

A Threshold Theory of the Humor Response

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The humor response has long been considered mysterious, and it is given relatively little attention in modern experimental psychology, in spite of the fact that numerous studies suggest that it has substantial benefits for mood and health. Existing theories of humor fail to account for some of the most basic humor phenomena. On most occasions when a humor response occurs, certain verbal or visual stimuli (the "setup" stimuli, which function as an establishing operation) must precede a critical stimulus (such as a "punch line" or the final panel or critical feature of a cartoon), which then occasions a sudden "revelation" or "understanding"; this revelation is often accompanied by the humor response. We suggest that the setup stimuli increase the strength of the revelatory response to a point just below the threshold of awareness and that the critical stimulus, properly designed and timed, edges the revelatory response to a point just above threshold. We also suggest that it is this threshold phenomenon that produces most instances of the humor response. We discuss these issues in the context of some notable humor of Carl Rogers and B. F. Skinner.

Key words: humor, B. F. Skinner, Carl Rogers, response strength, covert behavior

It is 1962 at the University of Minnesota at Duluth, and Carl Rogers has just made his opening remarks in a 2-day debate with B. F. Skinner. Rogers has criticized behavioral psychologists for wanting to manipulate and control people, for reducing people to unfeeling machines. We should, he said, be concerned with enhancing people's feelings of well-being and self-worth. We should acknowledge the importance of the subjective world, the inner world of feeling and experience. We should value and seek to enhance spontaneity, free choice, and the uniqueness of the individual. This

The second author's last name really is Joker. Born Veronica Baker, when she and her fiancé, Chris Joos, decided to marry, they blended their last names to create "Joker," and each took that name. Veronica is currently affiliated with Appalachian Behavior Support Services, Johnson City, Tennessee. The cartoons mentioned toward the end of the article were developed with the help of Lara Cohen, Catherine English, Josette Renault, Ashley Slack, and Dennis Thompson. We thank Pat Friman for helpful comments.

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perspective, says Rogers, is now blowing across the world like a breath of fresh air (Rogers & Skinner, 1976).

The following, transcribed from a tape of the debate, is Skinner's reply:

Thank you very much Dr. Gladstein, Carl Rogers. I always make the same mistake. When debating Carl Rogers I always assume that he will make no effort to influence the audience. [Laughter] And then I have to follow him and speak as I am speaking now to a group of people who are very far from free to accept my views. [Laughter] In fact, I was just reminded of a story that I once heard about Carl Rogers, and I will tell it now in hope to confirm or have him deny it. I suppose it is apocryphal. At least I'm sure it has grown in its dimensions. The story as I heard it is as follows. Carl Rogers was never much of a duck hunter, but he was persuaded upon one occasion to go duck hunting. He and some friends went into a blind and sat through a dreary cold early dawn, and no ducks arrived until the very end of the time when shooting was possible. Finally, one lone duck came in, and his friends allowed him to shoot, and he did. At the same time, along the shore a few hundred yards away, another man shot at the same duck. The duck fell, plopp. Dr. Rogers got out of the blind and started toward the duck. The other man got out of his blind and started toward the same duck. They arrived at the same moment. Dr. Rogers turned to him and said, "You feel that this is

your duck." [Much laughter] The reason that I was reminded of that story was that the end of it is that Dr. Rogers brought the duck home. [Much laughter] I shall do my best to prevent a similar ..." [Laughter]

Skinner's audience laughed heartily, as did we when we first heard the tape. The sides of our mouths curled upward, our eyes narrowed, our bodies shook, and we emitted short bursts of breath and sound—"respiratory convulsions," says the literature. When the humor response is weak, only our mouths react, or our mouths and our eyes, and a very weak response may be entirely covert. A strong humor response involves dramatic changes in facial expressions (Ekman, Friesan, & O'Sullivan, 1988; Grant, 1969; Provine, 1996), vocalizations, and irregular breathing for several seconds or longer, along with many detectable physiological changes (Fry & Stoft, 1971; Godkewitsch, 1976; Goldstein, Harman, McGhee, & Karasik, 1975; Jones & Harris, 1971; Langevin & Day, 1972; Lloyd, 1938; Overeem, Lammers, & Van Dijk, 1999).

