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Ivy Yee-Man LAU
Singapore Management University, ivylau@smu.edu.sg

Chi-Yue CHIU
University of Hong Kong

Ying-Yi HONG
Hong Kong University of Science and Technology

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I KNOW WHAT YOU KNOW: ASSUMPTIONS ABOUT OTHERS' KNOWLEDGE AND THEIR EFFECTS ON MESSAGE CONSTRUCTION

Ivy Yee-Man Lau and Chi-yue Chiu
University of Hong Kong

Ying-yi Hong
Hong Kong University of Science and Technology

Current models of interpersonal communication assume that estimation of listener's knowledge is a basis for message formulation. By introducing methodological modifications to the Fussell and Krauss (1992) paradigm, the present study provided more definitive evidence for the use of knowledge estimation in message productions. In the first experiment, participants indicated whether they knew each of 30 landmarks (thus providing the actual distribution of knowledge) and estimated the proportion of students who would know them. Participants' estimation of the relative distribution of knowledge corresponded impressively with the actual distribution. In the second experiment, a different group of participants described each of the landmarks to an intended audience. The length of the descriptions and the frequency of naming a landmark were predicted by the estimated identifiability from Experiment 1. These results replicated previous findings in a different culture and addressed unresolved issues related to the role of knowledge estimation in communication.

Communicative success requires coordination between communicative partners (Clark & Wilkes-Gibbs, 1986; Fussell & Krauss, 1992; Isaacs & Clark, 1987; Krauss & Fussell, 1991; Wilkes-Gibbs & Clark, 1992). Some types of coordination are directly observable, such as turn-taking; others are not directly observable, such as cognitively formulating what to include in each speaking turn. Message formulation is affected by the amount of knowledge shared between the speaker and the listener. Re-

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Correspondence concerning this paper should be sent to Ivy Y. M. Lau, Department of Psychology, The University of Hong Kong, Pokfulam, Hong Kong. E-mail: ilau@hkusua.hku.hk, cychiu@hkusua.hku.hk, or sohong@ust.hk.

searchers have examined at length the process of developing common information in the course of conversation (e.g., Clark & Wilkes-Gibbs, 1986; Isaacs & Clark, 1987; Krauss & Glucksberg, 1977; Krauss & Weinheimer, 1966; Wilkes-Gibbs & Clark, 1992), and a common ground of knowledge has been found to be essential for successful communication (Clark & Wilkes-Gibbs, 1986; Fussell & Krauss, 1991, 1992; Isaacs & Clark, 1987; Wilkes-Gibbs & Clark, 1992; Schober, 1998).

A logical first step in establishing a common ground is to estimate what one's communicative partner may or may not know. A few studies investigating the influence of knowledge estimation on message formulation (Fussell & Krauss, 1991, 1992; Krauss & Fussell, 1991) have clearly shown that speakers estimate the knowledge they share with their communicative partners concerning the topic area so as to tailor an appropriate message. However, these studies have also left a number of theoretical and empirical questions unanswered. In particular, the relation between assumptions about others' knowledge and message construction has been weak. Although a number of explanations have been put forward (see Fussell & Krauss, 1992), few studies have investigated how beliefs about others' knowledge might affect what information would be included in a message. The study reported in the present paper sought to examine these issues.

KNOWLEDGE ESTIMATION AND MESSAGE PRODUCTION

The importance of assumptions regarding one's communicative partner's informational background can be seen most clearly in referential communication, in which a speaker has to formulate one or a series of messages to permit a listener to identify a referent. In several referential communication experiments, Fussell and Krauss (1992) assessed the influence of knowledge estimation on message formulation. In Experiment 1, Columbia University undergraduates viewed pictures of 15 U.S. public figures (e.g., Woody Allen, George Bush). For each target, they rated how identifiable it was, estimated the actual proportion of Columbia University undergraduates who could name it, and indicated the target's name if they knew it. Correct identifications of the 15 targets ranged form 0% to 93%, and were highly correlated with the mean estimates of the identifiability made by the group for each target (r = .95). Thus participants were accurate in estimating their peers' knowledge of the public figures. Moreover, their accuracy was not determined by their own knowledge of the target. Both participants who could correctly name and those who could not name the target gave relatively accurate estimates of the percentage of people who would know the target (rs = .82 for the named estimates and .70 for the unnamed estimates). The

same pattern of results was found in experiments using everyday objects (e.g., kitchen utensils, tools) as the experimental stimuli (Experiments 3 and 4). Furthermore, there was evidence that participants' estimation of proportion of people who could identify a target figure or recognize a target object influenced their message formulation. In another experiment (Experiment 2), pairs of Columbia University undergraduates performed a referential communication task. One participant (the director) in each pair described each of the 15 previously used public figures so that the other participant (the matcher) could select the picture from the full array of 15.

