Understanding of Literal Truth, Ironic Criticism, and Deceptive Praise Following Childhood Head Injury

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Children with closed head injury (CHI) have semantic-pragmatic language problems that include difficulty in understanding and producing both literal and nonliteral statements. For example, they are relatively insensitive to some of the social messages in nonstandard communication as well as to words that code distinctions among mental states. This suggests that they may have difficulty with comprehension tasks involving first- and second-order intentionality, such as those involved in understanding irony and deception. We studied how 6- to 15-year-old children, typically developing or with CHI, interpret scenarios involving literal truth, ironic criticism, and deceptive praise. Children with severe CHI had overall poorer mastery of the task. Even mild CHI impaired the ability to understand the intentionality underlying deceptive praise. CHI, especially biologically significant CHI, appears to place children at risk for failure to understand language as externalized thought.

Key Words: closed head injury; irony; deception; nonliteral language; intentionality.

INTRODUCTION

Language conveys meaning in multiple ways, some involving the literal meaning of words and utterances, others requiring the understanding of nonliteral meaning (Sperber & Wilson, 1986). The range of communication is extended by nonliteral meanings, which allow utterances to be enriched by inferential and evaluative information.

Children with closed head injury (CHI) have semantic-pragmatic language problems that include difficulty in understanding and producing both literal and nonliteral statements. Deficits in literal language include problems conveying the flow of information, difficulty understanding ambiguous statements, inability to understand social scripts, and difficulty producing speech acts (Chapman, Culhane, Levin, et al., 1992;
Chapman, Levin, & Lawyer, 1999; Dennis & Barnes, 1990, 2000; Ewing-Cobbs, Fletcher, Landry, & Levin, 1985; Ewing-Cobbs, Levin, Fletcher, & Eisenberg, 1987; Gaidolfo & Vignolo, 1980; Jordan, Ozanne, & Murdoch, 1988, 1990; Levin & Eisenberg, 1979; Winogran, Knights, & Bawden, 1984). Children with CHI also show many difficulties in nonliteral language. They fail to understand idiomatic, figurative language in which what is said is not literally what is meant (Dennis & Barnes, 1990) and have difficulty understanding linguistic humor (Docking, Murdoch, & Jordan, 2000) and intentionality (Dennis, Barnes, Wilkinson, & Humphreys, 1998). Inferences are an important part of both literal and nonliteral language (Gazdar, 1981; Levinson, 1983); children with CHI fail to infer what mental state verbs imply (Dennis et al., 1998) and fail to make inferences that make a story coherent (Barnes & Dennis, 2001).

Biological and age variables moderate the effects of CHI on literal and nonliteral language. Three such variables are severity of CHI, focal frontal lobe injury, and age at CHI. Severe CHI impairs the ability to sustain conversations (Campbell & Dollaghan, 1990), generate narratives (Chapman et al., 1992, 1998; Ewing-Cobbs, Brookshire, Scott, & Fletcher, 1998), solve verbal problems (Levin et al., 1997), produce speech acts (Dennis & Barnes, 2000), understand deceptive intentions (Dennis et al., 1998), make inferences that enhance story coherence (Barnes & Dennis, 2001), and judge communicative adequacy (Dennis, Barnes, Donnelly, Wilkinson, & Humphreys, 1996). Children with frontal lobe contusions (which are common in moderate or severe childhood CHI; Mendelsohn et al., 1992), and children with a younger age at CHI, appear especially impaired on tasks of intentionality and metacognition (Dennis et al., 1996, 1998).

Irony and deception are paradigmatic instances of nonliteral communication. In ironic and deceptive utterances, what is said is not what is meant; in fact, it is usually the opposite of what is meant. Further, the ironist intends that the listener detect the deliberate falseness. That is, the ironic speaker makes an evaluation that violates the context and intends the hearer to recognize the evaluation. Inferencing, inhibitory control, intentionality and metacognition are all required in order to understand irony and deception. Children with CHI have deficits in each of these domains. They have difficulty going beyond the information given (e.g., making an inference); inhibiting the prepotent affective valence (e.g., inhibiting a smile when amused); judging communicative adequacy; and using language to monitor, transform, organize, and interpret mental states, an important skill in distinguishing among mental states and labeling facets of mental worlds (Hall, Scholnick, & Hughes, 1987; Scholnick & Hall, 1991).

