2010

The Effect of Comment Errors in Multilingual Electronic Meetings

Milam Aiken
University of Mississippi

Shilpa Balan
University of Mississippi

Mahesh Vanjani
Texas Southern University

Bart Garner
University of Mississippi

The Effect of Comment Errors in Multilingual Electronic Meetings

Milam Aiken
University of Mississippi
maiken@bus.olemiss.edu

Shilpa Balan
University of Mississippi
sbalan@bus.olemiss.edu

Mahesh Vanjani
Texas Southern University
vanjanim@tsu.edu

Bart Garner
University of Mississippi
bgarner@bus.olemiss.edu

ABSTRACT

Previous studies of multilingual electronic meetings have shown that members often comprehend the automatic translations, but accuracy is affected by errors in the source comments. However, no study has investigated to what extent these text errors reduce understanding. An experiment with six groups of students showed that participants were able to comprehend translations from German to English, even when the source text contained 5% word errors, but translations from source comments with no errors were understood better. Further, the differences in comprehension affected students' perceptions of the system's ease of use and usefulness.

Keywords: Electronic meetings, machine translation, comprehension

INTRODUCTION

The language barrier is a major source of frustration, dissatisfaction, and friction among employees in many multinational organizations (Neal, 1998; Tung & Quaddus, 2002). In an attempt to overcome this communication problem, many multinational companies are increasingly adopting English as a *lingua franca* (Piekkari, Vaara, Tienari, & Santii, 2005). However, some employees might not be sufficiently skilled in the chosen language to communicate well (Charles & Marschan-Piekkari, 2002; Kim & Bonk, 2002), and those who lack language skills might not be invited to attend key meetings (Louhiala-Salminen, Charles, & Kankaanranta, 2005).

Human interpretation can be used as an alternate solution, but it is often expensive or unavailable. In addition, participants in oral meetings must take turns speaking, reducing the amount of individual air time (Karahanna, Ahuja, Srite, & Galvin, 2002). On the other hand, electronic meetings with automatic translation of typed comments can be more efficient and effective (Fügen, Waibel, & Kolss, 2007), and prior studies have shown that comprehension can be relatively good (Aiken, 2008). When poor translation results occurred, these were sometimes attributed to spelling and grammatical errors in the source comments (e.g., Aiken, Martin, Paolillo, & Shirani, 1994), but no study has investigated the relationships among text errors, individual comprehension, ease of use, and system usefulness. From a practical perspective, it is important to know the extent that text errors affect ultimate translation comprehension, and from a theoretical perspective, this research will increase our understanding of the complex relationships among these selected variables.

First, we review prior studies of text errors in electronic communication and then describe a recently developed meeting system capable of translating among 58 different languages. Next, we present a model of language intermediation to develop hypotheses relating to textual errors, and an experiment with the multilingual meeting system is performed to test these hypotheses. The paper concludes with experiment limitations and directions for future research.

LITERATURE REVIEW

Text Errors in Electronic Communication

Most people make spelling errors while typing, even when trying to be accurate, and word error rates have varied based upon skill, text difficulty, and time constraints from 2.5% (Mitton, 1996) to 4.75% (Park, 2008). With electronic mail and especially instant messaging, errors can occur much more often as these forms of communication tend to be more informal and hurried, and there might be less concern for accuracy (Bloch, 2002; Jacobs, 2008; Wang & Chang, 1997). For example, one study of email messages showed that narrative sentences contained 2.4% grammatical errors, informative sentences averaged 2.9%, persuasive sentences averaged 3.4%, and expressive sentences averaged 3.5% (Li, 2000).

Electronic meetings are also characterized by informal communication, and one study showed about 6% spelling and grammatical errors (Rebman, Aiken, & Cegielski, 2003) while another showed 8.9% (Park, Aiken, Lindblom, & Vanjani, 2010). Misspellings and poor grammar might not cause comprehension to decline much when a single language is used in a meeting, but these errors could compound when translation is involved in a multilingual discussion.