Like the lever press or virtually any other operant response class, the humor response refers to a number of different actions. Unlike the lever press, however, which can be defined quite easily by its functional outcome, the humor response seems to be definable only by its subjective properties. This puts us in unfamiliar territory. The humor response seems more akin to a Pavlovian response (which is also not definable by its functional outcome) than to an operant, but even here we are not reassured. Many Pavlovian responses are relatively simple topographically (e.g., the eye blink or the knee jerk), and they tend to occur reliably in response to specific eliciting stimuli; we don't resort to subjective criteria in defining them. Nevertheless, the humor response seems every bit as unitary a response class as the lever press, even though its central defining property is simply that the behaving

organism "thinks something is funny." As nebulous as this may sound, given the robust existence of the humor response in everyday behavior, as well as in both everyday discourse and some scientific circles, it seems reasonable to assert that the humor response is indeed a unitary and quite distinct response class. Do expressions of humor actually have functional integrity? Do they serve some clear and distinct social purpose, for example? That is not clear.

Virtually everyone engages in this odd behavior from time to time, but neither its ontogenic nor its phylogenetic significance is understood (Provine, 1996), and relatively little progress has been made in specifying the conditions under which the humor response occurs. At a symposium on humor in England years ago, Miller (1988) commented that "humour is an unclassifiable and an unmanageable subject, something which has consistently defeated the attempts of scientists to explain it" (p. 6). The picture is not much brighter today, in spite of continued efforts (e.g., Wyer & Collins, 1992). We recently scanned 30 introductory clinical and health psychology textbooks and found no substantive references to humor, and in the research literature on emotion, humor is a vastly overlooked topic, compared to emotions such as depression or anger.

There is ample reason to believe that scientists should redouble their efforts to understand humor, for claims abound that humor is an extremely valuable phenomenon. For example, Sumners (1988) reports that humor is useful in helping to promote recovery from addiction, and Martineau (1972) claims that humor helps to establish and maintain relationships (also see LaFave, Haddad, & Maesen, 1976). Therapists and counselors report that humor facilitates problem solving and reduces anxiety and stress (e.g., Anderson & Arnoult, 1989; Lefcourt, Davidson, Prkachin, & Mills, 1997;

Lefcourt & Martin, 1986; Mindess, 1971; Porterfield, 1987; Robinson, 1977; Zwerling, 1955). Research shows that humor can serve a protective psychological function, shielding an individual from negative stimuli and thereby reducing negative reactions (Moran & Massam, 1999). Burn victims may benefit from viewing funny cartoons (Kelly, Jarvie, Middlebrook, McNeer, & Drabman, 1984), and others have also claimed that humor is beneficial in pain management (e.g., Black, 1984; Matz & Brown, 1998). Humor is said to be useful in treating child phobias and in family therapy (Ventis & Ventis, 1988), in child and adult psychotherapy (Allen & Zigler, 1986; Banmen, 1982; Richman, 1996; Sands, 1984), in treating alcoholism (Scott, 1989), in promoting the health of breastfeeding mothers (Dillen & Totten, 1989), in managing aggression (Jamieson, 1984; Kuhlman, 1988; Prerost, 1987; Ziv, 1987), in working with the elderly and dying (Cason & Thompson, 1980; Houston, McKee, Carroll, & Marsh, 1998; Lief, 1985), in anger management (Samuel, 1983), in treating depression (Nelson & Stern, 1988), in career counseling (Donald & Carlisle, 1983), in working with developmentally disabled clients (Foxy, 1985), in improving productivity and enhancing work relations (Decker & Rotondo, 1999), in treating head trauma patients (Carberry & Burd, 1983), and in medical practice (Dimatteo, Linn, Chang, & Cope, 1985). Accordingly, laughter has been shown to reduce serum stress hormone levels (Berk et al., 1989), as well as to boost the immune system, with some studies showing significant increases in natural killer cells (gamma interferon, B cells, and T cells), which improve the body's response to virus, infection, and certain cancers (Baim, 1998; Dillen & Totten, 1989; Long, 1987).

The importance of humor is clear, and an improved understanding of the humor response should be helpful

in improving a wide array of interventions, both psychological and medical. Finally, humor is intriguing because it appears to be unique to humans, and perhaps to our closest primate relatives (Provine, 1996; Van Hoof, 1972). Many of the claims about the benefits of humor are based on uncontrolled studies, unfortunately, and some on single cases, so it is easy to question any particular claim. But whether the humor response is a facilitator, indicator, or predictor, it is clearly associated with many important health and social phenomena.

