

Psycholinguistic Approaches to Humor

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Introduction

Interest in the psychological aspects of humor has a long history. There is, for example, Freud's (1905/1960) psychoanalytic theory of jokes and their relation to the unconscious, and Henri Bergson's (1950) theory of laughter as affirming the human values of spontaneity and freedom in the face of behavior that is rigid or mechanical. Apart from these and other influential theoretical accounts, there is by now a large body of empirical scholarship on humor (see Martin, 2010, for a review). Differences in the experience of humor have been studied in relation to the content or form of humor, and also in relation to individual differences in personality, character strengths (Ruch & Heintz, 2016), age, gender (Vaid & Hull, 1998), language, and culture (Vaid, 2006). Research has also considered functional aspects of humor, such as its role in creativity (Koestler, 1964; Vaid, 2014), emotion regulation (Samson & Gross, 2012), and group cohesion (Vaid, 1999; Billig, 2005).

At its core, humor is a cognitive experience that gives rise to feelings of mirth or joy. Accounts of humor that have foregrounded its cognitive aspect have been proposed by early philosophers such as Kant and Schopenhauer and by contemporary scholars (see Nerhardt, 1976; Attardo, 1997; Giora, 1991; Forabosco, 1992; Martin, 2010). The central idea is that the experience of humor arises from an initial tension created by encountering something unexpected, discrepant or incongruous in a situation and the subsequent relief felt when there is some resolution of the incongruity. How to study empirically, in real time, the cognitive processes that are thought to be responsible for humor perception, production, and use by language users falls under the domain of psycholinguistics.

Psycholinguistics is a branch of cognitive psychology concerned with how human language is acquired, processed, planned, and represented in the mind and brain. Although the discipline has been in existence for over 60 years, it has only recently begun to explore the processing of humorous language. Why has the study of humor *not* been a dominant focus within psycholinguistics? We offer three possible reasons. One is that language as it is theorized in psycholinguistics does not easily lend itself to the study of humor. That is, within psycholinguistics, the focus has been on what users must know tacitly about the structure of their language in order to be able to generate or understand a potentially infinite number of utterances using a finite set

of rules for combining words. The focus on how individual language users mentally represent their knowledge of language to allow them to communicate has meant that aesthetic, expressive, affective, or playful, aspects of language have been downplayed relative to propositional aspects.

Second, humor as a topic of empirical inquiry is hard to pin down, because potentially any aspect of language or any situation could be perceived as, or rendered, humorous, given that the experience of humor depends not just on the content or structure of the humor-eliciting stimulus but also on the identity of the humor producer and the relationship between the producer and the receiver. This variability and fluidity of humor make it a challenge to study in the form of experiments, the preferred research strategy in psycholinguistics. By its very nature, experimentation requires a “stripped-down” approach, in order to study it under controlled conditions to be able to make cause-effect claims. As a result, social and contextual aspects of humor may be lost when humor is studied under controlled conditions as compared to when it is studied under naturalistic conditions, or “in the wild.” Further, the emphasis in psycholinguistic research of the *individual* user’s language processing as the unit of analysis has meant that less attention has been paid to understanding the dynamics of language processing in *interpersonal* interaction, a key feature of humorous discourse.

A third challenge that the study of humor poses for psycholinguistics as an enterprise relates to underlying assumptions about how language is used by humans. Psycholinguistics has constructed the typical language user as one who is serious and seeks to be clear, direct, coherent, and informative. As a result, theories and research have been directed at understanding how it is that language users manage to understand one another as well as they do, given the potential for misunderstanding in the face of ever-present ambiguity in the signal. Thus, cues that are relevant for ambiguity resolution have been a major focus of psycholinguistic inquiry. It is now accepted that utterances are disambiguated by the use of predictive mechanisms that rely on language users’ tacit knowledge of the rules of grammar that specify permissible combinations of elements and thus constrain what an utterance could mean. In addition, the use of extralinguistic cues (e.g., pragmatic or contextual knowledge), is traditionally thought to occur after linguistic cues are processed, to further constrain what something could mean (see Coulson, 2015 for a critique of this view). Thus, linguistic and extralinguistic cues are enlisted by language users to narrow down the range of possible meanings of an utterance so that the most plausible meaning in a given context comes to the fore. All this makes sense if a serious mode were the only mode in which language users operated. Unfortunately (or fortunately), it is not. Language users (children and adults) are often not (at all) serious but indulge in play (e.g., Bell et al., 2014). In a playful mode, the usual rules of interaction may no longer apply, or they may apply in different ways. Psycholinguistics is just beginning to acknowledge the need to study language as used in a playful mode (see also Clark, 1996; Chafe, 2007).

