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Response to text-based social cues in the formation of causal attributions in adults with traumatic brain injury

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Abstract

Background.—Adults with traumatic brain injury (TBI) may have deficits recognizing spoken social cues, with major negative social consequences. We do not know if these deficits extend to written social cues. Written cues, such as letterhead, provide information we use to make critical inferences about an author's perspective, and interpret subsequent text considering that perspective, and thus are critical for social communication. This study examined response to written social cues in adults with and without TBI.

Methods and procedures.—We asked adults with TBI ($n=38$) and uninjured adults ($n=20$) to read an article describing actions of a mass murderer and give reasons for the those actions. Materials were presented on letterhead from either a social or a personality institute, to bias responses to either situational or dispositional factors. We hypothesised persons with TBI would be less likely to show bias consistent with the letterhead.

Main outcomes and results.—Significantly more comparison-group responses (72%) than TBI-group responses (52%) were biased ($p=0.01$) to match the institute in the letterhead.

Conclusions.—Results indicated reduced sensitivity to written social cues in adults with TBI. Our findings add to evidence of impaired social cue response after TBI, and extend this to written text.

Keywords

Social Perception; Social Conformity; Brain Injury; Traumatic; Reading; Social Communication Disorder

Introduction:

Adults with TBI commonly struggle with everyday social communication [1]. Social communication deficits have a more pervasive impact on daily living in persons with chronic

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Declaration of interest

The authors have no conflicts of interest to report.

TBI than physical deficits [1] and have been described as devastating to employability and social outcomes [2]. Social communication problems in persons with TBI have been linked to negative outcomes such as smaller social circles, fewer social outlets than before injury, and decreased community participation including employment difficulties [3,4,5].

Social communication deficits after TBI have been attributed to cognitive impairments broadly, and social cognition impairments in particular [6]. Social cognition is a higher-order construct built upon lower-order processes including social cue perception and evaluation, and behavioural regulation [7,8]. Social cue perception is essential to interpretation of thoughts and motivations of others, and thus is instrumental for social communication competence. Social cue perception deficits reported in adults with TBI include impairments recognizing facial affect [9,10], and prosody and vocal affect [11,12]. Social cue misperception can adversely affect social inferencing skills, which often are impaired in persons with TBI [12,13], and are related to the social communication deficits that pervasively contribute to social participation restrictions after TBI [2].

Social cue perception and inference are essential components of comprehending written text. Readers use written social cues to infer authors' motivations and perspectives, which in turn influence interpretation of subsequent text [14,15]. Written social inferences are made using local social cues (e.g., headings, titles, word choice) [16], as well as distal social cues, allowing readers to generate inferences about the texts' origins (e.g., where it was published or who wrote it). Such social cues, including cues to the text's origin, support comprehension by providing context and coherence [17]. Both face-to-face and written social cue perception and inference are automatic (without conscious awareness) enabling us to bind new information to previous information efficiently without disrupting the reading process [18]. These implicit processes facilitate comprehension in routine activities of daily living. Persons with TBI have demonstrated problems with detecting written cues for social immediacy at the sentence level as well when compared to healthy comparison groups [19] as well as difficulty with inference generation at the clause level [20].

A reader with poor sensitivity to global textual social cues can result interpreting material without the proper social assumptions (e.g., knowledge of the author or origins of the text) to assist with supporting accurate inference of the information bound in the text itself. Written social cues are ubiquitous in everyday life, from medical forms to digital media, and accurate inference from written information is important for everyday life. Medical forms, for instance, require the reader to understand what medical specialist the form will be going to. A neurologist might not require a long description of ankle sprains and other potentially irrelevant orthopedic information. Alternatively, digital social media can be politicized and understanding the nature of the publisher or author might provide necessary context from which to make an accurate inference.

Persons with TBI may have difficulty understanding written text due to impairments such as slowed processing and poor working memory and verbal reasoning [21,22,23]. To determine if impaired social cue perception was a factor as well, we investigated responses to written social cues using a paradigm designed by Norenzayan and Schwarz ²⁴ Norenzayan and Schwarz ²⁴ asked participants to give reasons why mass murderers committed their crimes.

They printed information on letterhead from an Institute of either Social or Personality Research. These two conditions served to provide bias to the questionnaire respondent, as it is intended to provide a social context for the recipient of the questionnaire. Results showed that participants' attributions conformed to the letterhead they saw, providing situational rationale for questionnaires intended for The Institute for Social Research, and dispositional reasons for The Institute for Personality Research. This attribution bias was interpreted to reflect implicit processing of social cues in text. We hypothesised that adults with TBI would not respond to the letterhead cues, whereas responses of uninjured peers would replicate results from the original study.

Methods

Participants

We recruited 49 adults with moderate-severe TBI through websites for persons with TBI and state-related TBI support agencies. Participants with TBI were required to be at least 12 months post onset, to capture performance in the chronic stage post-injury, and able to independently complete the task, by self-report. Level of severity was measured using self-reported length of loss of consciousness and Glasgow coma scores when available, collected via phone interview with either the participant or his or her caregiver. Adults with a self-reported history of psychosis were excluded, as were adults with self-reported uncorrected visual impairments. We recruited 20 uninjured adults through community sources as a comparison group. Participant characteristics are described in Table 1.