An Example Multilingual Electronic Meeting System

Multilingual, electronic meeting systems over the past 20 years have supported a few languages (Aiken, 2008), but a recently developed system called *Polyglot* provides translations among 58 different languages in 3,306 combinations (Aiken & Ghosh, 2009). In addition to the wide variety of languages supported, the accuracy appears to be fairly good overall, but some language combinations are better than others.

An automatic evaluation of a subset of the languages used in this meeting system resulted in the BLEU score (0 to 100) averages in Table 1, organized by language group (Aiken & Balan, 2011). That is, evaluations of translations between all language combinations in the group were used to arrive at an overall mean score. Based upon these values, we derived estimated Test of English as a Foreign Language (TOEFL) scores (range: 0 to 30) and estimated comprehension percentages using the method from Aiken and Park (2010). The TOEFL scores appear to meet the minimum criterion of 21 for UCLA's graduate program (University of California, Los Angeles, 2010) and Auburn's MBA program minimum of 16 (Auburn University, 2010). Thus, the system would probably do well with all language groups, but especially Latvians and Lithuanians or Albanians and Greeks, because of the language similarities.

Language Group	Languages	Mean BLEU Score	Estimated TOEFL	Estimated Comprehension
INDO-EUROPEAN		39.18	23.87	78.9%
Baltic	Latvian, Lithuanian	60.82	26.06	94.6%
Celtic	Irish, Welsh	21.40	22.07	66.0%
Germanic	Afrikaans, Danish, Dutch, English, German, Icelandic, Norwegian, Swedish, Yiddish	46.48	24.61	84.2%
Indo-Iranian	Hindi, Iranian	6.60	19.04	44.2%
Romance	Catalan, French, Galician, Italian, Portuguese, Romanian, Spanish	48.35	24.80	85.6%
Slavic	Belarusian, Bulgarian, Croatian, Czech, Macedonian, Polish, Russian, Serbian, Slovak, Slovenian, Ukrainian	35.03	23.45	75.9%
Other	Albanian, Greek	55.61	25.53	90.9%
Language Group	Languages	Mean BLEU Score	Estimated TOEFL	Estimated Comprehension

OTHER		35.00	23.45	75.9%
Afroasiatic	Arabic, Hebrew, Maltese	20.59	21.99	65.4%
Austronesian	Indonesian, Malay, Tagalog	35.65	23.51	76.4%
Uralic	Estonian, Finnish, Hungarian	48.76	24.84	85.9%
Overall		33.03	23.25	74.5%