Humor both exposes and disrupts the usual ways of using language. It also disrupts the rigidity of conventional ways of thinking, for it plays not only with the rules of language but also with the rules of logic. Yet humor clearly has a logic of its own. In this chapter we will consider how the logic of humor has been—or could be—explored from the lens of psycholinguistics and how the range of psycholinguistic research methods can be enlisted to study humor.

Aside from its cognitive core, two additional aspects are critical to humor and are, therefore, important to address in any comprehensive psycholinguistic account: humor’s aesthetic and social aspects. Verbal humor is not only a form of compressed thought (Veale, 2015) or interactive, creative cognition (Ward et al., 1997), but it also has a literary quality, and makes use of a range of devices (including polysemy, intertextuality, irony, under- or over-statement, metaphor, analogy, ambiguity, or figure-ground shifts) in a way that is poetic, memorable, and pleasing (Veale, 2015). The social nature of humor is also at the heart of conversational humor and

quires what Clark (1996) has called *joint action*, where speakers and listeners coordinate and co-construct meaning. For there to be even the possibility of sharing the experience of humor, parties must signal that they are open to engaging in a play mode (Bateson, 1953).

Questions of potential interest from a psycholinguistic perspective to humor include: How do listeners and speakers signal that they are in a play mode, or *not* intending to be taken seriously? How does the ability to comprehend and produce humor emerge and develop from infancy and across the life span? How does humor development relate to developmental milestones in theory of mind, empathy, or attachment? How are humorous texts structured and how do changes in their structure affect how they are perceived? How do cognitive aspects of humor processing (e.g., getting a joke) relate to affective aspects (e.g., liking a joke)? What is the temporal course of humor comprehension? Does humorous text facilitate or slow cognitive processing? How does humor generation relate to creativity? How is humor supported by neural structures? And how does social identity affect humor processing? In what follows we will address how recent work within psycholinguistics has begun to address some of these questions. Our review will necessarily be selective. We will begin with considering precursors of current work.

Historical Perspectives

Critical insights about humor of relevance for contemporary psycholinguistic research have come from early scholars in such diverse disciplines as ethology, cybernetics, philosophy, anthropology, linguistics, and Gestalt psychology. As noted at the outset, a central theme underlying a cognitive account of humor is that humor involves (or perhaps requires) the recognition of some incongruity. Early psychological theories of human motivation proposed two contrasting tendencies: a need for stability and security and a need for innovation and change. Humor is aligned more with the second of these principles but probably also reflects the tension between these two tendencies.

In a psychoanalytic account of humor, Freud (1905/1960) noted that certain topics tend to be particularly salient in humor, namely, topics that are transgressive in some way. Freud proposed the existence of mental censors that act to filter out these topics. However, by virtue of their structure, which involves a play on double meanings, jokes manage to bypass these censors. According to Freud, the pleasure experienced in joking is the pleasure associated with the release of repressed sexual or hostile impulses conveyed in humor. Building on this notion, Minsky (1984) proposed that our cognitive apparatus also has sensors to detect "bugs" in reasoning, so that inefficiency in thinking can be reduced. Minsky suggested that absurd humor is experienced as pleasurable because it exposes faulty logic or errors in reasoning. Minsky's proposal thus offers a broader account than the psychoanalytic one and a more cognitive account of why we experience pleasure in humor.

Encountering something incongruous may be perceived as funny but one might also react to incongruity with fear or anxiety. Speaking to this point, Maier (1932) proposed that for something to be experienced as amusing (rather than fear-inducing), the perceiver should not be overly invested emotionally in the situation. Further, the perceiver should be able to see the ridiculousness in the situation. In other words, one experiences a situation as amusing so long as one is affectively detached from it and can enjoy its absurd logic.

Related to this notion is another central insight, namely, that a precondition of humor is the adoption of a play frame, a tacit agreement that what is talked about inside the frame is not to be taken seriously (Bateson, 1953). By agreeing to this, space is created for other beliefs and perspectives to emerge, including those that may challenge the dominant view. The notion of a

play frame is also implicit in early writings of anthropologists on joking relationships. These are relationships observed in many traditional societies in widely dispersed regions such as Africa, Oceania, and Asia, and involve a socially sanctioned use of joking between kin related by marriage (e.g., brother-in-law/sister-in-law). In such relationships, as Radcliffe-Brown noted, "one is by custom permitted, and in some instances required, to tease or make fun of the other, who in turn is required to make no offence" (1965, p. 90). The existence of such relationships suggests that humor may serve to defuse potential conflict or socially transgressive behavior. These early notions of humor as needing a cooperative play frame and cultural sanction may be seen as precursors to current scholarship on safe spaces for difficult dialogues, and on the performance aspect of humor (e.g., standup comedy as a socially sanctioned form of bringing up difficult and otherwise often unspoken topics).

