MIS Quarterly

RESEARCH ARTICLE

THE EFFECTS OF COMMUNICATION MEDIA AND CULTURE ON DECEPTION DETECTION ACCURACY

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Appendix A

Creating the Stimulus Sets

All three stimulus sets were prepared from recorded interviews. The first set, in American English, was a by-product of an experiment (Tilley 2005) in which students were interviewed about a scholarship application, which they had enhanced in their favor. The interviews were done via either VoIP or e-mail, and those done via VoIP were recorded with the camera recording only the interviewee. The second stimulus set, in Spanish, was created for another experiment (Lewis 2009). Spain was chosen because of the language difference (i.e., Spanish) and because Hofstede's measures indicate that Spaniards substantially differ from Americans across all five cultural dimensions (geert-hofstede.com/dimensions.html). MBA students in Barcelona were asked to prepare a scholarship application and were then interviewed about it. The third stimulus set was created in 2011–2012. Indian students were asked to prepare scholarship applications and were then interviewed about them. Indians were chosen for the third stimulus set because Indians differ substantially from Americans on four of Hofstede's five cultural dimensions (all but the masculinity/femininity scale), and from Spaniards on two dimensions (i.e., power distance and uncertainty avoidance).

To create each stimulus set, applicants were asked to provide their résumés, in order to establish ground truth in each case. Researchers then compared the résumé to the enhanced application in order to determine what was truthful and what was dishonest on the application. In all cases, the participants were encouraged to complete the application form so as to make themselves appear as top candidates for the scholarship. The participants were not told to lie explicitly, but they were told that they could enhance their information if they wanted to. In all cases, each student was interviewed by a third party who was ignorant of the design of the study and of the study hypotheses. As such, both the interviewers and interviewees were independent of the researchers and were equally naïve as to the research purpose of the interviews. Interviewers were told to ask any questions they wanted about the scholarship application, and interviewees were asked to defend anything

on the application that the interviewer asked about. In total, 20 unique students were interviewed for each set of stimulus materials (20 Americans, 20 Spaniards, 20 Indians). The résumé task had been used in previous studies (George et al. 2008; George et al. 2014), where it was shown to successfully elicit genuine non-rehearsed deception from participants who were asked to prepare and defend their applications. As the task involved interactions between the interviewer and interviewee, following the process outlined in IDT, interviewees generated additional deceptions during the interviews in order to defend their initial enhancements.

The recorded interviews were used to create each stimulus set. For each set (one for American English, one for Spanish, and one for Indian English), the researchers carefully reviewed the full interviews and chose 32 brief snippets to be included in the stimulus set. The snippets for the Spanish and American English sets were chosen (and edited) by one author; the snippets for the Indian English set were chosen (and edited) by another author. For both, the challenge was to select snippets that were representative of honesty and dishonesty across each set of interviews. The snippets could not be too easy or too hard to evaluate. Each author also made sure that no single interviewee appeared in more than one video snippet (sound or not) within a stimulus set (where the face would be the same) and that no interviewee appeared in more than one audio only or full audiovisual snippet within a stimulus set (where the voice would be the same). Half of the chosen snippets were honest, and half were dishonest. Further, the snippets were edited so that each one appeared in one of four media formats: (1) full audiovisual, (2) video only, (3) audio only, and (4) text only.

For each stimulus set, eight snippets were in full audiovisual; eight were video only; eight were audio only; and eight were text only. Text snippets were transcribed from the interview recordings and translated into the language of the judge—into English for the English-speaking judges, and into Spanish for the Spanish-speaking judges. For snippets where gender was obvious (i.e., all but the written snippets), 60.42% of the interviewees were male, and 39.58% were female.

For the four simulated media to which the judges were exposed, the media capabilities associated with each medium (Dennis et al. 2008) were determined. For full audiovisual, transmission velocity was high, there were a moderate number of symbol sets (using the Dennis et al. assessment terms), and reprocessibility was low. For audio only, transmission velocity was high, the number of symbol sets was moderate but fewer than for full audiovisual, and reprocessibility was low. For text, transmission velocity was low, the number of symbol sets was low, and reprocessibility was high. Finally, for video only, transmission velocity was high, reprocessibility was low, and the number of symbol sets was low but not as low as that of text, given that visual symbols have the capacity to transmit more information that written words alone. It is interesting to note that, since all of the stimuli were recorded, all of the media had enhanced reprocessibility capabilities. Judges could replay all of the stimuli, giving them the ability to view and study the stimuli over and over. However, for whatever reasons, maybe because of their desire to finish the task in a timely manner, we observed hardly any judge "rewinding" a snippet. The "natural" level of reprocessibility for text was not affected, as judges could read the text snippet several times, just by looking at the text on the screen.

