptual information in their references if context does not require it. And since the autistic children's ability to make that judgment is in question, table 5.6 compares what forms the groups used for in-focus references.

The autistic group made 582 in-focus references, and the control children made 754. Both groups used personal pronouns for 89% of those (column 9) and explicit DPs for 6% (column 5).

Column	1	2	3	4	5	6	7	8	9
	a NP	*the* NP	*that* NP	*this* NP	Definite DPs (*the* NP, *that* NP, *this* NP)	*that*	*this*	Demonstrative DPs (*that* NP, *this* NP, *that*, *this*)	*he/she/it*
Autistics	.2%	3.8%	1.4%	.9%	6.0%	4.1%	.5%	6.9%	89.1%
Controls	.1%	5.6%	.3%	.7%	6.2%	3.7%	.8%	5.4%	88.9%
–ToM child	.4%	.1%	0	0	1.1%	3.7%	1.1%	4.9%	93.6%
Autistics (excl. –ToM child)	0	6.1%	2.6%	1.6%	10.0%	4.5%	0	8.6%	85.3%

Table 5.6 Distribution of forms used for in-focus referents

This virtually identical distribution is noteworthy if we recall from chapter 4 that Colle et al. (2008) and Arnold et al. (2009) both observed autistic subjects more frequently using conceptually explicit DPs in contexts where controls used personal pronouns. The implication

[51] Working with English language data, Gundel et al. coded 246 utterances as referring to something in focus; 214 (87%) were personal pronouns, 30 were definite article DPs (12%), and just two featured a demonstrative.

was that perhaps the autistic subjects' tendency to give more conceptual content than controls was due to an impaired ability to judge when their listeners needed information about conceptual content and when they did not. Thus the finding here that both groups equally used personal pronouns and explicit DPs for their in-focus references is somewhat unexpected. However, if we isolate the –ToM child (Diaz) from the rest of the autistic group, we see he used a personal pronoun for 94% of his in-focus references (column 9), compared to the controls' 89% ($p < .02$; risk factor 1.9; confidence interval 1.2 – 3.4). This is consistent with the numbers in section 5.3.1 that revealed Diaz's more frequent use of forms on the extreme ends of the Givenness Hierarchy (personal pronouns and indefinite article phrases) and less frequent use of the forms between the extremes. Looking at the rest of the autistic children (excluding Diaz), we see they were about 5% less likely than controls to use a personal pronoun when the referent was in focus (85% compared to 89%), which is borderline significant ($p < .08$). However, neither the difference between controls and Diaz nor the difference between controls and the other five autistic children was large enough to remain significant after a Bonferroni correction.

The comparisons of explicit DP use also take a different look when we consider Diaz on his own. His overall reliance on personal pronouns and indefinite article phrases is evident again, as he almost never used an explicit DP in reference to an in-focus entity (column 5). Thus, looking at the other autistic children, we see that the definite DP use is more frequent, accounting for 10% of their in-focus references. That is, when the referent was the focus of listener attention, the group of five autistic children was about 65% more likely to use an explicit DP than the control children ($p < 004$; $p = .064$ with Bonferroni correction; risk factor 2.0; confidence interval

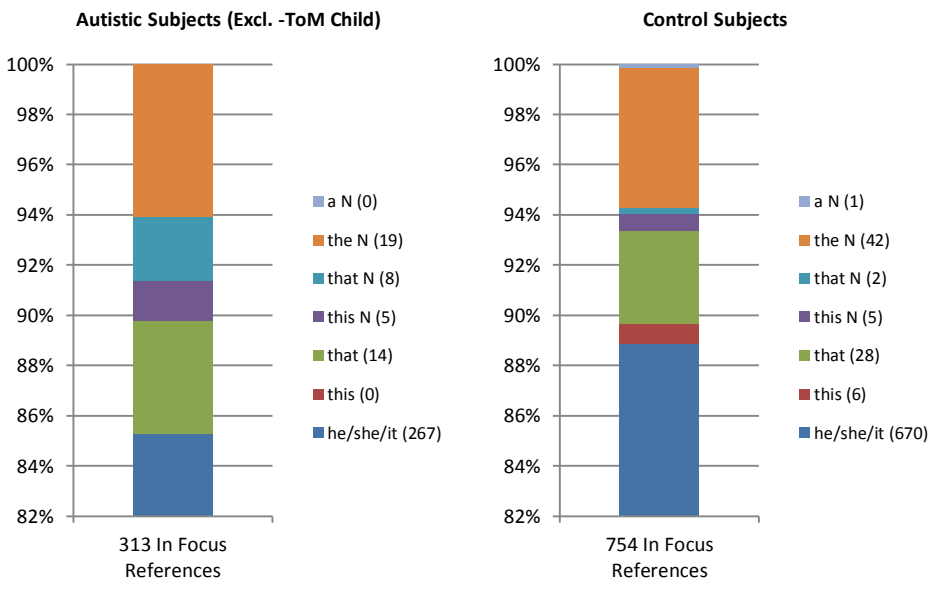


Figure 5.6 Forms used for in-focus references

1.3 – 3.3).[52] This represents a marginally significant tendency to use more conceptual content than controls. Of course, we have to accept the legitimacy of removing the –ToM child from the measurement. Moreover, if impaired theory of mind correlates with greater reliance on explicit content, it is puzzling that we see such conceptual overspecification only when we remove from the comparison the one autistic child known to be unable to pass a false belief task. I will consider interpretations of this observation in section 5.4.

5.3.4.3 Scalar Implicatures and Information about Cognitive Status

Another way to investigate pragmatic competence in reference production is to look for usage patterns consistent with the conversational implicatures that sometimes arise from the

[52] Test 12, figure 5.12.

scalar relationship of the forms and the procedural information about cognitive status they encode. Consider example (33) from the Fraser data:

Example 33

130 Josh: And then they s- sing a song. N- And I forgot how **some** of it goes.

Recall from chapter 3 that in most contexts *some* carries with it the implicature "not all," and thus the typical interpretation of an utterance like Josh's is that he means "I forgot how *some-not-all* of it goes." That would mean he was trying to think of a specific part of the song he wanted to describe or sing, but he could not remember it. If so, the use of *some* is a little odd, as something like "I forgot how this one part goes" would be a more natural-sounding choice of words. Alternatively, considering the frustration and processing strain his recollection efforts may have been producing, it is reasonable to suggest that Josh lost sight of what his use of *some* conveyed to his listeners. If so, Josh's intended meaning was more along the lines of "I forgot how it goes," and he was unaware that saying he forgot how some of it went actually conveyed to his audience that he did remember how the rest of it went. In any case, the utterance oddly ignores the typically inferred meaning, indicating a possible insensitivity to the scalar implicature. Josh's use of *some* here serves as a good example of a pragmatically odd, though not logically errant use of a scalar term, but the current study is concerned with pronouns and determiners that convey cognitive status meanings. The rest of the results will thus focus on the children's use of the pronouns and determiners that in some contexts give rise to conversational implicatures.

5.3.4.3.1 Indefinite Article

In looking for evidence of awareness of scalar implicatures associated with pronouns and determiners, one relevant form is the indefinite article *a(n)*. As discussed in section 3.5, while the form entails only that the entity to which it refers is at least type identifiable, the added information that the entity is *not uniquely identifiable* is a common scalar inference that listeners draw when a speaker uses it (Gundel et al. 1993). For example, the fictional statement in example (34) is consistent with the cognitive status conventionally signaled by the form *a(n)*, yet it so defies the implicature associated with this form that it is hard to imagine any competent English speaker saying it:

Example 34

131 Billy: Dad, the Johnsons got a new puppy, and **a new puppy** the Johnsons bought is really, really cute.

The procedural restrictions encoded in the DP "a new puppy" are honored both times it is uttered, but the pragmatic peculiarity of using an indefinite article phrase after the referent is activated is evident. And lest we think that the indefinite article actually entails "not uniquely identifiable," Gundel et al. (1993) use the following example from Dahl (1984) to illustrate that certain contexts render a referent's unique identifiability sufficiently irrelevant to permit the use of the indefinite article:

Example 35

132 Dr. Smith told me that exercise helps. Since I heard it from **a doctor**, I am inclined to believe it.

Since the point in (35) is that the information came from a physician, and not that it was specifically Dr. Smith, the statement is perfectly ordinary and acceptable. Gundel et al. point out that if non-identifiability were entailed by the indefinite article, "a doctor" in line 132 would have to refer to a doctor other than Dr. Smith.

Analysis of the data in the current study leads to the observation that there were very few uses of the indefinite article by any of the children that were not consistent with the implicature "not uniquely identifiable." Consider the following examples:

Example 36

133 Diaz: He had- there was a kid used to be in room B. He **a boy**'s dad.

Example 37

134 SAA: you could make horsies like (.) take a tire and put (.) **a tire** standing up here and bury it.

135 SAA: then, take another tire and put **it** (.) like the tire's here buried right there, then you put–.

Examples (36) and (37) are instances where a child activates something and immediately refers to it with the indefinite article. Diaz is telling people in (36) that he recognizes me as the father of a boy who used to be in Fraser room B. He activates the boy and then refers to him as "a boy." Example (37) comes from the CHILDES data, wherein Saasha makes an odd utterance in line 134 when she uses the form "a tire," after the tire has already been brought into focus. Then she introduces another tire in line 135 and promptly refers to it with the pronoun *it* as would be expected. Here are two more examples from the Fraser data that are arguably errant:

Example 38

136 T2: Um, I spy (unclear) right there. ((Josh nods))

137 D: I spy- ((reaches out for book)) where's the (scarf)?

138 T2: Look for it. ((sing songy voice:)) Reese!

139 Re: ((just off camera)) I ate all my food at once.

140 D: ((after looking on his own for several seconds)) I spy **a scarf**. ((waits four seconds for acknowledgement from T2)) I spy a scarf.

141 T2: Where?

Example 39

142 T1: Okay guys. Today our free play helper's gonna be Reese? ((teachers give enthusiastic inhales))

143 Re: I'm the free play helper?

144 T1: The free play helper. My weather reporter is gonna be Chris. ((teachers whisper "Awesome!"))

145 Re: [I really wanted to be free play helper today.]

146 T1: Calendar helper? Bella nella ding dong. ((laughs)) Fine motor helper's gonna be Richard. And my game time helper's gonna be Josh.

COUPLE MINUTES LATER:

147 ((T1 tries to get Bella to do calendar, but she sits without answering.))