Relatedly, the anthropologist Mary Douglas (1975), observed that the structure of a joke parallels its potentially subversive function. She noted that "a joke is a play upon form [which] brings into relation disparate elements in such a way that one accepted pattern is challenged by the appearance of another which in some way was hidden in the first" (1975, p. 98). The telling of a joke is a potentially subversive act in that it results in "a victorious tilting of uncontrol against control," the "levelling of hierarchy, the triumph of intimacy over familiarity, [and] of unofficial values over official ones" (1975, p. 98). This notion of humor as potentially subversive is echoed in a number of current approaches to humor, including cognitive linguistics, where humor is seen as arising from the subverting of a category (Veale, 2015), and in cultural studies, where marginalized or stigmatized groups may use humor to articulate and subvert their marginal status (Vaid, 2006; Bingham & Green, 2015). The emphasis here is on the *potential* for subversiveness that humor enables. Actual instances of humor will run the gamut of truly subversive humor that exposes and challenges the status quo to humor that is conservative in the sense that it endorses and reinforces the status quo (Vaid & Hull, 1998). Humor may also occur (to differing degrees in different cultures) as a response to embarrassment (e.g., Vaid et al., 2008). Finally, a potentially subversive use of laughter, termed "unlaughter" by Billig (2005), is when one chooses *not* to laugh when laughter may be the expected response in a situation.

Of greater relevance to the cognitive aspect of humor is the work of early Gestalt psychologists who pointed to the similarity between humor and the experience of insight in problem solving. As Maier (1932) noted, the experience of humor (like that of insight) involves a sudden and unexpected restructuring of the elements of a configuration leading to clarity and a solution. In other words, humor can lead to discovery. This aspect of humor was further developed by Arthur Koestler in his book, *The Act of Creation* (1964), in which he noted that discovery underlies art, science, and humor and that all three domains involve "bisociative" thinking, i.e., a form of thinking in which two disparate and "habitually incompatible matrices" are temporarily brought together and "momentarily fused" (p. 94). This notion of bisociative thought as a component of humor is widely held in contemporary work in humor, and the insight that humor is associated with a sudden sense of discovery has motivated recent studies (e.g., Amir et al., 2015; Chen & Vaid, 2004).

Finally, no account of the cognitive basis of humor would be complete without mention of the seminal incongruity/resolution information-processing model of humor proposed by Suls (1972; see also Shultz, 1972). Extending the observations of early scholars that to experience something as humorous requires the detection of some initial incongruity followed by a sudden insight that (at least partially) resolves the incongruity, Suls proposed that these two components of the mental experience of humor occur in separate and sequential stages of information processing. If a resolution is found then the situation is perceived as funny. If it is not found then the

incongruous information is just perceived as puzzling or odd but not as amusing. Suls and others (Wyer & Collins, 1992) also noted that the thought processes needed both to recognize the incongruity and to find a way to make sense of it are modulated by level of incongruity and saliency of the input. Suls's model of humor processing has been hugely influential in shaping subsequent research and can be considered a precursor to subsequent influential formulations, such as the script-opposition model of Raskin (1985; see Attardo, 1997) and the frame-shifting model of Coulson (2015).

We turn next to an overview of research methods used in psycholinguistics as applied to humor study, distinguishing between approaches used with infants or young children and those used with adults.

Psycholinguistic Methods as Adapted to the Study of Humor

With Children

Research methods that have been used to study children's humor appreciation, comprehension, and production have made use of a combination of approaches involving observation, judgments, preferences, and elicited responses. Studies of infants have relied on observational approaches to study infants' spontaneous smiling and laughter at different ages and in different situations in interaction with caregivers (e.g., Mireault et al., 2012). Some studies with young children have presented them with cartoons or verbal humor and asked them to judge which they find most funny and explain why (Shultz, 1996; Puche-Navarro, 2009). Other studies have interviewed parents of young children to get their insights into what the children found amusing at different ages (Reddy, 2008). Studies of humor generation have involved having children of different ages tell a funny story or draw a funny picture and explain why it is funny (Loizou & Kyriakou, 2016). The general logic of developmental research designs has been to observe humor appreciation, comprehension, or production by children under naturalistic or controlled conditions, comparing performance either over time (longitudinally) or across different age groups at a given time (cross-section studies), or examining their response to humor-eliciting stimuli that have been manipulated in systematic ways (e.g., varying the type of incongruity). Given that humor comprehension presupposes some understanding of another person's perspective, the study of the development of humor comprehension can provide insights into the onset of theory of mind, and may point to an earlier developmental onset of this concept than might be indicated based on other measures.