The directors' referential messages in their first speaking turn (i.e., messages constructed before receiving any feedback from the matchers) were analyzed. If the directors took estimated knowledge of the matchers into consideration, it should exert the most influence on these messages. For each target figure, the mean message length (number of words averaged across participants) was negatively related to the mean estimated identifiability of the target (Experiment 1). Participants included more information in the referential message when the target's estimated identifiability was low, and vice versa. This finding was replicated in a subsequent experiment (Experiment 4) using everyday objects as stimuli. Taken collectively, the findings from this series of experiments indicated that estimation of social distribution of knowledge is related to message formulation.

ISSUES ARISING FROM PREVIOUS STUDIES

The Fussell and Krauss (1992) experiments, however, also raised a number of interesting issues. First, although the correlation between stimulus identifiability and the length of the first turn message was significant (r = -.28), it was weak. There are several possible reasons for the low correlation. First, the identifiability of some stimuli may not be stable. For example, how widely known a particular public figure was might have changed between the time stimuli identifiability ratings were collected and the time the referential communication experiment was conducted. When the investigators used stimuli (everyday objects) that were less likely to vary in recognizability over time, the correlation between stimulus identifiability and message length increased to -.66.

Second, participants were not given the names of the stimuli, and only messages in which the target stimulus was named correctly were included in data analyses. The researchers noted, however, that compared to named messages, unnamed messages were substantially longer, and required more speaking turns to establish reference. By excluding the unnamed messages, the investigators might have restricted the range of

message length and hence underestimated the strength of association between estimated stimulus identifiability and message length. Moreover, if the unnamed messages were longer than named ones, the target stimuli in unnamed messages might have been less identifiable than those in the named messages. The same conclusion can be deduced from the premise that more widely known stimuli are more likely to be named. Accordingly, the messages included in the analysis might have contained fewer descriptions of low identifiability stimuli than descriptions of high identifability stimuli. Group estimates of message length might have been less reliable for descriptions of low identifiability stimuli than for descriptions of high identifiability stimuli, thus attenuating the correlation between stimulus identifiability and message length. Also, given the inclusion criteria, it is unclear whether the relationship between assumptions of others' knowledge and message construction could be generalized to the unnamed messages.

Finally, the investigators found that communicators "frequently provided little or no identifying information with the name of a stimulus, regardless of its recognizability" (p. 389). They suggested that two-way communication is a demanding task, as the speaker needs to formulate messages and monitor the addressee's feedback simultaneously. A typical communicative sequence begins with a referring expression, followed by feedback from the addressee, which can be used by the speaker to repair the expression. Hence, the interactive nature of the experimental task might have diminished the cognitive resources that the director needed in order to consider the addressee's perspective. Consequently, the director might have shifted the basis for message formulation from prior assumptions of the addressee's knowledge to feedback from the addressee.

However, even in an interactive communication task, communicators are expected to minimize collaborative effort in establishing reference (Clark & Wilkes-Gibbs, 1986). Furthermore, previous studies have shown that directors have no difficulty in taking the addressee's perspective even in an interactive communication task (Krauss, 1987). Thus, it is hard to understand why the director would in the first speaking turn shift all the responsibility to the addressee by mentioning only the name of the referent. A more reasonable strategy would be to make approximate estimates of the addressee's knowledge and rely on such rough estimates to construct a "comprehensible" message, which would be further refined based on the addressee's feedback.

To understand why many messages contained the name of the referent only, recall that Fussell and Krauss included in their analysis only those messages in which the director mentioned the name of the referent. Further, participants' estimates were biased in the direction of their

own knowledge. Fussell and Krauss (1992, Experiments 1, 3, and 4) found that estimates of the proportion of people who would know a particular referent were higher for participants who knew the name of the referent than for participants who did not. If those participants who knew the name of the referent believed that a considerable proportion of people in the population also knew its name, then the name of the referent should be sufficient for correct identification. Therefore, it would be reasonable for them to mention only the name in their description and wait for feedback from the addressee to refine their message. Consistent with these ideas, previous research has shown that people giving directions to others are more likely to use the proper name (Isaacs & Clark, 1987) when the target location is estimated to be known to most people. According to this line of reasoning, even those participants who mentioned only the name of the referent had taken into account the addressee's knowledge when they constructed their message. However, their message might not have been comprehensible to the addressee because their estimates of the addressee's knowledge were biased by their own knowledge.