148 R: I'll do it!

149 T1: You wanna help with calendar? Okay.

150 R: But I will still be **a fine motor**.

151 T1: Sure. ((does a lot of pointing at the calendar during the following exchange)) What is the month?

In (38), Diaz asks where the scarf is in an *I Spy* book, and T2 tells him to look for it. T2 gets occupied with Reese while Diaz searches, and Diaz announces he found "a scarf" when the scarf is at least still familiar to T2. In example (39) the teacher assigns each child a helper duty, so it is odd when Richard refers to being "a fine motor" a few minutes later, when he has been recently

established as the fine motor helper for the day. He is using a form the implicates "referential or type identifiable, *but not familiar*," even though the day's fine motor helper is still in memory for everyone. One could argue that (38) and (39) are appropriate because type is all that is relevant in the contexts, just as type was all that was relevant in the use of "a doctor" in example (35). That possibility could explain why those uses of the indefinite article do not sound as peculiar as those in (36) and (37), which are more clearly pragmatically errant uses that ignore the scalar implicature in contexts where it holds. In any case, there were so few

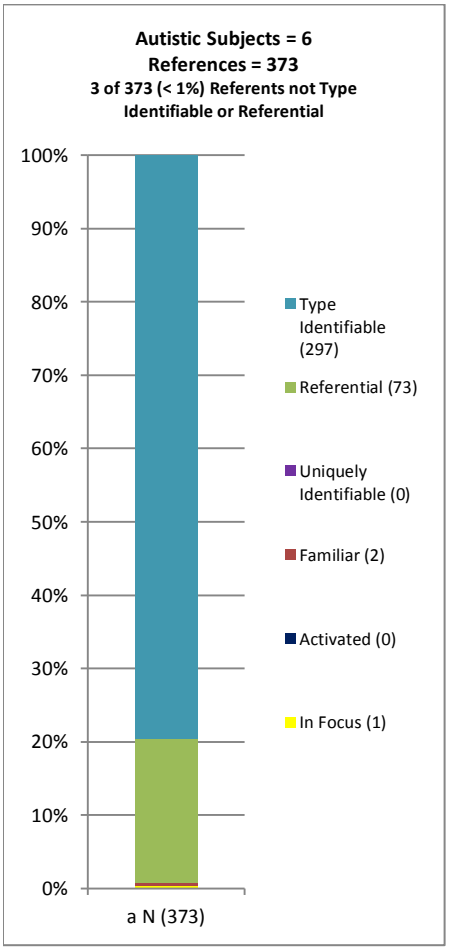


Figure 5.7: Autistic group
Cognitive status of indefinite article references

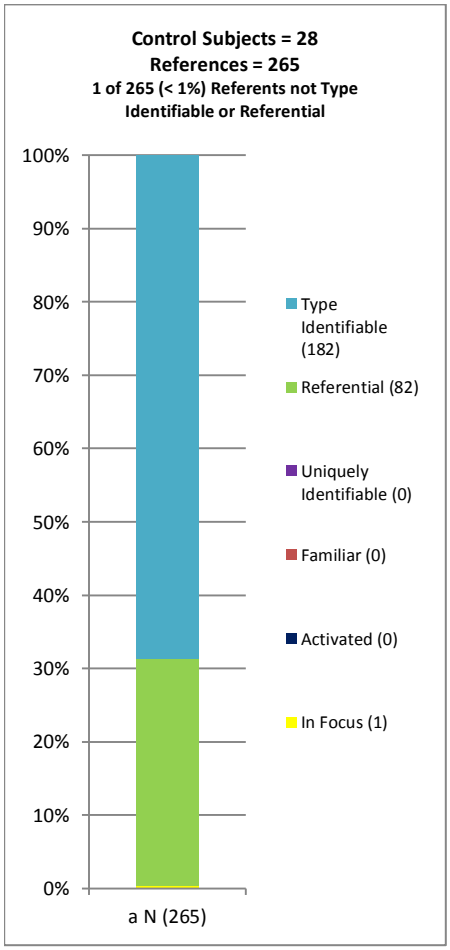


Figure 5.8: Control group
Cognitive status of indefinite article references

pragmatically errant indefinite article references that there is nothing noteworthy to be observed.

5.3.4.3.1.1 Summary of Indefinite Article Use

As seen in figures 5.7 and 5.8, less than 1% of each group's indefinite article utterances referred to something with a cognitive status greater than referential. The conclusion is that comparing the children's use of the indefinite article reveals little of significance.

5.3.4.3.2 Demonstratives

Similar to the "not uniquely identifiable" implicature associated with the indefinite article, demonstrative pronouns and determiners, which entail that the referent is at least familiar (in the case of the determiner *that*) or at least activated (in the case of the pronouns *this* and *that* and the determiner *this*), often implicate that the referent is not in focus. Recall from section 3.5 that this can be explained by the interaction of the forms' place in an implicational scale and speakers' need to provide all necessary and relevant information without providing any information that is not. The procedural information about cognitive status encoded in personal pronouns is the most specific of all the forms; a speaker offering no conceptual content in his utterance makes his referent most precise by instructing his listener, via a personal pronoun, to maintain his current focus, to not consider any other possible referents. A demonstrative pronoun is a poor choice for an in-focus referent, since it instructs listeners to consider possible referents that are merely activated, in addition to those currently in focus. That is, if an entity is in focus, demonstrative pronouns do not offer as specific information about cognitive status as is relevant. On the other hand, the conceptual content in an explicit DP is typically such that the

definite article *the*, indicating that the referent is at least uniquely identifiable, is all the procedural information about cognitive status that is needed. This is particularly the case when the referent is in focus, where indicating activated or familiar status via a demonstrative determiner is more information about cognitive status than an explicit reference to the current focus requires. That is, if an entity is in focus, demonstrative determiners offer irrelevant information about the referent's cognitive status.

Since demonstratives are often a poor choice compared to personal pronouns and definite article DPs, their use tends to be reserved for contexts where they convey some extra meaning (i.e. not in focus). Thus their frequent use could indicate an insensitivity to the cognitive status information demonstratives entail and/or to contexts when that information is relevant. And in contrast to the negligible pragmatic error tally observed with indefinite article use, compelling differences between the groups are evident in their use of demonstratives. In section 5.3.4.2 we noted the frequency with which both groups used personal pronouns (89%) and explicit DPs (6%) to make in-focus references. Now, in section 5.3.4.3.2.1, we look at how many of those explicit DPs were demonstrative determiner phrases versus definite article phrases, and in section 5.3.4.3.2.2 we will look at how the two groups used demonstrative pronouns for the remaining 5% of in-focus references.

5.3.4.3.2.1 Demonstrative Determiners

As we have just reviewed, typical speakers using an explicit DP to refer to an in-focus entity almost never use demonstrative determiners because they overspecify—they provide more information about the referent's cognitive status than needed. Signaling that the referent of a conceptually explicit reference to the current focus is at least activated provides the listener

with more information than necessary, and thus the information procedurally encoded in demonstrative determiners is considered irrelevant in such contexts. The result is that when a demonstrative determiner is used, it often has some special effect. One such use is to implicate that the referent not in focus, in order to distinguish it from whatever is currently in focus. Consider the following example, which is not from the data:

Example 40

152 I saw that man again today. He was talking to a guy, but the guy wasn't paying any attention to him, because he was staring at some other guy, and **that guy** looked furious.

By the time the speaker in (40) gets to her final clause, she has three men activated, the first two in focus. She cannot use the personal pronoun *he* to refer to the man being stared at, as her listener would likely infer she is referring to the staring man, who is currently in focus. Choosing an explicit DP, the speaker has a choice of determiner. If the she uses "the guy," it will still be difficult for her listener to distinguish whether she was referring to the staring man or the man being stared at. Both of those men are at least activated, so the procedural information encoded in the definite article is not enough to distinguish them. Thus, she deftly uses the demonstrative determiner *that* in her final reference to indicate that of the three activated men, she is referring to the one who is *not* currently in focus. Now consider this example from the Fraser data:

Example 41

153 J: (Cuz I-) I have another favorite thing.
154 T4: Oh, why don't you tell Reese and Bella.
155 J: And it is (.) watching Sponge Bob Christmas.

156 J: **That one** is <u>really</u> a Christmas video, and it's called Sponge Bob (.) 's First Christmas.

In line 155 Josh activates the Sponge Bob show while placing *watching* the show in focus. Thus, when he starts describing the show in line 156, he uses a demonstrative, because the show itself is not in focus when he begins the sentence. The "activated-but-not-in-focus" implicature associated with the demonstrative assists Josh's listeners in shifting their focus from watching the show to the show itself. This example suggests Josh has some awareness of the implicature often associated with demonstratives.

Another special effect a demonstrative determiner can serve is to indicate a contrast. Using a demonstrative even though the referent is in focus can signal that the referent stands in contrast to the previous in-focus referent. Consider Reese's use of a demonstrative determiner DP when a personal pronoun was licensed:

Example 42

157 Re: Hey guess what.

158 T4: Cuz we're talking [about w-]-

159 Re: [(Unclear)] show has a tons of shows in it and they're all Christmas ones.

160 T4: Oh, cool. But-

161 Re: There's- there's a Barney one in it, and remember I tol- and I seen a show called Pingu and there was a Christmas one on **<u>that</u> one**.

Reese brings up a show that is full of "Christmas ones." I believe the best interpretation is that he is talking about a DVD full of Christmas episodes of different shows, including "a Barney one." He then changes the focus to a Pingu DVD that featured a Christmas episode, or perhaps a Pingu cartoon with a Christmas plot in it. To illustrate that the Pingu DVD is indeed in focus

when Reese says “and there was a Christmas one on that one” in line 161, consider the alternative construction in example (42b) that isolates the statement from the DVD with Barney on it:

Example 42b

162 Re: I seen a show called Pingu, and there was a Christmas one on **it**.

When isolated from the preceding clauses, it is clear that “I seen a show called Pingu” is enough to place the Pingu DVD in focus. But by using the stressed demonstrative in “<u>that</u> one,” Reese creates a contrast that distinguishes the Pingu DVD from the Barney DVD—which is either still in focus or dropped to just activated after the utterance of “And I seen a show called Pingu”—more easily than a stressed use of the pronoun *it* could have achieved. The result is an explicit demonstrative DP that refers to an in-focus entity without implicating “not in focus.”

Example (42) shows that some demonstrative references to in-focus entities are not only not errant, but actually serve the pragmatic purpose to convey more information than just the procedural information that the referent is at least activated. However, such uses are limited to very specific contexts, and most explicit demonstrative DPs referring to in-focus entities are either overspecific conceptually—they offer unneeded conceptual information—or overspecific about cognitive status—they offer procedural information about cognitive status that is more specific than necessary. In the case of the latter, the demonstrative determiner indicates the referent is at least activated, but the information conveyed by the definite article, that the referent is at least uniquely identifiable, would be sufficient.

It is important to note, however, that most contexts will not give rise to a “not in focus” implicature just because a demonstrative is used. This is because the implicature requires a

context like that in examples (40) and (41), where the demonstrative DP could refer to more than one referent, and one of the possible referents must be activated but not in focus, while the rest are in focus. For this reason, many in-focus references made with demonstrative determiner DPs do not result in pragmatic errors. Here are some examples from the data where the use of a demonstrative determiner DP for something in focus causes no pragmatic confusion:

Example 43

163 T: So, let's um, what do we- what do we-

164 T4: I was thinking Duck Duck Gray Duck (unclear)

165 T: We did that yesterday. But we could- we could do it again, cuz it was pretty fun and everyone did a good job with it.

166 J: And I like **that game**.

167 T: Yep, so let's line up at the door.

T4 activates "Duck Duck Gray Duck" in line 164, and T refers to it accordingly as "that" in her response. Now the focus of conversation, T uses "it" to refer to the game three times in rapid succession. However, Josh conceptually overspecifies when he uses a full explicit demonstrative phrase to offer his support. A simple "and I like it" would likely have served his purpose. Alternatively, one could argue that in line 165 T actually places *playing* the game in focus, and not the game itself. This is particularly plausible given that a portion of line 164 was unclear. If Josh interpreted the current focus to be playing the game, his use of "that game" is an astute use of a demonstrative to refer to something that is activated *but not in focus*. If he considered the focus to be on the game itself, his use of "that game" offered his listeners unnecessary conceptual content and less restrictive/precise procedural information about the referent's cognitive status. In any case, there are two reasonable conclusions: the referent of "that one"

could be merely activated, and even if it is actually in focus, Josh's use of the determiner *that* is not pragmatically peculiar. The DP specifically identifies "game," and since there is no other game currently activated, Josh's listeners are not faced with a choice between two possible referents, one in focus and one only activated. Thus the context does not give rise to an "activated-but-not-in-focus" implicature.

Though unusually frequent use of demonstratives for in-focus references does not necessarily indicate frequent pragmatic errors and conversation breakdowns, it is nevertheless important if such frequency is observed. This is because greater frequency may indicate less sensitivity to what information about cognitive status is necessary and relevant.

