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SYNTACTIC AND SEMANTIC PATTERNS OF PEDANTIC SPEECH IN ASPERGER’S SYNDROME

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Individuals who have Autism Spectrum Disorders (ASD) comprehend expressions semantically but often have trouble resolving ambiguity when the context is not constrained (Happé 1997). They are comfortable with literal interpretations of discourse but can have overly literal interpretations and may not understand jokes or metaphors (Happé 1998). The spoken discourse of people with ASD can be quite technical and often reflects register-specific varieties, but individuals with ASD do not move flexibly between registers and often use linguistic expressions in the wrong contexts (de Villiers & Szatmari 2004). Such difficulties in social communication seriously impede everyday social functioning of people with ASD throughout their lifetime, but the precise nature of communication problems in this disorder is not fully understood, particularly in relation to cognitive functioning. A better understanding of the nature of semantic patterns in ASD speech is needed in order to develop targeted interventions.

There is some evidence in imaging research that suggests there is reduced right hemisphere function in autism. Right hemisphere function is responsible for maintenance of multiple connections and is directly involved in contextually based language use, including the comprehension of language features that require listeners to evaluate multiple meanings and discern intended meaning (e.g. humor, irony). There is also evidence of reduced synchronization of activation among brain areas.

This present study reviews the literature that suggests at least preliminary support for right hemisphere involvement and problems in connectivity between brain areas in ASD. The literature review is used as background for a text analysis of pedantic speech in a sample of Asperger’s Syndrome discourse. Semantic patterns are characterized and considered in terms of the research on brain bases reviewed now.

1. BACKGROUND. ASD is a continuum of disorders that includes autism, high-functioning autism (HFA) and Asperger’s Syndrome (AS) and is characterized by qualitative impairments in social reciprocity, including linguistic social impairments. Most of the communication impairments in ASD are pragmatic difficulties. These difficulties are mostly interpreted within the Theory of Mind (ToM) framework, the theory that people with ASD do not recognize mental states of others.

2. NEURAL BASIS. There is a growing literature on brain basis and the links between cognitive and biological studies in autism (U. Frith 1997). Current findings indicate no clear evidence for structural abnormalities in ASD. The most robust finding to date is the greater
brain weight in autism. This differential is not present at birth but is estimated to be between 100–200 grams or 5–10% more than expected in people under 12 years of age (C. Frith 2003, Bauman & Kemper 1985). Areas of the brain that studies have commonly found to be involved in autism include the limbic system (Bishop 1993), especially the amygdala (Shultz & Klin 2002) and the frontal lobes (Stuss & Anderson 2004, Minshew et al. 1997; Russell 1997). One major theory of the underlying cause of autism is Executive Dysfunction (EF), or frontal lobe dysfunction (Russell 1997, Minschew et al. 1997). Specificity of findings for brain regions has not been consistent. Recent studies have looked at Right Hemisphere (RH) involvement, Theory of Mind (ToM) reasoning, white matter and connectivity. Each of these four areas is discussed in turn.

2.1. RIGHT HEMISPHERE INVOLVEMENT. The recognition of the significant contribution of the RH to language, combined with the profile similarities between RH damage and ASD, has led to greater activity investigating RH dysfunction in ASD, while recognizing that function in both hemispheres needs to be intact for pragmatic communication to succeed. Several studies have described a profile seen in people with RH dysfunction that is similar to that found in AS (Ross & Mesulam 1979, Gunter et al. 2002) and some suggest a link between AS and right-sided cortical dysfunction (Ellis & Gunter 1999). Similarities to RH dysfunction invite comparison and, some argue, provide preliminary support for RH involvement (Joliffe & Baron-Cohen 2000).

Features that have been found to be associated with the right hemisphere include difficulties with:

(a) socially appropriate use of language (Ozonoff & Miller 1996);
(b) discourse comprehension and production (Gardner et al. 1983, Hirst et al. 1984, Code 1987, Bryan 1988, Obler & Gjerlow 1999);
(c) conversation management, including topic and turns (Winner & Gardner 1977, Wapner et al. 1981, Brownell et al. 1983);
(d) expectations about the organization of conversational and written texts, including quantity, choice and maintenance of appropriate level of formality, depending on context (Obler & Gjerlow 1999);
(e) generating inferences (Myers 1999, Coney & Evans 2000);
(f) non-literal language such as metaphor and humor (Gardner et al. 1983, Ozonoff & Miller 1996, Bottini et al. 1994, Monetta et al. 2004, Joanette 1990, Rogers et al. 1996; Myers 1999);
(g) interpreting words or phrases with more than one meaning (Shields et al. 1996);
(h) comprehension of speech acts (Hirst et al. 1984); and
(i) emotional prosodic processing (Ross & Mesulam 1979, Ozonoff & Miller 1996).