Table 1: Estimated Comprehension of Electronic Meeting System Languages

To use this system, a group member selects a language from a drop-down list and types comments in a text box. At any time, the participant can read in the selected language what others in the group have written (in any language). For example, Figure 1 shows a Hindi comment typed in the upper text box with the group's transcript thus far in the lower window. Some of the comments in the lower window could have been written in Hindi, while others could have been translated from other languages.
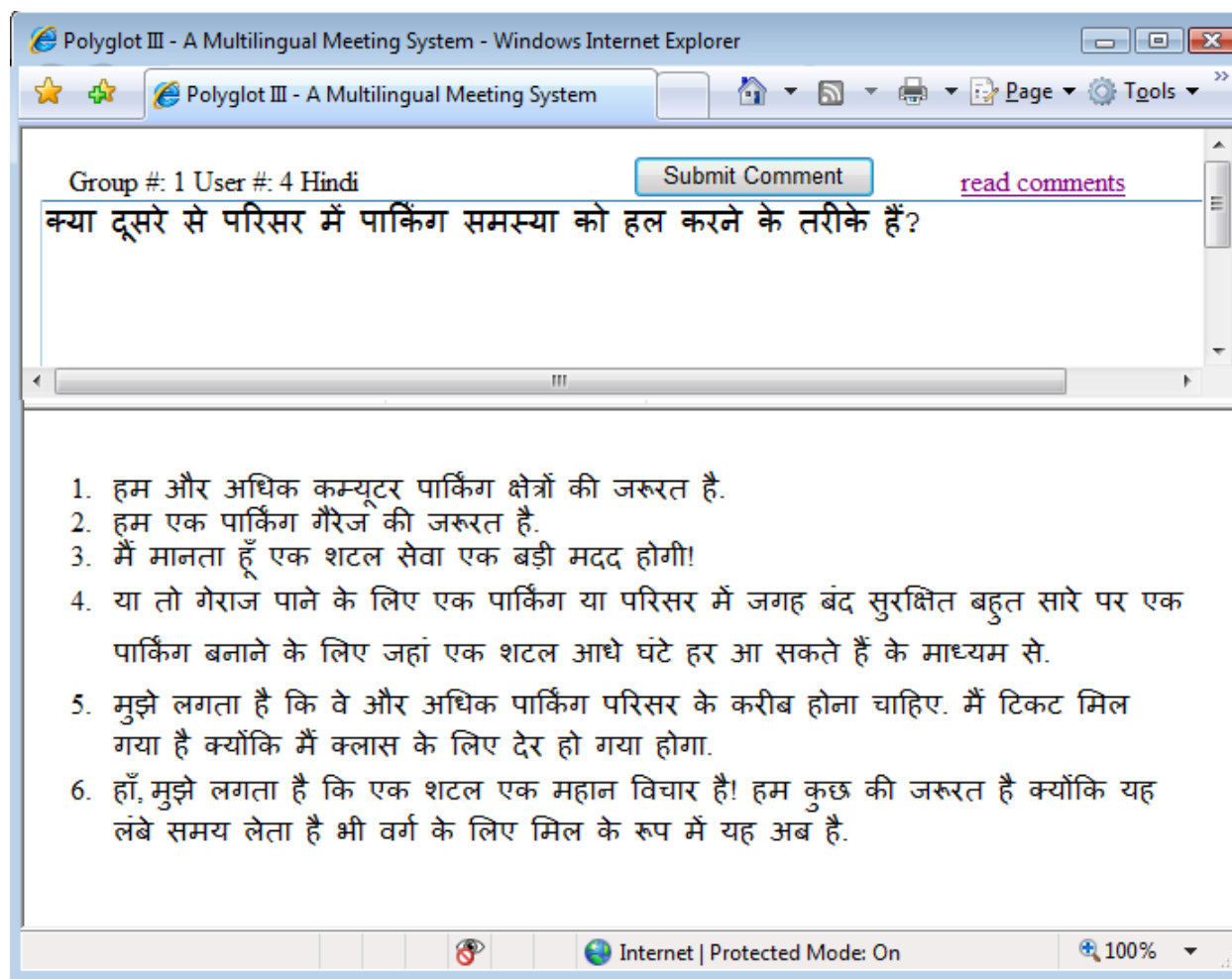
**Figure 1: Group Member Writing and Reading Hindi Comments
about the Parking Problem on Campus**

Message Translation Model

During a multilingual electronic meeting, comments are automatically translated between languages, and the goal of this inter-lingual mediation is to achieve the maximum relevant communication possible between the author and reader of a comment (Viaggio, 2006). True comprehension occurs only if the information stored in the receiver's mind is the same as what the sender means, but not necessarily what is written, and several factors affect this understanding (Maria, 1990; McNeil, 1992; Nist & Mealey, 1991):

Upon thinking of an idea, the author transcribes the thought to text. However, the author might make word choice, spelling, or grammatical errors when trying to form the message. Even an overly complex sentence structure could cause loss of understanding (O'Hagan & Ashworth, 2002).

Language mediator. After the comment is submitted in the source language, it is translated to the target language. However, even if the source text has perfect spelling and grammar, the resulting text can contain errors because of problems with machine translation. As shown in Table 1, comprehensions can vary dramatically, especially if the language pairs are different. And if the source text contains errors, the translated text will also have mistakes (Stüker, Paulik, Kolss, Fügen, & Waibel, 2007).

Reader. Even if the comment reader is able to perceive the words and phrases (that is, the resulting text in the target language has no spelling errors), he or she might not understand the message due to limitations of vocabulary and grammar (Rasinski, 2003). A larger vocabulary, including a good understanding of slang and idioms, allows the receiver to guess what was really meant. Similarly, if translated words are out of order or an incorrect verb tense is used, a good understanding of grammar might increase a person's ability to perceive the intent of the message.