Column	1	2	3	4	5	6	7	8	9
	a NP	*the* NP	*that* NP	*this* NP	Definite DPs (*the* NP, *that* NP, *this* NP)	*that*	*this*	Demonstrative DPs (*that* NP, *this* NP, *that*, *this*)	*he/she/it*
Autistics	.2%	3.8%	1.4%	.9%	6.0%	4.1%	.5%	6.9%	89.1%
Controls	.1%	5.6%	.3%	.7%	6.2%	3.7%	.8%	5.4%	88.9%
–ToM child	.4%	.1%	0	0	1.1%	3.7%	1.1%	4.9%	93.6%
Autistics (excl. –ToM child)	0	6.1%	2.6%	1.6%	10.0%	4.5%	0	8.6%	85.3%

Table 5.7 Distribution of forms used for in-focus referents (reprint)

With this in mind, let us look at table 5.7 (a reprint of 5.6), where we see again in column 5 that both groups used an explicit determiner phrase to make 6% of their in-focus references. Table 5.8 breaks down the content of those explicit DPs accounting for 6% of in-focus references. Looking at column 2 (table 5.8), it is noteworthy that the autistic children were twice as likely as controls (2% to 1%) to use a demonstrative determiner phrase when making in-focus references

($p < .04$; risk factor 2.6; confidence interval 1.1 – 6.9).[53] Looking at it more closely, of the explicit DPs that accounted for 6% of each group's in-focus references (column 1), the autistic group used a demonstrative determiner in 37% of those explicit DPs (column 3), compared to only 14% for the control group ($p < .02$; risk factor 3.6; confidence interval 1.3 – 10.9).[54] Stating this another way for clarity, column 1 shows that both groups were equally likely to make an in-focus reference using an explicit DP, i.e. they were equally likely to make an utterance with explicit conceptual content, (e.g. *the large house*, *that car*, etc.), and column 3 shows that when subjects made those explicit in-focus references, the autistic group was 2.6 times more likely to use a demonstrative determiner than the control group (37% to 14%). Conversely, the control

Column	1	2	3
	Percentage of total in focus references that were full explicit DPs (*the* NP, *this* NP, *that* NP)	Percentage of total in focus references that were demonstrative DPs (*this* NP, *that* NP)	Percentage of total in focus full explicit DP references (*the* NP, *this* NP, *that* NP) that were demonstrative (*this* NP, *that* NP)
Autistics	6.0%	2.2%	37.1%
Controls	6.2%	0.9%	14.3%
–ToM child	1.1%	0	0
Autistics (excl. –ToM child)	10.2%	4.2%	40.6%

Table 5.8 In-focus references using explicit, definite DPs

children used the definite article *the* for 86% of their explicit in-focus references, while the autistic children used *the* for only 63%. The importance of column 3, of course, is that those numbers reflect when subjects offered their listeners procedural information that was consistent with the cognitive status of the referent but was more than necessary for identifying

[53] Test 19, figure 5.11.
[54] Test 20, figure 5.11.

the referent. That is, when the autistic children used an explicit phrase for an in-focus reference, *they were 2.6 times more likely than controls to overspecify procedural information about cognitive status*.

An important caveat is that, despite the stark contrast in frequency, the total number of relevant demonstrative determiner phrases in the data is still quite small. While significant differences in table 5.8 are noted above, neither was significant after a Bonferroni correction, which is evident from the broad range of the confidence intervals. The fact that the autistic subjects used more demonstratives for in-focus referents is consistent with the assumption that they are less sensitive to the assessment of listener needs with respect to information about the cognitive status of referents. But the lack of statistical significance limits the confidence with which we can conclude that autistic children are indeed more likely than neurotypical children to use a demonstrative DP in conversational settings when referring to something that is in focus. However, once again, the performance of the –ToM child is relevant to the statistical significance of this measurement.

We saw in section 5.3.1 that Diaz used demonstrative

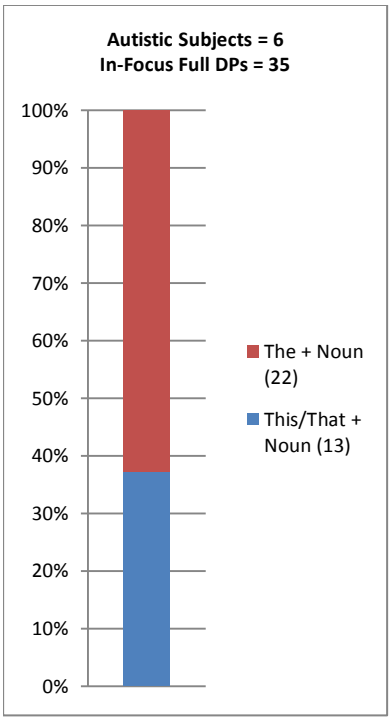


Figure 5.10 Distribution of determiners used for in-focus references: Autistic group

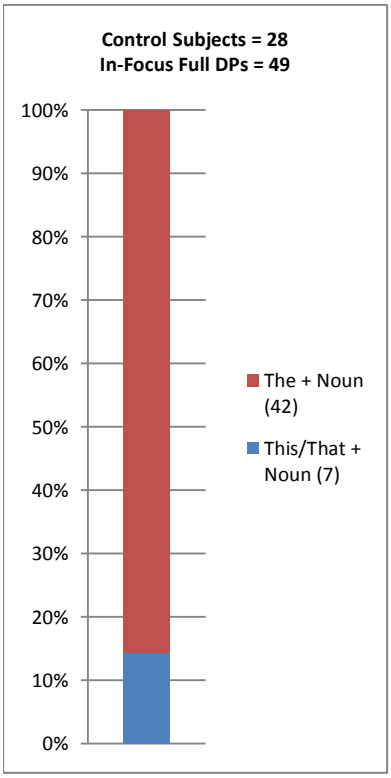


Figure 5.9 Distribution of determiners used for in-focus references: Control group

phrases (i.e. both demonstrative pronouns and determiners) significantly less than controls ($p <$ .02 with Bonferroni correction). As is evident in table 5.8, he rarely made an in-focus reference with an explicit DP (column 1) and never did so with a demonstrative DP (column 2). Thus, when Diaz is removed from the analysis, the numbers for the other five autistic children change significantly. The percentage of in-focus references the autistic children (excluding Diaz) made with demonstrative phrases (column 2) jumps to nearly five times as frequent as controls (4.2% to .09%), which proved significant even after adjusting for multiple comparisons ($p <$ .02 with Bonferroni correction; risk factor 4.9; confidence interval 2.0 – 13.0).[55] Thus, despite the overall small number of demonstrative phrases used by all subjects for in-focus referents, when Diaz is removed from the comparison, the total uttered by the five other autistic children exceeded controls enough to be statistically significant. It is difficult to say what, if anything, is underlying Diaz's unique pattern of use of demonstrative phrases. I will consider possible interpretations in section 5.4.

A final measure to look at with respect to demonstrative determiners is the distribution of the children's total uses of each demonstrative determiner by the cognitive status of each intended referent (table 5.9). This measurement reveals that when the autistic children used the determiner *that,* they were three times more likely to refer to something in focus than the control children (14.3% to 4.7%), though this was not statistically significant. Surprisingly, the autistic group was *less* likely than controls to make an in-focus reference when using the determiner *this,* though this difference is also insignificant (7.9% compared to 9.2% for controls).

[55] Test 18, figure 5.12.

	In-focus *this* NP	In-focus *that* NP
Autistics	7.9%	14.3%
Controls	9.2%	4.7%
–ToM child	0	0
Autistics (excl. –ToM child)	9.4%	15.4%

Table 5.9 Percentage of demonstrative determiner DPs that referred to in-focus entities

5.3.4.3.2.1.1 Summary of Demonstrative Determiner Use

- The autistic group used twice as many demonstrative determiner DPs for in-focus references as controls (2% to 1%), but this was not statistically significant.
    - When the –ToM child is removed from the comparison, the difference between group of the remaining five autistic subjects and controls doubles. The 4% to 1% comparison was significant, even with a Bonferroni correction ($p < .02$).

    - **This is evidence of procedural overspecification of cognitive status information**, since the less restrictive definite article would be more appropriate.

- The autistic and control groups both used an explicit DP (i.e. with an overt determiner) for 6% of their in-focus references.
    - Of those 6% explicit in-focus references, the autistic group used a demonstrative determiner phrase 2.6 times more than controls. However, due to small sample size, the 37% to 14% comparison is not significant after a Bonferroni correction.

5.3.4.3.2.2 Demonstrative Pronouns

Just as demonstrative determiner DPs are not usually used for in-focus references, speakers using a pronoun to refer to something in the listener's focus do not usually choose a demonstrative. This is because a personal pronoun signals that the referent is in focus, while a demonstrative pronoun signals only that it is at least activated. That is, demonstrative pronouns are less precise, less specific in the procedural information about cognitive status they encode. And in particular, if there are currently more than one activated entities, the listener is possibly going to have more referents to consider in order to infer the speaker's intention. The result is that demonstrative pronouns are often used for special effect, such as implicating that the referent not in focus, thus distinguishing it from the current focus. The following example shows one of the Fraser children skillfully employing a demonstrative pronoun for just such an effect.

Example 44

168 Re: ((holding frog toy)) I don't want little frog. I want no frog.

169 T1: Here, I can take it then.

170 R: Can I have the frog instead of <u>this</u>? ((sets a toy from his bucket on the table beside his bucket))

171 T1: Sure.

172 R: ((hand still on toy)) But I want to keep **this** cuz (unclear).

Line 170 features the first part of a common conversational script wherein a speaker activates an entity in the immediate physical environment with a gesture or eye gaze while referring to the entity with a demonstrative. Often, by the time the utterance is complete and the listener has processed its meaning, the entity momentarily occupies the focus of the listener's attention. Whether the next utterance comes from the listener or speaker, if the entity

is the subject of that utterance, it will typically be referred to with a personal pronoun. This is what occurs in example (45):

Example 45

173 J: ((looking directly at the toy he has in his hand)) **This** can totally not fit in.
174 T5: **It** can barely fit.
175 J: But **it** can't fit (unclear).

What makes example (44) interesting is that Richard correctly avoids the script we see Josh (correctly) follow in (45). Richard activates a toy in line 170 by referring to it as "this" while simultaneously moving its physical location. After a one-word response from the teacher, he refers to the toy again, yet he uses a demonstrative again. This is because the frog is the focus of line 170, and Richard's activation of his toy by uttering "this" is not enough to bump the frog from focus. It is possible that both toys are in focus in line 172 and Richard avoids the personal pronoun to avoid ambiguity. To test this possibility, consider the following constructed example where the toys are given genders that erase possible ambiguity:

Example 44b

176 Re: ((holding action figure)) I don't want this guy.
177 T1: Here, I can take him then.
178 R: Can I have him instead of her? ((sets a Wonder Woman action figure from his bucket on the table beside his bucket))
179 T1: Sure.
180 *R: ((hand still on toy)) But I want to keep her cuz (unclear).

Without any stress on "her", line 180 sounds odd; it produces the kind of discontinuity one experiences as a listener when one has to search for the speaker's intention. The reference is

not ambiguous, as there is no other likely referent for "her". But it would likely cost the listener extra processing effort to identify the referent, as the female action figure is not in focus, and the unstressed pronoun *her* gives the strong impression that there is an appropriate in-focus referent. This example offers evidence that in example (44) Richard keeps his hand on the toy and repeats his use of "this" in order to smoothly guide his listener away from the current focus (the frog), to his activated, but not in focus toy.

Use of a demonstrative pronoun for an in-focus referent that results in a failure to communicate the intended referent is unusual for the same reason identified for demonstrative determiners: the context where such a communication breakdown could occur is very unique. There would need to be more than one activated entity, one activated but not in focus and at least one in focus. Use of a demonstrative pronoun to refer to the in-focus entity in that context could give rise to an unintended "activated but not in focus" implicature that would interfere with a listener's successful determination of the intended referent. Since use of a demonstrative pronoun for an in-focus referent in precisely such a context is so uncommon, most in-focus uses of demonstrative pronouns do not result in misunderstandings. Here are some examples from the data, beginning with the following interaction between Bella and a teacher at Fraser:

Example 46

181 B: I need a break!
182 T: Okay. A quiet time break?
183 B: No.
184 T: Okay, what kind?
185 B: A nothing break.
186 T: I don't know what that means. What's a nothing break?
187 B: **That** means you just do cool stuff.