Appendix B

Measuring Culture

We measured culture using the scales for five dimensions of culture developed by Hofstede (1980) and Hofstede and Bond (1988). The actual items used for four of the dimensions (masculinity/femininity (MF); individualism/collectivism (IC); power distance (PD); uncertainty avoidance (UA)) came from Srite and Karahanna (2006) and are reproduced in Table B1. Srite and Karahanna relied on Hofstede (1980) and Dorfman and Howell (1988) when developing their scales. The items for long-term/short-term orientation (LT) came from Hofstede's VSM08 scales (2008) and are reproduced in Table B2.

Table B1. Measurement Scales for Four Hofstede Dimensions of Culture (Source: Srite and Karahanna 2006)	
Masculinity/Femininity (MF)	
MF1	It is preferable to have a man in high level position rather than a woman
MF2	*There are some jobs in which a man can always do better than a woman*[†]
MF3	It is more important for men to have a professional career than it is for women to have a professional career
MF4	Solving organizational problems requires the active forcible approach which is typical of men[†‡]
MF5	Women do not value recognition and promotion in their work as much as men do[†]
Individualism/Collectivism (IC)	
IC1	*Being accepted as a member of a group is more important than having autonomy and independence*
IC2	*Being accepted as a member of a group is more important than being independent*
IC3	Group success is more important than individual success
IC4	Being loyal to a group is more important than individual gain
IC5	*Individual rewards are not as important as group welfare*
IC6	*It is more important for a manager to encourage loyalty and a sense of duty in subordinates than it is to encourage individual initiative*
Power Distance (PD)	
PD1	Managers should make most decisions without consulting subordinates
PD2	Managers should not ask subordinates for advice, because they might appear less powerful
PD3	*Decision making power should stay with top management in the organization and not be delegated to lower level employees*
PD4	Employees should not question their manager's decisions
PD5	*A manager should perform work which is difficult and important and delegate tasks which are repetitive and mundane to subordinates*[†]
PD6	*Higher level managers should receive more benefits and privileges than lower level managers and professional staff*[†]
PD7	Managers should be careful not to ask the opinions of subordinates too frequently, otherwise the manager might appear to be weak and incompetent[†]
Uncertainty Avoidance (UA)	
UA1	Rules and regulations are important because they inform workers what the organization expects of them
UA2	Order and structure are very important in a work environment
UA3	It is important to have job requirements and instructions spelled out in detail so that people always know what they are expected to do[†]
UA4	It is better to have a bad situation that you know about, than to have an uncertain situation which might be better[†]
UA5	*Providing opportunities to be innovative is more important than requiring standardized work procedures*[†]
UA6	*People should avoid making changes because things could get worse*[†]

The italicized items were dropped from the final analysis due to poor psychometric properties.
[†]Item was dropped from the final analysis in Srite and Karahanna (2006) due to poor psychometric properties.
[‡]Item was not included in Study 2 in Srite and Karahanna (2006).

Table B2. Measurement Items for Hofstede's Long-Term/Short-Term Orientation Dimensions (Source: Hofstede 2008)

LT1 (VSM08 Item 25). Persistent efforts are the surest way to results Strongly Agree 1 2 3 4 5 Strongly Disagree
LT2 (VSM08 Item 28). We should honor our heroes from the past Strongly Agree 1 2 3 4 5 Strongly Disagree
LT3 (VSM08 Item 18). Are you the same person at work (or at school if you're a student) and at home? 1. quite the same 2. mostly the same 3. don't know 4. mostly different 5. quite different
LT4 (VSM08 Item 15). If there is something expensive you really want to buy but you do not have enough money, what do you do? 1. always save before buying 2. usually save first 3. sometimes save, sometimes borrow to buy 4. usually borrow and pay off later 5. always buy now, pay off later

All items used a five-point Likert scale, ranging from 1 for "strongly agree" to 5 for "strongly disagree," with 3 labeled as "undecided," except for the items in the long-term/short-term orientation scale. Two items (LT1 and LT2) each used a different five-point Likert scale. The other two items, LT3 and LT4, each had its own unique scale (Table B2).