With Adults

There is a sizeable body of work on disorders of laughter or humor in patients with unilateral or bilateral brain lesions arising from stroke, disease, or traumatic injury. Disorders of mirth can be distinguished from disorders of laughter and arise from different neuropsychiatric conditions. For example, pathological joking, or *witzelsucht*, involves right orbito-frontal structures and is associated with impaired humor appreciation coupled with a compulsion to produce routine jokes and witticisms (e.g., Granadillo & Mendez, 2016; see Vaid, 2002; Vaid & Kobler, 2000, for further discussion). In the interest of space we do not review this clinical literature but note simply that it has inspired a number of studies of the contribution of the two hemispheres to joke comprehension in neurologically intact individuals, using lateralized stimulus presentation (e.g., Coulson & Williams, 2005; Hull et al., 2006; McHugh & Buchanan, 2016). It has also motivated studies that seek to dissociate the neural circuitry involved in the cognitive vs. the

affective component of humor processing (e.g., Goel & Dolan, 2001; Vrticka et al., 2013) or the comprehension vs. elaboration aspects of humor processing (e.g., Feng et al., 2014).

Offline Behavioral Methods

One of the earliest ways to study humor is by using so-called offline techniques, that is, techniques in which the final product, rather than the time course of processing, is analyzed. Some relevant offline tasks used to study humor comprehension have included rating scales or choice tasks (judging the degree to which an item is amusing, or selecting the most amusing item out of a choice of items) (Giora, 1997; Martin, 2010; McGraw & Warren, 2010). Other studies have asked participants to come up with a funny caption for a cartoon, a funny title for a story, a funny rejoinder to a saying (Vaid, 2014), or to list humorous similarities or differences between two concepts (Hull et al., 2016).

Online Behavioral Methods

Online behavioral methods include priming and lexical decision, self-paced (word-by-word) reading, or eye-tracking during natural reading. As an example of a natural reading task, participants are to read a series of sentences containing funny or not funny one-liners and decide for each if it is funny or not. Overall reading time and accuracy are noted. A variant of this task is to present all but the final (punch line) word in the center of the screen and, after the participant has finished reading it, show the final word randomly and (very quickly) in the left or right visual field. This variation allows for a comparison of hemisphere differences in joke comprehension (see Coulson, 2015). Another variation is to present the initial joke centrally and present a target word to the right or left visual field and have the participant name the target word or decide if it forms a word or not (lexical decision). The target word in turn is either related to the joke meaning or is an unrelated word (e.g., Hull et al., 2006; Chen & Vaid, 2004).

In a lexical decision priming paradigm adapted to study joke processing, participants would be asked to read a joke text and at different points in the text they would be presented with a word that is related to the initially favored or the punch line meaning of the joke (or is a non-word). Participants must decide as quickly as possible if the target is a word or not a word (e.g., Vaid et al., 2003).

In the self-paced reading task funny or not funny sentences are shown one word (or phrase) at a time on a computer screen. Participants press a key to see the next word and reading times for each word (or phrase) are recorded. This method provides more fine-grained, moment-to-moment information on reading time (processing effort) but may feel somewhat unnatural.

Eye-tracking is a sensitive gaze-measuring technique used in many psycholinguistic studies. It tracks the eyes' trajectory when reading text on a computer screen and provides information on a number of dependent measures including first pass reading time/gaze duration (i.e., the amount of time spent reading specific material the first time all the way through), number of fixations (i.e., the number of times a participant stops and fixates on specific regions of interest), and total reading time (i.e., the total amount of fixations made for specific regions of interest) (Ferstl et al., 2016). Unlike self-paced reading task paradigms, eye tracking does allow for readers to go back and reread words, phrases, and utterances, which allows for a more naturalistic measure of reading.

Finally, psychophysiological measures are being used to study language processing and humor processing, in real time. Although this approach, like eye-tracking, provides an unobtrusive measure of physiological concomitants of the humor response (e.g., movements of facial muscles

around the eyes or mouth associated with smiling and laughter), and the potential for associating specific bodily changes (e.g., heart rate acceleration or deceleration) that may accompany cognitive changes at different points in reading or listening to a joke, there is some uncertainty as to how to interpret the findings observed thus far, and more replications and converging evidence is needed (Flaconi & Owen, 2015).