Children with CHI are insensitive to some of the social messages in nonstandard communication; further, adults with CHI have pragmatic language deficits (McDonald, 2000; McDonald & Pearce, 1995, 1996, 1998) that include failure to produce and understand irony (McDonald, 1992; McDonald & Pearce, 1996). It is not known how childhood CHI affects the understanding of irony and deception.

Irony is an instance of nonliteral pragmatic communication (Airenti, Bara, & Colombetti, 1993). In irony, there is an incongruity between what is said and what is meant, such that the speaker expresses an evaluation different from what is entailed by the literal meaning of the sentence. Irony varies along several dimensions. It may be intentional (as in ironic criticism) or nonintentional (as in the literary device of dramatic irony); it may directly assert the opposite of what is meant or indirectly imply the opposite of what is meant (Dews et al., 1996). It may be derived from that which is asserted by the subject–predicate relation or based on information presupposed by textual qualities (Haverkate, 1990).

Irony involves a rhetorical context having to do with praise or blame. It does so by praising in order to blame; blaming in order to praise; pretended agreement or
advice; and pretended omission, censure, or attack (Muecke, 1969). Through the use of the rhetorical functions of praise and blame, irony conveys social messages that include formulating a judgment (but muting its evaluative force; Dews & Winner, 1997) or establishing social distance through a negative assessment of the actions of the hearer (Havercate, 1990). The ironic speaker expresses an evaluative attitude, usually a criticism of the hearer or of an action associated with the hearer (Kaufer, 1981; Kreuz & Glucksberg, 1989; Kreuz & Roberts, 1993); more than 90% of ironic utterances involve ironic criticism (Dews, Winner, Nicolaides, & Hunt, 1995).

Irony is typically uttered in a deadpan or mock-sincere intonation (Winner, 1988) that includes heavy stress, slow speaking rate, and nasalization. Children are more likely to interpret ironic utterances as ironic if they are presented with mocking intonation (Capelli, Nagagawa, & Madden, 1990), although both children and adults detect irony without intonation if the context supports an ironic interpretation (Kreuz & Glucksberg, 1989; Sullivan, Winner, & Hopfield, 1995).

Irony is only gradually mastered by young children. Understanding irony requires first-order intentionality about the speaker’s belief, to avoid interpreting irony as a mistake, as well as second-order intentionality about the speaker’s beliefs about the listener’s beliefs, to avoid interpreting irony as a lie (Dews & Winner, 1997). Ironic comprehension emerges in tandem with understanding second-order intentionality (Astington, 1995), a concept which is necessary (although not sufficient) for understanding irony (Andrews, Rosenblatt, Malkus, Gardner, & Winner, 1986).

Deception, which also has a protracted developmental course, involves manipulation of the mental states of others. It is related to the developmental emergence of the concept of false belief (Peskin, 1996; Sullivan et al, 1995; Sodian, 1994), to the ability to construct and manipulate a representation of social interactions (Bara, 1995), to the metarepresentational skill required to hold simultaneous conflicting representations (Peskin, 1989), and to the development of inhibitory control (Carlson, Moses, & Hix, 1998). Studies of school-age children suggest that deception is acquired before irony, so that children turn ironic criticism into white lies (Demorest, Meyer, Phelps, Gardener, & Winer, 1984). In some paradigms, however, deceptive statements are more difficult than ironic statements for neurologically intact children (Bara, 1995; Bara & Buccicarelli, 1998) and for CHI adults (Bara, Tirassa, & Zettin, 1997).

Successful understanding of irony is associated with awareness of the distinction between the different intentions underlying irony and deception. Children do not detect the evaluation in irony unless they also make the distinction between the second-order intentions of the ironist and the liar. That is, they do not recognize that an ironic speaker is conveying a negative appraisal unless they also understand second-order intentions about what the speaker wanted the hearer to believe (Winner & Leekham, 1991). Irony has been understood when the individual can distinguish between the same utterance intended negatively or positively; for example, between “Great job!” intended as ironic criticism when someone has botched the job versus the same utterance intended as deceptive praise.

This article addresses the general question of how 6- to 15-year-old children, typically developing or with CHI, interpret truthful, ironic, or deceptive scenarios. Our two specific aims were concerned with how comprehension varied as a function of scenario (literal, ironic, or deceptive) and head injury severity.