The teacher asks Bella what kind of a break she wants, and Bella responds that she needs a nothing break. The focus of the interaction at that moment is the potential break they are negotiating and Bella's "A nothing break" utterance is not enough to place "a nothing break" in focus on its own. Bella's utterance activates the concept of a nothing break, and accordingly, the teacher responds with a demonstrative, "I don't know what that means." If the teacher had said "I don't know what that is," she very well may have followed with "What is it?" Or she could have skipped the "I don't know . . ." and simply asked "What's that?" In either case, the demonstrative *that* would have referred to "a nothing break" and thus made it the focus of the discourse. However, in saying "I don't know what that means," the teacher focuses the discourse on Bella's speech act, like saying "I don't know what 'I want a nothing break' means." This why she then uses the full phrase in asking "What's a nothing break?" At that point, at the end of line 186, the conversation is firmly focused on "a nothing break," and Bella could easily have responded "It means you just do cool stuff." Instead, by using the demonstrative pronoun *that*, she gives her listener less procedural information about cognitive status than she could. Alternatively, one could argue that she is actually referring to her statement "(I need) a nothing break," in which case she is using the demonstrative perfectly, conveying "the referent is activated, but not in focus." However, if that is her intention, the utterance is still odd, perhaps more so. If we fill in the referents explicitly, the exchange would be "What's a nothing break?" followed by "My statement that I need a nothing break means you just do cool stuff." However it is analyzed, Bella uses a demonstrative when a personal pronoun would have been appropriate and more precise, but no misunderstand occurs. Bella uses another demonstrative for an in-focus reference in the next example, this time the distal demonstrative pronoun *those*:

Example 47

188 ((B's bouncing on the hippity hop during a transition time))

189 B: Hey, today we're gonna check!

190 T: ((to Diaz)) What do you want to play? ((then across the room to B:)) Yeah, we're really close to doing [our check].

191 B: ((pointing at something on the wall off camera, across the room)) [Look at those] checks! Cool: checks! Where did you get **those**?

192 T: I made them!

"Check" in this example refers to something that is an activity and a prop on the wall, as in e.g. "All right, it's time to do checks. Everyone go to the board and check your list." In line 191 Bella activates the checks on the far wall by pointing and saying "Look at those checks." By the time T has processed Bella's utterance, the checks on the wall are T's focus of attention. Bella continues talking about them, but instead of saying "Cool checks! Where'd you get 'em?" she repeats her use of *those.* The distance across the room encourages the repetition of the distal demonstrative even after the checks have been placed in focus, and for this reason the utterance sounds perfectly natural.

Here is another case, this from the CHILDES data, where the distal demonstrative is used despite the referents' occupying the listener's attention:

Example 48

193 CHI: those two are ugly colors.

194 CHI: those eight xxx are ugly.

195 URS: which ones?

196 CHI: this and this and this.

197 MOT: you don't like those?

198 CHI: **those** are ugly.

The boy activates various colors in lines 193 and 194, but the investigator needs clarification, so the boy refers to three specific colors, almost certainly with an accompanying gesture. The mother refers to the three colors, now in focus, with a demonstrative as well; perhaps she is not seated as close to the colors as the child, so the distal element motivates her reference choice (notice she said "those" not "these"). But then in line 198, the boy also uses the distal demonstrative *those*. This is an interesting example of how children tend to overuse demonstratives. The mother's distance from the colors motivates her use of the distal pronoun *those* in line 197, even though the personal pronoun *them* would have been appropriate, and the boy repeats the form his mother used, even though the colors are not only clearly in focus but also probably closer to him than his mother, which is hinted at by his use of the proximal demonstrative pronoun *this* in line 196. In any case, the colors are squarely in focus by the end of line 196, but each speaker continues to use demonstrative pronouns to refer to them. The mother's use seems perfectly appropriate and boy's a bit odd, but neither result in any confusion or misunderstanding. The next example also features the repetition of a demonstrative when a switch to a personal pronoun would be appropriate.

Example 49 *Diaz holds up a tortilla chip from his plate for others to see.*

199 D: This is a chip. (Unclear words) So **this** must be a nacho.

Diaz holds up a chip and says "This is a chip." The moment before he grabbed the chip, the chips were familiar, perhaps activated, by virtue of being at the table with the interlocutors. By holding up a single chip Diaz activates that specific chip at that moment for his listeners, and by virtue of his reference to the chip with "this", he places the chip in the focus of attention of all the interlocutors. Thus, when he continues "So this must be a nacho," referring to the same

chip, he has used a demonstrative pronoun to refer to something clearly in focus. There is no procedural error here, of course, as the conventional meaning associated with *this* is a referent that is at least activated, and the chip is indeed activated. The boy in the previous example also repeated a demonstrative even though the referent was placed in focus, and both examples are a bit odd. Consider this example from the CHILDES corpus:

Example 50

200 CHI: That's not chocolate milk, **that**'s cake mix.

Once again the child repeats the demonstrative even after the referent has been placed in focus. What distinguishes this example from Diaz's chip reference is that the child in (50) is making a contrast or comparison, which motivates use of a demonstrative to help signal the comparison, even if the referent is in focus. Diaz's utterance in (49) makes no contrast or comparison, which makes his repeated use of "this" feel pragmatically odd. "This is a chip. (Unclear words) So it must be a nacho," is a more natural feeling way for Diaz to have made his reference. Even the child's comparison in (50) could easily have been achieved with a personal pronoun, as in "That's not chocolate milk, it's cake mix." Indeed, the following comparison, courtesy of George Lucas and Alec Guinness, is accomplished perfectly without repetition of the demonstrative, as Ben's use of the personal pronoun *it* leaves no question as to the referent,.

Example 51

201 Luke: Look at him; he's heading for that small moon.
202 Ben: That's no moon. **It**'s a space station.

Examples (46 – 51) show underspecification of procedural information about cognitive status, specifically uses of a demonstrative pronoun, which overtly signals only activation, when a personal pronoun, which signals in-focus status, would have been licit. Because demonstrative pronouns encode "at least activated," they leave more open a listener's options in determining the speaker's intended referent than would a personal pronoun that encodes "in focus." And since demonstrative pronouns offer no more conceptual content than personal pronouns, by their nature they burden a listener with a broader list of possible referents to consider. However, none of the examples caused a misunderstanding, as there were no potential referents that had to be considered due to the less specific procedural information about cognitive status encoded in the demonstrative pronouns. Nonetheless, the greater issue at hand is not whether conversation disruptions occur in the individual uses of demonstrative pronouns when personal pronouns were licensed—i.e. individual instances of under-specific procedural information about cognitive status—but rather that a greater frequency of such demonstrative uses by autistic children would indicate less sensitivity to what information about cognitive status is necessary and relevant, or, in other words, less sensitivity to the needs of their listeners in conversation.

We saw in section 5.3.4.2 that 95% of all in-focus references by both groups were made with personal pronouns and explicit DPs. This leaves the final 5% for demonstrative pronouns, which is detailed in columns 6 and 7 of table 5.10 (a reprint of tables 5.6 and 5.7). Both groups used the demonstrative pronoun *that* for about 4% of their in-focus references, and isolating Diaz from the other autistic children makes no significant difference. We see in column 7 that the autistic children, excluding Diaz, made no in-focus references with the demonstrative

pronoun *this*, though neither Diaz nor the control children did so for more than 1% of their references, so column 7 reveals nothing of significant either.

Column	1	2	3	4	5	6	7	8	9
	a NP	*the* NP	*that* NP	*this* NP	Definite DPs (*the* NP, *that* NP, *this* NP)	*that*	*this*	Demonstrative DPs (*that* NP, *this* NP, *that*, *this*)	*he/she/it*
Autistics	.2%	3.8%	1.4%	.9%	6.0%	4.1%	.5%	6.9%	89.1%
Controls	.1%	5.6%	.3%	.7%	6.2%	3.7%	.8%	5.4%	88.9%
–ToM child	.4%	.1%	0	0	1.1%	3.7%	1.1%	4.9%	93.6%
Autistics (excl. –ToM child)	0	6.1%	2.6%	1.6%	10.0%	4.5%	0	8.6%	85.3%

Table 5.10 Distribution of forms used for in-focus referents (reprint)

Table 5.11 looks at all the children's utterances of pronouns *this* and *that*, and tallies the percentage of those that referred to in-focus referents. We saw in section 5.3.1 that Diaz used the demonstrative pronoun *this* less than the other subjects—only 5% of his total coded utterances were *this,* compared to 9% for the other autistics and for controls (p = .06 with Bonferroni correction). Interestingly, we see in table 5.11 that when Diaz did use the pronoun *this*, he was far more likely to refer to something in focus than the other subjects: 11% of his *this* utterances were for in-focus referents, compared to only 4% for controls and none at all for the autistics other than Diaz. However, while these totals give the impression that Diaz was 3 times more likely than controls to procedurally under-specify cognitive status with the pronoun *this,* and that controls were at least 4 times more likely to do so than the rest of the autistic children, the sample sizes are far too small for statistical significance. There are just not enough control children with numerous uses of *this* to allow any assurance that the totals mean anything. The same pattern of under-specification holds true for the subjects' uses of *that,* though the

differences are small enough that even if they were based on a larger sample size, they would likely be insignificant.

	In-focus *this*	In-focus *that*
Autistics	2.5%	13.1%
Controls	3.7%	14.8%
–ToM child	11.1%	17.5%
Autistics (excl. –ToM child)	0	11.2%

Table 5.11 Percentage of demonstrative pronouns that referred to in-focus entities

Finally, in section 5.3.4.3.2.1 table 5.8 detailed some significant differences between the groups in the percentage of in-focus references that were made with full explicit DPs (*the* NP, *that* NP, or *this* NP); in the percentage of in-focus references that were made specifically with demonstrative DPs (*that* NP or *this* NP); and in the percentage of the full explicit DPs that were demonstrative. Table 5.12 looks at the same pattern of distribution, this time for pronouns, but nothing of significance is revealed. When referring to something that was in focus, both groups used a pronoun of any sort (personal or demonstrative) about 93% of time (column 1), and both used a specifically demonstrative pronoun about 5% of time (column 2). Of all the in-focus pronouns uttered, about 5% of them were demonstrative for each group (column 3).

Column	1	2	3
	Percentage of total in focus references that were pronouns (personal or demonstrative)	Percentage of total in focus references that were demonstrative pronouns	Percentage of total in focus pronouns that were demonstrative
Autistics	93.7%	4.6%	4.9%
Controls	93.4%	4.5%	4.8%
–ToM child	98.4%	4.8%	4.9%
Autistics (excl. –ToM child)	89.8%	4.5%	5.0%

Table 5.12 In-focus references using demonstrative pronouns

5.3.4.3.2.2.1 Summary of Demonstrative Pronoun Use

- There is evidence of procedural underspecification of cognitive status in both groups, though occurrences were minimal and no significant differences are apparent between groups.

- The –ToM child made underspecified references with *this* much more than the other autistic children and control children, but the totals were too small to confidently draw any conclusions.

The discussion section follows figures 5.11, 5.12, and 5.13 on the following pages.