Online Neurobehavioral Methods

Electrophysiological

Event-related potentials (ERP) are time-locked evoked responses of electrical activity of the brain. Components of the waves are described in terms of their (positive or negative) polarity, amplitude, onset, peak latency, and distribution on the scalp. ERPs have high temporal sensitivity that makes them particularly useful for psycholinguistic research, as they can measure phenomena at the millisecond level. Several notable components of ERPs of relevance for language include the N400, a negative evoked response with an average peak amplitude at 400 ms following stimulus onset; this component is sensitive to semantic violations. Second, the P600 is thought to tap syntactic violations, but has also been demonstrated to reveal a combination of syntactic and semantic processing. Finally, the late left anterior negativity (LLAN) occurs at about 500 ms and is associated with comprehension processes. Like eye-tracking, ERPs offer an unobtrusive way of studying natural language processing (e.g., reading a sentence) without requiring the participant to make any judgment.

Hemodynamic

Humor comprehension is also being studied using hemodynamic functional neuroimaging methods, most commonly, fMRI techniques. Although providing a less direct measure of neural activity than electrophysiological measures and with less temporal resolution, hemodynamic methods offer greater spatial resolution. Studies of humor comprehension using such measures typically contrast changes in blood flow in response to humorous material vs. various kinds of control conditions with the aim of examining the neural correlates of mirth, distinguishing between the appreciation vs. the comprehension of humor (e.g., Campbell et al., 2015), or between humorous and nonhumorous insight (Amir et al., 2015).

We turn next to a discussion of core findings from key studies in the acquisition, comprehension, and production of humor.

Core Findings

Developmental Studies

A classic early study of children's appreciation and comprehension of humor tested the incongruity/resolution model. Across two experiments, Shultz (1972) presented elementary-school-aged children (second through seventh graders) with different versions of cartoons and asked them which one they liked best and to explain the humor in them. The different versions included the original form, an incongruity-removed version, and a resolution-removed version. The results showed a developmental trend with the younger children preferring the cartoons showing incongruity without resolution and the older children preferring those in which there was resolution. This trend was replicated in a subsequent study of the appreciation of riddles

(Shultz, 1974). These findings suggest that children initially prefer humor that is purely incongruous and only later come to enjoy humor in which the incongruity is somehow resolved.

Relating children's preferences for different types of humor to their cognitive development, McGhee (1979) outlined four stages: in the first stage children enjoy humor that involves incongruous actions directed at objects. In Stage 2 they enjoy humor that involves incongruous labeling of objects and events. In Stage 3 they enjoy conceptual incongruity and in Stage 4 they enjoy humor that has multiple meanings. More recent work supports this characterization. Studying 2- and 3-year-olds, Hoicka and Akhtar (2012) found that young children were more likely to respond with laughter when they saw an object being used in an unusual way, such as placing underwear on someone's head. As an example of conceptual humor, children preferred humor that violated real world concepts (for example, when the parent pretends that a pig is saying *moo* rather than *oink*). In a study of visual humor, Puche-Navarro (2009) presented 3- and 4-year-olds with a series of images. The children were instructed to pick out which image out of three choices (congruent, incongruent or neutral) made them laugh more; they were then asked to explain their choice. For example, children were shown an image of someone watching television in three conditions. The incongruent condition depicted two televisions with a man in one of the screens talking to another person in the other screen. Children were able to successfully select the incongruent image as funny.

Taken together, developmental studies underscore the relevance of incongruity as a key factor in children's appreciation of humor, and further show that what is considered incongruous becomes more varied as children get older and develop schemas based on their additional knowledge (of language and of the social world). Although the perception of incongruity is central to understanding and using humor, in children as in adults, the use of humor by young children also provides insights into their social-emotional abilities and their creativity, as well as their cognitive abilities.

In one of the few studies that has examined young children's humor production, Loizou and Kyriakou (2016) emphasize providing different options—e.g., telling a humorous story or drawing a humorous picture—to allow for a fuller expression of children's ability to produce humor and tap into different skills.

Finally, developmental research on humor is looking also at the very first year of life to trace the precursors of humor and the role of social learning in humor appreciation. In a longitudinal study of preverbal infants, Reddy (2001) examined naturalistic play between parents and children and had parents describe and identify the different types of humorous encounters they had with their infants. Reddy found that "clowning" was one of the behaviors parents commonly observed in infants, as early as eight months of age and in 11-month-olds. It was further noted that infants seemed to be deriving meaning about what was funny from social cues of the caregiver. Reddy also suggested that children may be using social cues to test boundaries about what is permissible or not by whether their behavior elicits laughter. Reddy's work suggests that humor in the form of clowning and mocking the serious emerges towards the end of the first year (see also Mireault et al., 2012, which examines humor perception and creation between parents and their 3- to 6-month-old infants).