THE PRESENT STUDY

The study reported in this paper was an attempt to address these interpretive issues. The experimental procedures were similar to those in the Fussell and Krauss (1992) experiments, with the following exceptions. First, the participants were undergraduate students in Hong Kong and the target stimuli were landmarks from three cities (Hong Kong, Macau, and New York). By employing participants from a different culture, the generalizability of the relation between knowledge estimation and message formulation could be assessed. We used landmarks as the target stimuli because they were commonly used in referential communication tasks (e.g., Fussell & Krauss, 1991; see Yule, 1997) and their identifiability to the participants was relatively stable. Fussell and Krauss (1992) suggested that the nature of prior belief about others' knowledge should be established independent of its effect on message formulation. Accordingly, knowledge estimations and referential expressions were obtained from separate groups of participants. In Experiment 1, participants estimated others' knowledge of specific landmarks and also identified the landmarks themselves. Identification of landmarks provided a direct estimation of the proportion of people who know the landmarks in question. Participants in Experiment 2 formulated messages intended for another undergraduate student in their university.

Second, participants were not given addressee feedback. When communicative partners are interacting face-to-face, efficient referential

communication is achieved by minimizing the amount of collective effort it takes to arrive at a joint perspective of the referent (Clark & Wilkes-Gibbs, 1986). Thus, producing an ambiguous first referring expression to the listener could be an attempt to achieve the least collaborative effort by shifting the responsibility of repairing the expression to the listener. When addressee's feedback is precluded, estimation of the listener's knowledge assumes urgency. To enable correct identification, one would have to be much more precise in gauging the knowledge shared with the audience. Accordingly, the correlation between knowledge estimation and message length should be much larger when addressee feedback is precluded. However, if the director does consider the addressee's knowledge even when direct interaction with the addressee is allowed, absence of addressee feedback should not increase the size of the correlation.

Finally, participants were given the names of the referents and could decide whether or not to include them in the referential messages. Both named and unnamed messages were analyzed. For someone who knew a landmark, its name should be one of the most useful pieces of identification information. Therefore, if participants estimated that the audience would know the name of the landmark, they would need to provide very little additional identifying information once they had named it.

The above line of reasoning led to the following three hypotheses. First, message length should be negatively related to stimulus identifiability, i.e., participants would include less identifying information when they believed that the stimulus was widely known than when they believed otherwise. Second, target stimuli should be named in a message more frequently when they were believed to be highly identifiable than when they were not. Third, the more frequently a particular landmark was named, the shorter the messages for this landmark would be.

If these three hypotheses were supported, it would suggest that participants took the addressee's perspective when they constructed a referential message. In addition, it would also suggest that participants considered what information would be sufficient for establishing common reference with the addressee.

EXPERIMENT 1: KNOWLEDGE ESTIMATION

Previous studies have found that people are generally quite sensitive to the actual distribution of knowledge of city landmarks (Fussell & Krauss, 1991), public figures (Fussell & Krauss, 1992, Experiment 1), and everyday objects (Fussell & Krauss, 1992, Experiment 3). However, peo-

ple's estimates of others' knowledge are also influenced by what they themselves know (Fussell & Krauss, 1991, 1992; Nickerson, Baddeley, & Freeman, 1987). Therefore, it was expected that participants would be sensitive to the actual relative distribution of knowledge of landmarks across different cities, but there would also be a tendency for them to give higher estimates to places they themselves could identify.

METHOD

PARTICIPANTS

Ninety-eight undergraduates (34 males and 64 females with an average age of 21.55) at the University of Hong Kong participated as part of a classroom exercise.

PROCEDURE

Thirty slides of landmarks from Hong Kong, Macau, and New York City (ten from each locale) were shown to participants in a random order. The landmarks were selected with the criterion that they would be within a wide range of familiarity for Hong Kong people in general. Each landmark was shown, then removed for the first time for participants to indicate on paper (a) whether they knew the place shown on the slide and (b) the name of the place if they knew it. Then the slide reappeared for participants to write down the percentage of classmates they thought would know the place.