Specific Aim 1: Literal, Ironic, and Deceptive Scenario Effects

We compared relative difficulty for the three scenarios. We predicted that, for both typically developing children and children with CHI, literal truth would be easier than deceptive praise, which would be easier than ironic criticism.
TABLE 1

<table>
<thead>
<tr>
<th></th>
<th>Mild CHI</th>
<th>Severe CHI</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>13</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Age at test (years)</td>
<td>11.6 (2.3)</td>
<td>11.3 (3.0)</td>
<td>11.5 (2.4)</td>
</tr>
<tr>
<td>Sex (F/M)</td>
<td>3/10</td>
<td>6/7</td>
<td>7/9</td>
</tr>
<tr>
<td>Age at injury (years)</td>
<td>7.6 (3.1)</td>
<td>7.3 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Glasgow Coma Scale</td>
<td>14.3 (0.9)</td>
<td>5.8 (2.1)</td>
<td></td>
</tr>
<tr>
<td>Time since injury (years)</td>
<td>4.0 (1.9)</td>
<td>4.0 (2.8)</td>
<td></td>
</tr>
<tr>
<td>Oral vocabulary (%)</td>
<td>37.8 (21.3)</td>
<td>27.7 (19.7)</td>
<td>54.6 (14.6)</td>
</tr>
</tbody>
</table>

Note. Values in tables are means (standard deviations).

Specific Aim 2: Head Injury Severity

We compared children with mild CHI or severe CHI to age-matched controls. We hypothesized that (1) all three groups will be proficient at understanding literal truth, which requires a common core of semantic meaning; (2) compared to controls and children with mild CHI, children with severe CHI will show poorer understanding of nonliteral scenarios (ironic criticism or deceptive praise); (3) compared to controls and children with mild CHI, children with severe CHI will show poorer understanding of second-order than of first-order intentions.

METHODS

Participants

The study included 42 school-age children and adolescents divided into three groups. Participants in the control group were identified from local school systems according to the following criteria: English as a first language, no known learning disabilities or neurological disorders, and typical school performance in the middle two quartiles of the class (i.e., within the average range) in language arts and reading (Barnes & Dennis, 1992).

CHI participants, who had previously sustained a CHI requiring a hospital visit, were divided into two injury severity groups (Mild or Severe) on the basis of nonparalyzed Glasgow Coma Scale (GCS) ratings, length of loss or disruption of consciousness, neurosurgical interventions, and neuroimaging findings. GCS ratings were taken as the lowest assigned GCS score in the ambulance or on admission to the emergency room. Length of loss or disruption of consciousness was recorded in minutes or days. The Mild group had GCS ratings of 13–15, loss of consciousness of less than 15 min, no neurosurgery, and negative neuroimaging findings. The Severe group had GCS ratings of 3–8, with most individuals having positive neuroimaging findings, which included in 9/13 cases clear evidence of bleeds or contusions in the frontal lobe. All CHI participants had either Verbal IQ and/or Performance IQ scores above 70 on a standard test of intelligence (Wechsler, 1974, 1991). Table 1 shows the demographic characteristics of the sample. The CHI groups did not differ in gender composition, age at test, age at injury, or time since injury. By inclusion criteria, the groups differed in GCS ratings \( F(1, 24) = 173.3, p = .000 \). Children with severe CHI had significantly lower oral vocabulary scores (Woodcock & Johnson, 1989) than Controls or Mild or Moderate CHI groups \( F(2, 39) = 7.9, p = .001 \).

Task

The Irony and Deception task measured children’s understanding of first- and second-order intentionality associated with literal truth, ironic criticism, and deceptive praise. Six everyday situations depict a task (tidying a room, baking a cake, raking a leaf pile, building a block tower, erasing a blackboard, and fixing a bicycle) with two participants, a speaker who made a speech act about the task and a hearer who had performed the task. The situations were simple and unambiguous in order to equate children for situational knowledge and to make it possible for children to make inferences if they were capable of so doing (since inferencing is known to depend on the availability of and access to a relevant knowledge base; Barnes, Dennis, & Haefeli-Kalvaitis, 1996; Bjorklund & Bernholtz, 1986; Morrow, Bower, & Greenspan, 1990). The pictured situations were present throughout the questioning in order to reduce
working memory load, since working memory is important in producing speech acts, and speech act errors may occur when the output requires an excess amount of computational resource (Bock, 1982).

**Literal Truth, Ironic Criticism, and Deceptive Praise scenarios.** For each scenario, participants were told the goal of the task (e.g., to tidy a room), shown the outcome of the task (“this is what the room looked like”), and told the speaker’s character (“he liked to bug and annoy people”) and statement directed by the speaker to the hearer (he said, “You did a great job tidying your room”). The statements were recorded by two actors with exaggerated but appropriate intonation in an audiotape that accompanied the pictured scenario.

