

Cues to Deception in Online Chinese Groups

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Abstract

Advancing our knowledge about cues to deception is crucial to successful deception detection. A lengthy list of cues to deception has been identified via a myriad of deception studies. Nonetheless, we identified two major limitations of existing cues to deception: the lack of cues in computer-mediated communication and in non-Western group communication. In this research, we aim to make some contributions to addressing this line of inquiry. We conducted an empirical study on cues to deception using a large real-world online Chinese community. Through hypotheses testing, we observed a number of interesting findings. For example, we found that deceivers tended to communicate less and showed low complexity and high diversity in their messages. These findings provide significant implications to deception research and the broad online communication community.

1. Introduction

Deception is defined as intentionally transmitting messages to receiver(s) to foster a false belief or conclusion [1]. It is practiced in various ways such as telling white lies, falsification, hiding truth, and embellishment by many people on a daily basis as a routine of living. Different ways and natures of deception result in different consequences to the victims of deception. When the possibility of serious damage is high, it is not surprising that people spend a lot of effort identifying deception. However, the accuracy of lie-truth discrimination by an average person is only slightly better than chance [2]. One of the contributing factors to the poor performance in deception detection is our limited knowledge about cues to deception.

Traditional deception research assumes that deception detectors observe potential deceivers face-to-face (FtF) and thus have access to both of their verbal behaviors and non-verbal clues. The advancement of communication technology, such as e-mail, VoIP, and

chat room, as well as the globalization have significantly reduced the cost of communication, fostering more connections between people across organizations and generating more venues for deception, especially online deception (e.g., [3, 4]). Compared with detecting deception in FtF communication, deception detection in computer-mediated communication (CMC) is even more challenging. This is because it is difficult to identify and access to a rich set of cues to deception in an online environment, as what people have got used to in FtF communication. Additionally, the rapid pace of interaction, the physical separation of communication partners, and the prevention of production blocking make it inefficient and impractical for people to filter and screen information manually during CMC, especially in synchronous CMC that is characterized by minimal amount of time delay between two consecutive message transmissions. To address the above challenges, we focus on addressing cues to deception in text-based synchronous CMC in this study.

Cues to deception are fundamental to successful deception detection. Only a handful of recent studies have investigated cues to deception in CMC to date (e.g., [5-8]). All of those studies were conducted with participants from Western cultures, mostly Americans. To the best of our knowledge, there has been no study on cues to deception in CMC that involves deceivers from a non-western culture such as Chinese. According to China Internet Network Information Centre (CNNIC), China added another 14 million Internet users in 2006, retaining its status as the world's second-largest Internet market with totally 137 million users. As a result, identifying cues to deception from deceivers in online Chinese groups becomes increasingly important to understanding their similarities and differences with deceivers from a western culture, which in turn helps improve the performance of deception detection by developing customized deception detection methods and techniques.

To address the above limitation, we investigate cues to deception in Chinese online groups via an empirical study using data collected from a real-world online interactive environment. Then, we develop techniques for automatically extracting cues to deception in Chinese by applying natural language processing technologies.

This study makes multi-fold contributions to deception research. First, this is the first effort to examine cues to deception in online Chinese groups. Second, this is the first empirical study of cues to deception in groups with the size larger than three. Third, we validate some of the existing cues to deception with a real-world dataset, which is much larger than the data used in previous deception research.

The rest of paper is organized as follows. In Section 2, we provide the background on cues to deception and their relationship to culture and develop research hypotheses. Section 3 describes research methodology in detail. Section 4 reports the results of data analysis; Section 5 discusses the findings, their implications to research and practice, and future research issues. We finally conclude the paper with Section 6.

2. Theoretical Background and Hypotheses Development

In this section, we review previous research on cues to deception in CMC and discuss the related models for predicting special characteristics of deception in Chinese culture. We then present our research hypotheses.

