Information exchange in chatroom conversations of people with and without traumatic brain injury (TBI)

Abstract

This study describes how people with and without traumatic brain injury (TBI) exchange information in small chatroom groups. Each of the ten participants with moderate-severe TBI and twelve control participants conversed with two unknown communication partners in a moderated chatroom on two occasions. Rates of information exchange were measured. Statistically significant differences were found in the: (1) frequency of information requests made by TBI participants and (2) frequency of information giving and negotiation/repair by communication partners of TBI participants (both reduced in the TBI group). Further research is required to validate results and explore the impact of alternate chatroom compositions.

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Introduction

There is growing research demonstrating benefits for people with traumatic brain injury (TBI) in using the computer and Internet for cognitive retraining/support (Ehlhardt, Sohlberg, Glang, & Albin, 2005 ; Kirsch et al., 2004; Sohlberg, Ehlhardt, Fickas, & Sutcliffe, 2003) and increasing social connectivity (Fraas & Balz, 2008 ; Todis, Sohlberg, Fickas, & Hood, 2005; Vaccaro, Hart, Whyte, & Buchhofer, 2007). Chatrooms are one type of electronic communication forum that enables social connectivity for people from different geographic locations(Greenfield & Subrahmanyam, 2003; Magnan, 2008; Neuage, 2002). Chatrooms offer opportunities to conceal location and personal identity/disability (Bowker & Tuffin, 2003), which may be beneficial for people with TBI. However, the synchronous communication of chatrooms may be demanding on literacy, written communication, typing, cognitive, and social skills for people with TBI (Prichard, 2000; Todis, et al., 2005; Vaccaro, et al., 2007). There is limited literature describing how people with TBI communicate in chatrooms, and further research is required in this area (Kilov, Togher, Power, & Turkstra, 2010).

Exchange structure analysis (ESA) has been used reliably to study the communication of people with TBI by describing how information is exchanged in interactions (Togher, Hand, & Code, 1996; Togher, Hand, & Code, 1997; Tu, Togher, & Power, 2011) while considering context and task complexity (Togher, 2001). Given the sensitivity of ESA in revealing the interactional difficulties of people with TBI, this analysis was chosen to examine chatroom communication of people with TBI. There were two main research questions:
(1) do people with and without TBI differ in the rate of information exchange in chatroom conversations?
(2) do communication partners (CPs) of people with and without TBI differ in the rate of information exchange in chatroom conversations?
It was hypothesized that people with TBI would provide information and request information slower than people without TBI, and experience higher frequencies of negotiation/repair (due to impaired pragmatics and cognitive-communication skills). It was hypothesized that CPs of people with/out TBI would not differ in the rate of information exchange as they did not receive prior training on how to modify their communication with people with TBI.

Method

Ten participants with moderate-severe TBI and twelve control participants matched for age, gender, and education level were recruited for this study (Tables 1,2). Each participant was allocated to a pair of unknown communication partners (CPs) of the same gender and age range (Tables 3,4). TBI/control participants and their respective CPs were called a communication “team”.

Participants were asked to find out about each other in a moderated chatroom for 20-30 minutes on two occasions. Chatroom transcripts were converted to moves. Moves are similar to T-units, and they are the basic semantic units of analysis for ESA (Coelho, 2007; Shadden, 1998; Togher, 2001) . There were three codes used to describe chatroom moves: (1) K1

moves (information giving), (2) K2 moves (information requesting/receiving), (3) dynamic moves (negotiation/repair) (Example 1). The number of K1, K2, and dynamic moves produced by TBI/control participants and their respective communication partner pairs were tallied. These tallies were then converted into frequency measures so that the number of K1, K2, and dynamic moves produced per minute were able to be compared between TBI and control participants, and between CPs of TBI and control participants.

Data was screened in SPSS. All data was normally distributed. One TBI participant (#8) was removed from the analysis as they were an outlier (two standard deviations from mean). Alpha significance level was set at $p<0.05$ to minimize Type II errors (Argyrous, 2005; Perneger, 1998). Mean inter-rater reliability of ESA coding was 83.20% on 25% of randomly selected samples (second rater was blind to group allocation), and mean intra-rater reliability was 89.03% on 25% of randomly selected samples.