Why does the humor response occur? Freud (1905/1960) characterized joking as masked aggression (Berger, 1987, p. 9; cf. Skinner, 1957, pp. 287-288), or a release from tension, or "a benign form of love-making" (Neve, 1988, p. 46). The English philosopher Hobbes advanced a superiority theory: We laugh at the "sudden conception" that we are superior to another (Berger, p. 7). Incongruity theories of humor are perhaps the most common: We laugh when we encounter a discrepancy between what we expect and what we get (Bergson, 1911; Deckers & Devine, 1981; Deckers, Jenkins, & Gladfelter, 1977; Deckers & Kizer, 1975; Kant, 1892; Nerhardt, 1977; Paulos, 1980; Rothbart, 1976; Schultz, 1972; Wicker, 1981; Wyer & Collins, 1992). Closely related are modern cognitive theories that focus on paradox or the resolution of logical problems (e.g., Bateson, 1972; cf. Murdock & Ganim, 1993). Notice that some of these ideas give humor some social utility (and hence, by implication, some evolutionary value), whereas others relegate humor to the realm of epiphenomenon.

Behavioral psychologists have said relatively little about the humor response, consistent, perhaps with their avoidance of the topic of emotion in general (Friman, Hayes, & Wilson, 1998). In *Notebooks* (1980), Skinner

gave several examples of remarks that provoke a humor response, but he offered no explanation. In *Verbal Behavior* (1957), he offered several "reasons why men laugh" (p. 285) at speech and text, one reason being especially notable: People may laugh or feel amused when a verbal stimulus supplements weak verbal behavior. The functional significance of this effect was not suggested, and no research was cited. Wrote Skinner,

There are many reasons why men laugh, and they do not all apply here. Even in the verbal field, some behavior may be laughable merely because it is clumsy, awkward, surprising, or otherwise amusing in character. Stuttering or lisping and marked dialects are stock devices in humorous writing. ... Verbal behavior is also amusing when it describes an amusing episode. (p. 285)

The supplementary evocation of any *feeble* response is usually funny. A trivial feature of a stimulating situation may be responsible for a tenuous metaphorical extension, as in the classical anecdote about the dentist, who, in repairing his car, took a firm grip on a sparkplug with a pair of pliers and said *Now this is going to hurt a little*. ... The exchange:

SOLDIER: I've caught a tartar.

SERGEANT: Bring him along.

SOLDIER: I can't.

SERGEANT: Then come along yourself.

SOLDIER: He won't let me.

is funny not because it is illogical but because *He won't let me* following upon *I've caught him* is very weak. We describe the condition of the reader by saying he doesn't "expect" the response. (p. 286)

Supplemental strengthening of weak verbal responses seems to be reinforcing in itself and to explain much wit. ... (p. 287)

We propose to add yet another theory to the existing lot, one that we believe bridges the gap between Skinner's perspective and the prevailing incongruity theories of humor. The theory is a threshold theory, very much in the spirit of the response-strength concept that Skinner (1957) proposed, although it does not restrict itself to the verbal realm. The theory lends itself to quantitative expression, and it suggests directions for empirical research.

A THRESHOLD THEORY OF HUMOR

All or virtually all humorous situations involve the equivalent of a "setup" (which can be considered a type of establishing operation) and a "punch line" or trigger, by which we mean auditory or visual stimuli that supplement an individual's recent history in a specific ways. The trigger, whether auditory or visual, is not funny without the setup, and even the setup will not be sufficient to set the stage for the humor response if the individual's prior experience is inadequate. So we begin with a prepared individual, we supplement his or her history in some way, and then, at some optimal time, we present a stimulus that evokes a humor response. In lengthy jokes and multi-panel cartoons, we do this systematically, but even in sight gags and single-panel cartoons, the same sequence occurs. The sight of the rotund gentleman as his posterior is just about to strike the floor isn't funny; we need first to see him approach a banana peel and slip: Even here, we need what the cognitivist calls an "expectation." In single-panel cartoons, we do not laugh instantly. We first examine key features of the cartoon that have been strategically placed to increase the likelihood that we will examine them in a particular order. Even puns (e.g., "cheese and quackers") aren't funny without preparation ("What do you get when you cross a cow and a duck?"). (Puns, of course, make most people groan rather than laugh, but if you smiled after reading the last sentence, note that the punch line—"cheese and quackers"—was used in this instance as the preparatory stimulus. With a suitable listener—in this case, a child—the humor response would presumably be strongest if the speaker first posed the question, then paused for some optimal period of time, and then finally spoke the punch line.)

Even situations that do not immediately fit the setup-trigger format may in fact involve a similar sequence. In slapstick comedy, for example, setups aren't as well defined as they are in multipanel cartoons, but they still exist. A very brief clip of Moe poking his finger into Curly's eyes would not be particularly funny. It *becomes* funny (at least to young males with appropriate environmental histories) when the viewer first sees Curly accidentally pouring water on Moe's head and then sees Moe starting to fume with anger. As we will see, just how funny the eye poke is depends on several factors, all of which can be analyzed objectively.