2.1. Cues to deception in computer-mediated communication (CMC)

Despite a longstanding history of studying cues to deception in face-to-face communication, the research on cues to deception in CMC remains at its infancy. Through a handful of pioneering studies on cues to deception in CMC (e.g., [5-8]), some promising cues have been found to show opposite directions in CMC and in FtF communication. For example, deceivers are found to involve in an instant messaging environment more actively than do truth-tellers by showing shorter pause [7]; they display a larger quantity of words, verbs, noun phrases, and sentences than do truth-tellers in an email environment [8]. Therefore, it is necessary to investigate cues to deception in CMC separately from FtF communication. Since the availability of nonverbal behavior is significantly reduced in CMC, the extant cues to deception discovered from CMC

mainly rely on verbal behavior. By definition, verbal cues are directly related to the content or the linguistic style of online messages. The following are some major categories of verbal cues to deception that have been identified in previous online deception studies.

Quantity: Interpersonal Deception Theory [1] describes how a deceiver interacts with a receiver dynamically by continuously managing their behavior in response to receiver's reactions. The theory suggests that deceivers be more reticent than receivers by using fewer words and sentences or taking less talk time in face-to-face communication. To avoid being caught, deceivers may give less information and detail in their messages than expected. However, some opposite patterns of cues to deception have been observed in email communication that deceivers use a high quantity of words, verbs, noun phrases, and sentences [8]. The above inconsistency between email and FtF communication could be laid at the feet of the unique characteristics of asynchronous, distributed, text-based communication and specific tasks, because deceivers in such settings have plenty of time to prepare messages and make their messages more persuasive.

Language complexity: Deception is a complex task in which a deceiver has to monitor any suspicion arousal at the receiver side while involving in normal communication. Thus, deception is believed to require more cognitive processing than does telling the truth. Faced with such cognitive challenges, deceivers would likely produce messages with lower language complexity than truth-tellers. For example, deceivers were found to show lower sentence complexity in their online messages in comparison to truth-tellers [5-8].

Language diversity: Deceivers' language used for describing fake events may fail to reflect the rich diversity of actual events because deceivers are lack of truthful memory or experience that differs in quality from that of a fake event. It has been repetitively shown from previous research that deceivers often display less diversity at both lexical and content levels than do truth-tellers [8].

Non-immediacy: Non-immediacy refers to the language of a message expressing a distant relationship to the referent of the message. To avoid the accountability for their own messages and to shift the attention on others, deceivers may strategically choose language that help separate them from their messages. Sample cues of non-immediacy include few self-references but a lot of references to third parties [9].

2.2. Culture and deception

Most published deception studies involved participants from the Western culture. There is only scattered research on deception in the Oriental culture.

Over the Internet, the chance for a person to communicate with someone from a disparate cultural background nowadays is higher than ever. Thus, it becomes important to understand deception in non-western cultures.

It is suggested that culture context be an influential factor on deception [10-12]. It has also been shown that the perception of deception varies across different cultures [13]. Traditional culture models [14-17] suggest that there are distinct differences in more than one cultural dimension between Americans (a representative of Western culture) and Chinese (a representative of Oriental culture), including individualism-collectivism, power distance, and so on. Thus, we must take culture context into consideration while studying cues to deception.

The research on deception in a non-Western culture is scarce to date. Despite a few extant cross-cultural studies on deception detection [10, 18], they all exclusively focus on nonverbal behavior (e.g., eye contact and pause in the middle of speaking) in FtF communication. Verbal cues to deception in online communication in oriental culture groups remain to be discovered.

This study takes an innovative and initiative effort to investigate deception behavior in online Chinese groups. Compared with U.S. culture, Chinese culture is featured with high collectivism [16] and high context [15]. Collectivism refers to “a preference for a tightly knit social framework in which individuals can expect their relatives and other in-groups to look after them, in exchange for unquestioning loyalty” [14]. People in a high context culture prefer much covert and implicit messages and nonverbal coding, and react more inwardly [14]. The above characteristics of Chinese culture lead us to predict that deception behaviors may vary between Chinese and Americans in a mediated communication environment.