Results

Between group comparisons are outlined below (Tables 5 and 6).

TBI and control participants
There were statistically significant differences found between TBI and control participants in the number of K2 ($t=-4.34$, $df=18$, $p=0.00$) and dynamic ($t=-2.54$, $df=18$, $p=0.02$) moves produced per minute of chatroom time. TBI participants had significantly lower frequencies of K2 and dynamic move productions compared with controls. There were no statistically significant differences found between TBI and control participants in the number of K1 moves that they produced per minute of chatroom time ($t=-1.97$, $df=18$, $p=0.06$).

Communication partners (CPs)
There were statistically significant differences found between CPs of TBI and control participants in the number of K1 ($t=-3.42$, $df=18$, $p=0.00$) and dynamic ($t=-3.44$, $df=18$, $p=0.00$) moves produced per minute of chatroom time. CPs of TBI participants had significantly lower frequencies of K1 and dynamic move productions compared with CPs of control participants. There were no statistically significant differences found between CPs of TBI and control participants in the: number of K2 moves that they produced per minute of chatroom time ($t=-2.02$, $df=18$, $p=0.06$)

Discussion

People with TBI are increasing their use of the computer and Internet to maintain relationships and increase social connectivity through emails, chatrooms, and a variety of other electronic communication forums (Fraas & Balz, 2008 ; Magnan, 2008; Prichard, 2000; Todis, et al., 2005; Vaccaro, et al., 2007). This study revealed that people with TBI are able to participate in chatrooms and exchange information with unfamiliar communication partners (CPs). However, when compared with controls, it was evident that people with TBI had difficulty asking questions, and generally slowed down the rate of information exchange in this communication context. This may be due to their diminished linguistic resources (Mortensen, 2005) or lack of initiation and role-sharing in conversation(Coelho, Youse, & Le, 2002). Nevertheless, in the chatroom, there were no significant differences in the rate of information giving or negotiation/repair of TBI and control participants, which was surprising

because they are known to lack efficiency and productivity (Coelho, Grela, Corso, Gamble, & Feinn, 2005) in verbal and written discourse production. This finding may be explained by the aim and nature of the chatroom task. There were only three speakers in the chatroom, which may have limited the amount and demands of cross talk for people with TBI. Also, all speakers were unfamiliar with each other. This may have naturally increased opportunity and motivation for people with TBI to provide information about themselves. Additionally, people with TBI were able to provide information without feeling excluded or stigmatized because the chatroom concealed physical and other signs of their disabilities (Bowker & Tuffin, 2003), which is not always possible in face-to-face/telephone conversations.

Communication partners (CPs) of TBI and control participants differed in some parameters of information exchange in the chatroom. The most noticeable difference was that CPs of TBI participants provided and negotiated/repaired information at much slower rates than their control counterparts. This may be attributed to natural adaptations made by CPs online, even though they had not received formal communication training. Or it may be attributed to reduced typing speed, response time, or communication output of TBI participants, which had an overall slowing effect on the information exchanges (Prichard, 2000; Todis, et al., 2005; Vaccaro, et al., 2007).

Conclusion:

Participants with and without TBI were able to share information and participate in chatroom conversations with unknown communication partners (CPs). Overall, there were not many significant differences in their information exchange profiles, but TBI participants had significantly reduced information requesting/receiving compared with controls. CPs appeared to adapt to, and compensate for, slower information exchange of TBI participants, which is encouraging for the success of people with TBI in electronic communication forums. However, this was a small study and ESA and it only explored chatroom conversations of people with/out TBI in small, gender specific groups. Further research with larger samples and more complex chatroom compositions is necessary to validate results of this study.