Self-generated musings can also produce the humor response, presumably because those musings produce both the setup and the trigger, sometimes because one is remembering a past experience (in other words, reexperiencing that experience perceptually in a degraded fashion) in which the setup and trigger occurred. A mild humor response might also occur because of stimulus pairing: If you recently witnessed the stand-up comedy of Robin Williams, the mere mention of his name might make you smile. Presumably, this is an instance in which classical conditioning has turned certain stimuli into elicitors of a weak humor response. It is notable, however, that the mention of Robin Williams' name is unlikely to produce a full-fledged guffaw. Classical conditioning, it seems, can attach only very weak humor responses to conditional stimuli. Even more important, it seems that no stimulus on its own can produce a humor response of significant magnitude. Responses of the latter sort always require both a setup and a trigger.

We suggest that the setup or preparation phase of a humorous encounter has a curious function: It strengthens certain covert responses, verbal or perceptual, to a point just below the threshold of awareness. The trigger (a punch line or its

equivalent) is a stimulus that edges the strengthened response to the threshold point or to a point just above the threshold point of awareness. Note that incongruity theories make a very different claim. They suggest that setups lead people astray from some response in order to surprise them, whereas the threshold theory suggests that the setup is preparing the subject to emit a specific response.

Consider once again the exchange between two soldiers cited by Skinner in *Verbal Behavior* (1957):

SOLDIER: I've caught a tartar.

SERGEANT: Bring him along.

SOLDIER: I can't.

SERGEANT: Then come along yourself.

SOLDIER: He won't let me.

Skinner focuses on the line *I've caught a tartar*, but in fact every line is critical for the humor effect. The first three lines, and especially the line *I can't*, strengthen a variety of responses in the listener or reader, among them responses like *He won't let me*. The variety depends on the individual's prior history. Some responses will be very weak, others will hover just below the threshold of awareness, and others are apparent and hence "conscious." We suggest that the last line, *He won't let me*, rapidly raises a similar response to a point just above the threshold of awareness.

The threshold theory is consistent with many common observations about humor and also with a variety of empirical research: Adults don't usually laugh at children's jokes because the outcomes are too obvious, which is to say that the setup makes the target response (which may or may not match the punch line) too strong too rapidly (Figure 1a). The response needs to remain at least briefly just below the threshold of awareness and then to be strengthened suddenly for the humor response to occur (Figure 1d). The humor response is, in effect, a by-