Each of the six situations was presented as involving literal truth, ironic criticism, or deceptive praise. In the **Literal Truth** scenario, the speaker was characterized in a neutral manner (“He/she liked to chat and talk to people”) and the valence of his/her statement matched the completed task (which was well performed in three instances and poorly performed in the other three). In the **Ironic Criticism** scenario, the speaker was characterized as someone likely to be sarcastic (“He/she liked to bug and annoy people”) and his/her statement was positive but with a sarcastic intonation about the poorly performed task. In the **Deceptive Praise** scenario, the speaker was characterized as someone likely to be empathic (“He/she liked to cheer people up”) and his/her statement was positive with an empathic intonation about the poorly performed task.

Each scenario was presented in each condition so that each subject received 18 trials. Seven questions were asked for each trial. These concerned comprehension of the pictured situation, the speaker’s literal statement, what the speaker believed about the job (first-order question), what the speaker believed about the hearer (first-order question), what the speaker wanted the hearer to believe about the task (second-order question), what the speaker wanted the hearer to believe about himself/herself (second-order question), and memory for the speaker’s literal statement at the end of each trial. We measured situation comprehension and literal comprehension at the beginning and end of each item to provide an internal control over the understanding of the literal aspects of comprehension for each item. We asked two first-order and two second-order intentionality questions to increase the number of responses. The child’s spontaneous intonation in producing what the speaker said was recorded for each item.

**Example of Literal Truth scenario.** While looking at Fig. 1, the child heard the following vignette and was asked the following questions:

Sally decided to tidy her room. When she was finished, the room looked really tidy, just like this. Ben looked at the room. He liked to chat and talk to people. He said [neutral intonation], “You did a terrific job tidying up!”

Situation Comprehension: What was Sally’s room like?
Literal Comprehension: What did Ben say?
First-Order (task): What did Ben think about the room?
Example of Ironic Criticism scenario. While looking at Fig. 2, the child heard the following vignette and was asked the following questions:

Betty decided to bake a cake. When she was finished, the cake looked awful, just like this. Jim looked at the cake. He liked to bug and annoy people. He said [sarcastic intonation], "You made a terrific cake!"

Situation Comprehension: What was Betty’s cake like?
Literal Comprehension: What did Jim say?
First-Order (task): What did Jim think about the cake?
First-Order (person): What did Jim think about Betty?
Second-Order (task): What did Jim want Betty to think about the cake?
Second-Order (person): What did Jim want Betty to think about herself?
Literal Recall: What was it that Jim said?

Example of Deceptive Praise scenario. While looking at Fig. 3, the child heard the following vignette and was asked the following questions:

Paul decided to build a block tower. He couldn't get the blocks to stay together, and it looked just like this. Mary looked at the tower. She liked to cheer people up. She said [empathic intonation], "You made a great tower!"

Situation Comprehension: What was Paul’s tower like?
Literal Comprehension: What did Mary say?
First-Order (task): What did Mary think about the tower?
First-Order (person): What did Mary think about Paul?
Second-Order (task): What did Mary want Paul to think about the tower?
Second-Order (person): What did Mary want Paul to think about himself?
Literal Recall: What was it that Mary said?

Scoring

Situation comprehension. Situation comprehension was the sum of the scores for all situation questions.

Literal comprehension. Literal comprehension score was the sum of the scores for all literal questions.
Each of the following two first-order and two second-order intentionality questions was scored as either correct or incorrect. A correct response (scored as 1; e.g., She doesn’t know how to make a cake) was relevant and clearly articulated the positive or negative valence of the speaker. An incorrect response (scored as 0) articulated an incorrect valence or, less commonly, produced an irrelevant response.

First-order (task) comprehension. First-order (task) comprehension was the sum of the scores for the first-order intentionality questions about the task.

First-order (person) comprehension. First-order (person) comprehension was the sum of the scores for the first-order intentionality questions about the person.

Second-order (task) comprehension. Second-order (task) comprehension was the sum of the scores for the second-order intentionality questions about the task.

Second-order (person) comprehension. Second-order (person) comprehension was the sum of the scores for the second-order intentionality questions about the person.

Literal recall. Literal recall score was the sum of the scores for all literal recall questions.

Intonation. The number of times the children spontaneously produced appropriate or inappropriate intonation during the literal comprehension and literal recall questions was counted. A total intonation score was obtained by summing across both appropriate and inappropriate intonation and across speech act types.