2.3. Hypotheses Development

In the current study, we predict that there are differences in online behavior between deceivers and truth-tellers. The language that people use in their messages could reveal their underlying thoughts, emotions, and motives. In synchronous communication such as FtF communication and instant messaging, people are under significant time constraints while editing their messages [7]. In such a fast-paced environment, deceivers have to distribute their limited cognitive resources between committing deception while creating a “truthful” impression and participating in the task at hand. As a result, deceivers tend to lower their productivity by displaying less amount of information than truth-tellers. Along the same vein,

compared with truth-tellers, deceivers are found to show lower sentence complexity [5-8] and lower language complexity in dyads [19]. Thus, we propose the first two hypotheses as follows:

H1. Deceivers send fewer messages than do truth-tellers.

H2. The complexity of deceivers' messages is lower than that of truth-tellers' messages.

Several studies on cues to deception in CMC have revealed that deceivers show a lower level of language diversity than do truth-tellers [5-8]. We also expect to see the above patterns in Chinese online groups because deceivers need to deal with the special challenges of interpersonal deception under time pressure. Given the lack of actual experience and short response time, deceivers may opt to use simple and repetitive language in their messages. Therefore, we propose the following hypothesis:

H3. The diversity of deceivers' messages is lower than that of truth-tellers' messages.

Any message sent by deceivers may be later verified and used against them for detection. This concern becomes even more serious due to the built-in recordability of online communication tools. Thus, it is of deceivers' interest to manage their information in such a way that they are not directly attached to their messages [8]. To reduce their accountability for the content of their messages, deceivers are expected to take a low-key, submissive approach to separate themselves from their messages. Thus, the non-immediacy of deceivers' language should be higher than that of truth-tellers'. So we propose the fourth hypothesis as follows:

H4. Deceivers display higher non-immediacy in their messages than do truth-tellers.

3. Research Methodology

3.1. Data Collection

To test our hypotheses, we chose the Mafia game [20] as the specific task scenario, in which players interacted with one another via synchronous online chat rooms. The Mafia game has many variances that involve different roles and functions. We focused on a police version of the game, where players (i.e., participants) were grouped into three types of roles: 1) mafia, who deceived by denying being a mafia and/or incriminating others, 2) villagers, who told truth by

voting for mafia and/or protecting themselves or other villagers from being misjudged, and 3) policeman, who detected suspects, and helped villagers identify and eliminate mafia. In other words, the mafia members were treated as deceivers, and villagers and policemen as truth-tellers. The role of each player was randomly assigned by a third-party game coordinator. No one was aware of other members' roles in the game. In this study, we selected those games that consisted of one mafia, one policeman, and multiple villagers. The messages sent by mafia and policemen were compared in order to discover cues to deception. The number of village players involved in those games varied from 4 to 6. Thus, the size of communication groups varied from 6 to 8.

Each run of the game consisted of two stages. The first stage was day time, which lasted for 3 minutes. At the beginning of that stage, all players (mafia, policemen, and villagers) discussed in public through an open online chat room and cast votes to decide which member might be a mafia. If a player received a majority vote (i.e., over 50%), he/she would be eliminated from the game. Otherwise, everyone stayed alive, and the game entered the night stage, which lasted for two minutes. During the night stage, the mafia cast vote in a private chat room to eliminate one village member. After that, the policeman chose one suspect whom he/she thought most likely to be a mafia and the game coordinator would reveal the true identity of the suspect to the policeman. Then, the game returned to the day-time stage. The mafia would win a game after he/she had eliminated either all villagers or the policeman; and the villagers and policemen would win after they eliminated the mafia member. A screenshot of the game system interface is shown in Figure 1.