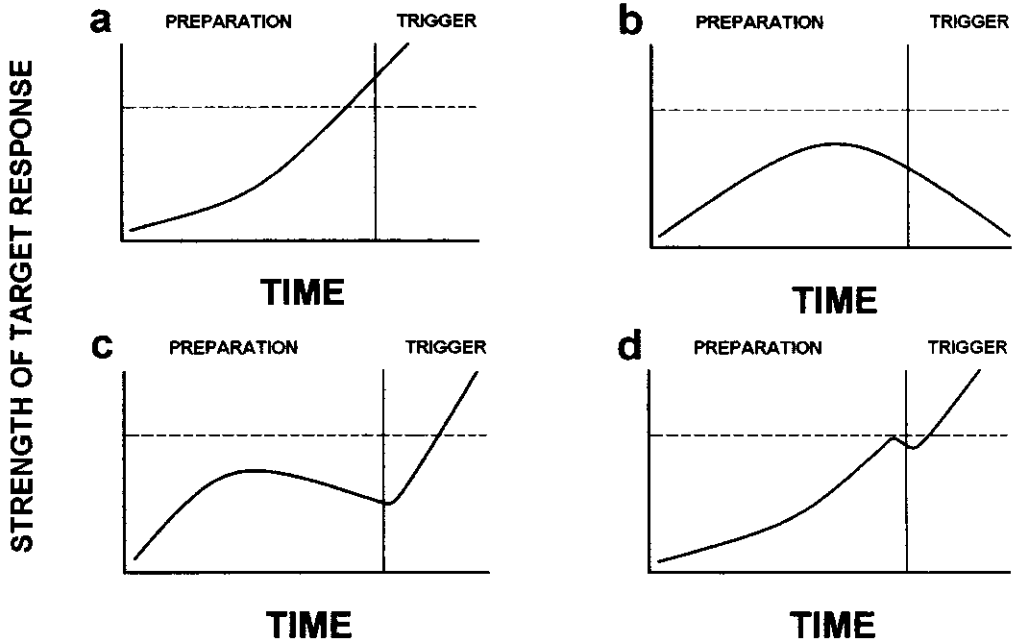


Figure 1. Response strength over time, with the dashed lines indicating a threshold. In Panel a, no humor response occurs because the target behavior (typically a verbal or perceptual response) occurs too rapidly; in the context of a joke, the punch line is too obvious. In Panel b, neither the preparation nor the trigger raises the target behavior to the threshold of awareness, so no humor response occurs. In Panel c, the target behavior weakens over time long before the trigger is presented, so the humor response is very weak or does not occur at all; in the context of a joke, this sometimes means that the listener failed to “get it” and perhaps that someone later explained it. In Panel d, the dynamics are optimal for providing a humor response: The strength of the target behavior is raised to just below the threshold of awareness, after which the trigger strengthens that response to a point just above that value. The humor response appears to be a by-product of this particular dynamic.

product of precisely this phenomenon.

If a joke is told poorly or the listener's history is inadequate, the target response will probably not occur, and neither will the humor response (Figure 1b). Timing is critical in producing the humor response because the responses strengthened by the setup are in constant flux and, unsupported by relevant stimuli, will tend to decrease in strength. If the punch line comes too late, the target response will have diminished in strength to a point well below threshold (Figure 1c). People who are skilled at making people laugh often repeat a critical question or some other part of the setup, presumably because they are sensitive to the threshold dynamics. If too much time

has passed after the setup has been delivered, the speaker may need to prepare the listener once again: “Do you give up? What do you get if you cross a cow and a duck? [Pause] Cheese and quackers!”

“Explaining” a joke or cartoon provokes at best a very mild humor response, presumably because no threshold dynamics are involved. We are simply informing a listener, rather than playing games with the nervous system. Moreover, we sometimes laugh or smile in situations that aren't usually labeled humorous, presumably because any sequence of stimuli that produces the threshold effect has the potential to produce a humor reaction.

Stimulants and depressants should have little effect on judgments about

congruency, but they should have a significant effect on response thresholds and hence should affect the humor response, and research confirms this (e.g., Weaver, Masland, Kharazmi, & Zillman, 1985).

The threshold phenomenon may even be applicable to the motor realm, but we can cite no confirming reports at present. Perhaps the physical tickle makes us laugh because it causes certain motor responses to hover around a threshold point. The humor response not evoked by a physical tickle is, in effect, a tickle of the neural circuitry that controls perceptual and verbal responses, engineered by a delicate sequence of auditory and visual stimuli. As we might expect, certain types of brain damage greatly impair the humor response (e.g., Brownell & Gardner, 1988), although the details are poorly understood.

Although we are making the rather strong assertion that the threshold phenomenon we have described is responsible for most occurrences of the humor response, we doubt that this is the whole story. The humor response is far more likely to occur in certain situations (e.g., at a comedy club where many people are laughing) than in others (e.g., at a funeral). It appears to be at least somewhat imitative, and some situations clearly suppress it. Moreover, the dynamic we have described is determined in large part by the listener's personal history, and it presumably operates differently in different people. Some people laugh heartily at jokes, after all, whereas others rarely laugh at anything at all.

In certain contexts, it is also easy enough to imagine the threshold dynamic we have described producing a negative reaction rather than the humor response. This will occur, for example, when the target response is threatening to the listener. When an employer summons an employee to his or her office with the intention of firing that employee, the employer's first few sentences

could conceivably bring certain target behaviors in the listener just below the threshold of awareness—but with a sense of great foreboding. A pause, followed by the punch line in this situation (“So—we’re going to have to let you go”), could produce feelings of horror, not humor.

AN APPROACH TO TESTING

One advantage of the threshold theory we have outlined is that it lends itself to empirical testing. We have developed special multipanel cartoons that we believe will be helpful in such testing. The last panel of each of these cartoons contains some feature that is critical in evoking the humor response; in other words, it is the equivalent of the punch line. This feature can be varied in a continuous fashion from one extreme, at which the punch line is too obscure to be understood, to another extreme, at which the punch line is much too obvious. We predict that these cartoons will evoke the largest humor response when the critical feature is presented at a threshold of recognizability, determined in a baseline study by reactions to the 10 different last-panel variants. We also predict that the humor response will be largest when the last panel is presented with some optimal delay.