Measures and Data Analyses

Mastery scores. The mastery score for each scenario involved a score of 1 for each story in which a child produced a correct response on all four first- and second-order questions. The rationale for this score is that, while children may produce correct responses to individual questions, overall mastery of the task requires that each first- or second-order question be answered correctly for each of the six situations.

Intentionality scenario. Intentionality questions were grouped to form a first-order score and a second-order score for each scenario. The four individual questions (first-order task, first-order person, second-order task, and second-order question) were also analyzed separately for each scenario.

Statistical analyses. Mastery scores were analyzed in a 3 (Group) × 3 (Scenario) ANCOVA. Test age was significantly correlated with each measure so it was used as a covariate. Situation comprehension, literal comprehension, intonation, and literal (recall) scores were analyzed separately using one-way ANCOVAs. First- and second-order questions were analyzed using a 3 (Group) × 3 (Scenario) × 2 (Question Order) mixed model. Each first- and second-order question was analyzed separately in a 3 (Group) × 3 (Scenario) ANCOVA. The Least-Significant Differences (LSD) test was used for post hoc analyses of interactions. To evaluate the contribution of general language skill, a simple linear regression model was fitted to test scores, using oral vocabulary as the regressor (Table 2).
TABLE 2

<table>
<thead>
<tr>
<th></th>
<th>Mild CHI</th>
<th>Severe CHI</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation Comprehension (18)</td>
<td>18.0(0.0)</td>
<td>17.8(0.6)</td>
<td>18.0(0.0)</td>
</tr>
<tr>
<td>Literal Comprehension (18)</td>
<td>18.0(0.0)</td>
<td>18.0(0.0)</td>
<td>18.0(0.0)</td>
</tr>
<tr>
<td>Literal Truth Mastery Score (6)</td>
<td>5.5(0.9)</td>
<td>4.3(1.8)</td>
<td>5.3(0.8)</td>
</tr>
<tr>
<td>Literal Truth (First-order) (12)</td>
<td>11.9(0.3)</td>
<td>11.3(1.3)</td>
<td>11.9(0.3)</td>
</tr>
<tr>
<td>Literal Truth (Second-order) (12)</td>
<td>11.4(1.7)</td>
<td>10.0(2.3)</td>
<td>11.3(0.9)</td>
</tr>
<tr>
<td>Ironic Criticism Mastery Score (6)</td>
<td>4.2(2.4)</td>
<td>3.1(2.9)</td>
<td>3.8(2.7)</td>
</tr>
<tr>
<td>Ironic Criticism (First-order) (12)</td>
<td>11.6(1.1)</td>
<td>9.8(3.0)</td>
<td>11.9(0.3)</td>
</tr>
<tr>
<td>Ironic Criticism (Second-order) (12)</td>
<td>9.0(4.4)</td>
<td>7.8(4.5)</td>
<td>7.6(5.3)</td>
</tr>
<tr>
<td>Deceptive Praise Mastery Score (6)</td>
<td>2.3(2.5)</td>
<td>1.2(2.2)</td>
<td>4.4(1.7)</td>
</tr>
<tr>
<td>Deceptive Praise (First-order) (12)</td>
<td>8.4(4.6)</td>
<td>8.5(4.0)</td>
<td>11.3(1.1)</td>
</tr>
<tr>
<td>Deceptive Praise (Second-order) (12)</td>
<td>8.5(4.8)</td>
<td>6.7(4.2)</td>
<td>10.6(2.4)</td>
</tr>
<tr>
<td>Literal Recall (18)</td>
<td>17.9(0.3)</td>
<td>16.9(1.4)</td>
<td>17.6(0.8)</td>
</tr>
<tr>
<td>Intonation (Appropriate) (36)</td>
<td>10.4(9.1)</td>
<td>12.2(8.1)</td>
<td>7.8(11.4)</td>
</tr>
<tr>
<td>Intonation (Inappropriate) (36)</td>
<td>0.5(1.1)</td>
<td>1.5(2.2)</td>
<td>0.4(1.5)</td>
</tr>
</tbody>
</table>

Note. Values in tables are means(standard deviations). Maximum score is in parentheses after variable name.

RESULTS

Situation Comprehension

Groups did not differ in situation comprehension (whether the room was messy, whether the bicycle had been fixed, and so on).

Literal Comprehension

Groups did not differ in literal comprehension of the speaker’s utterance, with all groups obtaining perfect or near perfect scores.