Figure 5.11 Confidence intervals for tests run on group of 6 autistic children

Test	Risk Factor	2.5%	97.5%
1	0.5147554	0.3073591	0.8327887
2	0.5161172	0.4298270	0.6181597
3	0.6681034	0.1387321	2.5878094
4	0.8448276	0.2229391	3.2005222
5	0.8467511	0.6603165	1.0830263
6	0.8734177	0.4823301	1.5711767
7	0.9211332	0.8010807	1.0589600
8	1.0233014	0.7310341	1.4381527
9	1.1069519	0.6377482	1.8788447
10	1.1242628	0.9633180	1.3119782
11	1.1337109	0.9134977	1.4067038
12	1.1447584	0.7232102	1.8050162
13	1.2000000	0.8529628	1.6955685
14	1.2915952	0.3576733	4.6640975
15	1.3695988	0.9467852	1.9877657
16	1.5312400	1.0252484	2.3024597
17	1.8314507	1.5390262	2.1820284
18	2.2818221	1.4156570	3.7514187
19	2.6167247	1.0813880	6.9432807
20	3.6521739	1.3264286	10.8672137
21	3.8437500	0.9253812	26.1625343
22	5.8756477	1.5072208	38.6369244

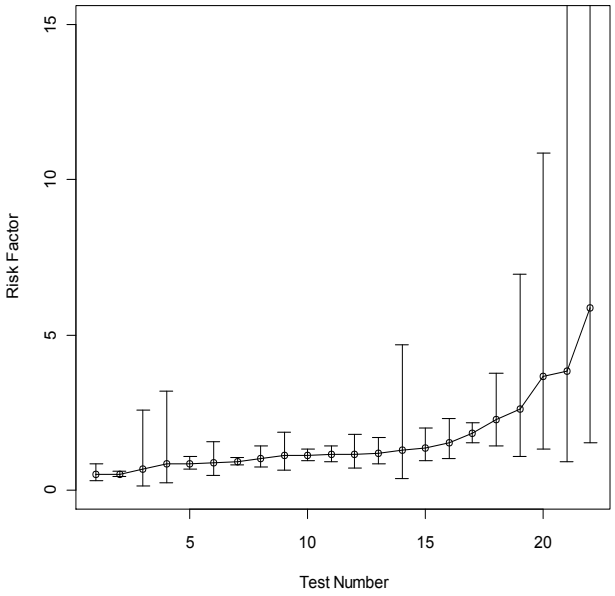


Figure 5.12 Confidence intervals for tests run on group of 5 autistic children (excluding –ToM child)

Test	Risk Factor	2.5%	97.5%
1	6.196601e-07	NA	5.818544e+11
2	6.434865e-01	0.5260626	7.841358e-01
3	6.649164e-01	0.5633848	7.835767e-01
4	7.118806e-01	0.4912967	1.040984e+00
5	7.252252e-01	0.3563295	1.417850e+00
6	1.020833e+00	0.2681096	3.887015e+00
7	1.028202e+00	0.7837610	1.341619e+00
8	1.213262e+00	0.9525636	1.540671e+00
9	1.428314e+00	1.2049483	1.692185e+00
10	1.769060e+00	1.4546246	2.150728e+00
11	1.803447e+00	1.2231589	2.657951e+00
12	2.026640e+00	1.2573112	3.245865e+00
13	2.233520e+00	1.4818242	3.383477e+00
14	2.380757e+00	1.3592802	4.163402e+00
15	2.390476e+00	0.6606264	8.650125e+00
16	4.193182e+00	1.0068374	2.858634e+01
17	4.200000e+00	1.5084105	1.264889e+01
18	4.908497e+00	2.0217097	1.306069e+01
19	1.093891e+01	2.7996640	7.201897e+01

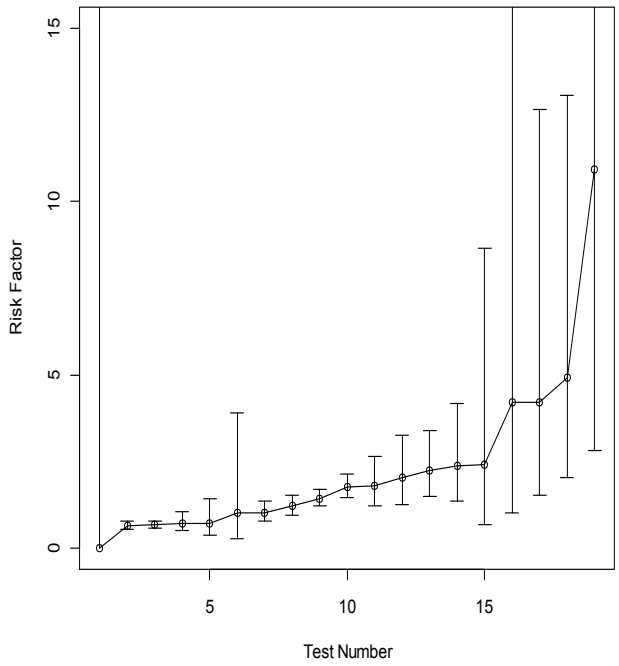
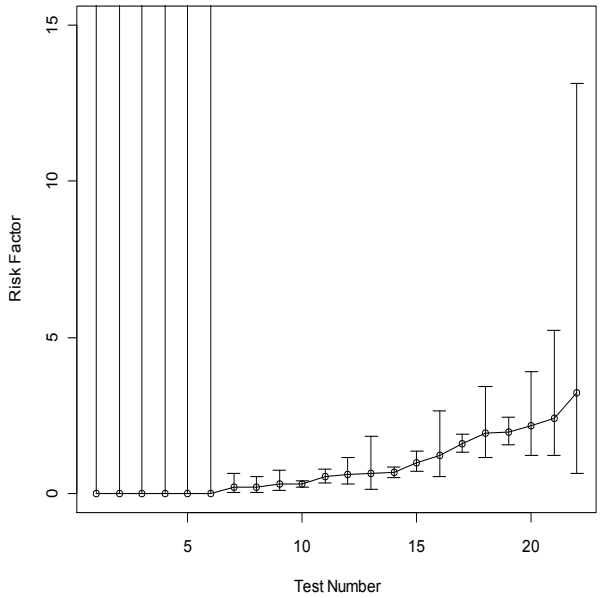


Figure 5.13 Confidence intervals for tests run on –ToM child

Test	Risk Factor	2.5%	97.5%
1	1.656405e-07	NA	6.289774e+32
2	2.325142e-07	NA	3.091291e+39
3	3.604192e-07	NA	4.522207e+40
4	5.756718e-07	NA	3.610978e+57
5	5.836015e-07	NA	5.491672e+64
6	1.600975e-06	NA	2.404613e+72
7	1.902357e-01	0.03064634	6.340939e-01
8	1.929919e-01	0.04647524	5.354429e-01
9	3.009774e-01	0.09025942	7.471334e-01
10	3.025864e-01	0.21696510	4.127165e-01
11	5.287839e-01	0.34072935	7.904978e-01
12	6.020214e-01	0.28703464	1.138481e+00
13	6.279070e-01	0.14781381	1.822041e+00
14	6.615476e-01	0.51675324	8.402141e-01
15	9.911887e-01	0.71961073	1.346341e+00
16	1.223404e+00	0.53213719	2.631480e+00
17	1.578029e+00	1.30339690	1.910665e+00
18	1.939245e+00	1.15973658	3.431524e+00
19	1.948470e+00	1.54195775	2.454741e+00
20	2.175004e+00	1.20596174	3.883572e+00
21	2.400000e+00	1.20210624	5.226853e+00
22	3.229167e+00	0.64820876	1.312983e+01



5.4 Discussion

Looking at the frequencies with which the groups used the pronouns and determiners (irrespective of pragmatic or procedural appropriateness), if we divide the range of forms into three groups—personal pronouns, definite/indefinite article phrases, and all the demonstrative forms—the two groups of children have similar distributions of usage. The striking difference is how the autistic children used the two articles: The autistic group used the definite article for 13% of their references and the indefinite article for 24%, while the control children had the opposite pattern, with 23% definite articles and only 15% indefinite. That is, the autistic children used the indefinite article *a(n)* much more frequently than the control children, while they used the definite article *the* much less frequently than controls. Both differences were statistically

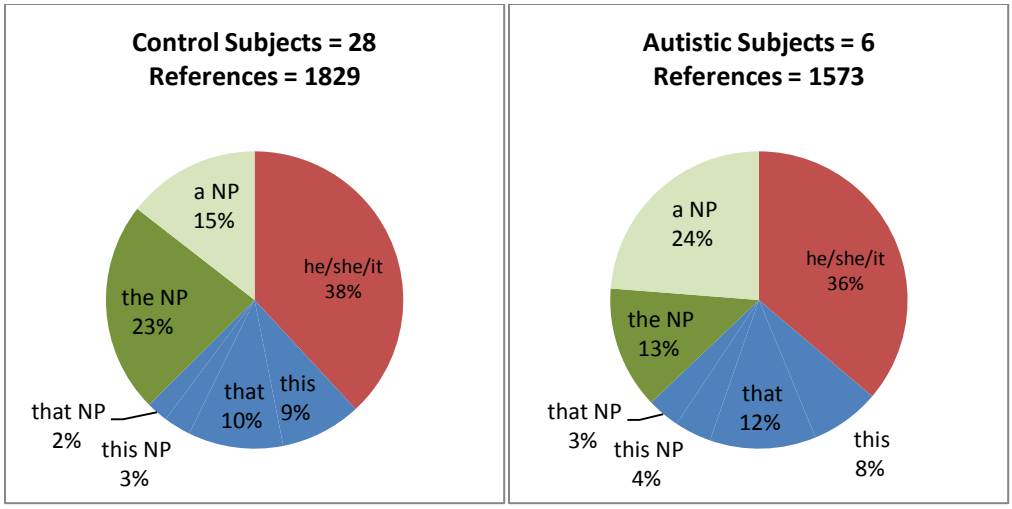


Figure 5.14 Distribution of forms by frequency

significant after adjusting for multiple comparisons. To my knowledge, this finding, which suggests more frequent introductions of new referents among the autistic children and possibly lengthier topic maintenance among controls, has not been previously observed. It may be a

contrast that is apparent only in naturalistic settings, as narrative tasks, the typical source of experimental data, focus subjects on a specific story, which could narrow the range of possible referents and topics. In contrast, the freedom allowed by informal conversations to discuss whatever comes to mind would lend itself to frequent introductions of new referents if a child had that propensity.

The reference production of the autistic child who failed the false belief task (Diaz) was markedly different from both the control children and the other autistic children, as he relied more exclusively on forms at the extreme ends of the Givenness Hierarchy (personal pronouns and indefinite article phrases) than on forms between the extremes (phrases with demonstratives or the definite article). Personal pronouns and indefinite article DPs accounted for 74% of Diaz's references, compared to 62% by the other autistic children and only 53% by the control children, and demonstratives accounted for only 18% of his references, compared to 32% by the autistics and 24% by the controls. All those differences were statistically significant after adjusting for multiple comparisons. That Diaz proved incapable of passing a false belief task suggests a conspicuous inability to engage in the kind of representational thinking required for conscious appreciation of the mental states of others. Yet, like the high-functioning children around him who did pass the false belief task, Diaz is extremely talkative. The implication is that, because autistic children with considerably impaired theory of mind presumably dwell in a state of limited interest in and consideration of the thoughts and attention of those around them, those who are highly verbal thus use most of their references to bring something up and focus on it until they either introduce another topic or stop actively participating in the discourse. This would explain why personal pronouns and indefinite article phrases so dominated Diaz's reference choices, and why he used personal pronouns for 94% of his in-focus referents and

explicit DPs for only 1%, compared to 89%/6% for controls and 85%/10% for the other autistic children. A discourse style of lengthy monologues would favor indefinite article topic introductions and continuous personal pronoun in-focus referents, and the limited interaction with discourse partners—which would diminish the typical conversational give-and-take in which topics fade from focus and return to focus again later as interlocutors keep a variety of each other's interests and contributions in mind—could limit the need for the definite articles and demonstrative determiners often employed to bring previously activated referents back into focus. Obviously further study of a larger test population is necessary to test this hypothesis, but Diaz's behavior is consistent with what might be expected of a talkative child with limited awareness of the mental states of the people around him.

With Diaz analyzed separately, the group of the five other autistic children still exhibited the pattern of definite/indefinite article use that so contrasted the entire autistic group with controls, and two more significant differences were revealed: the five autistic children used personal pronouns less than controls (38% to 29%) and demonstratives more (32% to 24%). Both these differences were statistically significant after adjusting for multiple comparisons. The less frequent personal pronoun use, coupled with the finding that 10% of their in-focus references were made with explicit DPs, compared to 6% by the control group, suggests some degree of conceptual overspecification. This is consistent with the previous research reviewed in chapter 4 that analyzed the references autistic subjects made in story-telling tasks. The results suggest impaired ability to assess when conceptual information is necessary.

