Grammaticality Judgment: Effects of Attention and Short Term Memory

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BACKGROUND:

-Grammaticality judgment is a metalinguistic, “off-line” task which involves syntactic processing as well as conscious reflection. (3,4)
-Used by a number of research labs to help formulate theories of comprehension in patients with aphasia.
-Because it involves conscious reflection, it may make greater demands on short term memory than does the parsing of comprehension.
-Some theories of aphasic comprehension suggest that short term memory is an important factor in these individuals’ abilities to process language. (2)
-Prior tasks examining task performance in different levels of distraction suggest that the qualitative aspects of background noise affect processing more so than dB level. (1)
-Distraction which is phonetic/phonological and/or changeable may interfere with cognitive/linguistic tasks more so than steady state and/or noise distraction. (1,5)
-Little is known about how normal individuals process written language, in particular grammaticality judgment, in distracting settings.
-Varying performance has been reported in other tasks related to auditory distraction. (5)

PURPOSE

-To compare reaction time in a reading grammaticality judgment task, stimuli are varied by location of extra words (“padding”) and varied by sentence structure and reversibility.
-To compare reaction time in the above tasks in quiet and two types of auditory distraction.

SUBJECTS AND SETTING

Subjects: Sixty undergraduate and graduate students in audiology and speech pathology. Mean age 22.15 (range 20-25).
Passed reading screening and hearing screening (25dB@5, 10, 20, 40 kHZ). No reported CNS disability/disease or use of medications that have CNS side effects.
Distraction Settings:

- Quiet - GI task performed in quiet room
- Noise - GI task performed to ambient cafeteria noise played at 70dB SPL
- Talk - GI task performed to ambient oral reading of “Anne of Green Gables” at same intensity.

Background noise and talk was played via iTunes through peripheral speakers; sentence structure and reversibility.

Development of Stimuli: Consider the following Base sentences:

The mouse is eating the cheese.
*The mouse is the cheese.
To increase demand on short term memory, extraneous words (6-8 syllables) were placed either inside or outside the grammatical constraint to construct Reversible and Nonreversible Simple Active Declarative and Passive sentences.

In the corner of the kitchen, the mouse is eating the cheese.
(SAD, outside, good, nonreversible)
The mouse is slowly but still quite quickly eat the cheese.
(SAD, inside, bad, nonreversible)

In the middle of the field, the dog was chased by the cat.
(passive; outside, good, reversible)
The dog was Automatically but happily chased the cat.
(passive, inside, bad, reversible)

For each base sentence (active and passive), four stimulus sentences were constructed: half grammatical, half ungrammatical, half with padding inside the grammatical constraint and half with padding outside the constraint.

Total: 80 stimulus sentences, plus the 40 base sentences (filers)
Presented in four blocks (20 sentences each) and randomized for presentation. Counterbalanced across blocks for content, length, grammaticality, and reversibility.

Task: Subjects read sentences presented on a computer screen and pressed a key as quickly as possible to indicate if each sentence was good (grammatical, permissible in English) or bad (ungrammatical, not permissible in English). Subjects determined which keys would be used to indicate “good” and “bad.”

Reaction time to the reading task measured in ms using Superlab experimental software (Cedrus, 2006). Data were evaluated with analysis of variance (SPSS).

STIMULUS SENTENCES

GRAMMATICALITY JUDGMENT TASK

- Grammaticality and attention: Slower RT for BAD (as compared to GOOD) in the QUIET condition as opposed to the same comparison in the TALK condition. Focused attention appeared to make the GI task easier. No other interactions were noted with Attention in terms of the distraction, but semantic and syntactic differences were noted that may suggest an influence of attention.

- Grammaticality seemed to have an effect on RT, which became slower in the reversible condition good sentences. The reversible condition appeared to require additional attentional resources, slowing reaction time.

- SENTENCE x GRAMMATICALITY x Padding: In the inside and outside conditions for GOOD PASSIVE and GOOD SAD sentences, RTs were faster for GOOD-INSIDE-sad than GOOD-OUTSIDE-sad. However, RTs were SLOWER for GOOD-INSIDE-PASSIVE than GOOD-OUTSIDE-PASSIVE.

- There were interactions between syntax and semantics noted. It had been hypothesized that extraneous items in the inside condition would increase the RT due to RT recall demands within the grammatical structure. This was true for GOOD PASSIVE sentences only.

- However, padding inside the verb and the constraint resulted in faster RTs for the SAD sentences. In Nonreversible sentences, the extraneous items in the Outside condition increased reaction time far more than in the Reversible condition.

DISCUSSION

Main Effects

No Difference in RT by:

- Sentence type
- Reaction Times were FASTER:
  - In distracting conditions, especially in TALK
  - For BAD Sentences
  - With padding inside the grammatical constraint.
  - For NONREVERSIBLE sentences
  - Reaction times were SLOWER:
  - In QUIET condition
  - For GOOD Sentences
  - With padding OUTSIDE the grammatical constraint.
  - For REVERSIBLE sentences.

CONCLUSIONS/FUTURE DIRECTIONS

Attention and short term memory appeared to interact with semantic and syntactic variables in the grammaticality judgment task.

- At times, cognitive demand seemed to improve attention and performance, while in other conditions, demand may cause performance to decline.
- It may be that under certain conditions, finding...but in the reading modality, the subject may not need to read the entire sentence in order to make a “bad” judgment.

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