We recently piloted an experiment with 40 undergraduate subjects, with encouraging results. Each subject made simple judgments about the last panels for certain cartoons (which they never saw in their entirety), and they also saw entire cartoons with 1 of the 10 variant last panels. We videotaped facial reactions to the full cartoons and coded humor reactions on a 4-point scale (cf. Ekman et al., 1988; Gavanski, 1986; Klein, 1985; Sroufe & Wunsch, 1972). The procedures we have used thus far are not precise enough to allow us to draw any firm conclusions, but our results are in the predicted direction.

If our theory is correct, at some point neuroscientists should be able to identify brain activity—just more behavior, after all—that corresponds to the threshold dynamics we have described, but even studies that focus on observable behavior could be helpful both in testing the theory and in determining its value in relation to incongruity theories or other theories of humor.

Perhaps the best way to demonstrate the viability of the threshold theory at this point is with an example, and with this we conclude our discussion. The beginning of this paper has very likely prepared you to emit a humor response to the following excerpt from the Rogers–Skinner debate. Note that without the setup to which you were exposed earlier, this excerpt would not normally produce such a response. Here then is Carl Rogers' reply to the duck story. He has been introduced by the moderator but is reluctant to begin the substantive part of his talk. Says Rogers,

I think first I'd like to clear up this duck story. [Laughter] There's a great deal of truth in that story except for the punch line. Instead of saying "You feel that you shot the duck," we resorted instead to a procedure very highly regarded in scientific circles. We flipped a coin, and that proved that I had shot the duck. [Much laughter, applause]

REFERENCES

- Allen, L., & Zigler, E. (1986). Psychological adjustment of seriously ill children. *Journal of the American Academy of Child Psychiatry*, 25, 708–712.
- Anderson, C. A., & Arnoult, L. H. (1989). An examination of perceived control, humor, irrational beliefs, and positive stress as moderators of the relation between negative stress, and health. *Basic and Applied Social Psychology*, 10, 101–117.
- Baim, P. (1998). Recipe for health: Laughter and killer cells. *Nursing Spectrum* (New England ed.), 12(1), 6.
- Banmen, J. (1982). The use of humour in psychotherapy. *International Journal for the Advancement of Counseling*, 5, 81–86.
- Bateson, G. (1972). *Steps to an ecology of mind*. New York: Ballantine.
- Berger, A. A. (1987). Humor. *American Behavioral Scientist*, 30, 6–15.
- Bergson, H. (1911). *Laughter: An essay on the meaning of the comic*. New York: Macmillan.
- Berk, L. S., Tan, S. A., Fry, W. F., Napier, B. J., Lee, J. W., Hubbard, R. W., et al. (1989). Neuroendocrine and stress hormone changes during mirthful laughter. *American Journal of Medical Science*, 298, 390–396.
- Black, D. (1984). Laughter. *Journal of the American Medical Association*, 252, 2995–2998.
- Brownell, H. H., & Gardner, H. (1988). Neuropsychological insights into humour. In J. Durant & J. Miller (Eds.), *Laughing matters: A serious look at humor*. New York: Longman Scientific & Technical.
- Carberry, H., & Burd, B. (1983). Social aspects of cognitive retraining in an outpatient group setting for head trauma patients. *Cognitive Rehabilitation*, 1, 5–7.
- Cason, A., & Thompson, V. (1980). Working with the old and dying. *Naropa Institute Journal of Psychology*, 1, 58–69.
- Decker, W. H., & Rotondo, D. M. (1999). Use of humor at work: Predictors and implications. *Psychological Reports*, 84, 961–968.
- Deckers, L., & Devine, J. (1981). Humor by violating an existing expectancy. *Journal of Psychology*, 108, 107–110.
- Deckers, L., Jenkins, S., & Gladfelter, E. (1977). Incongruity versus tension relief: Hypotheses of humor. *Motivation and Emotion*, 1, 261–272.
- Deckers, L., & Kizer, P. (1975). Humor and the incongruity hypotheses. *Journal of Psychology*, 90, 215–218.
- Dillen, K. M., & Totten, M. C. (1989). Psychological factors, immunocompetence, and health of breast-feeding mothers and their infants. *Journal of Genetic Psychology*, 150, 155–162.
- Dimatteo, M. R., Linn, L. S., Chang, V. L., & Cope, D. W. (1985). Affect and neutrality in physician behavior: A study of patients' values and satisfaction. *Journal of Behavioral Medicine*, 8, 387–408.
- Donald, K. M., & Carlisle, J. M. (1983). The "diverse decision makers": Helping students with career decisions. *Vocational Guidance Quarterly*, 31, 270–275.
- Ekman, P., Friesan, W. V., & O'Sullivan, M. (1988). Smiles when lying. *Journal of Personality and Social Psychology*, 54, 414–420.
- Foxx, R. M. (1985). Decreasing behaviours: Clinical, ethical, and environmental issues. *Australia and New Zealand Journal of Developmental Disabilities*, 11, 189–199.
- Freud, S. (1960). *Jokes and their relation to the unconscious*. New York: Norton. (Original work published 1905)
- Friman, P. C., Hayes, S. C., & Wilson, K. G. (1998). Why behavior analysts should study