Regarding the greater frequency of demonstratives, recall that an explanation for the relatively high frequency of demonstratives compared to adults in the speech of neurotypical children under age 4 is that children at that age utilize their knowledge of how forms encode

procedural information about a referent's cognitive status before acquiring the understanding of pragmatic principles that assist in appreciating the limited contexts for which older speakers tend to reserve demonstratives, specifically in understanding how much information about cognitive status is appropriate in a given context (Gundel 2009: 85). This would explain why excessive demonstrative use is observed here in a population associated with mindreading impairment. It is interesting, however, that most of those references were made by autistic children who passed a false belief task,[56] given the suspicion that children may be unable to appreciate the scalar implicatures associated with demonstratives until they have developed a level of mindreading sophistication evidenced by passing a false belief task (Gundel 2009: 94). One possibility is that scalar implicature appreciation correlates more with 2nd order theory of mind, which is usually considered developed between age 5 and 7 in typically developing children (Wimmer and Perner 1985). Since none of the autistic children tested passed the 2nd order false belief task, this would explain the excessive demonstrative use in the group of five autistic children, particularly the finding that 4% of their in-focus references were made with an explicit demonstrative DP, compared to only 1% by controls (also statistically significant after adjusting for multiple comparisons).

We are still left to explain the surprising finding that of the four children given a false belief task, the only one who failed is the only one who did not overuse demonstratives and explicit

[56] Recall that two of the autistic children (Bella and Silas) were not available to take the false belief test. When performance is analyzed excluding Diaz, 82% of the references were made by the three autistic children who passed the false belief task (Josh, Reese, and Richard). That is, all reference performance by the group of five autistic children (excluding Diaz) is disproportionately the performance of the three children who passed the 1st order false belief task.

DPs.[57] The suspicion during the planning stages of this study was that the more evidence of theory of mind impairment a child exhibited, the more likely the child would be to overspecify conceptual content by using full determiner phrases when a pronoun would be appropriate and to use demonstratives when the activated/familiar cognitive statuses they communicate are not relevant. Instead, the child with the poorest theory of mind performance is the child who was least likely to overspecify for conceptual or procedural content. It is possible that Diaz is employing a compensatory measure to avoid errors by avoiding explicit DPs. Personal pronouns and indefinite article DPs represent two opposite ends of the Givenness Hierarchy, the former encoding the most specific procedural information about cognitive status and the latter the least. It is possible the extremes are less challenging to master, and thus the other forms are avoided. Consider the connections between the early stages of mindreading development (i.e. joint attention); the developing awareness of others as separate intentional beings and of words and gestures as intentional acts; and the emerging appropriate use of pronouns and determiners with respect to the procedural information they encode (cf. Baron-Cohen 1995; Tager-Flusberg 2001; Tomasello 1988, 1995). An intriguing possibility is that impaired development of the earliest stages of mindreading can interfere with acquisition of pronouns and determiners as procedural markers of listener attention state, and that because of this, Diaz has a weakened understanding of when definite determiners (*the/this/that*) are useful and which one is appropriate to a given context. If this is the case, the compensatory measure is quite successful, given that when he did use definite determiners, he was not significantly more error prone than the control children.

[57] Recall that two of the autistic children were no longer attending Fraser when false belief tasks were given.

In any case, there is evidence here for impaired competence in recognizing what information regarding cognitive status and conceptual content listeners require. It appears that the autistic children in this study represent two outcomes of that impaired competence, particularly with respect to demonstratives. One, observed in Diaz's reference pattern, minimizes errors by avoiding their use; another, observed in the rest of the autistic subjects, results in more frequent use and misuse than neurotypical children.

In the area of procedural competence, when using a personal pronoun, the autistic children were twice as likely as controls to refer to something not in focus, which was statistically significant after adjusting for multiple comparisons. This means that the autistic children were more likely to make references that placed a processing burden on their listeners, ranging from what is likely minimal extra reference resolution effort to a communication breakdown requiring clarification. The 9% autistic error rate (compared to 4% by controls) was consistent irrespective of performance on the false belief task, which raises the question of whether this difference in procedural competence is rooted in autism severity, theory of mind impairment, or other factors, such as verbal IQ or working memory. Unfortunately this question cannot be answered without a second control group of non-autistic children with impaired verbal IQ. It is noteworthy, however, that the one autistic child who had a markedly higher Vineland communication score than the others did not have a corresponding lower error rate (table 5.13).

	Josh	Reese	Bella	Diaz	Silas	Richard
VABS Communication Score	72	97	74	67	72	NA
Personal Pronoun Procedural Error Rate	8%	11%	0	7%	11%	13%

Table 5.13 Procedural performance and Vineland communication scores

This suggests that procedural competence with personal pronouns is not a function of verbal IQ, but given that this is just one child of six, the observation serves more to motivate further investigation than to support a firm conclusion.

The evidence of impaired ability to use personal pronouns in a manner consistent with the procedural information about cognitive status they encode is a bit of a puzzle. The errant use of personal pronouns is consistent with previous findings of ambiguous references in the literature on autistic children, in that using a personal pronoun to refer to something that is not in focus is one way ambiguity can occur. Yet part of why the finding is surprising is that it is not a tendency previously observed in young neurotypical children age 2-4, who, lacking metarepresentational ability, are a natural comparison group to the autistic subjects because of the presence of metarepresentational impairment across the autism spectrum. Given the suggestion that an early mastery of the procedural information encoded about cognitive status in pronouns and determiners explains the competence with which typical 3-year-old children use pronouns and determiners (Gundel 2009), I have maintained in this study that many or most everyday uses of pronouns and determiners probably rely relatively little on deliberate conscious consideration of the mental states of one's listeners, and that impaired autistic performance likely occurs most often in specific contexts that require it. Yet here we have evidence that 5-6-year-old autistic children (all of whom can be assumed to have at least *some* theory of mind impairment) are more prone than 5-6-year-old neurotypical children (who can be assumed to have a working 1st order theory of mind, and possibly 2nd order) to using personal pronouns for references not licensed by the cognitive statuses of the intended referents—a type of reference choice that I suspected does not typically require metarepresentation. I have three possible explanations:

One important characteristic that the groups of 5-6-year-old children in this study almost certainly share more with each other than with neurotypical children under age 4 is the length and complexity of the conversations in which they take part. The children in this study are engaging in more sophisticated interactions than children under age 4—interactions involving, among other things, sentential complements, increased patience in taking turns, and consideration of whether an entity recently referenced is still in the listener's focus of attention or whether some conceptual content is required for the intended referent to be understood. While neurotypical children at this age handle this increasing sophistication smoothly, perhaps it presents autistic children with linguistic and cognitive challenges that are beyond their current ability. Recall the discussion in section 2.6.3 of autism as a neurological connectivity disorder wherein impairments are most manifest when the processing demands are highest. The computational load presented by the social interactions in the Fraser classroom would without doubt be much greater than that of a 2- or 3-year-old talking with a parent or researcher, and this could have a detrimental effect on the autistic children's ability to assess the cognitive status of intended referents.

Another possibility is that, while a metarepresentational mind is not necessary for most pronominal references, what *is* necessary is a properly developing/functioning precursor. As suggested on p. 210, impairment in the earliest stages of theory of mind development may disrupt acquisition of linguistic procedural markers in a manner that I did not anticipate. Researchers argue that the foundations of language and social skills are found in the earliest stages of theory of mind, such as joint attention and the recognition of others as intentional beings (Baron-Cohen 1995; Tager-Flusberg 2001; Tomasello 1988, 1995). Thus, autistic 5-6-year-olds may be compromised by delayed or impaired development in those early theory of mind

stages to an extent that results in incompetent assessments of cognitive status (even though they typically do not require metarepresentation). In contrast, typical 3-year-olds may be at a sufficient stage of (pre-metarepresentational) mindreading development to make references appropriate to the conversational needs of that age and, thus, show no impairment despite, like the autistic 5-6-year-olds, not having a fully developed metarepresentational mind.

Finally, the finding could simply be a product of the inability to take stressed pronouns into account in this study. Since most of the CHILDES transcripts did not indicate when speakers stressed the personal pronouns they uttered, stress was not acknowledged in coding the procedural appropriateness of pronominal references by any of the children. Only activated status is required for use of a *stressed* personal pronoun, while an entity must be in focus in order to refer to it with an unstressed personal pronoun (Gundel et al. 1993). In analyzing the data in the current study, personal pronouns were identified and the cognitive statuses of their intended referents were judged, but the presence or absence of stress was not noted. Of all the personal pronouns judged to be references to activated-but-not-in-focus entities, ideally any that were stressed would not be considered procedural errors. I am skeptical of this explanation, as the potential for errant coding has been equal with both groups of subjects, but the possibility that the result is inaccurate has to be acknowledged. If nothing else, the actual occurrence of these procedural errors could be infrequent enough to render the two-to-one error ratio statistically insignificant. That is, a contrast in occurrence rate of, for instance, 2% to 1% would admittedly be less significant than the 9% to 4% ratio observed.

5.5 Conclusion

In conclusion, let us return to the questions raised at the end of chapter 4:

Do autistic persons show similar impairment (and lack of impairment) when making references in natural, everyday conversational interactions?

Of course it is difficult to compare this study to the others reviewed in this dissertation, given the contrast in data and the variety of methods of measurement and comparison employed by the different researchers, but a few general observations can be made:

Previous studies analyzing references made in narratives found some tendency toward conceptual overspecification and underspecification, i.e. more uses of explicit DPs when personal pronouns were appropriate and more uses of personal pronouns when listeners may have needed some conceptual content to reactivate the referent. The same tendencies have been identified in the current study, as well, as seen in the autistic children's procedural errors with personal pronouns and the greater frequency of explicit DPs for in-focus referents by five of the six autistic children.

Previous studies in which referential communication tasks were administered showed that when context requires a conscious assessment of what conceptual information is relevant to a listener, autistic subjects show impairment. This is more difficult to compare with the results of the current study, as it is difficult to identify such contexts with certainty in corpora of thousands of conversational utterances, but the frequency of conceptual over- and underspecification observed here does suggest a weakness in discerning the conceptual content listeners need. On the other hand, it seems likely that many of those "errant" personal pronoun references did not require the kind of conscious assessment a listener's mental state required in the referential communication tasks. The other relevant finding is the overuse of

demonstratives observed here, which has been argued to correlate with impairment in the kind of sophisticated mindreading that could be required for success in referential communication tasks and false belief tasks.

In short, I would suggest yes, the autistic children in this study exhibit a level of impairment similar to previous studies. On the strength of this study alone, it is difficult to say whether the results here indicate *greater* impairment in naturalistic settings compared to structured experiments. The intriguing contrast in definite/indefinite article use observed here is particularly noteworthy in that it may be apparent only in naturalistic settings where subjects are free to steer conversation in whatever direction they wish.

What role might compensatory strategies not involving mindreading play in reference production in naturalistic conversational settings?

The infrequency with which Diaz, who failed the false belief task, used the definite article and demonstratives is consistent with a strategy of using only the most restrictive forms (personal pronouns and indefinite article phrases) while avoiding the others. If a child is experiencing difficulty identifying what and how much referential information is necessary and relevant, sticking to the forms at the extreme ends of the hierarchy is one possible strategy for avoiding errors. Personal pronouns, when used for in-focus entities, satisfy the need to include only relevant information by offering the most specific procedural information about cognitive status while not burdening the listener with any conceptual information. Indefinite article phrases also succeed by providing adequate conceptual information while placing only the minimal procedural restrictions on the cognitive status of the intended interpretation. And as we saw, uses of the indefinite article when more specific, restrictive cognitive status information was necessary were almost nonexistent.

Can we pin down a developmental trend in use of reference in autism?

As discussed, Arnold et al. (2009) observed impairment in their younger autistic subjects but not in the older group, but Colle et al. (2008) observed impairment among autistic adults in a similar study. Chevallier, Wilson, Happé, and Noveck (2010) were very surprised to observe autistic adolescents equally adept as controls at inferring scalar implicatures and suggested that studying younger subjects is warranted to investigate whether the ability they observed was evidence of intact pragmatic competence or the result of compensatory strategies.