RESULTS AND DISCUSSION

As shown in Table 1, correct identifications of the 30 landmarks ranged from 0% to 96.0% (M = 27.02, SD = 33.36). Mean estimates of identifiability ranged from 10.6% to 97.1% (M = 39.89, SD = 24.91). Mean estimates of identifiability correlated highly with correct identifications (r = .94, $p < .001$, compared to r = .95 in Fussell & Krauss, 1992, Experiment 1). Impressive as the correlation was, however, participants might have based their estimation on whether they thought they knew the place or not. That is, if they thought they knew the place (regardless of accuracy), they gave a high estimation of knowledge, and if they did not know the place, they gave a low estimation of knowledge. If that was the case, then the correlation reflects a simple judgment of similarity and not an awareness of distribution of knowledge amongst their classmates. To investigate this possibility, estimated knowledge

TABLE 1. Percentage of Correct Identification and Mean Identifiability Estimates for Landmarks

			Mean identifiability estimates			
Landmark	Location	% correct	All observations	Named	Incorrectly named	Unnamed
Lisboa Hotel	Macau	88.0	87.4	89.9	82.5	58.0
Guia Lighthouse	Macau	12.0	31.5	51.1	30.1	28.7
Government Palace	Macau	18.7	37.1	58.6	43.2	28.5
Penha Church	Macau	14.7	32.8	50.9	40.8	28.1
S. Francisco Garden	Macau	1.3	22.3	NA	30.0	21.4
Ruins of St. Paul	Macau	84.0	87.0	91.2	83.8	55.0
Po Chai Sin Yuen	Macau	1.3	45.1	NA	56.9	38.0
P. N. Da Silva Hospital	Macau	0	23.7	NA	30.9	22.7
Weather Observatory	Macau	16.0	25.5	39.8	45.0	21.2
Sao Domingos Church	Macau	0	20.7	NA	23.3	20.5
Tai O Tin Hau Temple	Hong Kong	1.3	22.9	NA	37.3	19.1
Tai O Pier	Hong Kong	41.3	44.5	56.6	52.7	28.5
Lantau Po Lin Monastery	Hong Kong	45.3	49.2	65.6	40.3	33.2
Bird Street	Hong Kong	53.3	43.4	54.6	NA	28.6
Tung Chung Fortress	Hong Kong	13.3	30.6	43.0	40.7	26.6
Cheung Chau	Hong Kong	1.3	39.4	NA	55.5	21.3
Stanley Main Street	Hong Kong	93.3	88.5	88.8	NA	83.3
Repulse Bay	Hong Kong	70.7	72.3	80.6	NA	52.0
Ocean Terminal	Hong Kong	78.7	72.8	81.6	NA	36.7
Temple Street	Hong Kong	0	25.5	NA	30.8	24.5
Statue of Liberty	New York	96.0	97.1	97.3	93.0	NA
U. S. Grant Memorial	New York	0	26.6	NA	50.0	22.5
United Nations	New York	20.0	26.1	37.7	39.8	20.3
Washington Square	New York	1.3	33.6	NA	64.8	20.0
Empire State Building	New York	45.3	40.3	51.4	NA	31.9
Metropolitan Museum	New York	5.3	18.9	23.3	25.7	17.6
Lincoln Center	New York	1.3	12.5	NA	18.3	12.2
World Trade Center*	New York	5.3	14.8	41.3	28.3	12.4
Natural History Museum	New York	0	10.6	NA	10.0	10.6
Rockefeller Center	New York	1.3	14.2	NA	14.7	14.1

Note. Group estimates were not available when 0 or only 1 observation fell into the named, incorrectly named, or unnamed category. *This study was conducted prior to September 11, 2001.

was regressed on actual knowledge separately for observations in which participants knew the name of the landmark (named; Column 5 in Table 1) and for those in which they did not (unnamed, Column 7 in Table 1). We also regressed estimates for observations in which participants incorrectly identified the landmark (incorrectly named, Column 6 in Table 1), although the results from this analysis should be interpreted with caution because it was based on relatively few participants' estimates. The regression coefficient for and correlation with mean identifiability ratings for the three groups are as follows: $b + SE = .62 + .06$, $t(16) = 10.80$, $p < .001$, $r = .94$ for correctly named observations; $b + SE = .57 + .09$, $t(23) = 9.96$, $p < .001$, $r = .78$ for incorrectly named observations; and $b + SE = .43 + .05$, $t(27) = 8.47$, $p < .001$, $r = .85$ for the unnamed observations. Because the numbers of observations in the three regression equations were not the same due to missing data, we compared the 95% confidence intervals of the regression coefficients in the equations and found that the slopes of the three regression lines did not differ significantly from each other.

