Multiple sclerosis (MS) is a chronic relapsing inflammatory disease of the central nervous system (CNS) which causes a wide variety of physical changes and progressive neurological deficits (Sliwa & Cohen, 1998). Physical signs of MS are variable dependent upon the site of lesion. Similarly, cognitive and speech effects are not universal but are frequently present. Longitudinal studies of MS patients indicated that visuo-spatial process deteriorated slightly over time (Canter, 1951), sentence comprehension (e.g., Grossman et al., 1995), and confrontation naming and verbal expression (Friend et al., 1999). The present study sought to examine the impact of multiple sclerosis on form, content, and use as examined through language transcription and analysis via Systematic Analysis of Language Transcripts (SALT: Miller & Chapman, 1984)

**Methods**
- Ten individuals with MS were included in the present study. In order to participate in the study
- Subjects had a diagnosis of definite MS according to a combination of neuroradiological and clinical signs made by a neurologist or medical doctor.
- Subjects had no history of a speech or language disorder prior to the onset of MS symptoms,
- Subjects were native speakers of English
- Subjects had no diagnosis of dementia, Alzheimer’s or other primarily dementing illness, cerebrovascular accident, or coexisting neurological disease other than MS, as determined by self-report on a medical questionnaire
- Nine (90%) of the total MS sample were female (mean age 48.4 ± 12.2 years, range 22-58 years, mean amount of education 15.4 ± 2.3 years, range 12-18 years).
- Ten non-neurologically impaired individuals matched for age, sex, and education level served as controls.
- Control subjects had a) no history of traumatic head injury, cerebrovascular accident, brain tumour, cerebral abscess, alcohol abuse, dementia, Alzheimer’s or other primarily dementing illness, cerebrovascular accident, or neurological disease or disorder, as determined by self-report on medical questionnaire; b) have no history of a speech or language disorder, and c) be native speakers of English.

**Instruments**
- Systematic Analysis of Language Transcripts (SALT) (see Table 1)
- Medical questionnaire
- administration was recorded using a Panasonic, Variable Speech Control cassette recorder with an internal microphone.

**Table 1: Elements used in SALT Analysis**

<table>
<thead>
<tr>
<th>Language Measure</th>
<th>Level of Measurement</th>
</tr>
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<tbody>
<tr>
<td>FORM</td>
<td></td>
</tr>
<tr>
<td>MLU in words</td>
<td>Ratio</td>
</tr>
<tr>
<td>MLU in morphemes</td>
<td>Ratio</td>
</tr>
<tr>
<td>Total bound morphemes</td>
<td>Ratio</td>
</tr>
<tr>
<td>No. of Errors at the Utterance Level</td>
<td>Ratio</td>
</tr>
<tr>
<td>CONTENT</td>
<td></td>
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<tr>
<td>Type Token Ratio (TTR)</td>
<td>Ratio</td>
</tr>
<tr>
<td>- No. diff word roots</td>
<td></td>
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<tr>
<td>- Total main body words</td>
<td></td>
</tr>
<tr>
<td>USE</td>
<td></td>
</tr>
<tr>
<td>Utterances with mazes</td>
<td>Ratio</td>
</tr>
<tr>
<td>Total maze words</td>
<td>Ratio</td>
</tr>
<tr>
<td>Maze words as % of total words</td>
<td>Ratio</td>
</tr>
<tr>
<td>Average words per maze</td>
<td>Ratio</td>
</tr>
<tr>
<td>Total number of mazes</td>
<td></td>
</tr>
<tr>
<td>- Tangents</td>
<td></td>
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<tr>
<td>- Repetitions</td>
<td></td>
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<tr>
<td>- Revisions</td>
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</tbody>
</table>

**Procedures**
- WJ- III was administered according to standardized instructions.
- Subjects were engaged in conversation while being audio taped
- Fifty utterances of the conversation (from the middle two questions, questions two and three) were used as the language sample and analysed using the SALT.

**Results**
- Alpha was set at .10 due to small sample size
- No significant difference in 2 (group) by 17 (variable) multivariate analysis of variance (MANOVA) on the SALT.
- Multiple paired t-tests examined differences between subjects with MS and controls. Two-tailed hypothesis was used, so Bonferroni correction was inappropriate.
• Results revealed significant differences on Number of Errors at Utterance Level ($p = .068$) and Tangents ($p = .059$) (Figure 1).
• Inequality of variance and lack of normalcy led to calculation of non-parametric statistics for those two variables.
• Mann-Whitney and the Wilcoxon Signed Ranks tests revealed significant group differences for Number of Errors at Utterance Level and Tangents, with coefficients of .063 and .074 on Mann-Whitney and .035 and .026 on Wilcoxon Signed Ranks tests, respectively.

Figure 1: Number of Tangents by group.

Figure 2: SALT Analyses of the Number of Tangents

Performance within the WJ-III
• A $t$-test revealed no difference between groups on the WJ-III test

Correlation Coefficients

Education Level
• Positive correlations between Control group education level and performance on SALT measures of MLU in words ($r = .666$), MLU in morphemes ($r = .679$), Number of different root words ($r = .700$), and Total main body words ($r = .666$).

Age
• Positive correlations between control age and performance on SALT for variables of Number of bound morphemes and Number of errors at utterance level).

Summary
• Results reveal significant difference between the group with MS and the controls for form and use category of language: Number of errors at the utterance level and Tangents.
• Positive moderate correlations were found among the control group for education level and the language areas of form and content, specifically MLU in words, MLU in morphemes, and total main body words.
• High correlation were found for the number of different words.
• Positive moderate correlations found among control group for age and language categories of form, specifically Number of bound morphemes.
• High correlation for Number of errors at utterance level for control group.

References
(Canter, 1951),