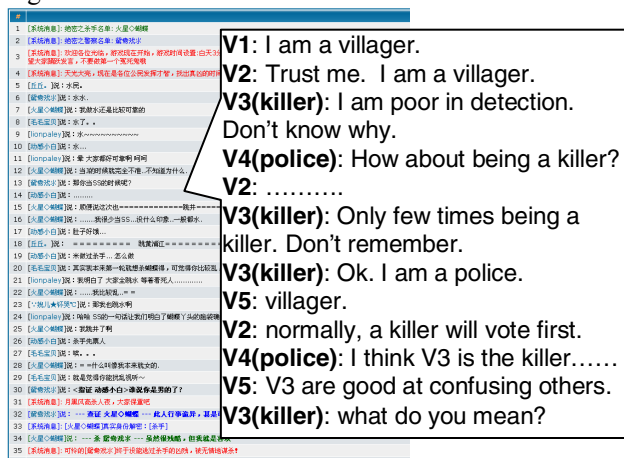


Figure 1. Mafia game message logs

We collected data from a popular dedicated Chinese online mafia game website dated from May

10, 2007 to June 5, 2007. There were 1,192 valid games in total. All players were Chinese and all the messages exchanged were written in Chinese. The messages sent by the mafia and the policemen during the day time stage were extracted for analysis.

3.2. Content Analysis

To support the extraction of cues to deception, we developed a systematic procedure to analyze message content. The first step of data analysis was pre-processing, which involved extracting messages of mafias and policemen by removing unrelated information and special repeating characters.

We then segmented messages into individual text unit(s), including words and terms, using a Chinese processing toolkit called SEGSDK [21]. The tool is developed based on a competitive and valid Chinese processing framework [22]. Based on the output of SEGSDK, we developed a parser to extract and encode individual cues with numerical values. For example, redundancy (defined in section 3.3) is measured through the following steps: 1) Chinese words in a game message were identified and tagged with parts-of-speech; 2) the total number of function words and the total number of sentences were counted based on the output of step 1; and 3) redundancy was computed as dividing the total number of function words by the total number of sentences. The analysis of other potential cues to deception followed a similar procedure.

3.3 Variables and Measurements

We adapted some cues from a previous study of deception in English [8] to investigating deception behavior in Chinese. A list of selected cues to deception and their respective measurements are described as follows:

Quantity

- Number of words (NoW): the total number of words sent by a player.
- Number of messages (NoM): the total number of messages posted by a player.

Complexity

- Syntactic complexity (SC): the average sentence length.
- Lexical complexity (LC): the average word length.

Diversity

- Lexical diversity (LD): the ratio of the total number of unique words to the total number of words.

- Content word diversity (CD): the ratio of the total number of distinct content words to the total number of content words.
- Redundancy (RD): the ratio of the number of function words to the number of messages.

Non-Immediacy

- First-person pronouns (FP): the total number of first-person singular and plural pronouns used in a game.
- Third-person pronouns (TP): the total number of singular and plural third-person pronouns used in a game.

A game was treated as the unit of analysis. The values of the above variables were derived for the deceiver (i.e., mafia) and the truth-teller (i.e., policemen) separately.

4. Results

A paired-sample T-test was performed to test the proposed hypotheses. Table 1 shows the descriptive statistics of each variable.

Table 1. Descriptive statistics of the selected cues

Cues	Mean		Std. Dev.		Std. Error Mean	
	D*	T*	D	T	D	T
NoM	24.04	26.21	14.89	16.06	0.43	0.465
NoW	85.02	103.7	65.13	66.22	1.89	1.918
SC	3.61	4.11	1.52	1.55	0.04	0.045
LC	1.14	1.10	0.27	0.09	0.008	0.002
LD	0.61	0.57	0.17	0.18	0.005	0.005
CD	0.66	0.60	0.16	0.16	0.005	0.005
RD	1.71	1.89	0.87	0.84	0.025	0.024
TP	6.64	5.51	5.70	5.25	0.165	0.152
FP	0.59	0.59	0.96	0.94	0.028	0.027

*: D as deceivers, T as truth-tellers

Table 2 presents the statistical results of all the measures. It is shown that the means of all the cues to deception except self-reference (FP) significantly differ between deceivers and truth-tellers.

The test results on both variables indicating quantity show that the amount of messages sent by deceivers was significantly less than that sent by truth-tellers. Compared with truth-tellers, deceivers used fewer words ($p < 0.001$) and sentences ($p < 0.001$). Thus, hypothesis H1 is supported.