- emotion: The example of anxiety. *Journal of Applied Behavior Analysis*, 31, 137-156.
- Fry, W. F., & Stoft, P. E. (1971). Mirth and oxygen saturation levels of peripheral blood. *Psychotherapy and Psychosomatics*, 19, 76-84.
- Gavanski, I. (1986). Differential sensitivity of humor ratings and mirth responses to cognitive and affective components of the humor response. *Journal of Personality and Social Psychology*, 51, 209-214.
- Godkewitsch, M. (1976). Physiological and verbal indices of arousal in rated humour. In A. J. Chapman & H. C. Foot (Eds.), *Humour and laughter: Theory, research and applications* (pp. 117-138). London: Wiley.
- Goldstein, J. H., Harman, J., McGhee, P. E., & Karasik, R. (1975). Test of an information-processing model of humor: Physiological response changes during problem and riddle solving. *Journal of General Psychology*, 92, 59-68.
- Grant, E. C. (1969). Human facial expression. *Man*, 4, 525-536.
- Houston, D. M., McKee, K. J., Carroll, L., & Marsh, H. (1998). Using humor to promote psychological wellbeing in residential homes for older people. *Aging & Mental Health*, 2, 328-332.
- Jamieson, J. (1984). Coping with physical violence: Some suggestions. *Maladjustment and Therapeutic Education*, 2, 38-45.
- Jones, J. M., & Harris, P. E. (1971). Psychophysiological correlates of cartoon humor appreciation. *Proceedings of the American Psychological Association*, 6, 381-382.
- Kant, I. (1892). *Kant's kritik of judgment*. (J. H. Bernard, Trans.). London: Macmillan.
- Kelly, M. L., Jarvie, G. J., Middlebrook, J. L., McNeer, M. F., & Drabman, R. S. (1984). Decreasing burned children's pain behavior: Impacting the trauma of hydrotherapy. *Journal of Applied Behavior Analysis*, 17, 147-158.
- Klein, A. J. (1985). Humor comprehension and humor appreciation of cognitively oriented humor: A study of kindergarten children. *Child Study Journal*, 15, 223-235.
- Kuhlman, T. L. (1988). Gallows humor for a scaffold setting: Managing aggressive patient on a maximum-security forensic unit. Conference of the Institute for the Advancement of Human Behavior. *Hospital and Community Psychiatry*, 39, 1085-1090.
- LaFave, L., Haddad, J., & Maesen, W. (1976). Superiority, enhanced self-esteem and perceived incongruity humor theory. In A. J. Chapman & H. C. Foot (Eds.), *Humour and laughter: Theory, research and applications* (pp. 63-91). London: Wiley.
- Langevin, R., & Day, H. I. (1972). Physiological correlates of humor. In J. H. Goldstein & P. E. McGhee (Eds.), *The psychology of humor: Theoretical perspectives and empirical issues* (pp. 129-142). New York: Academic Press.
- Lefcourt, H. M., Davidson, K., Prkachin, K. M., & Mills, D. E. (1997). Humor as a stress moderator in the prediction of blood pressure obtained during five stressful tasks. *Journal of Research in Personality*, 31(4), 523-542.
- Lefcourt, H., & Martin, R. (1986). *Humor and life stress*. New York: Springer.
- Lief, J. (1985). Attentive care: Working with the dying patient. *Naropa Institute Journal of Psychology*, 3, 11-17.
- Lloyd, E. L. (1938). The respirator mechanism in laughter. *Journal of General Psychology*, 10, 179-189.
- Long, P. (1987). Laugh and be well? *Psychology Today*, 21, 28-29.
- Martineau, W. (1972). A model of the social functions of humor. In J. H. Goldstein & R. E. McGhee (Eds.), *The psychology of humor: Theoretical perspectives and empirical issues* (pp. 101-125). New York: Academic Press.
- Matz, A., & Brown, S. T. (1998). Humor and pain management: A review of current literature. *Journal of Holistic Nursing*, 16(1), 68-75.
- Miller, J. (1988). Jokes and joking: A serious laughing matter. In J. Durant & J. Miller (Eds.), *Laughing matters: A serious look at humor* (pp. 5-16). New York: Longman Scientific & Technical.
- Mindess, H. (1971). *Laughter and liberation*. Los Angeles: Nash.
- Moran, C. C., & Massam, M. M. (1999). Differential influences of coping humor and humor bias on mood. *Behavioral Medicine*, 25(1), 36-42.
- Murdock, M. C., & Ganim, R. M. (1993). Creativity and humor: Integration and incongruity. *Journal of Creative Behavior*, 27, 57-70.
- Nelson, L. D., & Stern, S. L. (1988). Mood induction in a clinically depressed population. *Journal of Psychopathology and Behavioral Assessment*, 10, 277-284.
- Nerhardt, G. (1977). Operationalization of incongruity in humour research: A critique and suggestions. In A. J. Chapman & H. Foot (Eds.), *It's a funny thing, humour* (pp. 47-51). London: Pergamon.
- Neve, M. (1988). Freud's theory of humour, wit and jokes. In J. Durant & J. Miller (Eds.), *Laughing matters: A serious look at humor* (pp. 35-43). New York: Longman Scientific & Technical.
- Overeem, S., Lammers, G. J., & Van Dijk, J. G. (1999). Weak with laughter. *Lancet*, 354, 838.
- Paulos, J. A. (1980). *Mathematics and humor*. Chicago: University of Chicago Press.
- Porterfield, A. L. (1987). Does sense of humor moderate the impact of life stress on psychological and physical well-being? *Journal of Research in Personality*, 21, 306-317.