Each of these areas of difficulty is also described in the literature of autism discourse and pragmatics.
2.2. THEORY OF MIND REASONING. One recent direction implicating right lateralization involves attempts to characterize neural correlates of ToM. Sabbagh (2004) looks at Event Related Potential (ERP) activity to examine orbitofrontal contributions to ToM reasoning. He finds that decoding others’ mental states is associated with the anterior frontal systems (most likely related to the orbitofrontal/medial temporal circuit), and that these may be lateralized to the right hemisphere. (This is contrasted with reasoning about mental states, where reviews of considerable evidence suggest that the left hemisphere makes critical contributions cf. U. Frith & C. Frith 2001.)

2.3. WHITE MATTER ABNORMALITIES. Gunter et al. (2002) suggest that the neurological underpinnings of AS may be dysfunction of white matter affecting right hemisphere functioning and interhemispheric communication. (White matter consists of the cables that connect the various parts of the brain to each other and facilitate communication between and within hemispheres.) Some speculative research (Rourke 1987, 1988) suggests that the right hemisphere is more susceptible than the left because of its greater abundance of white matter and relatively longer communication links.

2.4. COOPERATION AND CONNECTIVITY BETWEEN BRAIN REGIONS. In participants with autism, Just et al. (2004) find systematic differences in the distribution of brain activation across main language areas (Wernicke’s and Broca’s) using functional magnetic resonance imaging (fMRI) techniques. Participants with high-functioning autism produced reliably more activation than the control group in the regions associated with the processing of meaning of individual words (the left superior temporal gyrus/Wernicke’s area) and less activation in regions associated with the processing of syntactic meaning (the left inferior frontal gyrus/Broca’s areas). Just et al. hypothesize that participants with autism may rely more on an enhanced word processing ability (signaled by more than normal activation in Wernicke’s area), and less on integrating processes that bring the words of a sentence together into an integrated syntactic and semantic structure (signaled by less than normal activation in Broca’s area).

In the same study, they also find differences in functional connectivity. The functional connectivity between the various participating cortical areas was consistently lower for the participants with autism than for the control participants, suggesting the brain in HFA engages less in the integrative aspects of sentence processing than the brains of control participants, hence the Theory of Underconnectivity.

Overall, the results described converge on a picture where, on the whole, the right hemisphere is involved in the integration of information and world knowledge as well as the organization of information at the pragmatic communicative level, and this function is limited in people who have ASD. The reduced connectivity in ASD limits coordination and integration between different brain areas.

3. SEMANTIC PATTERNS: PEDANTIC SPEAKING. I now present two excerpts of spoken discourse to illustrate one kind of linguistic behavior characteristic of ASD—pedantic speaking. In pedantic speaking a speaker uses a register-specific variety that sounds like the
original context in which it was used, often with more technical detail and specificity than the context demands (Gunter et al. 2002, Attwood 1997). The discourse sample is from a follow-up study of children who were assessed or in treatment at a Pervasive Developmental Disorder service of six different centres that serve preschool children with developmental disabilities in southern Ontario. In this study, spoken conversations with children and adolescents diagnosed with ASD were audio-taped and transcribed. The text analyzed is a semi-structured conversation involving a young man with AS who has been characterized as pedantic. This conversation has three major phases: a casual conversation portion and two pedantic stretches, one on a favorite topic.

Example (1) is a portion of the pedantic phase on the favorite topic, weather:

(1) CHI: um -: what month was this?
RES: that was in # July.
CHI: that might have been the uh time of the severe thunderstorm outbreak.
RES: I think so.
CHI: with the # six tornadoes.
RES: mmmhm.
RES: I think it was.
CHI: (be)cause they were saying that was the worst severe thunderstorm outbreak to ever occur in cottage country.
RES: uhhuh?
RES: <I think there> [>].
CHI: <there were> [<] six tornadoes.
RES: mmmhm?
RES: I think there was just too much hot weather at once eh?
CHI: yeah.
RES: and that caused it.
CHI: yeah.
CHI: when you get temperatures of ninety-five the # the air sometimes rises itself.
CHI: and then # causes a storm without a cold front.
RES: mmmhm?
CHI: so you can get severe storms either from # hot air rising up so high that it cools off or # a hot air mass actually colliding with a different cold air mass.
RES: mmmhm?
CHI: and I’m sure it must o(f) been a cold front if the storms were that bad # with tornadoes.

The speech of the speaker with AS has characteristics associated with written (or expert) text. Syntactically it is complex. There is also considerable register-specific lexis associated more with weather reporting than casual conversation. The pattern differs, however, in the more casual phase, which occurs at the beginning of the conversation.