Table 1: Summary of demographic data for TBI participants recruited for small, gender specific chatroom conversations

Participant number	Age (years)	Gender	Education level	Years of education	SCATBI severity score	LCQ score	Injury location	Cause of TBI	TPO (years)	PTA (days)	Current occupation (employment status)	Frequency of computer/ Internet use	Frequency of chatroom use
TBI 1	32	F	TAFE	15	12	58	Bilateral	MVA-pedestrian	23	120	Skilled trade (e)	1-2 days/ week	1-2 days a week
TBI 2	32	M	Year 10	11	8	46	Bilateral	MVA	6	30	Pension	1-2 days a week	Never
TBI 3	45	M	TAFE	22	11	38	Left	MVA-pedestrian	26	120	Pension	Several times a day	Every few weeks
TBI 4	25	M	TAFE	15	12	74	Left	MVA	4	99	Student	Several times a day	Several times a day
TBI 5	31	F	Year 11	11	8	63	Left	MVA	11	180	Skilled trade (e)	1-2 days a week	Less often
TBI 6	57	F	University	14	11	63	Right	MVA	5	75	Skilled trade (e)	Several times a day	Never
TBI 7	24	M	TAFE	15	10	68	Bilateral	MVA- Push bike	3	1	Student	Several times a day	3-5 days a week
TBI 8	55	M	Year 10	10	8	32	Bilateral	MVA-pedestrian	11	180	Unemployed	About once a day	Less often
TBI 9	38	M	TAFE	14	N/A	46	Bilateral	Sporting injury	8	28	Skilled trade (e)	Several times a day	1-2 days a week
TBI 10	44	M	University	22	N/A	30	N/A	MVA- Push bike	4	28	Skilled trade (e)	Several times a day	Less often

M = Male; F = Female; TAFE = Trade school; MVA= Motor Vehicle Accident; PTA = Post Traumatic Amnesia; TPO = Time post onset; SD = standard deviation; (e) = employed; N/A = not available

Inclusion criteria: 18-65 years of age; having a diagnosis of moderate to severe TBI according to medical reports and allied health reports; having no ongoing PTA or state of confusion (according to medical reports); having a social communication disorder according to Speech Pathology reports based on the Pragmatic Protocol (Prutting & Kirchner, 1987); having a cognitive communication disorder according to Speech Pathology reports, and where possible, utilizing scores obtained in the Scales of Cognitive Abilities following Traumatic Brain Injury (SCATBI) (severity score below 17) (Adamovich & Henderson, 1992) and/or utilizing scores obtained from self- reports and carer/ therapist reports using the La Trobe Communication Questionnaire (LCQ) (Douglas, et al., 2000); having no presentation of aphasia, which manifests as a specific impairment of basic language function consequent to brain damage (Cools & Manders, 1998); having functional reading and writing skills for computer use (that is, reading text off a screen and using a keyboard to write messages independently); being able to independently use a computer and internet chatroom for at least 20-30 minutes; having an interest in using chatrooms to get to know about other people; being able to provide consent to participate in the study, along with written consent and agreement of a witness or guardian.
Participants were not excluded on the basis of their socio-economic status or gender. TBI participants were only excluded if they had a diagnosis of psychiatric illness, a known pre- morbid language disorder, or if they did not have English as a primary language.

Table 2. Summary of demographic data for control participants recruited for small, gender specific chatroom conversations

Participant number	Age (years)	Gender	Education level	Years of education	Current occupation/ employment status	Frequency of computer/ Internet use	Frequency of chatroom use
C1	33	M	TAFE	17	Business manager (e)	Several times a day	Never
C2	27	M	TAFE	13	Skilled trade (e)	Several times a day	Never
C3	27	F	University	17	Corporate professional 9e)	About once a day	3-5 days a week
C4	28	F	University	17	Skilled trade (e)	Several times a day	Never
C5	21	F	TAFE	13	Apprentice	3-5 days a week	Never
C6	24	M	University	16	Skilled trade (e)	Several times a day	Never
C7	29	M	University	15	Corporate professional (e)	Several times a day	Every few weeks
C8	27	F	University	17	Corporate professional (e)	Several times a day	About once a day
C9	19	M	Year 12	13	Student	Several times a day	About once a day
C10	29	M	University	16	Corporate professional (e)	Several times a day	1-2 days a week
C11	39	F	TAFE	14	Corporate professional (e)	Several times a day	Never
C12	61	M	TAFE	15	Skilled trade (e)	Several times a day	Never

TAFE = Trade school; M = Male; F = Female; SD = standard deviation; (e) = employed

Inclusion criteria: 18-65 years of age; having functional reading and writing skills for computer use (that is, reading text off a screen and using a keyboard to write messages independently); being able to independently use a computer and internet chatroom for at least 20-30 minutes; having an interest in using chatrooms to get to know about other people; being able to provide consent to participate in the study, along with written consent and agreement of a witness or guardian;
Participants in the control group were not excluded on the basis of their socio-economic status or gender. Control participants were excluded only if they had a diagnosis of psychiatric illness, a diagnosis of TBI, a known language/ learning disorder, or if they did not have English as their primary language.