A reader's knowledge of the earlier comments in the discussion will also affect their ability to understand and even predict what will be in a new comment. That is, comments in a discussion often use similar words, especially nouns (Aiken & Carlisle, 1992).

Topic knowledge affects comprehension as a reader is likely to be able to understand a comment better if he or she is well-versed in the subject matter. New information must be linked to existing knowledge in their mind in order for understanding to occur. For example, the reader must be able to recognize and understand the jargon of a particular field such as law or medicine if the discussion is on that topic.

Finally, motivation is a factor. Some readers might want a thorough understanding of the discussion and will work harder and take more time to read a comment. Others, however, might not be interested in a particular comment or the discussion as a whole and will not make much effort, greatly limiting how much is understood.

However, some of these limitations can be overcome by building redundancy into the system, e.g., by allowing the reader to request clarification of a misunderstood comment, marking text that is unclear, or some other means (Pearson, 2009).

Hypotheses

Because of the problems of writing, mediating, and reading a message, misunderstandings can occur in multilingual meetings, and different people can have different comprehension of the same comment in a transcript. After language mediation errors, however, mistakes in the source text are most likely to be the cause of misperceptions among the readers. Even though poor spelling and grammar are usually not so bad that a sentence cannot be understood, errors can leave a bad impression and cast doubt on the quality of the idea conveyed (Aiken & Vanjani, 2005; Figueredo & Varnhagen, 2005). In addition, misspelled words confuse and distract readers, possibly slowing down the reading process (Pynte, Kennedy, & Ducrot, 2004). Therefore, we propose:

H1: Group members reading comments with errors will understand less.
H2: Group members reading comments with errors will believe the meeting system is less easy to use.
H3: Group members reading comments with errors will believe the meeting system is less useful.
H4: Language fluency is significantly correlated with reading comprehension.
H5: Comprehension is significantly correlated with perceived system ease of use.

H6: Comprehension is significantly correlated with perceived system usefulness.

EXPERIMENT

In order to determine how well group members might understand translations with inaccurate source text, we conducted an experiment.

Subjects

This study was conducted with 52 business undergraduate students from a large university in the southern United States, and each received extra credit for participation. The students were randomly assigned into one of two treatments. Three groups of 10 each copied prepared comments with typographical errors into the electronic meeting user interface, and three other groups of 7, 7, and 8 copied comments without errors. Each of these group sizes met the minimum necessary to achieve the benefits of electronic meeting technology (Wong & Aiken, 2003).

Task

Sample comments from a previous meeting of students discussing the parking problem on campus were translated to German by an expert human interpreter. The original transcript contained 221 words overall with 6 misspelled (2.7% word error rate). A fluent German speaker prepared two new transcripts in German from this English sample: one containing no spelling errors and the other containing 5% errors (177 words total, 9 misspelled). Each group member was assigned two or three German comments to copy and paste into *Polyglot*, described above, simulating an actual multilingual meeting. Each meeting was allocated 10 minutes, a time generally sufficient for this problem (Wong & Aiken, 2006).

After the simulated meetings, the students evaluated the comments translated by the meeting software back to English, as shown in Appendix 1 and 2. The transcript with 5% errors shows that comments 2, 7, and 13 simply repeated the misspelled German words "Begenzen", "Baun" and "Menshen" as there was no recognized translation. However, the system did manage to translate the other six misspelled German words. Finally, the students completed a questionnaire about the meeting, shown in Appendix 3.

EXPERIMENTAL RESULTS

The questionnaire summary shown in Table 2 indicates that group members believed they were fluent in English, the translations from German to English were comprehensible, the electronic meeting system was easy to use, and the system was useful. In addition, the Cronbach's alpha values of the aggregate items are all above 0.80, considered good by most researchers (George & Mallery, 2003, p. 231).