The test on complexity measures yielded mixed results. On the one hand, the messages sent by deceivers were shorter than those by truth-tellers ($p < 0.001$). On the other hand, the average word length of deceivers' messages was longer than that of truth-tellers' ($p < 0.001$). Thus, hypothesis H2 was partially

supported. The above discrepancy between the results of syntactic complexity and lexical complexity is discussed in Section 5.

The results of the first two measures of diversity consistently revealed that deceivers displayed a high level of diversity in their messages than truth-tellers. Specifically, the messages sent by deceivers showed higher lexical diversity ($p < 0.001$), higher content diversity ($p < 0.001$) than those of truth-tellers. Those findings were in the opposite direction as hypothesized (Hypothesis H3). However, the redundancy of deceivers' messages were lower ($p < 0.001$) than that of truth-tellers as expected.

The analysis of non-immediacy variables yielded mixed results. Specifically, deceivers were found to use more third-person references than truth-tellers ($p < 0.001$), but there was no significant difference in the usage of self-references between deceivers and truth-tellers ($p = n.s.$). Thus, hypothesis H4 was partially supported.

Table 2. T-test results for cues to deception

Cues	Mean (d-t)*	Std. Dev.	Std. Error Mean	p-value
NoM	-2.168	17.532	.508	.000
NoW	-18.680	77.342	2.240	.000
SC	-.491	2.036	.0590	.000
LC	.04037	.2821	.0082	.000
LD	.0465	.2087	.006	.000
CD	.0552	.2005	.0058	.000
RD	-.1798	1.154	.0334	.000
TP	1.131	6.492	.188	.000
FP	.005	1.237	.036	.888

*: d as deceivers, t as truth-tellers

5. Discussion

5.1. Major findings

This study seeks to determine the validity of using verbal cues to distinguish truthful messages from deceptive ones in Chinese text-based synchronous CMC. The empirical results fully or partially support most of our hypotheses about cues to deception, including quantity, complexity, and non-immediacy. However, our results do not provide support for the hypothesis about diversity.

Some of the findings of the current study are consistent with findings of prior research studied on Americans in synchronous communication [23]. For example, deceivers tend to display a lower quantity of words and sentences, a lower syntactic complexity, and a higher non-immediacy in terms of third-person pronouns than truth-tellers. However, the findings on diversity are contradictory to our predictions and

previous research findings from Americans. The diversity of deceivers' messages was found to be higher than that of truth-tellers' messages. In addition, self-reference, which is a typical indicator of immediacy in FtF communication, was not found to be effective in CMC.

The finding on quantity in this study is contrary to the related finding of another study on deception in email communication [8]. Such a discrepancy can be attributable to different choices of communication media in two studies. Email is considered as a leaner communication medium in comparison to instant messaging in terms of the pace of feedback and the level of interactivity. As a result, deceivers involved in asynchronous email communication could take more time to refine and edit their messages, which is infeasible for synchronous communication as used in this study. Additionally, compared with laboratory experiments, the stakes held for real-world interactions are much higher. As the level of deception arousal increases, deceivers tend to adopt more protective strategies while interacting with receivers by talking less.

The finding of a higher level of diversity of deceivers than truth-tellers is unexpected. There are a few alternative explanations for this finding. First, the group size used in this study was much bigger than those used in previous studies, which involved mostly monologue and at most triadic groups. When communicating with more receivers, such as 4 to 6 in the current study, a deceiver has to be on higher alert of any sign of suspicion from any other members and try to adjust the content of his messages more dynamically to keep himself undetected. Second, the potential diversity of deceptive content is higher than truthful content in the selected game scenario. For example, a deceiver could disguise himself as either a villager or a policeman in the game. A deceiver may even assume different roles at different runs of a game. On the other hand, there is no reason for a policeman to claim himself as a mafia in the game. Third, a good portion of game messages was about indicting possible deceivers and presenting evidence. A truth-teller is more likely to investigate a small set of suspects; whereas a deceiver is more likely to change targets over time.