Humor Comprehension

Two issues have been the focus of psycholinguistic research in humor comprehension. The first addresses whether humor facilitates or slows sentence or text comprehension. The second addresses the issue of whether in processing humorous text (jokes, in particular), the initially salient meaning (related to the setup phase just before the incongruity is encountered) remains

active once the punch line meaning is introduced or is suppressed. We consider each issue in turn.

Does Humor Speed Up or Slow Down Comprehension?

To contextualize this issue it is important to refer to an important conceptual framework, the space structuring model, a model of language comprehension that was motivated by conceptual blending theory and cognitive grammar. In this model various kinds of information including perceptual input, linguistic input, social context, and a speaker's current cognitive state, all contribute to constructing a cognitive model of the discourse situation (Coulson, 2015). Both linguistic and non-linguistic information is consulted in retrieving frames from long-term memory, which is used to construct the cognitive model. Whereas frames normally serve a useful function of organizing conceptual knowledge and guiding expectations, they also fall short in certain situations, particularly when competing frames are encountered and a restructuring of elements in the message-level representation of a situation becomes necessary. Frame-shifting refers to the semantic and pragmatic reanalysis required in such cases, and is particularly common in processing jokes, as jokes are structured precisely to suggest one frame initially while keeping another frame in the shadows.

Thus, to understand a joke requires engaging in a restructuring of the situation model whereby the initially presented information has to be revised when it is found to be inconsistent with the current text representation. A new frame has to be retrieved from long-term memory on which the current representation can be mapped. Joke comprehension thus involves situation model updating and as such is likely to be costly in terms of processing.

Accordingly, one would predict that there would be a processing disadvantage for joke texts compared to otherwise similar non-humorous texts. In a series of studies, Coulson and colleagues have provided support for this prediction. Using a self-paced reading paradigm in which sentences are presented one word at a time with the sentence's final word either determining the joke or non-joke status of the sentence, Coulson and Kutas (1998) found longer reading times for the last word of jokes. Similarly, an ERP study by Coulson and Kutas (2001) showed that joke endings elicited a larger N400 component than did non-joke endings of comparable stimuli. And in an eye-tracking study, Coulson et al. (2006) found longer overall reading times and more regressive eye movements for jokes than non-jokes. Importantly, there were no differences in first-pass reading times between jokes and non-jokes. Taken together, these studies suggest that humorous material takes longer to read and process given the re-reading (and reconceptualizing) required to integrate the punch line.

While Coulson's work clearly lends support to the view that joke comprehension can be effortful because of the frame-shifting required, it is also possible that a portion of the processing cost may arise from not knowing that one may be encountering a joke. If one were explicitly told that some of the material one will be reading may be funny, and one has to in fact monitor for humor, would there still be a processing cost associated with jokes compared to non-jokes?

This question was examined in a joke detection task devised by Vaid et al. (2015). One-liner jokes in English adapted from previous studies by Coulson were randomly intermixed with one-line non-jokes. The joke stimuli were further classified into two types: linguistic and extralinguistic bases of the humor. Linguistic humor involved wordplay of various kinds (punning, ambiguity). Extralinguistic humor relied on world knowledge. An example of a joke involving extralinguistic humor is *The difference between a good speaker and a bad one is often a nice nap*. The two types of jokes were randomly presented with non-joke counterparts created by replacing the punch line meaning with another word that rendered the sentence coherent but not funny.

Each sentence was shown individually on a computer screen, and participants were to decide as quickly as possible if it was meant to be a joke or not. The results showed that participants were more accurate in classifying jokes than non-jokes, particularly for jokes involving wordplay (91.9% vs. 71.5% accuracy, respectively). Furthermore, response times to correctly classified joke stimuli were significantly faster than those to non-jokes. Also, jokes that involved extralinguistic humor were detected significantly faster than jokes relying on linguistic humor.

The Vaid et al. (2015) study suggests that joke texts need not take longer to process than non-joke counterparts if readers are expecting to see humorous material. Moreover, the finding that jokes that make use of wordplay took longer to read than those involving extralinguistic sources of humor suggests that activation of multiple meanings (which is more likely in wordplay when the humor rests on keeping the different meanings in mind) creates interference. By contrast, extralinguistic humor is more likely to involve the punch line meaning canceling the initially salient meaning leaving only a single meaning active. Other work, using an eye-tracking paradigm, has also shown that joke texts do not have to take longer to process (Fersti et al., 2016).