As in Fussell and Krauss (1992), the estimates of others' knowledge were biased in the direction of the participants' own knowledge. The intercept of regression for the named observations ($a + SE = 33.57 + 3.16$) was significantly higher than that of the regression line for the unnamed observations ($a + SE = 18.23 + 2.01$). Although participants were sensitive to the social distribution of knowledge in the undergraduate student population, estimates of identifiability were higher for participants who knew the landmarks than for those who did not.

The intercept of the regression line and its standard error for the incorrectly named observations was 32.10 + 3.22, which was not reliably different from that for the named observations, but was significantly higher than that for the unnamed observations. Taken together, the results suggested that as long as the participants believed that they knew the name of a particular landmark, regardless of whether or not their knowledge was accurate, they tended to give higher estimates of identifiability than did those who did not name the landmark.

In short, Experiment 1 replicated the basic findings reported by Fussell and Krauss (1992), and did so in a different culture. Participants were reasonably sensitive to what others knew, although their estimates of others' knowledge were also biased in the direction of their own knowledge. Would people consider these estimates when they construct a message for their communicative partners? Experiment 2 addressed this question.

EXPERIMENT 2: KNOWLEDGE ESTIMATION AND MESSAGE FORMULATION

METHOD

Nineteen undergraduate students (9 females and 10 males, average age = 20.32) from the University of Hong Kong volunteered to participant in the present experiment. The participants described pictures of the 30 landmarks used in Experiment 1 in their mother tongue of Cantonese (a Chinese dialect spoken in Hong Kong), one at a time, with the aim that another student from the same campus could listen to their description and pick out the target landmark from the set of 30 pictures. The name of each landmark was written on the back of the picture and therefore participants could always name the target if they chose to. Each participant described the landmarks in a different random order. All descriptions were recorded on audiotape and then transcribed.

For each landmark, we calculated the average message length (in number of words) across the 19 descriptions (one from each participant). We also counted the number of descriptions in which the name of the landmark was mentioned and divided this number by 19 to form a naming percentage. Next, the 19 sets of transcriptions and the 30 pictures, with the name of the picture concealed, were given to 4 decoders who were Cantonese-speaking Hong Kong residents and blind to the hypotheses. The decoders' task was to pick out from the array of pictures the referent for each description. For each landmark, we counted the number of times its descriptions were successfully decoded and divided the number by 76 (19×4) to form a decoding accuracy percentage.

RESULTS AND DISCUSSION

Table 2 shows that average decoding accuracy was high for all the landmarks (range = 85.53% to 97.37%, M = 92.54%, SD =3.06). Moreover, decoding accuracy was not related to naming percentage (r = .16) or average message length (r = -.08). That is, regardless of how long, or short, a message was and whether the name of the landmark appeared, the message contained sufficient information for accurate decoding.

Message length ranged from 20.84 to 86.63 words (M = 55.80, SD =15.41). To examine the influence of knowledge estimation on message formulation, data of Experiment 2 were examined in relation to the estimated percentage of knowledge of the landmarks obtained in Experiment 1. Message length was negatively correlated with estimated identifiability of the landmarks (r = -.68, $p < .001$). When the percentage

TABLE 2. Decoding Accuracy Percentage, Naming Frequency Percentage, and Average Message Length for the Landmarks

Landmark Location	Decoding accuracy (percentage)	Naming (percentage)	Message length (number of words)
All landmarks	92.54 (3.06)	37.19 (20.82)	55.80 (15.41)
Hong Kong	92.56 (8.32)	42.63 (30.70)	48.04 (25.07)
Macau	92.79 (6.17)	32.11 (35.21)	60.57 (41.47)
New York	94.08 (6.63)	36.84 (35.13)	59.33 (35.30)

Note. Standard deviations are shown in parentheses.

of estimated knowledge of a place increased, its corresponding message length decreased. Note that the correlation between estimated identifiability and message length was not discernibly higher in the present study than in the Fussell and Krauss (1992) experiment (r = -.66 in their Experiment 4), even when addressee feedback was absent in the present study. This finding suggested that participants in the Fussell and Krauss experiment might have engaged in perspective taking at least to the same extent as the participants in the present study. However, Fussell and Krauss based their analysis exclusively on messages that contained the referent's name, and we included all the messages in our analysis. Thus, the correlations in the two studies should not be compared directly.