Example (2) is an excerpt from the casual phase:
Comparison of syntactic complexity in the text’s three phases included measures of Mean Length of Utterance (MLU, measured by the number of words per independent clause) and clause complexity (measured by the ratio of dependent clauses [all types] to independent clauses). Comparison of lexical density was measured by the proportion of lexical words to total words. Results are presented in Table 1. For each of the three phases lexical density and syntactic complexity are compared. Semantic patterns are then discussed and the applicability of neural findings to pedantic speaking in ASD is considered.

Both lexical density and syntactic complexity are greater in written than spoken text, since lexically dense or syntactically complex clauses require more information processing. In this text, the young man’s scores were consistent with norms for written text (10) for syntactic complexity in the pedantic phase and consistent with spoken norms (5) for the more casual phase: his scores were (5) for the casual portion and (10) and (10.47) for pedantic portions. The overall MLU for the conversation was (9.05).

For lexical density as well, it is apparent that the casual portion is much less lexically dense than the pedantic portions. One observation that can be made is that in this text over all, the pedantic stretches represented most of speaker’s discourse. Had the pedantic
phases represented a smaller proportion of the text, the overall MLU score would have been
significantly affected. This highlights the value of a representative data sample but also the
value of a close text analysis that shows the variation in semantic patterns, here realized as
different phases (casual and pedantic).

The speaker’s text is also quite verbose, partly as a consequence of the lexical density.
To further characterize this quality, lexical repetition and collocation patterns are now
examined.

3.1. Repetition of weather items. Of the five most common lexical items, four are
weather words and one (severe) regularly collocates in a marked way. The five most com-
mon lexical items follow, with number of occurrences appearing in parentheses: thunder (18), lightning (13), tornado (7), severe (7) and clouds (6). Other weather words occur as
well, making this a very rich lexical set:

(3) thunder, lightning, tornado, clouds, wind, storm, power, hot, high, fall, rain, strikes,
cold, mass, front, downpour, conditions, temperatures, hurricane, threaten, brew, rise,
cool, bolts, knocking, flashing, cracks, growing, gusts, loud, sounds, gear, activity, humid,
forecasting, breaks, calm, streaks, bang, continuous, line, strokes, chain, ground

3.2. Weather collocations. The other very marked pattern in this text is one of regis-
ter-specific collocations from the field of weather reporting (e.g. ‘we’re getting back into fall
temperatures’; ‘today it threatened to thunderstorm’; and ‘and if conditions are right that
could trigger off a thunderstorm later’). There is significant technical vocabulary and detail,
with attention focusing on the register rather than the salient points.

4. Discussion: applicability of neural findings. Individuals with ASD have dif-
ficulty with many of the linguistic functions that seem to be supported by the right hemi-
sphere, such as disambiguation or understanding of metaphor, instances of language that
require the listener to evaluate and maintain multiple meanings and discern which mean-
ing best reflects a speaker’s communicative intent. This may relate to neural connectivity
because the patterns exhibited in ASD seem to reflect a simple kind of modeling where
fewer connections are made between multiple models.

In the case of pedantic speaking, the speaker talks about a particular topic without being
able to link up the discourse with semantic patterns that are new. It would appear that the
generic situation-specific variety is internalized and used each time the topic is addressed,
without recontextualization from the context in which it was first learned. Looked at this
way, pedantic speaking can be seen as another case where there are problems in multiple
modeling or multiple inheritance. Thus the rigid use of specialized register-specific lexis
seems to reflect a special interest but also allows speculation about neural connectivity.

Just et al. (2004) propose a link to the theory of Weak Central Coherence (U. Frith
1989), the theory that people with autism have a local processing style with localized
skills and special interests. They propose that the brain likely adapts to low connectivity
by developing more independent, free-standing abilities in each brain centre. Activation
patterns may be different when a person is speaking on a favorite topic. While the pedantic phase is more verbose, it is also syntactically more complex, suggesting that the material may be over-coded and recalled, with the syntactic structures coming straight out of the register. It is interesting to speculate that speaking about favorite topics may afford some communicative advantages, such as posing less demand on processing relative to the demands of more open-ended causal conversation.

5. IMPLICATIONS FOR FUTURE RESEARCH. Current research into semantic patterns in ASD may be useful in the assessment of communication skills in ASD and for the planning of individual treatment programs. Observable patterns could be used to develop validated measurement tools for assessing the presence and extent of impairments in individual speakers. Specific patterns could also be targeted for interventions. In the future, semantic patterning could also be related to underlying mechanisms for a better understanding of the causes of communication difficulties in ASD.

REFERENCES