Intonation

Groups did not differ in spontaneous production of appropriate, inappropriate, or total intonation.

Literal Recall

Groups differed in literal recall of the statements \([F(2, 39) = 3.6, p = .035]\), with the Severe group recalling the original utterance less accurately at the end of the intentionality questions than the Mild group.

Group Mastery Score

Analysis of mastery scores for each scenario revealed main effects of group \([F(2, 38)= 6.6, p = .003]\) and test age \([F(1, 38) = 10.1, p = .003]\). The Severe CHI group performed more poorly than either the Control or Mild CHI groups. The group effect was qualified by an interaction trend with scenario \([F(4, 76) = 2.4, p = .056]\). Post hoc analyses indicated that children with mild or severe CHI performed more poorly than the Control group on Deceptive Praise (but not Literal Truth or Ironic Criticism).
Group, Scenario, and Intentionality Question Analyses

The overall ANCOVA revealed main effects of group \(F(2, 38) = 7.1, p = .002\), first/second-order question \(F(1, 38) = 8.1, p = .007\), and test age \(F(1, 38) = 9.6, p = .004\). The main effects of first/second-order question and test age were qualified by a significant interaction \(F(1, 38) = 4.2, p = .047\), indicating that older children performed better than younger children, but only on second-order questions. The main effect of group was qualified by a significant interaction with scenario \(F(4, 76) = 2.8, p = .033\). While children with severe CHI performed more poorly than the Mild or Control groups, post hoc analyses revealed that the groups did not differ in Literal Truth or Ironic Criticism scores, but that Mild and Severe CHI groups performed more poorly than the Control group on Deceptive Praise.

Individual First- and Second-Order Intentionality Questions

No significant effects were found for the first-order question about the situation. Group effects were found for the first-order question about the person \(F(2, 38) = 4.8, p = .013\). Post hoc analyses revealed that the Severe group performed more poorly than the Control group. The main effect of group for the first-order person question was qualified by an interaction with scenario \(F(4, 76) = 3.3, p = .017\). Post hoc analyses of this interaction indicated that there were no group differences in the Literal Truth condition for this question, but for Ironic Criticism, the Severe group performed significantly worse than the Control and Mild groups, and for the Deceptive Praise, both Mild and Severe groups scored significantly lower than the Controls. Main effects of test age were found for the two second-order questions (situation question: \(F(1, 38) = 7.2, p = .011\); person question: \(F(1, 38) = 15.2, p = .001\), indicating that older children were more successful on these questions than younger children.

Regression of Oral Vocabulary on Literal Truth, Ironic Criticism, and Deceptive Praise

To determine whether results are a function of the lower general language skill in children with CHI, especially those with Severe CHI, oral vocabulary scores were regressed on the test scores. Oral vocabulary did not predict Literal Truth, Ironic Criticism, or Deceptive Praise for any group.

DISCUSSION

Children with chronic-stage CHI had more difficulty than their chronological age peers in understanding scenarios involving intentionality. Despite being able to perform the task (understanding the situation and what the characters were saying), they were less adept than age peers in answering questions about the beliefs and intentions of the speaker who uttered a nonliteral statement in which what was said was not what was meant. The data bear on two issues: the relation between literal and nonliteral language comprehension in typically developing children and adults and in children with CHI and the role of CHI severity in nonliteral language deficits that involve a failure of intentionality.

Whether literal language is processed differently from nonliteral language is still a matter of some debate (see Clark & Gerrig, 1984; Glucksberg & Brown, 1995; Jorgensen, Miller, & Sperber, 1984; Kumon-Nakamura; Sperber & Wilson, 1981). Earlier studies suggested that irony takes no more time to process than literal meaning.
(for example, sarcastic indirect requests such as *Why don’t you take your time washing the dishes?*) require less processing time than do literal statements; (Gibbs, 1986), suggesting that speaker meaning might be accessed without full processing of the literal meaning and its incongruity (e.g., Gibbs, 1986; Long & Graesser, 1988). Against this view are a number of recent studies. Adults take longer to understand an ironic as opposed to a metaphorical meaning of a target statement (e.g., *children are precious gems*) where comprehension has been biased as either metaphoric (*children are valuable*) or ironic (*children are a burden*) (Pexman, Ferretti, & Katz, 2000). The literal meaning of an ironic utterance is activated during comprehension and slows processing of the key ironic portion of the utterance as well as the literal part of the utterance that follows; these data are consistent with the idea that the muting effect of irony occurs because literal meaning is at least partially processed (Schwoebel, Dews, Winner, & Srinivas, 2000). Both literal and nonliteral meaning seem to be obligatorily processed (Dews & Winner, 1999), and retention of the literal meaning of irony, usually the most salient meaning for that utterance (Giora, 1997), may provide the evaluative force of the ironic utterance.

