Surprise and Coherence:
Sensitivity to Verbal Humor
in Right Hemisphere Patients

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Jokes reflect one of the most intriguing human competences. In this paper, we focus on jokes as a narrative form and examine how they are processed by patients with cortical brain damage. These results provide empirical support for theoretical components of normal humor processing.

Jokes have been subjected to considerable analysis by scholars representing several disciplines. Despite numerous differences in focus, nearly all formulations about jokes stress the importance in humor of incongruity: A feature or features are surprising and unexpected at one level, but follow plausibly when another level or dimension is considered (see Goldstein and McGhee, 1972; McGhee, 1979, for reviews). Take, for example, the following joke:

> The neighborhood borrower approached Mr. Smith on Sunday afternoon and inquired: "Say Smith, are you using your lawnmower this afternoon?"
>
> "Yes, I am," Smith replied warily.
>
> The neighborhood borrower then answered: "Fine, then you won't be needing your golf clubs. I'll just borrow them."

Upon hearing the body of the joke, the listener has an expectation of what will follow plausibly: For example, the borrower will be disappointed, or he will ask to borrow the lawnmower on a subsequent occasion. The punchline is surprising at one level precisely because it departs radically from these expectations about the normal course of events. What converts the feeling of surprise into a reaction of humor is the fact that, viewed from a different perspective, the punchline does follow from the premises introduced in the body of the joke. After all, the borrower does end up asking for a loan, and the wariness displayed by the possessor of the lawnmower provides the perfect pretext for the second request.

This analysis identifies two potentially separable components of jokes, termed here surprise and coherence, that are utilized in the normal appreciation of verbal humor. Assuming for the moment that an individual has an intact understanding of the ordinary meanings and uses of language, he must also possess a schema, or script (cf. Abelson, 1981), which covers the normal course of events (in this case, a request to borrow an item from a neighbor). Against this background, the individual must be able to detect discrepancies from the normal course (sensitivity to surprise). However, in order to appreciate the joke, mere detection of discrepancy does not suffice; the listener must be able to appreciate the relation among the elements in the body of the joke and keep them sufficiently in mind so that he can attempt to relate them to the punchline (appreciation of coherence).

Of course, appreciation of jokes requires syntactic and lexical-semantic skills. In view of this account, two questions arise. First, can narrative competences such as sensitivity to surprise and the ability to generate a coherent interpretation of the punchline in the light of the joke's beginning be impaired apart from other linguistic abilities? Second, can the two hypothesized components of the joke narrative form be distinguished empirically?

Patients with unilateral right hemisphere disease provide a useful population for studying these issues. First, these patients have superficially intact syntactic and semantic capacities and so, unlike aphasic patients who have damage in the left cerebral hemisphere, their difficulties with jokes or other forms of connected discourse cannot be attributed to difficulties in processing individual words or sentences. Second, it has recently been suggested by Wapner, Hamby and Gardner (1981) that right hemisphere patients can understand the details of a story but may have difficulty weaving them together into a single coherent interpretation. According to this line of analysis, right hemisphere damaged patients should understand the details presented in the body of a joke but may demonstrate difficulty relating the punchline to the body of the joke. They should detect when a punchline is at variance with the overt content of the rest of the joke and yet may prove unable to find in the joke a second level of interpretation that integrates the punchline with the body of the joke. Right hemisphere damage, then, may selectively impair patients' sensitivity to one of two vital components of verbal humor.

Method

To secure information on these issues, a joke completion task was administered to right hemisphere damaged stroke patients and to a set of matched normal controls. The task required a subject to listen to the body of a joke and then to select from a set of four alternatives the correct punchline.

To illustrate each of the four types of alternative, consider the joke described above:

> The neighborhood borrower approached Mr. Smith on Sunday afternoon and inquired: "Say Smith, are you using your lawnmower this afternoon?"
>
> "Yes, I am," Smith replied warily.
>
> The neighborhood borrower then answered:

1) Correct ending: "Fine, then you won't be needing your golf clubs, I'll just borrow them."

2) Nonsequitur ending: "You know, the grass is greener on the other side."