After the data were collected, we conducted a confirmatory factor analysis on each scale using AMOS (part of IBM's SPSS statistical package, version 21), except for the long-term orientation scale. That is because the LT scale was designed to be calculated using the following formula (Hofstede et al 2008):

$$LT = 40(m18 - m15) + 25(m28 - m25) + C(ls)$$

where C(ls) is a constant that can be introduced to raise or lower all of the LT scores.

The relevant statistics from each of the four CFA tests are reported in Table B3.

Table B3. Standard Regression Weights from AMOS CFA for Five Hofstede Cultural Dimensions

Item	Weight	Item	Weight	Item	Weight	Item	Weight
PD1	.738	UA1	.768	MF1	.853	IC1	.441
PD2	.860	UA2	.916	MF2	.328	IC2	.298
PD3	.365	UA3	.821	MF3	.899	IC3	.695
PD4	.758	UA4	.602	MF4	.900	IC4	.717
PD5	.442	UA5	-.314	MF5	.861	IC5	.349
PD6	.076	UA6	-.628			IC6	.391
PD7	.622						
Chi^2 (*df*)	46.94 (*14*)		9.54 (*9*)		31.69 (*5*)		51.64 (*9*)
Chi^2 p	.000		.389		.000		.000
RMSEA	.920		.015		.139		.131

The only model that fit the data well was the uncertainty avoidance scale, as the chi-square value was not significant and the RMSEA value was less than the recommended 0.05 cutoff. For the three remaining scales, some items were pruned, based on their values. All items with values below 0.60 were dropped, and the CFAs were run again.

For the PD scale, when items PD3, PD5 and PD6 are removed, the resulting chi-square for the model is 3.086 (df = 2), with a p-value of 0.214. The RMSEA value is 0.000, less than the recommended 0.05 cutoff. Both indices indicate the model is a good fit to the data. For the MF scale, when item MF2 is removed, the resulting chi-square for the model is 1.696 (df = 2), with a p-value of 0.428. The RMSEA value is .044 indicating the model is a good fit to the data. After pruning, the IC scale had only two items, so no CFA could be conducted.

We then calculated reliability measures for each scale, using the items remaining after the AMOS CFA tests. The Cronbach alphas for the scales were as follows: PD: 0.831; UA: 0.385; MF: 0.930; IC: 0.703. All of these reliability measures are above standard cutoff levels (of 0.70) except for UA. The SPSS output suggested that the reliability would improve to 0.708 if UA6 were removed. An additional reliability test of the remaining UA scale items showed that the Cronbach alpha would increase to 0.862 if UA5 were dropped. Considering that both UA5 and UA6 had negative standard regression weights, and that the reliability of the scale increased without them, we decided to drop both items from the scale. For a CFA test in AMOS without UA5 and UA6, the chi-square was 1.54 (df = 2), with a p-value of 0.4634. The RMSEA value was 0.000, indicating the model was a good fit to the data.

Four dimensional scores were then created for each participant by averaging the values of the items for each scale. Descriptive statistics are shown in Table B4.

Table B4. Descriptive Statistics for Hofstede's Scale—Average Scores

Cultural Dimensions	N	Min	Max	Mean	Standard Deviation
Individualism/Collectivism (IC)	279	1	5	3.60	0.83
Masculinity/Femininity (MF)	279	1	5	2.87	1.40
Uncertainty Avoidance (UA)	279	1	5	3.19	1.03
Power Distance (PD)	279	1	5	2.78	0.98
Long-Term/Short-Term Orientation (LT)	279	-130.00	220.00	23.91	61.37

We then ran a one-way ANOVA to determine if the Hofstede scales as calculated could distinguish among the three cultural groups of judges (Americans, Indians, and Spaniards), especially in terms of the dimensional rankings established by Hofstede (geert-hofstede.com). There were statistically significant differences for all five dimensions, as follows: IC: $F(2,276) = 6.255$, $p \leq 0.002$; MF: $F(2,276) = 464.0$, $p \leq 0.001$; UA: $F(2,276) = 117.3$, $p \leq 0.001$; PD: $F(2,276) = 215.72$, $p \leq 0.001$; LTO: $F(2,276) = 23.675$, $p \leq 0.001$. We also ran pairwise Bonferroni tests, at the $\alpha \leq 0.05$ level. The results are shown in Table B5.