As expected, naming percentages (which ranged from 10.53% to 94.74%, M = 37.19%, SD =20.82) had a strong positive correlation with estimated identifiability of the landmarks (r = .74, p < .001). When a landmark was estimated to be identifiable, more speakers named it in the message. Also as expected, naming percentages were negatively related to average message length (r = -.60, p < .001). Participants who included the name of the landmark in the message were less likely to provide detailed information for identification in the message. Finally, canonical correlational analysis showed that estimated identifiability of the landmarks was highly correlated with a linear combination of naming percentages and average message length (.62 × naming percentage - .59 × average message length), r = .79, p < .001.

Taken collectively, results of the two experiments showed that participants were sensitive to the distribution of knowledge among their intended audience and took it into consideration when formulating messages that were sufficiently informative for establishing reference. When they believed that the addressee would know the target stimulus, they would mention the name of the stimulus and provide little addi-

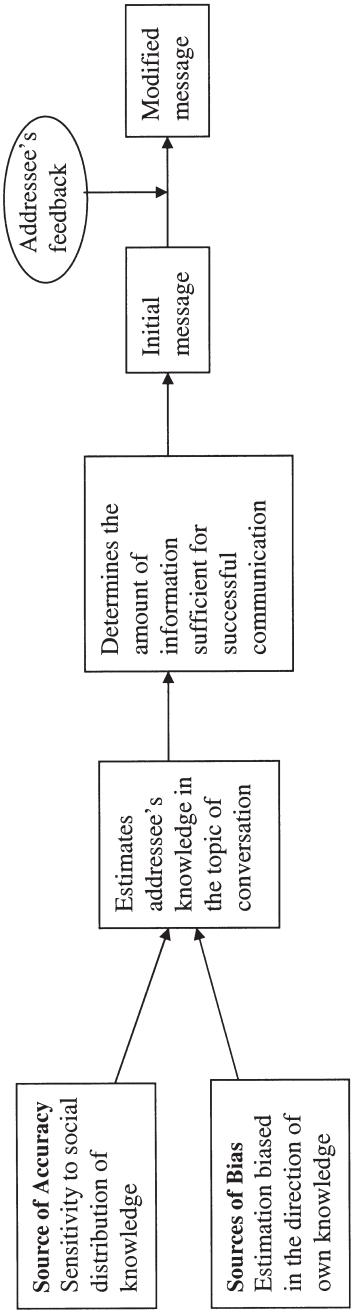

FIGURE 1. A tentative model of knowledge estimation and message construction.

tional identification information. When they believed that the addressee would not know the target stimulus, they would not mention the name of the stimulus. Instead, they would provide detailed information to facilitate identification. Although we did not include in this study an interactive communication task, the results of the Fussell and Krauss experiments suggested that communicators in an interactive task might have engaged in similar perspective-taking process, at least when they formulated their first referential message.

GENERAL DISCUSSION

The present study replicated the basic findings of Fussell and Krauss (1992) within the context of a very different culture, thus establishing their generalizability. Furthermore, by introducing methodological modifications, the present study extended the previous findings and provided direct evidence supporting the utility of knowledge estimation in message formulation. In Figure 1, we present a tentative model of knowledge estimation and message construction based on the evidence from the present research. In this model, people are impressively accurate in their estimation of the social distribution of knowledge among those who are similar to them (in the present context, other undergraduate students from the same university). Message construction follows the principle of informational sufficiency. Speakers construct messages that are of sufficient informational value for the addressee to understand the message. Taking into consideration the estimated knowledgeability of the addressee in the topic of conversation, speakers either formulate succinct messages that include the name of the referent or provide longer messages containing detailed identification information. The same tendency applies regardless of the speaker's own knowledge of the target.

The results from Experiment 1 illustrate one possible source of errors in knowledge estimation: communicators tend to bias their estimation of knowledge in others in the direction of their own knowledge. This bias could lead to inclusion of redundant information when the message constructor does not possess much knowledge in the topic of conversation. The same bias could also lead to construction of messages containing insufficient information for effective decoding when the message constructor knows a topic well. Such problems in message construction are presumably corrected when the addressee's feedback is available.

Findings of the present study highlighted the importance of knowledge estimation in message formulation. In turn, what is the basis for knowledge estimation? A good basis is the addressee's personal characteristics, such as social category membership and geographic residence.

In Experiment 2, because the intended audience was other Hong Kong residents, participants would assume that the addressees knew landmarks in Hong Kong more than those in Macau or New York City. As shown in Table 2, participants provided names and/or relatively short descriptions more often for landmarks located in Hong Kong than for those in Macau or New York City. Future research should examine other personal characteristics and also other factors that could influence knowledge estimation.

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