This latter ending, like the correct punchline, includes an element of surprise - it does not follow directly from the joke's beginning. However, unlike the correct ending, the nonsequitur could not be coherently integrated with the premises on a second level to form an acceptable resolution to the joke's story. Thus, the choice of a nonsequitur ending would indicate a preserved sensitivity to the surprise component of humor, but an inability to integrate the body of the joke and its punchline into a coherent interpretation.

The nonsequiturs were divided into two groups. Half were topically unrelated to the body of the joke, and half were topically related to the body of the joke, including, for instance, a word associated with an element of the joke. Of this last group, half were common sayings. The nonsequitur above, for example, is a proverb ("The grass is greener on the other side"), in which "grass" in related to "lawnmower". Neither of these factors of topical relatedness or familiarity as a proverb had a significant effect, and they will not be discussed in detail.

3) Straightforward neutral ending: "Do you think I could use it when you're done?"

This ending follows directly from the joke's beginning. The straightforward endings complemented the nonsequiturs in that they preserved a coherent sense of story but provided no disconfirmation of expectations; choice of this incorrect ending would indicate an insensitivity to the importance of surprise in humor.

4) Straightforward sad ending: "Gee, if only I had enough money, I could buy my own."

The straightforward sad endings, like the straightforward neutral endings, are coherent but provide no disconfirmation of expectancies; in addition, they reflect on characters mentioned in the joke in a sad or pathetic fashion. Choice of this ending would indicate not only an insensitivity to the importance of surprise in humor, but also an attraction to negatively toned emotional content.

Results and Discussion

Data analysis was performed in two stages. First, subjects' proportions of correct choices were examined. In this analysis of variance, there was a clear effect of subject group, $p < .05$; the right hemisphere subjects (mean proportion correct = .60) performed significantly worse overall than did the normal controls (mean proportion correct = .81). This result provides a clear demonstration that right hemisphere damage, and possibly brain damage in general, results in a humor deficit.

In the second stage of data analysis, subjects' error patterns were examined more closely. On any trial, if a subject did not choose the correct alternative, he might have chosen any of the three incorrect alternatives. Three separate ANOVA's, which as a group were independent of the original analysis of proportion correct, were performed -- one for each error type. A data point in these analyses consisted of the number of times a subject chose a certain type of ending from among the three incorrect alternatives, divided by his total number of errors. Neither the straightforward neutral endings nor the straightforward sad endings ANOVA's revealed any effects that approached significance, $F < 1.0$ for both ending types. However, analysis of subjects' choice of the nonsequitur endings (collapsing across the three subtypes of nonsequitur) showed that the right hemisphere subjects were significantly more attracted to this ending type (mean proportion of total errors = .50) than were the normal controls (mean proportion of total errors = .18), $p < .01$. Error data from the right hemisphere subjects were further examined using t-tests for effects of the three subtypes of nonsequitur endings. These tests did not reveal any reliable effects, although within the associated nonsequiturs, the common sayings were marginally ($p < .10$) more attractive than the unfamiliar associates.

In summary, there are two major results of this experiment. First, the right hemisphere patients showed a marked disability relative to control subjects in selecting correct punchlines. Second, right hemisphere patients were clearly more attracted to or fooled by the nonsequitur endings than were the normals. This pattern of results supports a model of humor processing based on two narrative skills: the ability to detect surprise, and the capacity to establish coherence, in these cases between the surprising ending and the body of the joke. The confusion by right hemisphere patients between the nonsequitur and the correct endings suggests a preservation of the first narrative skill and an impairment of the second. The right hemisphere patients appreciate that a joke must end in a surprise, and they recognize which endings are surprising; but they cannot establish a second level of interpretation that ties the ending coherently to the body of the joke.

The present study does not establish whether this impairment is the result of right hemisphere damage specifically, or of brain damage in general. The obvious control for unilateral right hemisphere disease - unilateral left hemisphere disease - is of course inappropriate because of the effects of aphasia. Similarly, the study does not conclusively demonstrate a dissociation between narrative competence and linguistic competence; it only suggests that a narrative skill can be impaired in the face of intact linguistic ability at the sentence level. Nevertheless, an inability to integrate the body of a joke and its ending into a coherent interpretation is consistent with earlier claims (cf. Wapner et al., 1981) that right hemisphere patients exhibit an inability to integrate content across parts of a narrative unit.

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