- Prerost, F. J. (1987). Health, locus of control, humor, and reduction in aggression. *Psychological Reports, 61*, 887-896.
- Provine, R. (1996, January-February). Laughter. *American Scientist, 84*, 38-45.
- Richman, J. (1996). Jokes as projective technique: The humor of psychiatric patients. *American Journal of Psychotherapy, 50*(3), 336-346.
- Robinson, V. (1977). *Humor and the health professions*. Thorafare, NY: Slack.
- Rogers, C. R., & Skinner, B. F. (1976). *A dialogue on education and the control of human behavior: A 6-cassette album edited by Gerald A. Gladstein*. New York: Psychology Today Library Cassettes.
- Rothbart, M. K. (1976). Incongruity, problem-solving and laughter. In A. J. Chapman & H. C. Foot (Eds.), *Humour and laughter: Theory, research and applications* (pp. 37-54). London: Wiley.
- Samuel, R. (1983). ABC of anger management. *Canada's Mental Health, 31*, 21.
- Sands, S. (1984). The use of humor in psychotherapy. *Psychoanalytic Review, 71*, 441-460.
- Schultz, T. R. (1972). The role of incongruity and resolution in children's appreciation of cartoon humor. *Journal of Experimental Child Psychology, 13*, 456-477.
- Scott, E. M. (1989). Humor and the alcoholic patient: A beginning study. *Alcoholism Treatment Quarterly, 6*, 29-39.
- Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.
- Skinner, B. F. (1980). *Notebooks* (R. Epstein, Ed.). Englewood Cliffs, NJ: Prentice Hall.
- Sroufe, L. A., & Wunsch, J. P. (1972). The development of laughter in the first year of life. *Child Development, 43*, 1326-1344.
- Sumners, A. D. (1988). Humor: Coping in recovery from addiction. *Issues in Mental Health Nursing, 9*, 169-179.
- Van Hoof, J. A. (1972). A comparative approach to the phylogeny of laughter and smiling. In R. A. Hinde (Ed.), *Non-verbal communication* (pp. 209-241). London: Cambridge University Press.
- Ventis, W. L., & Ventis, D. G. (1988). Guidelines for using humor in therapy with children and young adolescents. *Journal of Children in Contemporary Society, 20*, 179-197.
- Weaver, J. B., Masland, J. L., Kharazmi, S., & Zillman, D. (1985). Effect of intoxication on the appreciation of different types of humor. *Journal of Personality & Social Psychology, 48*, 781-787.
- Wicker, F. W. (1981). A rhetorical look at humor as creativity. *Journal of Creative Behavior, 19*, 175-184.
- Wyer, R. S., Jr., & Collins, J. E., II. (1992). A theory of humor elicitation. *Psychological Review, 99*, 663-688.
- Ziv, A. (1987). The effect of humor on aggression catharsis in the classroom. *The Journal of Psychology, 121*, 359-364.
- Zwerling, I. (1955). The favorite joke in diagnostic and therapeutic interviewing. *Psychoanalytic Quarterly, 24*, 104.