Materials

Two articles were selected from newspaper profiles of alleged mass murderers [25,26]. One article profiled Seung-Hui Cho, defendant in a shooting at Virginia Tech [26]; and the other profiled Timothy McVeigh, convicted of the Oklahoma City bombing in 1995 [26]. We chose two articles and assigned them randomly, to mitigate against any stimulus effects on conditions. Norenzayan and Schwarz²⁴ used crime reports because they are more likely to elicit spontaneous attributions about causal factors [27]. Articles were adapted to read at an 8th grade reading level (using Flesch-Kincaid grade-level readability scores) and edited to have similar word-counts (McVeigh = 396; Cho = 452). Each article and questionnaire were presented on one of two letterheads: The Institute of Personality Research or The Institute of Social Research. Article and letterhead conditions were randomly assigned to participants, and participants were asked to list five reasons the person in the article might have committed the crime.

Procedure

Procedures were in accordance with Helsinki Declaration and approved by the Institutional Review Board of the University of Wisconsin -- Madison. Participants were mailed the following materials: a) consent form and instructions checklist, b) an article, c) a questionnaire, and d) a return envelope. Upon return of questionnaires, we called participants to obtain demographic and injury information. Participants were reimbursed with a five-dollar money order for completing the study.

Coding

We categorized responses as one of two types, situational or dispositional, based on a coding scheme from Miller²⁸, Morris and Peng²⁷, and Norenzayan and Schwarz²⁴ (see addendum). Situational responses were answers that implicated an *external* influence to the profiled person, tied to a particular time, place, or situation (e.g., 'Some paranoia appears after Army', 'Possible sexual abuse as a child'). Dispositional responses referred to forces internal to the person, including psychological states (e.g., 'He wrote disturbing plays and decided to carry out his fantasies', 'He had a very difficult time relating to other people "feeling alienated"').

The lead author coded all participant responses and a trained graduate student re-coded 24% of responses for reliability. The graduate student viewed only typed versions of responses, to remove any potential penmanship cues to group membership due to motor impairments in the TBI group. This scorer was blinded to group, article, and letterhead conditions.

Dependent Measures

We calculated two dependent variables: the percent of responses corresponding with the letterhead, and a weighted score derived by Norenzayan and Schwarz²⁴ that combined the number of corresponding responses and response order. For the weighted score, the first corresponding response received a score of five, the second a score of four, and so on to a score of one for the fifth response. No points were provided for responses that did not correspond to the letterhead condition. Therefore, there was a maximum score of 15 when all responses corresponded with the letterhead and a score of zero if no responses corresponded to the letterhead. Norenzayan and Schwarz²⁴ used this weighted score to capture the relative influence of the biasing stimulus on responses, with the rationale that responses given closer in time after observing the letterhead were most influenced by that letterhead, with each successive response being progressively less influenced due to the diminishing memory trace of the letterhead. They hypothesised that the weighted score would be a more sensitive indicator of response bias.

Analysis

Data were analysed using a 2 (group) x 2 (letterhead) x 2 (article) between-groups analysis of variance (ANOVA) for each dependent variable. We hypothesised a main effect of group and no effect of letterhead or article or interaction of group with letterhead or article. We also hypothesised that effect sizes would be larger for the weighted score than the percent corresponding score, consistent with the claim by Norenzayan and Schwarz²⁴ that the latter was a more sensitive indicator of bias.

Results

We excluded responses from 11 participants with TBI. Seven of these participants reported caregiver assistance, potentially influencing their responses. Two participants' responses were illegible, and data from two participants were excluded because the participant disclosed at follow-up that they were less than 12 months post onset. Thus, the final data set

included 38 questionnaire responses from participants with TBI and 20 from the comparison group.

There was no significant between-groups difference in age in years, $t(42) = 2.02$, $p = 0.86$; or years of education, $t(36) = 2.02$, $p = 0.14$. Institute of Social Research letterhead was returned by 25 participants and Institute of Personality Research was returned by 33 participants. Twenty-six participants read the Seung-Hui Cho article and 23 participants read the Timothy McVeigh article.

Inter-rater reliability for response coding was 92.1%. All disagreements were resolved by discussion.

There was no significant main effect of article or letterhead on percent or weighted measures, so data from both articles and letterheads were combined. There was a significant main effect of group on percent of corresponding responses, $F(1,1) = 6.87$, $p = 0.01$. As indicated in Figure 1a, the comparison group provided more responses conforming to letterhead conditions ($M = 0.72$, $SD = 0.25$) than did persons with TBI ($M = 0.52$, $SD = 0.31$), who gave responses conforming to letterhead conditions at chance accuracy. There also was a significant main effect of group on the weighted score, $F(1,1) = 8.89$, $p = 0.005$. As hypothesised, the effect size was larger for the weighted score than the percent corresponding score (partial Eta squared = 0.162 vs. 0.130). As indicated in figure 1b, the comparison group not only provided more responses conforming to the letterhead condition but also listed conforming responses earlier in their answers (control group $M = 10.35$, $SD = 3.12$ vs. TBI group $M = 7.32$, $SD = 4.42$). Overall, participants provided more dispositional responses ($M = 0.64$, $sd = 0.29$) than situational responses ($M = 0.53$, $sd = 0.31$), but this difference was not significant for the percent measure, $F(1,1) = 1.436$, $p = 0.24$; or the weighted measure, $F(1,1) = 1.314$, $p = 0.26$, $d = 0.331$.