Table 3. Summary of demographic data for communication partners of TBI participants recruited for small, gender specific chatroom conversations

Team number	Gend -er	CP1 age (years)	CP2 age (years)	Mean age of CP1 and CP2 (years)	Mean level of education of CP1 and CP2	CP1 years of education	CP2 years of education	Mean years of education of CP1 and CP2	CP1 chatroom use	CP2 chatroom use
TBI 1	F	26	24	25	University	16	16	16	3	1
TBI 2	M	28	24	26	University	19	16	17.5	2	1
TBI 3	M	28	31	29.5	University	16	16	16	2	1
TBI 4	M	23	24	23.5	University	15	15	15	2	1
TBI 5	F	25	25	25	University	16	18	17	2	1
TBI 6	F	60	52	56	University	18	16	17	2	1
TBI 7	M	27	31	29	University	16	21	18.5	2	1
TBI 8#	M	33	34	33.5	University	16	16	16	3	1
TBI 9	M	55	60	57.5	University	18	20	19	2	1
TBI 10	M	27	26	26.5	University	13	16	14.5	2	1

TBI = Traumatic Brain Injury ; M = Male; F = Female; TAFE = Trade school; 1 = Never; 2 = Less Often ; 3 = Every few weeks

Inclusion criteria: 18-65 years of age; having functional reading and writing skills for computer use (that is, reading text off a screen and using a keyboard to write messages independently); being able to independently use a computer and internet chatroom for at least 20-30 minutes; having an interest in using chatrooms to get to know about other people; being able to provide consent to participate in the study, along with written consent and agreement of a witness or guardian;
Communication partners of TBI participants were not excluded on the basis of their socio-economic status or gender. They were excluded only if they had a diagnosis of psychiatric illness, a diagnosis of TBI, a known language/ learning disorder, or if they did not have English as their primary language.

Table 4. Summary of demographic data for communication partners of control participants recruited for small, gender specific chatroom conversations

Team number	Gend -er	CP1 age (years)	CP2 age (years)	Mean age of CP1 and CP2 (years)	Mean level of education of CP1 and CP2	CP1 years of education	CP2 years of education	Mean years of education of CP1 and CP2	CP1 chatroom use	CP2 chatroom use
CONTROL 1	M	24	29	26.50	University	17	18	17.50	2	1
CONTROL 2	M	25	27	26.00	University	15	16	16.50	2	1
CONTROL 3	F	26	26	26.00	University	16	16	15.75	3	1
CONTROL 4	F	26	25	25.50	University	16	16	16.00	2	1
CONTROL 5	F	23	24	23.50	University	15	16	15.75	1	1
CONTROL 6	M	23	26	24.50	University	16	18	16.25	3	1
CONTROL 7	M	31	30	30.50	University	16	16	16.00	1	1
CONTROL 8	F	27	26	26.50	University	17	16	16.25	2	1
CONTROL 9	M	18	18	18.00	Year 12	13	13	14.75	5	4
CONTROL 10	M	29	31	30.00	University	17	15	14.50	2	1
CONTROL 11	F	42	38	40.00	University	16	16	16.00	1	1
CONTROL 12	M	52	61	56.50	TAFE	13	14	13.50	1	1

Year 12 = final year of high school; M = Male; F = Female; 1 = Never; 2 = Less Often; 3 = Every few weeks; 4 = 1-2 days a week; 5 = 3-5 days a week

Inclusion criteria: 18-65 years of age; having functional reading and writing skills for computer use (that is, reading text off a screen and using a keyboard to write messages independently); being able to independently use a computer and internet chatroom for at least 20-30 minutes; having an interest in using chatrooms to get to know about other people; being able to provide consent to participate in the study, along with written consent and agreement of a witness or guardian;
Communication partners of control participants were not excluded on the basis of their socio-economic status or gender. They were excluded only if they had a diagnosis of psychiatric illness, a diagnosis of TBI, a known language/ learning disorder, or if they did not have English as their primary language.