The results reported here provide the beginnings of a measured understanding of how reference production develops in autism. There is evidence of delay or impairment in the group of 5-6-year-olds studied here; a larger study that includes a group of 3-4-year-olds and a group of 7-8-year-olds would provide the data needed for a developmental analysis in autism. An enormous challenge is the varied nature of impairment across the autism spectrum, whether a product of autism severity or some other factor(s). Recall that Nadig et al. (2009) observed impairment that surprisingly did not correlate with autism severity as measured by ADOS scores**.** Connectivity disorder theory (see section 2.6.3) suggests that a task's relative demand on higher processing determines the degree of impairment observed in autistic subjects (though it is hard to imagine autism severity wouldn't be a factor as well). Such a theory would predict that impaired understanding of how much conceptual and cognitive status information is relevant in references would be particularly evident in natural spontaneous data, and this has arguably been observed here in the –ToM child's avoidance of definite article phrases and demonstratives, and in the greater frequency of explicit DPs and demonstratives by the group of the other five autistic subjects. Yet, at least *some* sophisticated uses of demonstratives to

implicate “not in focus” occurred, as seen in Josh’s and Richard’s references in examples (41) and (44).

At this point, the answer to this developmental question remains out of reach. We need a bigger body of naturalistic data to investigate the observations reported here, including a battery of test scores to correlate with the reference production. This might help in addressing the challenge from the wide variety of functionality, impairment, and developmental delay across the autism spectrum. I am optimistic that some degree of developmental subtypes might be recognizable in the reference production of young verbal autistic children, with more significant variation occurring with age, as some individuals are more successful than others in gradually attenuating the impairment. That would explain why Arnold et al. (2009) observed impairment in autistic pre-adolescents but no impairment in autistic adolescents, while Colle et al. (2008) observed impairment in autistic adults.

Chapter 6 Conclusion

Two questions motivated this dissertation:

1. How much and in what ways do speakers consider the mental states of their listeners when making references in everyday conversational settings?

2. Does impairment in autistic children's ability to assess the mental states of others result in atypical reference production in spontaneous conversations?

6.1 Autistic Reference

Let's start with the second question. By and large, the autistic children in this study are quite successful in choosing referring forms that allow their listeners to infer the entities to which they refer. Nonetheless, several significant differences have been described, some between the control group and the entire autistic group, some between the control group and the autistic subject who failed the false belief task (i.e. the –ToM child), and some between the control group and the autistic group excluding the –ToM child. Here is a summary:

FREQUENCY OF FORMS:

- Overall frequency of each form used was analyzed, regardless of context and cognitive status of referent.
    - The autistic children used more indefinite articles than the control children (24% of total utterances compared to 15%) and fewer definite articles (13% to 23%).

    - The –ToM child used personal pronouns significantly more than the control children (49% of total utterances to 38%), while the other five autistic children used them significantly less (29% to 38%).

- The –ToM child used demonstratives significantly less than controls (18% of total utterances to 24%), while the other autistic children used them significantly more (32% to 24%).

PROCEDURAL COMPETENCE:

- For each form used, the cognitive statuses of the intended referents were judged in order to measure ability to match the forms with referents that meet the minimum cognitive status required for appropriate use of the form.
  - The autistic group used personal pronouns to refer to entities that were not in focus more than twice as frequently as the control group (9% to 4%).

ASSESSMENT OF RELEVANT INFORMATION (PRAGMATIC COMPETENCE):

- Forms referring to in-focus entities were analyzed for evidence of competence in determining what conceptual and cognitive status information was necessary and relevant to include.
  - When referring to something in the focus of their listeners' attention, the group of five autistic children (excluding the –ToM child) used an explicit DP (an overt determiner plus an explicit noun phrase) more than controls (10% to 6%).
    - When using those explicit DPs, the group of all six autistic children were more than twice as likely as controls (37% to 14%) to use a demonstrative determiner.

6.1.1 Two Outcomes of Impaired Awareness of Relevant Information

The –ToM child (i.e. failed the false belief task), Diaz, exhibited a unique pattern of references that sharply distinguished him from the control group and, in some respects, the rest of the children in the autistic group. He used personal pronouns and indefinite article phrases

significantly more than the others—i.e. 74% of all his references, compared to 62% by the other autistic children and only 53% by the control children. I have speculated that this pattern may be characteristic of his particular status as a very verbal autistic child with significantly impaired mindreading ability. With limited interest in or knowledge of others' mental states, Diaz seems to make references primarily to bring something up and focus on it until he either introduces another topic or stops actively participating in the discourse. This results in frequent uses of the indefinite article *a(n)* to introduce topics and personal pronouns to then refer to the entities he has placed in focus. Such a monologuing, one-way conversation style could result in less frequent references to familiar entities that require activation or reactivation in order to bring them into focus, as a more interactive speaking style demands willingness to flow with numerous topic changes and patience to wait for a chance to return to an earlier topic. Diaz's unwillingness or inability to participate in such interactions would explain his relatively infrequent use of definite article phrases and demonstratives, as they are particularly well-suited for the activating and reactivating references he avoids.

Diaz's speaking style could reflect a compensatory strategy to avoid errors by avoiding explicit DPs. Personal pronouns and indefinite article DPs represent two opposite ends of the Givenness Hierarchy, the former encoding the most specific procedural information about cognitive status and the latter encoding the least. It is possible they are more easily learned and wielded than the other forms, which may require more competence in determining what conceptual and cognitive status information is necessary and relevant to the listener. Diaz's speaking style could be the result of impaired ability to make those determinations and/or impaired understanding of the purpose that determiners and the procedural information they encode serve in linguistic communication.

The five other autistic children included three who passed the 1st order theory of mind task (the other two were unavailable for testing); the three passers produced over 80% of the references in the group of five total. The finding that, compared to controls, the group of five used more explicit DPs for in-focus references is consistent with previous findings of autistic conceptual content overspecification. The finding of greater demonstrative determiner use than controls, particularly when the referent is in focus, suggests an insensitivity to what cognitive status information is relevant—specifically, when it is relevant to overtly signal to listeners that a referent is activated or familiar. In agreement with Gundel (2009, 2011), I have speculated that such judgments of information relevance may require the level of cognitive development associated the emergence of a metarepresentational mind. However, because this impairment is evident in the three boys who exhibited evidence of metarepresentational ability in passing the 1st order false belief task, I have suggested that perhaps recognition of the pragmatic principles that restrict demonstrative use is better correlated with the mindreading ability required to pass a 2nd order false belief task. Typical children can pass a 2nd order false belief task between ages 5 and 7, so it is reasonable to assume that some, if not most, of the control children had acquired this ability, while, in contrast, none of the four autistic children tested passed the 2nd order task. If mindreading ability is at the heart of the differences in the groups of children's uses of demonstrative determiners, the likely distinction between their 2nd order abilities is a possible explanation.

Taken as a whole, the results suggest impaired competence in recognizing what information regarding cognitive status and conceptual content listeners require. The findings are not surprising, as some degree of atypicality in these two areas was predicted in section 1.1, though it is hard to argue that they fulfill the expectations of the many researchers (see end of chapter

4), myself included, who have suggested that comparisons of reference production and understanding of implicatures in natural, unstructured settings would yield more striking contrasts. I have suggested that the divergent patterns of reference production among the autistic children represent two outcomes of incompetent recognition of relevant information. With the –ToM child, we see reference behavior that minimizes errors by avoiding use of explicit DPs with overt definite determiners (i.e. *this, that, the*). With the rest of the autistic subjects, definite determiners are not avoided, but impaired recognition of when to use them is evident in their pattern of use.

6.1.2 Procedural Competence

That the autistic children used personal pronouns for entities not in focus twice as frequently as controls is somewhat surprising. Since children under age 4, who typically cannot exhibit metarepresentational ability, have been shown to use the full range of pronouns and determiners competently, there was reason to suspect that the autistic children's mindreading impairments would not affect their ability to assess referent cognitive statuses and use forms entailing those statuses. Thus it was predicted in section 1.1 that the two groups would perform comparably in matching form and cognitive status. Finding instead that that autistic children made more errant references, I have offered three possible explanations:

1. Social interactions at age 5-6 place far greater demands on higher processing than the relative simplicity of a 2-3-year-old interacting with an adult. The autistic children's assessments of cognitive statuses may suffer at times under the greater computational load.

2. Any developmental impairment in the earliest mindreading stages that interferes with emerging awareness of others as separate intentional beings and speech acts as intentional acts may impair or delay mastery of pronouns and determiners as procedural markers of referent cognitive statuses that are dependent on ongoing assessment of listener attention and memory.

3. Stressed personal pronoun references to activated entities should not be considered errant, but limitations in study design prevented acknowledgement of vocal stress. Potential for errant analysis was equal in both test groups, but it is possible that the autistic children relied on stress more than controls, which would mean that the 9% error finding is inaccurately inflated.

6.1.3 Contrast in Definite and Indefinite Article Use

Finally, the finding that the group of autistic children differed so markedly in frequency of definite and indefinite article use is perhaps the most intriguing; it has not been previously reported in the literature, and it was not anticipated when this study was developed. The autistic greater use of indefinite articles may be indicative of more frequent topic changes, while the less frequent use of definite articles may be the result of the two outcomes identified above in section 6.1.1: Diaz avoids all explicit definite DPs and the other children overuse demonstrative determiners, both of which diminish definite article use.

Whatever the explanation, I have suggested that the contrast in article use may be correlated with the natural, unstructured settings of the data, as the freedom allowed by informal conversations to discuss whatever comes to mind may allow more frequent introductions of new referents than a story-telling task, which narrows the range of possible referents and topics.

6.2 Representational Thinking in Reference Production

As for the question of how much representational thought is involved in spontaneous conversational reference production, the results of this study support the hypothesis that most day-to-day uses of pronouns and determiners do not involve the kind of conscious consideration of one's listeners that requires a metarepresentational comparison of speaker and listener mental states. While the autistic group did use personal pronouns for not-in-focus referents more frequently than controls, impaired metarepresentational ability interfering with assessments of cognitive status is not suspected as the explanation.

Consistent with the research of Professor Gundel (2009, 2011) and others, my view is that the procedural information encoded in pronouns and determiners is acquired early in childhood, guided by children's emerging understanding of others as separate intentional beings and of words and gestures as intentional acts. The ability to make an implicit assessment of a referent's status in a listener's attention and memory develops early, and more conscious consideration of listener epistemic states emerges gradually as increasing conversation complexity (including sentential complements) demands it and emerging metarepresentational thinking ability allows it. Under such a framework, typical speakers only spend the extra processing effort to represent their listeners' mental states when it is readily apparent that it may not be the same as their own. As children's mindreading ability develops in sophistication, with an increasing awareness of sentential complements in use by others possibly contributing to the steady development of 1st order theory of mind, followed by 2nd order, then 3rd order, etc., their awareness of the mental states of others emerges and progresses. Once children recognize the relevance, in

general, of the unique knowledge and attention states of their listeners, they begin to recognize when it is relevant to make mental representations comparing these states with their own.

Many autistic children do not appear to develop the ability to make metarepresentational comparisons, and those who do are likely delayed in getting there. And presumably, most if not all autistic young people who see the relevance in considering the mental states of others have some degree of impairment in doing so that may or may not attenuate with age and experience. However, importantly, because mental representations of others' thoughts, perceptions, and attention are often not required when making references, autistic speakers do not make frequent obvious reference errors. Yet children with mindreading impairment, mild or severe, are surely less adept at recognizing when a comparison of their mental state with those of their listeners is necessary, and when they do make the recognition, their ability to make such a comparison may be impaired, as well. In short, while most reference contexts do not require metarepresentational comparisons, autistic speakers are less adept at recognizing when they are needed, and they are less adept at constructing them when they do recognize the need. This would explain why autistic subjects might favor conceptual content over pronoun use, so as to avoid conceptually underspecified references, as seen here and in Arnold et al. (2009). Impaired recognition of those instances when a metarepresentational comparison might inform the choice between pronoun and explicit DP motivates a cautious strategy that errs on the conceptually explicit side. Impaired awareness of when and how to make metarepresentational comparisons could also explain a speaking style like that of Diaz, the –ToM child, wherein his inability to recognize the mental states of others also motivates a compensatory strategy, in his case the avoidance of definite articles and demonstratives.