As this mail-based study did not allow testing of participants' vision, a potential confounding factor, we contacted all participants with TBI and asked if they currently reported any uncorrected vision problems, including field cuts, neglect, or double vision. Ten of 38 participants reported visuospatial deficits 'not fixed by the use of corrective lenses'. Independent t-tests comparing participants with vs. without self-reported 'unfixed' vision impairments revealed no significant difference in percent measures; $t(36) = -0.468$, $p = 0.65$; or weighted measures, $t(36) = 0.01$, $p = 0.99$.

Discussion

We make inferences about the information we read by using information drawn from the text and inferences about the origins and/or purpose of the text. Social cue perception and interpretation are important components of this inference generation. Our findings indicate that people with TBI respond differently to biasing social cues embedded in writing than controls. Typical adults biased their responses to fit the letterhead on which questions were written, replicating the earlier experiment by Norenzayan and Schwarz²⁴, whereas adults with TBI did not.

Adults in the study by Norenzayan and Schwarz²⁴ provided dispositional responses more frequently than situational responses. The authors attributed this finding to a fundamental attribution error; that is, the tendency to explain behaviour as being motivated internally while underestimating social influencers of behaviour. Although our participants followed the same pattern, the difference was not statistically significant. This might be due to the fact that Norenzayan and Schwarz²⁴ had a larger sample size ($n=60$) than our study. The effect size for this trend ($d=0.331$) demonstrated a small effect, further supporting that a larger-sized sample might be required to show this.

Our findings provide support for an overall deficit in social cue misperception in persons with TBI. The study was not designed to identify perceptual and cognitive mechanisms underlying these impairments, about which there continues to be much debate [29], and this is an important next step.

Limitations

Neuropsychological measures of reading, attention, or visuospatial skills were unavailable, as this study was completed via mail. Neuropsychological data would help to identify mechanisms underlying performance differences, as would methods such as eye-tracking, which would show if participants scanned the letterhead portion of the page. Also, both groups were culturally homogeneous, and the cues studied here might be more or less salient to readers from other cultures. Even with these limitations, however, it was noteworthy that for reading materials that echoed what one might encounter in everyday life (sensational news stories, 8th grade reading level); adults with TBI were significantly less responsive to cues than their uninjured peers.

Conclusion:

Persons with TBI responded differently to social cues embedded in written text than did persons without TBI. These findings may have implications for interpretation of routine written materials used by persons with TBI, including interpretation of newsprint and online media, as well as medical and other forms of written instruction in which inference errors may have critical consequences. Studies of spoken communication have shown that adults with TBI do not shape their responses to 'meet the needs of the listener', in part because of failure to respond to social cues [30]. Our results suggest that this may extend to written communication as well.

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Addendum

Addendum. Coding Schema for Situational versus Dispositional Responses

Situational	Attributional
Any response that indicates the subject acted under forces that were external to himself	Any response that the subject acted under his own motivations
Behaviour and activities are related to a social role	Behaviour and activities are related to attitude or general disposition
Behaviour related to attitude is molded by the environment	Behaviour is related to personal practices, habits or hobbies
The situation, environment and conditions surrounding the subject were a product of influences outside of himself	The situation, environment and conditions surrounding the subject were of his own making
The action was related to poor timing	The subject planned and organized the timing of events
Certain social groups led the subject to have murderous motivations	Internal motivations led the subject to participate in or sympathize with certain social groups
External events influenced a frenzied, paranoid or otherwise antisocial state	Subject drove himself to a frenzied, paranoid or otherwise antisocial state
Conditions incited a mental illness	Poor reasoning, not mental illness led to actions
People failed to help the subject or subject was unable to connect with people	The subject rebuffed offers to help, never reached out for help or saw need to seek help
Sociodemographic conditions were a factor	Individual ignored pull of upbringing or environment
Cultural or domestic forces were a factor	Individual acted autonomously from established cultural or domestic upbringing
Views were indoctrinated by extremist associations	Views and beliefs were present and no explanation given for their presence
Mental illness caused actions	Free will caused actions

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Figure 1.
Responses to biasing letterhead conditions

Table 1.

Participant Characteristics

	Control Participants	Participants with TBI
Number	20	38
Male	10	15
Female	10	23
Age	M = 43.75 sd = 14.16	M = 42.99 sd = 14.99
Education	M = 15.79 sd = 2.27	M = 14.84 sd = 1.24
Years post Onset		M = 14.80 sd = 13.64
TBI Severity		Severe = 25 Moderate = 8 Mild = 5