Our data bear indirectly on this issue. Nonliteral language scenarios were more difficult to understand than a literal scenario of exactly the same form, and difficulties with nonliteral language in children with CHI did not reduce to literal language deficits in either oral vocabulary or literal comprehension. That impairments in comprehension of intentionality occurred even when literal comprehension was equal across groups is consistent with other data on children with CHI, showing, for example, that vocabulary level does not account for the inability to understand idioms (Dennis & Barnes, 1990) and that comprehension of literal, but not inferential, aspects of stories may be intact (Barnes & Dennis, 2001).

Even mild and chronic CHI was associated with poor comprehension. Although there were no differences between the groups for Literal Truth and Ironic Criticism total scores, the Mild CHI group performed more poorly than the Control group on Deceptive Praise. In addition, the Mild CHI group was less able than Controls to answer questions about what the speaker intended the hearer to think about him/herself (i.e., the evaluative attitude the speaker intended to convey). The finding of poor performance relative to controls for children with mild CHI is consistent with data showing that mild CHI does not produce clinical language deficits or impairments of core aspects of production and comprehension, but may be associated with some long-term language and discourse deficits, such as problems in producing speech acts (Dennis & Barnes, 2000).

Severe CHI was associated with more comprehension deficits than mild CHI. Children with severe CHI were poorer on the overall mastery of Deceptive Praise and were unable to answer questions about first-order intentionality toward the person for either Ironic Criticism or Deceptive Praise. Failure to understand first-order questions suggests a fairly basic comprehension failure. Although the Severe group had poor oral vocabulary skills, the results are not due to general language problems: oral vocabulary was unrelated to test performance for the Severe group, who were also able to understand Literal Truth scenarios as well as Controls. It is unclear why the Severe group made more errors in recalling the original utterances. They may have poorer long-term memory for literal text; alternatively, processing the series of comprehension questions may have changed the contents of their original representation of the scenarios.

The impairments of the Severe group add to the information showing that biologically significant childhood CHI is associated with difficulties in discourse-level skills for both literal and nonliteral language. The difference between the Severe and Mild groups is consistent with the literature on language deficits after childhood CHI in
showing that biological features of CHI, such as injury severity, moderate the level of language impairment.

Frontal brain regions have been implicated in tasks requiring awareness of mental states, beliefs, and intentions (Baron-Cohen et al., 1994; Goel, Grafman, Sadato, & Hallett, 1995). Within the frontal brain regions, the orbito-frontal lobe has been associated with poor performance on theory of mind tasks, whereas dorsolateral frontal-lobe-damaged patients show problems with working memory (Stone, Baron-Cohen, & Knight, 1998). Some 70% of our severe cases had frontal lobe injury on CT scans, and it is not clear that the others did not also have frontal lobe injury that might have been demonstrable on more recent imaging modalities such as MRI. Our data are broadly consistent with other evidence for the role of the frontal lobes in the production and comprehension of nonliteral communication; however, because our injuries were coded on the basis of neuroimaging reports, no quantitative, regional, or morphometric analyses were performed. Studies with morphometric and functional MRI that correlate cognitive CHI outcome with frontal lobe injury, such as those by Levin et al. (1997), are needed to delineate the biological parameters of these nonliteral language deficits.

Ironic criticism was heavily marked in our paradigm (by information about the speaker’s character, by a side smirk in the picture of the speaker, by sarcastic intonation in the recorded speaker utterance) and was facilitated by the presence of the pictured state of affairs and by the fact that the intonation cues matched the situation if not the utterance. Perhaps more important, our paradigm provided a biasing context. Normal adults use the personal characteristics of the speaker to bias their interpretation of a statement as either metaphoric or ironic (Pexman et al., 2000). The biasing context (being told that the ironist is a person who likes to bug and annoy people) might have helped children with severe CHI to understand the affective valence of ironic criticism. Whether these children would understand irony without a strong biasing context remains to be studied. In any event, the present data indicate that children with severe CHI do not truly understand irony because they fail to distinguish between the same utterance intended ironically and deceptively.