6.3 Further Research

There are important results here that could be verified and expanded upon by a follow-up study. Here are important details that should be addressed when designing the study:

- There should be a larger population of autistic subjects, each with scores measuring autism severity, theory of mind ability, and verbal IQ.
    - This would allow more confident conclusions if any of the differences observed here between those who could and could not pass a false belief task are repeated.

    - Such thorough assessments of correlation would also provide an important follow-up to Nadig et al.'s (2009) finding that their autistic subjects' significantly impaired reference production did not correlate with measurements of autism severity. Nadig et al. considered this further evidence that autistic success has more to do with advanced ability to solve a structured task than from advanced social skills.
        - Since the follow-up study would again use data from naturalistic conversational settings, any differences and correlations observed would be free of the test performance confounding factor.

- A second control group of moderately learning disabled children should be included for a distinction between mindreading impairment and verbal IQ impairment.
    - Since MLD children have repeatedly exhibited superior performance in theory of mind tests than autistic children of similar or higher verbal IQ test performance, the extra comparison group would eliminate verbal IQ as a confounding factor in conclusions correlating impaired autistic reference performance and impaired mindreading ability.
        - This would be of particular interest in assessing performance with respect to the procedural information about cognitive status encoded in the forms. If autistic children were again observed

making more personal pronoun references to not-in-focus entities, this would be strong evidence of correlation of mindreading ability with relatively simple references not necessarily associated with representational thinking.

- Comparison data should all come from film footage.
    - This would increase confidence in the comparability of the different conversational settings being analyzed.

    - Video footage of all subjects would also eliminate any possible incongruity in the current study resulting from comparing coding judgments based on transcript and video to judgments based on transcript alone.
        - References of indeterminate intention could be tallied, as all references would offer equal contextual clues to the coder making the determinations.

    - Finally, the video footage would also allow consideration of the use of stress in personal pronoun use.
        - Stressed personal pronouns could be categorized with the demonstrative forms that entail "at least activated."

        - This would greatly increase the accuracy procedural competence comparisons, as only *unstressed* personal pronoun references to not-in-focus entities would be considered errors.

- All references resulting in listener confusion should be tallied, i.e. references provoking a listener request for more information to determine speaker intention.
    - For example,
        - Speaker A: "Where is he now?"
        - Speaker B: "Who?"

        - Speaker A: “John.”

- Such references were not uniquely categorized in the current study. Clarifications like speaker A’s “John” utterance reveal the speaker’s intention in the initial reference (in this case the personal pronoun *he*), and the cognitive status of the intended referent (in this case John) was then judged.

- Treating such interactions uniquely would allow for distinctions between
    - personal pronoun references to not-in-focus entities that resulted in ambiguity (e.g. if, in the above example, the ambiguity resulted because John was not in focus),

    - personal pronoun references to not-in-focus entities that were understood without clarification, and

    - personal pronoun references that were ambiguous despite the referent’s in-focus cognitive status (e.g. if, in the above example, the ambiguity resulted because another possible male referent was also in focus).

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Appendix A: Coding Protocol for Statuses on the Givenness Hierarchy

(Gundel, Hedberg and Zacharski 1993)

October 2007

USING THE CODING PROTOCOL[58]

The terms IN FOCUS, ACTIVATED, FAMILIAR , UNIQUELY IDENTIFIABLE, REFERENTIAL, AND TYPE IDENTIFIABLE each describe a cognitive status on the Givenness Hierarchy (Gundel, Hedberg and Zacharski 1993). Cognitive statuses are properties of cognitive entities/mental representations. When determining cognitive status using the protocol, imagine you are the speaker/writer and ask yourself what you can assume about the cognitive status of the intended interpretation/referent for the addressee at the point just before the form is encountered. Check the criteria for each status in the order they are listed below. That is, start with the cognitive status IN FOCUS. If none of the criteria apply, try ACTIVATED. If none of the criteria apply, try FAMILIAR, and so on. Stop when you find a criterion that applies. This is the highest cognitive status for the referent/interpretation you are checking.

(Note: the criteria in this coding protocol are sufficient, not necessary conditions for assigning a particular cognitive status; they have never been published and are being revised as research progresses; revisions include making the criteria more precise, as well as adding or amending criteria, where appropriate). Most of the criteria as assumed to be language independent. But some, in particular the criteria for in focus status could differ from one language to another.

A referent is IN FOCUS if it meets at least one of the following criteria:

1. It is introduced in a syntactically prominent position in the immediately preceding sentence (e.g. subject, syntactic topic, focus of a cleft or existential sentence, etc., where syntactic topics include topicalized or dislocated phrases, topic marked phrases, e.g. the *wa* phrase in Japanese).

[58] The following people have contributed to development of this protocol: Jeanette Gundel, Nancy Hedberg, Ron Zacharski, Ann Mulkern, Tonya Custis, Bonnie Swierzbin, Amel Khalfoui, Linda Humnick, Bryan Gordon, Mamadou Bassene, and Shana Watters.

a. Midge pushed thick, wiry black hair back from her square forehead with a sturdy brown arm. Nothing unsubstantial or fairylike about her. (From *Murder after Hours*, Agatha Christie)

b. John Kerry lost in Ohio. This cost the Senator the election.

c. There was a mouse on the table. It looked scared.

d. It was Bill turned the light on. I told him to do it.

2. It is part of the interpretation of a previous part of the same sentence.

    a. You can wear my scarf if you can find it.

    b. If you stand on this chair, the chair will break.

3. It is a higher level topic that is part of the interpretation of the preceding sentence (whether it is overtly mentioned there or not).

    a. The kitchen has a new countertops and a beautiful tile floor. There's also a big walk-through closet. Would you like to take a look at it? Both the kitchen (criterion 3) and the closet (criterion 1) are in focus.

4. It is part of the interpretation of each of the two immediately preceding clauses.

    a. It was the dog that Bill was afraid of. Small animals didn't usually frighten Bill. He was very large. (*him* most likely to be interpreted as Bill, not the dog)

    b. Speaker A: She will be nice to Gerda and she will amuse Henry, and she'll keep John in a good temper and I'm sure she'll be most helpful with David –

    Speaker B: David Angkatell?

    Speaker A: Yes. He's just down from Oxford. (From *Murder after Hours*, Agatha Christie)

5. It is the event denoted by the immediately preceding sentence.

    a. John fell off his bike. This/it happened yesterday.

A referent is ACTIVATED if it meets one of the following criteria.

1. It is part of the interpretation of one of the immediately preceding two sentences.

a. Central to the case was a Lewinsky-Tripp conversation that Mrs. Tripp taped on Dec. 22, 1997. This was the last talk between the two women that Mrs. Tripp recorded.

2. It is something in the immediate spatio-temporal context that is activated by means of a simultaneous gesture or eye gaze.

    a. (looking at the wrench) Please hand me that (wrench (over there))

3. It is a proposition, fact, or speech act associated with the eventuality (event or state) denoted by the immediately preceding sentence(s).

    a. Speaker A: John fell off his bike.

       Speaker B: That's not true.

    b. Speaker A: John fell off his bike.

       Speaker B: Can you say that again?

A referent is FAMILIAR if it meets one of the following criteria.

1. It was mentioned at any time previously in the discourse.

    a. A Philippine Airlines jet with 290 people aboard was hijacked today by a man who took everyone's money and then parachuted to the ground outside Manila's airport and the passengers were let off safely. The jetliner left Davao City, in the southern Philippines, for the 90-minute flight to Manila with 278 passengers and 12 crew aboard, PAL said. The hijacker, wearing a blue ski mask and carrying a handgun…

2. It can be assumed to be known by the hearer through cultural/encyclopedic knowledge or shared personal experience with the speaker.

    a. If one takes a step back and looks at the rest of this week's music-group news, the situation looks bad for ugly, unpredictable rock 'n' roll: one of the most popular American rock bands of the 90's.

A referent is UNIQUELY IDENTIFIABLE if it meets one of the following criteria:

1. The referring form contains adequate descriptive/conceptual content to create a unique referent.

    a. Speaker A: Hello can I help you

    Speaker B: Yeah I want t- I want to determine the maximum number of boxcars of oranges that I can get to Bath by 7 a.m. tomorrow morning so hm so I guess all the boxcars will have to go through oran- through Corning because that's where the orange juice factory is [Trains Corpus. Heeman and Allen 1995]

2. A unique referent can be created via a 'bridging inference' by association with an already activated referent.(e.g. A house….the front door)

    a. She got into bed, laid her head on the pillow, and in two minutes was sleeping like a child. (From *Murder after Hours*, Agatha Christie)

    b. (Looking at a box) I think the bottom fell out.

A referent exists, is REFERENTIAL, if it meets one of the following criteria.

1. It is mentioned subsequently in the discourse.

    a. When my youngest child was 3 or so, we were at a friend's house visiting and my friend was babysitting her infant nephew.

2. It is evident from the context that the speaker intends to refer to some specific entity.

    a. I want to tell you about this strange guy I saw today.

An interpretation is TYPE IDENTIFIABLE if the sense of the phrase (the descriptive/conceptual content it encodes) is understandable.

1. I don't have a VCR and neither does my neighbor.

2. Whenever Mary passes that store, she always picks up a newspaper.

Appendix B: Studies Relevant to Theory of Mind in Autism

Happé (1995)

STUDIES RELEVANT TO THEORY OF MIND IN AUTISM

Date	Authors	Relevant Results
1985	Baron-Cohen, Leslie, & Frith	Most autistic subjects fail a first-order false belief task (Sally-Ann)
1986	Baron-Cohen, Leslie, & Frith	Autistic subjects show selective problems sequencing "intentional" story pictures
1987	Dawson & Fernald	Autistic subjects are impaired in "conceptual perspective taking," cannot choose gifts appropriate for different people
1988	Harris & Muncer	Autistic subjects find "false" desires as hard as false beliefs
1988	Leslie & Frith	Autistic subjects understand seeing but not knowing or believing (even tested with real actors, not puppets; "3-Boxes" test)
1988	Riviere & Castellanos	Autistic subjects fail Sally-Ann task
1989a	Baron-Cohen	Even those autistic subjects who pass first-order false belief tasks fail a second-order false belief task
1989b	Baron-Cohen	Autistic subjects fail to distinguish mental vs. physical entities, appearance vs. reality, and the mental functions of the brain
1989[a]	Oswald & Ollendick	Autistic subjects not significantly worse than MH controls on picture sequencing or Sally-Ann tasks but worse on a "hide the penny" game
1989	Perner, Frith, Leslie, & Leekam	Autistic subjects fail "Smarties" test of false belief, cannot infer knowledge from perceptual access, and fail to communicate preferentially information unknown to hearer. Controls were specific-language-impaired children
1990	Nunez & Riviere	Autistic subjects fail Sally-Ann task
1990[a]	Prior, Dahlstrom, & Squires	Autistic subjects only significantly different on Sally-Ann task, not on Smarties, "Sally-Ann" with people, or picture sequencing
1990	Reed & Peterson	Autistic subjects fail both ignorance and false belief questions (Sally-Ann)
1991	Baron-Cohen	Autistic subjects show specific deficits in understanding only those emo-

TABLE 1 (*Continued*)

Date	Authors	Relevant Results
1991	Roth & Leslie	Autistic subjects fail to attribute a false belief to a hearer given a deceptive message
1991	Russell, Mauthner, Sharpe, & Tidswell	Autistic subjects fail the "windows" test of deception
1991[a]	Tan & Harris	Autistic subjects recall correctly their own past, unfulfilled desires
1992	Baron-Cohen	Autistic subjects can occlude an object from vision in a penny hiding game but do not conceal information
1992[a]	Bowler	A group of "Asperger's syndrome" subjects do as well on second-order false belief as normal controls
1992	Charman & Baron-Cohen	Autistic subjects fail Sally-Ann task but pass a "false" line-drawing task
1992	Leslie & Thaiss	Autistic subjects fail Sally-Ann task but pass "false" photo or map tasks
1992	Sodian & Frith	Autistic subjects can sabotage but not deceive a competitor and cannot attribute a false belief
1993[a]	Hughes & Russell	Autistic subjects are bad at the "windows" task even with deception component removed

[a] Failure to replicate usual autistic theory of mind failure.