Table 5. Summary of descriptive (mean and standard deviation) and statistical results from between group comparisons of ESA measures for TBI and control participants in small chatroom conversations

ESA measures	TBI participants M(SD)	Control participants M(SD)	Interpretation from statistical analysis
Frequency of K1 moves (number of K1 moves produced per minute of chatroom time) produced by TBI and control participants	0.66(0.36)	0.95(0.31)	No statistically significant difference
Frequency of K2 moves (number of K2 moves produced per minute of chatroom time) produced by TBI and control participants	0.14(0.07)	0.33(0.11)	TBI participants produced significantly less information requests per minute of chatroom time compared with controls
Frequency of DYNAMIC moves (number of DYNAMIC moves produced per minute of chatroom time) produced by TBI and control participants	0.24(0.15)	0.43(0.17)	TBI participants produced significantly less negotiation/repair moves per minute of chatroom time compared with controls

TBI = traumatic brain injury; M = mean; SD = standard deviation

Table 6. Summary of descriptive (mean and standard deviation) and statistical results from between group comparisons of ESA measures for communication partners (CPs) of TBI and control participants in small chatroom conversations

ESA measures	CPs of TBI participants M(SD)	CPs of control participants M(SD)	Interpretation from statistical analysis
Frequency of K1 moves (number of K1 moves produced per minute of chatroom time) produced by CPs of TBI and control participants	0.68(0.34)	1.53(0.65)	CPs of TBI participants produced significantly less information giving moves per minute of chatroom time compared with controls' CPs
Frequency of K2 moves (number of K2 moves produced per minute of chatroom time) produced by CPs of TBI and control participants	0.59(0.28)	0.88(0.34)	No statistically significant difference
Frequency of DYNAMIC moves (number of DYNAMIC moves produced per minute of chatroom time) produced by CPs of TBI and control participants	0.47(0.14)	0.80(0.25)	CPs of TBI participants produced significantly less negotiation/repair moves per minute of chatroom time compared with controls' CPs

TBI = traumatic brain injury; M = mean; SD = standard deviation; CPs = communication partners

Information exchange in chatroom conversations of people with and without traumatic brain injury (TBI)

Example 1. Excerpt from a chatroom transcript demonstrating the application of exchange structure analysis (ESA) to a chatroom conversation of three communicators (D, G, S), using K1 moves (information giving), K2 moves (information requesting/receiving), and dynamic moves (DM) (for clarification/negotiation)

Speaker	Move	Exchange number	ESA element
G	I have some friends who are surfers.	19	K1
G	That's a skill you need to start when you're a kid I think.		K1
G	What do you think?	20	K2
D	Surfing is a difficult sport I think.		K1
G	Smith have you ever surfed?	21	K2 (requesting)
S	Yes		K1
S	but i disagree	20	DM
S	I think you can learn it at any age if you try.		DM
S	I often go surfing.	21	K1
G	That's encouraging!		K2 (receiving)
G	Is any particular beach preferable for beginners?	22	K2 (requesting)
S	Bondi maybe?		K1
D	Is there particular equipment thats good for beginners Smith?	23	K2 (requesting)
S	Where are you guys from?	24	K2
D	Like specific types of boards.	23	K2 (requesting)
G	I'm from Bondi.	24	K1
G	I understand that beginners use bigger boards than experts?	25	K2 (requesting)
G	True?		DM
S	Yes.		K1
S	cause the bigger the board the easier the balance.		K1
S	Once you become a good surfer you can move to a smaller longer board to go faster!		K1

References

Argyrous, G. (Ed.). (2005). *Statistics for research with a guide to SPSS*. London: Sage Publications.

Bowker, F., & Tuffin, K. (2003). Dicing with Deception: People with Disabilities' Strategies for Managing Safety and Identity Online *JCMC, 8*(2). Retrieved from http://jcmc.indiana.edu/vol8/issue2/bowker.html

Coelho, C. (2007). Management of discourse deficits following traumatic brain injury: progress, caveats, and needs. *Seminars in Speech & Language, 28*(2), 122-135.