Lexical complexity shows an opposite pattern to syntactic complexity in this study. Chinese belongs to a distinctively different language family from English. For example, Chinese sentences are written in a continuous sequence of words and there is no space between two consecutive words. We had to segment Chinese sentences into words in order to compute the value for lexical complexity. The above segmentation process may introduce noise when extracting Chinese

words and phrases. For example, in case of an unknown word, each character in that word would be treated as a separate word, which may lower the level of lexical complexity. The above problem is minimized in processing English text. Additionally, Chinese words are relatively short with small variation in word length in relation to English words. Thus, the measurement of lexical complexity may not be accurate and appropriate. Syntactic complexity should be a better predictor of Chinese language complexity than lexical complexity.

The lack of support for self-references observed in this study may be attributed to the game context. It is noted from Table 1 that both deceivers (mean=0.59) and truth-tellers (mean=0.59) used very few self references, which were much fewer than the usage of third-person references (6.64 for deceivers vs. 5.51 for truth-tellers). The messages sent by both deceivers and truth-tellers talked about others because their primary task was to 'detect' deception of others rather than to describe their own experience or memory unless they tried to defend themselves after being indicted by others. Both deceivers and truth-tellers could adopt a similar strategy by diverting the attention to others in order to win a game. As a result, they both tended to disassociate themselves from their messages.

5.2 Implications

The present study provides several new, useful insights and offers practical guidance concerning deception detection in text-based synchronous CMC and cues to deception in Chinese groups. This study reveals that some cues such as quantity and complexity are more generalizable than others across different cultural environments. For those cues that differ from the findings of previous studies with American participants, we are not yet in a position to conclude that the differences are caused by culture difference alone because the different results could also be attributable to the unique research design employed in this study. Nonetheless, they highlight the necessity of validating cues to deception in a different culture environment.

We took an initiative to investigate cues to deception in groups with size larger than three in this study. A quick comparison with the findings of previous studies with smaller groups suggests some possible effects of group size on cues to deception for future investigation.

We adopted a real-world dataset to examine cues to deception in online communication. The motivations for both deception and deception detection success are generally higher in real world than in a laboratory environment. This study demonstrates both

opportunities and challenges of conducting deception research with real-world data.

We extended the techniques for extracting cues to deception in online communication from English to Chinese. The significant results from the computer-generated measures used in this study demonstrate that an automatic approach, such as natural language processing, is valid for deriving the values of the various variables being examined. By combining computerized cues with machine learning techniques, we could learn the weights of different cues to create deception patterns in that context. Given a list of deception patterns and their applicable contexts, we can build an automatic deception detection system and ultimately deception detection could become available to laypersons.

5.3 Limitations and Future Research

One limitation of this study is related to the design of group communication. To focus on individual behavior and to make a fair comparison between deceptive and truth-telling behavior, this study treated all villagers in a game as confederates. It will be interesting to investigate collaborative deception detection by villagers in future. Given that deceivers (i.e., mafia) in our selected task scenario may disguise himself as a police officer or a villager, we will also examine linguistic cues to deception by comparing deceptive officers with real officers or comparing deceptive villagers with real villagers. Another limitation concerns our choice of linguistic cues to deception. We focus on a subset of linguistics based cues in this study. It is worth to explore other types of verbal cues such as affect and expressiveness, which have been proven effective in other studies of deception in a Western culture. Further, we did not consider non-verbal cues in this study. It is worth to verify some non-verbal cues to deception in synchronous online communication such as pauses [7] in Chinese groups.

6. Conclusions

Discovering cues to deception is an important and challenging task. In online communication, some of the cues to deception identified from American deceivers, including quantity, language complexity, and third-person references, are generalizable to Chinese. Other cues such as diversity and self references vary across different contexts. By surfacing cues to deception associated with Chinese online groups, and providing empirical evidence regarding the efficacy of these cues, we feel that we have contributed to a richer understanding of deception behavior in order to

facilitate deception detection. Given the importance of deception detection in the online environment, we hope that our findings will be useful to others who are engaged in research aimed at enriching our collective understanding of cues to deception across different cultures and communication media.

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