Variable	0% Errors Treatment		5% Errors Treatment	
	Mean	Std Dev	Mean	Std Dev
Fluency (Cronbach's Alpha = 0.96)	6.57	1.28	6.53	0.96
Q1: I speak English fluently.	6.68	1.29	6.57	1.07
Q2: I know a large number of English words.	6.45	1.30	6.50	0.90
Comprehension (Cronbach's Alpha = 0.87)	6.09	1.27	4.98	1.16
Q3: I understood the comments translated to English.	6.23	1.41	5.27	1.51
Q4: I obtained information from the comments translated to English.	6.00	1.45	5.43	1.22
Q5: I believe the translations were accurate.	6.05	1.21	4.23*	1.36
Variable	**0% Errors Treatment**		**5% Errors Treatment**	
	Mean	Std Dev	Mean	Std Dev
Ease of use (Cronbach's Alpha = 0.92)	6.09	1.20	5.11	1.17

Q6: The multilingual meeting system was easy to use.	6.09	1.27	5.03	1.33
Q7: The functionality of the meeting system was clear.	5.95	1.21	4.87	1.48
Q8: I learned how to use the multilingual system quickly.	6.23	1.27	5.43	1.10
Usefulness (Cronbach's Alpha = 0.93)	6.11	1.20	4.52	1.58
Q9: I would use this system in a multilingual meeting.	6.00	1.15	4.30*	1.82
Q10: A multilingual meeting could benefit from this system.	6.23	1.31	4.73	1.51

*Not significantly different from neutral value of 4 at $\alpha = 0.05$

Table 2: Questionnaire Summary

There was no significant difference between the treatments in terms of English fluency (F=0.01, p = 0.91), but results varied significantly for comprehension (F=10.75, p < .01), ease of use (F=8.69, p < .01), and usefulness (F=15.76, p< .01). That is, groups exchanging comments with errors understood less of the translations and believed the system was less easy to use and useful. Therefore, H1, H2, and H3 cannot be rejected.

English fluency was significantly correlated with comprehension (R = 0.56, p < 0.01), so H4 cannote rejected. In addition, fluency was significantly correlated with ease of use (R = 0.48, p < 0.01) and usefulness (R = 0.39, p < 0.01).

Comprehension was significantly correlated with ease of use (R = 0.51, p < 0.01) and usefulness (R = 0.53, p < 0.01), so H5 and H6 cannot be rejected. Finally, ease of use was correlated with usefulness (R = 0.84, p < 0.01).

CONCLUSION

Summary

Three groups of college students copied German comments with no errors into a multilingual electronic meeting system and three groups entered comments with 5% errors. Then, they evaluated the system's translation of the text to English for accuracy. Results showed that, as expected, groups understood the transcripts with errors less, and consequently, thought the system was less easy to use and useful. However, even with the errors, the students rated comprehension, ease of use, and usefulness highly.

Limitations

The study suffers from two major limitations. First, because of the unavailability of foreign-language speakers and the need to ensure that certain amounts of errors were included in the transcripts, students simply copied and pasted prepared comments, and thus, the experiment did not use 'real' electronic meetings. Group members' perceptions of ease of use and usefulness could have been affected in this artificial meeting environment. Second, only one language pair was selected for the simulated meetings: German to English. Translation quality between other language combinations could be better or worse.

Future Research

Future research should investigate the effect of errors using different language pairs as well as even higher word error rates. In addition, research should focus on methods of preventing spelling errors in electronic meetings, e.g., including integration of a spelling checker with the system. Finally, it may be necessary incorporate a more complex theoretical model to study these phenomena, including, for example, the effects of computer self-efficacy and language fluency on subsequent comprehension.

REFERENCES

Aiken, M. (2008). Multilingual collaboration in electronic meetings. In N. Kock (Ed.), *Encyclopedia of E-Collaboration* (pp. 457-462). Hershey, PA: IGI Global.

Aiken, M., & Balan, S. (2011). An analysis of Google Translate accuracy. *Translation Journal, 16*(2).

Aiken, M., & Carlisle, J. (1992). An automated idea consolidation tool for computer supported cooperative work. *Information and Management, 23*, 373-382.

Aiken, M., & Ghosh, K. (2009). Automatic translation in multilingual business meetings. *Industrial Management & Data Systems, 109*, 916-925.

Aiken, M., Martin, J., Paolillo, J., & Shirani, A. (1994). A group decision support system for multilingual groups. *Information and Management, 26*(3), 155-161.