Coelho, C., Grela, B., Corso, M., Gamble, A., & Feinn, R. (2005). Microlinguistic deficits in the narrative discourse of adults with traumatic brain injury. *Brain Injury, 19*(13), 1139-1145.

Coelho, C., Youse, K., & Le, K. (2002). Conversational discourse in closed-head-injured and non-brain-injured adults. *Aphasiology, 16*(4-6), 659-672.

Ehlhardt, L. A., Sohlberg, M. M., Glang, A., & Albin, R. (2005). TEACH-M: A pilot study evaluating an instructional sequence for persons with impaired memory and executive functions. *Brain Injury, 19*(8), 569-583.

Fraas, M., & Balz, M. A. (2008). Expressive electronic journal writing: freedom of communication for survivors of acquired brain injury. *Psycholinguistic Research, 37*(2), 115-124.

Greenfield, P. M., & Subrahmanyam, K. (2003). Online discourse in a teen chatroom: New codes and new modes of coherence in a visual medium. *Journal of Applied Developmental Psychology, 24*(6), 713-738.

Kilov, A. M., Togher, L., Power, E., & Turkstra, L. (2010). Can teenagers with traumatic brain injury use Internet chatrooms? A systematic review of the literature and the Internet. *Brain Injury, 24*(10), 1135-1172

Kirsch, N., Shenton, M., Spirl, E., Simpson, R., Lopresti, E., & Schreckenghost, D. (2004). An assistive-technology intervention for verbose speech after traumatic brain injury: a single case study. *Journal of Head Trauma Rehabilitation, 19*(5), 366-377.

Magnan, S. S. (Ed.). (2008). *Mediating Discourse Online* Amsterdam/ Philadelphia: John Benjamins Publishing Company.

Mortensen, L. (2005). Written discourse and acquired brain impairment: evaluation of structural and semantic features of personal letters from a systemic functional linguistic perspective. *Clinical Linguistics and Phonetics, 19*(3), 227-247.

Neuage, T. (2002, 2002). Discourse Analysis of chatroom talk. Retrieved 17 March, 2009, from www. neuage.org/neuage_view/bus.html

Perneger, T. (1998). What's wrong with Bonferroni adjustments. *British Medical Journal, 316*(7139), 1236-1238.

Prichard, C. L. F. (2000). Assessing computer-mediated communication discourse of a traumatic brain injury survivor. from http://wvuscholar.wvu.edu:8881//exlibris/dtl/d3_1/apache_media/

Shadden, B. (1998). Information Analyses. In L. Cherney, B. Shadden & C. Coelho (Eds.), *Analyzing discourse in communicatively impaired adults* (pp. x, 251 p.). Gaithersburg, Md.: Aspen Publishers.

Sohlberg, M., Ehlhardt, L., Fickas, S., & Sutcliffe, A. (2003). A pilot study exploring electronic (or e-mail) mail in users with acquired cognitive-linguistic impairments. *Brain Injury, 17*(7), 609-629.

Todis, B., Sohlberg, M., Fickas, S., & Hood, D. (2005). Making electronic email accessible: Perspectives of people with acquired cognitive impairments, caregivers and professionals. *Brain Injury, 19*(6), 389-401.

Togher, L. (2001). Discourse sampling in the 21st century. *Journal of Communication Disorders, 34*(1-2), 131-150.

Togher, L., Hand, L., & Code, C. (1996). A new perspective on the relationship between communication impairment and disempowerment following head injury in information exchanges. *Disability & Rehabilitation, 18*(11), 559-566.

Togher, L., Hand, L., & Code, C. (1997). Analysing discourse in the traumatic brain injury population: telephone interactions with different communication partners. *Brain Injury, 11*(3), 169-189.

Tu, L., Togher, L., & Power, E. (2011). The impact of communication partner and discourse task on a person with traumatic brain injury: the use of multiple perspectives. *Brain Injury, 25*(6), 560-580.

Vaccaro, M., Hart, T., Whyte, J., & Buchhofer, R. (2007). Internet use and interest among individuals with traumatic brain injury: A consumer survey. *Disability and Rehabilitation: Assistive Technology, 2*(2), 85-95.