Are Initially Salient Meanings of Joke Texts Suppressed Once the Punch Line Meaning Is Activated?

To examine this issue we turn to two studies that examined multiple-meaning activation in processing humorous texts. The first study also examined the time course of meaning activation (Vaid et al., 2003). In this study, a primed lexical decision paradigm was used. Participants were presented with jokes and probes that were related to the initially salient meaning of the text and probes that were related to the actual joke meaning. Participants had to decide whether or not probes were words or not. In the first experiment, probes were presented at three different time points: at the setup, incongruity, or resolution. Priming of probes related to the setup meaning occurred when probes were presented at the setup stage, as expected. Priming of both the initial and the joke meaning was found immediately after the punch line meaning was introduced, suggesting that both meanings were still active. However, when (in a second experiment), the probe was presented somewhat later to allow time to process the joke meaning, only that meaning now showed a priming effect. Thus, this study suggests that the initial meaning of a joke text is eventually suppressed and only the joke meaning survives. Interestingly, in a recent study by Fein et al. (2015), the initial meaning of the joke text persisted; there was a failure to suppress the initially salient meaning. This study used pictorial humor (a series of images). As such, it is likely that the initial meaning was still salient because it was still actually present, and part of the pleasure in the joke experience was comparing the initial meaning to the joke meaning (see also Attardo, 1997). Taken together, one may conclude from these studies that if keeping the initial meaning in mind is somehow relevant to enjoying the joke, then that meaning will remain active, whereas when the joke meaning is of a garden path type, i.e., is truly different from the initial meaning and does not require the initial meaning to be kept in mind in order to appreciate the joke, the initial meaning will be suppressed.

Mayerhofer et al. (2015) conducted a priming study involving garden path jokes. They looked at the effect of presenting a single word prime prior to the presentation of the joke text; the prime was related either to the initial meaning or the joke meaning of the text. For example, a participant would be primed with the word *diet* followed by the garden path joke, *I still have the body of an 18-year-old*. "Diet" would activate the salient meaning to be healthy, but the punch line, *It is in my cellar*, would make it difficult to suppress the *diet* meaning until the follow-up sentence is presented (e.g., *There are rats in the cellar as well*). Mayerhofer and colleagues found that ambiguous prime words presented at the setup actually slowed reaction time.

l, studies of humor processing have shown a range of outcomes. Part of the discrepancy studies may reflect task demands (whether the humor is unexpected or expected), the type of the humor stimuli (verbal vs. pictorial, linguistic vs. extralinguistic humor), the timing of the primes, and the temporal course of meaning activation. There is clearly a need for more studies of humor comprehension, supplemented with neurocognitive approaches, to better understand how meaning activation unfolds in joke processing under different conditions.

Studies of Humor Production

Compared to studies of humor appreciation or comprehension, there has been far less research on humor generation, particularly under controlled conditions. This gap may in part reflect the early emphasis in the literature on studies of humor appreciation, which typically used readily available canned jokes as stimuli. A few early experimental studies that used joke production or other humor elicitation methods (e.g., coming up with figure captions for cartoons) were typically not designed to study cognitive aspects of humor generation but simply to compare different groups in their ability to generate humor. Studies that examine joking in natural or performance contexts (Norrick, 1993; Vaid, 2006) offer important insights for understanding of humor delivery and have underscored the importance of timing, repetition, prosody, and gesture.

In a recent experimental study of elicited humor, Hull et al. (2016) sought to examine the role of incongruity in humor production by means of a concept comparison task. This task was chosen as it was thought to capture a key element of humor noted in several studies of humor production or comprehension: that humor arises when there is a juxtaposition between a dominant and an uncommon aspect of a situation. In the study participants were to compare or contrast the meanings of pairs of discrete concepts (e.g., MONEY and CHOCOLATE). Other variables were also manipulated, including the task (finding differences or similarities between the concepts), semantic relatedness of the concepts, semantic content (neutral or taboo), gender of participants, and whether or not the instructions explicitly asked for funny responses to be generated. The actual responses generated were analyzed for their humorousness.