Aiken, M., & Park, M. (2010). The efficacy of round-trip translation for MT evaluation. *Translation Journal, 14*(1).

Aiken, M., & Vanjani, M. (2005). Typographical errors and consumer trust in electronic commerce. *Business Research Yearbook, 12*(1), 494-498.

Auburn University. (2010). Entrance exams. Retrieved from http://mba.business.auburn.edu/prospective-students/application-process/entrance-exams/

Bloch, J. (2002). Student/teacher interaction via email: The social context of Internet discourse. *Journal of Second Language Writing, 11*(2), 117-134.

Charles, M., & Marschan-Piekkari, R. (2002). Language training for enhanced horizontal communication: A challenge for MNCs. *Business Communication Quarterly, 65*(2), 9-29.

Figueredo, L. & Varnhagen, C. (2005). Didn't you run the spell checker? Effects of type of spelling error and use of a spell checker on perceptions of the author. *Reading Psychology, 26*, 441-458.

Fügen, C., Waibel, A., & Kolss, M. (2007). Simultaneous translation of lectures and speeches. *Machine Translation, 21*(4), 209-252.

George, D., & Mallery, P. (2003). *SPSS for windows step by step: A simple guide and reference* (11.0 Update, 4th ed.). Boston, MA: Allyn and Bacon.

Jacobs, G. (2008). We learn what we do: Developing a repertoire of writing practices in an instant messaging world. *Journal of Adolescent & Adult Literacy, 52*(3), 203-211.

Karahanna, E., Ahuja, M., Srite, M., & Galvin, J. (2002). Individual differences and relative advantage: The case of GSS. *Decision Support Systems, 32*(4), 327-341.

Kim, K., & Bonk, C. (2002). Cross-cultural comparisons of online collaboration. *Journal of Computer Mediated Communication*, *8*(1). doi:10.1111/j.1083-6101.2002.tb00163.x

Li, Y. (2000). Linguistic characteristics of ESL writing in task-based e-mail activities. *System, 28*(2), 229-245.

Louhiala-Salminen, L., Charles, M., & Kankaanranta, A. (2005). English as a lingua franca in Nordic corporate mergers: Two case companies. *English for Specific Purposes, 24*, 401-421.

Maria, K. (1990). *Reading comprehension instruction, issues and strategies*. Parkton, MD: York Press.

McNeil, J. (1992). *Reading comprehension new directions for classroom practice* (3rd ed.). Los Angeles, CA: University of California.

Mitton, R. (1996). *English spelling and the computer*. London, United Kingdom: Birkbeck.

Neal, M. (1998). The culture factor: Cross national management and the foreign venture. Basingstoke, United Kingdom: McMillan Press.

Nist, S., & Mealey, D. (1991). Teacher-directed comprehension strategies. In R. Flippo & D. Caverly (Eds.). *Teaching reading and study strategies at the college level*. Newark, DE: International Reading Association.

O'Hagan, M., & Ashworth, D. (2002). *Translation-mediated communication in a digital world: Facing the challenges of globalization and localization*. Toronto, Canada: Multilingual Matters.

Park, S. (2008). Speech recognition faster more accurate than typing. Retrieved from http://www.voicescene.com/article-53.html

Park, M., Aiken, M., Lindblom, K., & Vanjani, M. (2010). Spelling and grammatical errors in electronic meetings. *Issues in Information Systems, 11*(1), 384-391.

Pearson, P. (2009). The roots of reading comprehension instruction. In S. Israel & G. Duffy (Eds.), *Handbook of research on reading comprehension*. New York, NY: Routledge.

Piekkari, R., Vaara, E., Tienari, J., & Santii, R. (2005). Integration or disintegration? Human resource implications of a common corporate language decision in a cross-border merger. *The International Journal of Human Resource Management, 16*(3), 330-344.

Pynte, J., Kennedy, A., & Ducrot, S. (2004). The influence of parafoveal typographical errors on eye movements in reading. *European Journal of Cognitive Psychology*, *16*(1/2), 178-202.

Rasinski, T. (2003). The fluent reader. New York, NY: Scholastic.