Intonation seems to have a general, rather than a specific, effect on irony comprehension. It enhances irony comprehension (Cappelli et al., 1990), although it does not help to distinguish the negative attitude conveyed by irony from the positive attitude conveyed by a white lie (Winner & Leekham, 1991). Our groups did not differ in terms of their spontaneous production of either appropriate or inappropriate intonation in restating the statement of the speakers in the three conditions; but, to be sure, the fact that children did not differ in their ability to repeat intonation is not directly relevant to whether intonation served as a comprehension cue.

Irony comprehension involves both the speaker’s intended meaning and the recognition of the discrepancy between the words and the meaning (Dews & Winner, 1997). For example, one way that irony differs from literal language is in the products of comprehension (Gibbs & Gerrig, 1989), including the fact that the speaker meaning is muted or seen as funny. We tested only the speaker’s intended meaning; the fact that children with severe CHI were unable to understand the intended effect on the person hearing the ironic statement suggests that they may fail to understand the second aspect of irony.

Other facets of irony comprehension warrant study in children with severe CHI. Individuals speak ironically to express their own understanding of a statement as being ironic, which is part of everyday language usage (Gibbs, 1984; Gibbs, O’Brien, & Doolittle, 1995). Further, different forms of irony involve different emotional reactions; for example, some forms of irony serve to reveal the speaker’s emotions rather than to affect the hearer’s emotions (Leggitt & Gibbs, 2000).
Chronological age was an important determinant of success in comprehension of nonliteral language. For both children with CHI and typically developing children of school age, increased age improved understanding of second-order intentionality for literal truth, ironic criticism, and deceptive praise. This adds to the data that recursive intentionality has a protracted developmental course (e.g., Andrews et al., 1986).

Children with CHI, whether mild or severe, had difficulty understanding deceptive praise, which suggests that they take deception as literal truth. In young, typically developing children, inability to understand deception is related to problems in cognitive inhibition (Carlson et al., 1998). It would be of interest to study whether comprehension of deceptive praise is related to cognitive inhibition in young children and children with CHI, for whom there is independent evidence for cognitive inhibitory impairments (e.g., Dennis et al., 1998).

For young children and children with CHI of either level of severity, deceptive praise was more difficult than ironic criticism or literal truth. Children only gradually understand the intentionality of lying (Peterson, 1991; Feldman & Philippot, 1991). In deceptive praise, the false statement is intended to be taken literally by the story character; to show understanding, however, the subject in the experiment is supposed to recognize the deception. That is, the speaker believes that the performance is poor, but the speaker wants the hearer to feel positive. Our deceptive praise statements are discrepant from the belief of the speaker, but are congruent with the speaker’s intention. It may be that understanding of the kind of deceptive statements used here has a more protracted developmental course than does understanding false statements that are intended to mislead (see Demorest et al., 1984).

Why might children have more difficulty with deceptive praise than with ironic criticism? Irony is the intentional expression of insincerity and, as such, violates pragmatic conventions of quality (sincerity) and politeness (irony appears to be polite on the surface level, but the underlying message is impolite). The deceptive praise violates a nontransparent maxim of sincerity. For ironic criticism, the valence of the intention is congruent with the state of the task, so, in one sense, the speaker is expressing an intention that is congruent with the facts, if not saying what he or she means. For deceptive praise, the valence of the intention is incongruent with the state of the task, and so the speaker is expressing an intention that is incongruent with the facts while also not saying what he or she means. This incongruity may contribute to the greater difficulty with deceptive praise, at least as it is measured in the present paradigm.

Our measures of both ironic criticism and deceptive praise were accuracy measures. In on-line comprehension, first- and second-order intentionality must be identified promptly. In future studies, it will be important to measure comprehension speed as well as comprehension accuracy.

Nonstandard forms of communication, such as ironic criticism and deceptive praise, fulfill communication goals that are difficult to express literally (Kreuz, Long, & Church, 1991). To the extent that children with CHI have limited communicative competence, some communicative goals may escape them, such as the indirect communication of affect (Dews et al., 1996).

Finally, the data underscore the difficulties of children with CHI in understanding intentions. Intentionality is central to language as a vehicle for externalizing thoughts; in new theoretical accounts of meaning, such as Default Semantics, intentions are primary features of semantic interpretations and contribute fundamentally to how propositional representations are formed (Jaszczolt, 1999). CHI, especially biologically significant CHI, appears to place children at risk for failure to understand language as externalized thought.
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