

Surprise But Not Coherence: Sensitivity to Verbal Humor in Right-Hemisphere Patients

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Verbal humor deficits were investigated in right-hemisphere-damaged patients. It was hypothesized that the appreciation of jokes presupposes two elements: sensitivity to the *surprise* element entailed in the punch line of a joke and apprehension of the *coherence* which results when the punch line has been integrated with the body of the joke. The possible dissociation between these elements was tested by asking subjects to select from four alternatives the appropriate ending to a joke. Right-hemisphere patients exhibited a selective attraction to endings which contained an element of surprise but which were not otherwise coherent with the body of the joke. This finding suggests that right-hemisphere patients have difficulty in integrating content across parts of a narrative and confirms the psychological reality of the proposed distinction between the surprise and coherence elements of humor processing.

The ability to make and appreciate a joke is one of the most intriguing of human competences. Such sensitivity to the realm of humor allows one to comment upon diverse aspects of everyday living and facilitates social contact; conversely, the absence of a sense of humor can have debilitating interpersonal consequences and can deprive an individual of an important source of pleasure. Given the importance of jokes, it is not surprising that this narrative form has been subjected to considerable

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analysis by scholars representing several disciplines (see Goldstein & McGhee, 1972; Keith-Spiegel, 1972; McGhee, 1979, for reviews).

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. 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 punch line 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 punch line 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 punch line (appreciation of coherence). Perversely, in the case of "shaggy-dog" and "chicken-crossing-the-road" jokes, the very failure of a vignette in the form of a joke to have an incongruous ending is surprising and, therefore, contributes to the amusement of the listener. This informal model of humor appreciation suggests two stages: First, the listener builds expectations that are disconfirmed by the surprising punch line; next, he reconciles the incongruity through a second level of interpretation that ties the punch line coherently to the body of the joke (see Suls, 1972, for an example of such a two-stage model of humor processes).

Of course, in addition to the two narrative skills outlined above, 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 punch line 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, 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, such patients should understand the details presented in the body of a joke but may demonstrate difficulty relating the punch line to the body of the joke. They should detect when a punch line 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 punch line with the body of the joke. Right-hemisphere damage, then, may selectively impair patients’ sensitivity to one of two vital components of verbal humor.

To secure information on these issues, a joke completion task was administered to right-hemisphere patients and to a set of matched normal controls. In view of the foregoing description of these patients, we expected that the patients would be able to appreciate the element of surprise in the punch line of a joke but would not be able to relate the punch line to the body of the joke sufficiently well to allow normal appreciation of humor.

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 punch line. Subjects were instructed to pick the alternative that best completed the joke, i.e., the punch line; thus, the humorous nature of the task was made explicit.

To illustrate each of the four types of alternative, we can 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 punch line, 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 punch line 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" is 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.

To summarize, on each trial in a multiple-choice task, a subject listened to the body of a joke and then selected the correct punch line from a set of four alternatives: the correct funny ending, a straightforward sad ending, a straightforward neutral continuation, and a nonsequitur.

METHOD

Subjects. Two groups of 12 adult subjects (less than 65 years old) were tested. The brain-damaged subjects, all of whom were right handed, had suffered unilateral right-sided damage due to a stroke. Lesion site was established on the basis of clinical signs (e.g., hemiplegia, sensory deficits, field cuts) and confirmed by CT scans whenever possible. Of

the 12 patients, two had exclusively anterior (pre-Rolandic) lesions; two had exclusively posterior (post-Rolandic) lesions; and eight had mixed lesions including both some anterior and posterior damage. Twelve control subjects with no known history of neurological disorder were drawn from the same general population as the brain-damaged subjects.

Stimuli. The 16 stimulus items used in this experiment were drawn from the authors' personal repertoires of jokes and from a published collection (Moulton, 1942). Half of the jokes were linguistic in that their (correct) punch lines turned on puns, and half were nonlinguistic in that their correct punch lines did not contain puns, as in the above example. The stimuli were standardized for length and presented in the same pseudorandom order to all subjects. The order in which the four types of endings was presented was varied over trials such that each ending type occurred equally often in each serial position.

Procedure. Subjects were tested individually. On each trial, the experimenter read the body of the joke (twice if requested) to the subject, minus the punch line. The subject was then presented with the four endings typed on a white index card. The experimenter next read each alternative ending, and the subject chose one as the correct punch line. Before starting the task, the subject received two practice items which were not used in the experiment itself. After the 2nd, 4th, 7th, and 11th items, the subject was asked to explain his choice of punch line. The testing session lasted approximately 20 min.

RESULTS AND DISCUSSION

Analyses reported below were performed on the proportion of correct responses. Parallel analyses were carried out on transformed (arcsine) scores as suggested by Kirk (1968) since the right-hemisphere subjects' data were generally more variable than those of the control subjects. The patterns of statistical significance were identical for both sets of analyses.

Data analysis was performed in two stages. First, subjects' proportion of correct choices were examined in an analysis of variance including subject group (right hemisphere damaged, controls) and joke type (linguistic, nonlinguistic) as factors. In this analysis, there was a clear effect of subject group, $F(1, 22) = 7.73, p < .05$; 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 ANOVAs, 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. Each ANOVA included subject group and joke type (linguistic, nonlinguistic) as factors. Neither the straightforward neutral endings nor the straightforward sad endings ANOVA's revealed any effects that approached significance. The straightforward neutral endings accounted for an average of .29 of

the control subjects' errors and for .23 of the right-hemisphere subjects' errors, $F < 1.0$. The straightforward sad endings accounted for an average of .24 of the control subjects' errors and for .19 of the right-hemisphere subjects' errors, $F < 1.0$. However, analysis of subjects' choice of the nonsequitur endings (collapsing across the three subtypes of nonsequitur) showed that, while joke type still made no difference, 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), $F(1, 22) = 13.03, p < .01$. 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. There were no reliable effects involving joke type (linguistic, nonlinguistic) in any of the three analyses of errors.

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 punch lines. Second, right-hemisphere patients were clearly more attracted to or fooled by the nonsequitur endings than were the normals. Thus, of the possible errors that subjects in the experiment could have made, when analyzed separately, only the nonsequitur type clearly distinguished the normal from the brain-damaged subjects. More definitive assessment of the attractiveness of the other alternative types must be postponed until later studies.

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. This impairment thus supports the psychological reality of the two-stage model of humor processing outlined above.

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.

Finally, the atypical sense of humor exhibited by right-hemisphere patients, noted in a number of clinical reports (Gainotti, 1972; Gardner, 1975; Geschwind, 1976; Weinstein & Kahn, 1955) and experimental investigations (Gardner, Ling, Flamm, & Silverman, 1975; Heilman, Scholes, & Watson, 1975) deserve comment in light of the present results. The narrative deficit described in this study could contribute to the inappropriateness of a patient's responses to jokes, stories, or conversations. Indeed, a narrative deficit might result in an inappropriate response to any linguistic unit larger than a single sentence. Another possible explanation, however, rests on these patients' decreased abilities to deal with affectively laden materials (Cicone, Wapner, & Gardner, 1980; Ross & Mesulam, 1979; Valenstein & Heilman, 1979; Wechsler, 1973). The relative contributions of narrative and affective disorder need to be assessed in subsequent investigations.

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