The findings showed that funny responses were more likely when instructions did not explicitly ask for them; they were also more prevalent for taboo than neutral items, for semantically unrelated than related items, and when the task required looking for differences rather than similarities. Furthermore, responses that were judged funny typically highlighted a property that was high in output dominance (frequency of mention) for one concept of the pair but simultaneously low in output dominance for the other concept of the pair. Responses judged not funny did not show this pattern of output dominance divergence. These findings are consistent with prior claims that humor arises when there is a bringing into alignment of a dominant interpretation of a situation (in this case, a dominant feature of a concept) and an uncommon one. For example, for the concept pair MONEY and CHOCOLATE, a response judged humorous was "one swells the wallet, the other swells the hips." This response brings into alignment a dominant feature associated with the concept money (a fat wallet) and a less dominant feature associated with the concept chocolate (large hips).

Finally, a recent line of work has examined wordplay in the use of proverbs in written discourse. Proverbs are examples of often metaphorical statements that articulate a culturally shared perspective about the human condition, expressed in the form of anonymous, self-contained, concise phrases. Mieder and Litovkina (1999) and others (e.g., Arnaud et al., 2015) have examined characteristics of rejoinders to established proverbs (or "anti-proverbs") that may challenge the received wisdom of established proverbs, based on compilations of such

non-canonical occurrences in newspaper or magazine headlines, advertisements, or graffiti or in casual conversation.

Arnaud et al. (2015) analyzed a corpus of 303 non-canonical occurrences of six English proverbs from the Corpus of Contemporary American English for occurrences of wordplay, i.e., clever and humorous formal manipulations. They noted that the vast majority of non-canonical occurrences involved noun phrase substitutions that did not change the meaning in significant ways. A subset of 32 non-canonical occurrences presented to a group of native speakers of English for their judgments showed that, to be rated as clever or humorous, some semantic manipulation of the original proverb was required; simple substitutions of noun phrases was not enough.

Moving beyond a corpus-generated approach, Vaid (2014) conducted a proverb rejoinder elicitation study. Native English speakers were given a set of 20 common proverbs and were asked to provide rejoinders to them starting either with the word "and" or the word "but." The elicited rejoinders were subsequently analyzed in terms of their correspondence in form and meaning to the original proverbs and were rated by judges on their humorousness. The optimal innovations hypothesis proposed by Giora and colleagues (Giora et al., 2004) provided a basis for predicting which responses would be given higher ratings. A structure is considered optimally innovative if it provides a novel response to a familiar stimulus, but the response still allows for the recovery of a salient response relative to that stimulus. Vaid (2014) hypothesized that optimally innovative rejoinders judged most appealing (humorous) would be those that preserve the surface form of the original proverb but replace a single element with a novel word or phrase that changes the meaning of the original proverb. The results supported this hypothesis: rejoinders judged to be humorous (particularly rejoinders that began with the word "but") were significantly more likely to resemble the original proverb in form but differ from it in meaning (e.g., *Familiarity breeds contempt, but unfamiliarity breeds bad grades; Haste makes waste, but waste makes good fertilizer*).

Taken together, these findings indicate that one important way in which humor is generated is by subtly altering the meaning of standard sayings or collocations (see also Dynel, 2009). The findings further support the claim by Hanks (2013) that "exploitation" of linguistic norms, defined as "a deliberate departure from an established pattern of normal word use" (p. 121) is a common device for generating creative and humorous discourse and is a particularly effective device, rhetorically, as it produces memorable outputs.

New Directions

As noted at the outset, studies using a psycholinguistic approach to the study of humor are still fairly few in comparison to the broader psychological literature on humor and there is thus much scope for more research. The existing research has nevertheless uncovered a number of interesting observations that will need to be substantiated in further work and extended to consider a broader range of stimuli, whether verbal or pictorial, and a broader range of paradigms and tasks. In addition, an increasing number of neuroimaging and neuropsychological studies of humor comprehension and production are emerging that complement studies that use behavioral methods. Furthermore, psycholinguistics research is beginning to investigate the effects of knowing more than one language on humor production and comprehension (e.g., Bell et al., 2014; Vaid et al., 2015).

Looking ahead, a psycholinguistic approach to the study of humor can be particularly illuminating if it is integrated with a sociological and ethnographic approach and builds in ways of studying the interaction of the social identity of interlocutors with how humor is processed. One would like to see studies, for example, of how humor processing is affected by whether the

humor producer (or the humor receiver) is a member of a dominant social or linguistic group or a marginalized group. Studies to examine the effectiveness of different forms of humor as an intervention in the classroom to promote learning, as well as the effectiveness of using (and teaching) humorous forms of resistance against social injustice would be equally interesting. Examining the interaction of humor content, the social and linguistic context in which humor is exchanged, and the cognitive aspects of processing humorous text will, we believe, lead to rich theoretical insights as well as provide a unique perspective on less studied aspects of humor.

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