Table B5. Differences in Hofstede's Cultural Dimension Scales across the Three Groups of Judges (Mean, Standard Deviation)

	IC		MF		UA		PD		LTO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Spain	3.51	.93	4.44*	.55	2.02*	.45	3.75	.65*	47.59	63.51
USA	3.54	.76	1.97	.79	3.92	.46	2.22	.60	-.076‡	51.69
India	4.01†	.65	1.75	.54	3.89	.51	2.08	.56	42.07	54.92

*Spain differs from the USA and India, but the USA and India do not differ from each other.
†India differs from the USA and Spain, but the USA and Spain do not differ from each other.
‡The USA differs from India and Spain, but India and Spain do not differ from each other.

While the results for the individualist/collectivist (IC) dimension successfully distinguish among the groups, the results are not what Hofstede would have predicted. The USA should be clearly individualistic, with Spain and India scoring as collectivist. The results show all of the groups scoring near the individualist end of the scale, with the Indians being the most individualist. This is most likely due to issues with the IC scale which, after pruning, consisted of only two items.

For masculinity/femininity (MF), the results are in line with Hofstede's predictions: higher scores indicate a feminine culture, and Spain should be the most feminine culture of the three. The Spanish score here indicates a feminine culture, as the "5" end of the scale represents femininity on the scale, and the Spanish judge score is very close to the extreme value, at 4.44. The same agreement with Hofstede's findings is true for uncertainty avoidance. The Spanish culture should exhibit the highest level of uncertainty avoidance. That is the case here, where smaller values mean the most avoidance of uncertainty.

For power distance (PD), the results successfully distinguished among the groups, but they do not align exactly with Hofstede's findings. Indians should tolerate the greatest gap in power between those at the top of the hierarchy and those at lower levels, the Spaniards should be in the middle, and the Americans should have the smallest power distance. While the Indian judges had the lowest power distance scores (meaning the most tolerance for inequality), they were statistically no different than the Americans, while the Spaniards were at the other end of the scale, with the least tolerance for inequality.

For long/short-term orientation (LT), the results are largely in line with Hofstede's findings. The United States should be the lowest scorer, indicating a normative society, where traditions are preserved and change is viewed suspiciously. Spain and India should score close together in Hofstede's assessment, but higher than the United States. India is seen as a pragmatic society with a more long-term focus. While Spain's score is very close to India's and is considered intermediate, Spain is seen by Hofstede as a normative country, very much living in the moment. In order to run binomial regression tests using Hofstede's cultural dimensions, it was necessary to convert the scale values to categories, as binomial regression requires that predictors be categorical rather than continuous (IBM SPSS Statistics Help). For each dimension, we created two categories, for those scoring high on the dimensional scale and for those scoring low. The percentages of participants from each group of judges for each category for each cultural dimension are shown in the following tables (Tables B6 to B10).

Table B6. Distribution of IC Scale Values across Judges

	USA	Spain	India
Below median (collectivist)	31.7%	34.0%	37.3%
Above median (individualist)	68.3%	66.0%	62.7%

Table B7. Distribution of MF Scale Values Across Judges

	USA	Spain	India
Below median (masculine)	71.5%	0%	88.9%
Above median (feminine)	28.5%	100%	11.1%

Table B8. Distribution of UA Scale Values across Judges

	USA	Spain	India
Below median (high avoidance)	11.5%	98%	11.1%
Above median (low avoidance)	88.5%	2%	88.9%

Table B9. Distribution of PD Scale Values across Judges

	USA	Spain	India
Below median (high power distance)	64.9%	3.8%	73.3%
Above median (low power distance)	35.1%	96.2%	26.7%

Table B10. Distribution of LTO Scale Values across Judges

	USA	Spain	India
Below median (short-term orientation)	62%	30%	40.6%
Above median (long-term orientation)	38%	70%	59.4%