Rebman, C., Aiken, M., & Cegielski, C. (2003). Speech recognition in the human-computer interface. *Information & Management*, *40*(6), 509-519.

Stüker, S., Paulik, M., Kolss, M., Fügen, C., & Waibel, A. (2007, April). Speech translation enhanced ASR for European Parliament speeches: On the influence of ASR performance on speech translation. *IEEE International Conference on Acoustics, Speech and Signal Processing 2007 (ICASSP)* (pp.1293-1296). Honolulu, HI: IEEE. doi:10.1109/ICASSP.2007.367314

Tung, L., & Quaddus, M. (2002). Cultural differences explaining the differences in results in GSS: Implications for the next decade. *Decision Support Systems, 33*(2), 177-199.

University of California, Los Angeles. (2010). Admissions: English requirements. Retrieved from http://www.gdnet.ucla.edu/gasaa /admissions/ENGREQ.HTM

Viaggio, S. (2006). *A general theory of interlingual mediation*. Berlin, Germany: University of Frank & Timme.

Wang, J., & Chang, C. (1997). Fast retrieval of electronic messages that contain mistyped words or errors. *Systems, Man, and Cybernetics, 27*(3), 441-451.

Wong, Z., & Aiken, M. (2003). The effect of group size on electronic idea generation. *International Journal of Human Resources Development and Management, 3*(3), 265-274.

Wong, Z., & Aiken, M. (2006). The effects of time on computer-mediated communication group meetings: An exploratory study using an evaluation task. *International Journal of Information Systems and Change Management, 1*(2), 138-158.

Appendix 1

German Comments (0% errors) Translated to English.

1. Give it a big parking problem now.
2. Begin the use of temporary parking permit.
3. We should build more free parking.
4. Additional parking.
5. A solution is to create more parking for the faculty.
6. Students should be encouraged to use public transport.
7. Build more parking spaces in the immediate vicinity of the campus to use for students.
8. Students should park a little further and walk to campus. This is a good exercise for them.
9. More faculty parking in the vicinity of major classroom buildings are needed.
10. Everyone must know the parking policy.
11. A public bus actually helps a lot. Discourage students from using their own vehicles.
12. Most of them should live on campus.
13. Many people will not understand parking policy until after a fine.
14. Build more bus shelters at the various sites on campus.
15. Build some tunnels connecting buildings.
16. Increase in school bus rides to and from parking lots and between the campus.
17. Get more staff for the police.
18. Reduce the cost of the garage.
19. Additional parking.
20. We should use real-time parking cameras to see what parking is available.

Appendix 2

German comments (5% errors) Translated to English
Unrecognized Words Shown in Bold.

1. Give it a big parking problem now.
2. **Begenzen** the use of temporary parking permit.
3. We should build more free parking.
4. Additional parking
5. A solution is to create more parking for the faculty.
6. Students should be encouraged to use public transport.
7. **Baun** more parking spaces in the immediate vicinity of the campus to use for students.
8. Students should park a little further and walk to campus. This is a good exercise for them.
9. More faculty parking in the vicinity of major classroom buildings are needed.
10. Everyone must know the parking policy.
11. A public bus actually helps a lot. Discourage students from using their own vehicles.
12. Most of them should live on campus.
13. Many will not understand **Menshen** parking policy until after a road money.
14. Build more bus shelters at the various sites on campus.
15. Build some tunnels connecting buildings.
16. Increase in school bus rides to and from parking lots and between the campus.
17. Get more staff for the police.
18. Reduce the cost of the garage.
19. Additional parking.
20. We should use real-time parking cameras to see what parking is available.

Appendix 3

Survey Instrument

Please answer the following questions using this scale:

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

Fluency
I speak English fluently.
I know a large number of English words.

Comprehension
I understood the comments translated to English.
I obtained information from the comments translated to English.
I believe the translations were accurate.

Ease-of-use
The multilingual meeting system was ease to use.
The functionality of the multilingual meeting system (how it works) was clear.
I learned how to use the multilingual meeting system quickly.

Usability
I would use this system in a multilingual meeting.
A multilingual meeting could benefit from this system.