Finally, we explored the cross-cultural equivalence of our instrumentation and its results. Cross-cultural equivalence is the extent to which research designs across different cross-cultural contexts can be employed in the same fashion. Essentially, cultural differences create challenges in surveys being utilized in their same form among cultures. Thus, it was necessary to take steps to ensure data equivalence so as to be sure that any significant differences among cultures are truly a reflection of cross-cultural distinctions, and not due to construct operationalizations and types of scales used (Hult et al. 2008). To this end, this study examined three aspects of equivalence: construct, measurement, and sample. Construct equivalence, which determines whether a concept has the same meaning among cultures (DeCarlo et al. 2007; Kumar 2000), was achieved through a variety of methods that provide typical reliability and construct validity for the study measures reported previously in this appendix. Measurement equivalence was ascertained by using Hofstede's measures, which have been used and validated in 50 countries and translated into 20 different languages (Hofstede 1983). Regarding sample equivalence, appropriate measures were taken to ensure that the veracity judges were similar. We therefore limited our sample to students. Further evidence of limited variability among the sample was exhibited by the commonality of language. Of the three groups of judges, all of the American and Indian judges spoke English, as well as 72% of the Spanish group. It is also important to note that the three groups are comparable demographically. The mean age of the Americans, Spaniards, and Indians was approximately 23, 22, and 21 years, respectively. Regarding gender, the American (64%), Spanish (66%), and Indian (66%) judges were primarily represented by males. ANOVA tests among the groups for age and gender were not significant.

Appendix C

Creation of Media Capabilities Variables

In this study, medium was a treatment, as participants were exposed to four different media: (1) full audiovisual (AV), (2) video only, (3) audio only, and (4) text. In order to recode the media categories into variables based on media capabilities, we relied on the study by Dennis et al. (2008), which provided ratings for five media capabilities in their media synchronicity theory (MST): (1) transmission velocity, (2) parallelism, (3) symbol sets, (4) rehearsability, and (5) reprocessability. Neither parallelism nor rehearsability were appropriate capabilities for our study.

In their Table 2 (p. 589), Dennis et al. provided ratings for media capabilities across several media. Their "video conference" compares most favorably to our full audiovisual mode; "telephone conference" matched our audio-only mode; and "asynchronous electronic mail" best approximated to our text-only mode. There was no medium in their table that matched our video-only treatment, so we made some conjectures about this medium in order to classify it. Table 3 in the main paper shows the results of matching the media from MST to those in our study. All values are from Dennis et al. except those for the video-only mode.

We created three new variables, one for each media capability that was identifiable in our study. For "transmission velocity" and "reprocessibility," we coded high as 4 and low as 1. For symbol sets, we used four codes: 4 for very high; 3 for high; 2 for moderate; and 1 for low. Dennis et al. list eight different categories of symbol sets: physical, visual, verbal, written words, tables, images, videos and mathematical models (p. 584). Another way to look at symbol sets is to consider nonverbal behavior, which we can break down into subcategories such as kinesics (body language), proxemics (the use of space in communication), vocalics (the use of pitch, volume, intonation and so on), and haptics (touch) (Burgoon et al. 2016). Dennis et al. cover proxemics and haptics under physical symbol sets and kinesics under visual but they do not explicitly consider vocalics. We consider vocalics to be a separate symbol set that we added to their list.

We reasoned that our full audiovisual snippets included three of these symbol sets: visual, verbal, and vocalics. We also reasoned that audio-only snippets contained two symbol sets, verbal and vocalics. Text featured only one, written words. Video-only snippets also only featured one symbol set, visual, but we considered visual symbol sets to be capable of conveying more information that written words alone. Therefore, we assigned very high (4) to full audiovisual, high (3) to audio, moderate (2) for video only, and low (1) for text. In MST terms (Dennis et al. Table 2), the labels could have been medium, less than medium, few, and less than few, but the distinctions between the categories are equivalent.

For transmission velocity, 75% of the values were high; for reprocessibility, 75% of the values were low. The values for symbol sets were evenly distributed, at 25% each, across the four categories. (See Appendix A for additional information.)

Appendix D

Cues to Deception

Open-ended responses were coded by four of the authors. The process began with one author reviewing the responses from one set of judges. He listed each cue (or indicator) of deception found in the judges' responses, and counted the number of times each one occurred. He then trained a second author to tabulate responses on indicators. Once she had tabulated the responses for a second set of judges, the first author compared their results. Inter-rater agreement was over 90% (Cohen's Kappa of 0.888). Using the set of codes so created, four authors (including one of the original coders) then completed the coding of all 1,807 responses. Each of the responses could contain multiple cues, resulting in up to three codes per response. The results yielded 23 cues. Their raw counts, and their incidence for each group, are in Table D1.

Table D1. Coded Responses Related to Indicators of Deception in Correctly Identified Dishonest Snippets

Cues	USA (#)	Proportion (%)	Spain (#)	Proportion (%)	Indian (#)	Proportion (%)	Total
Tone/Pitch	16	1.53	363	31.48	7	3.00	386
Fidgeting	167	16.00	191	16.57	12	5.15	370
Vague Reply	191	18.30	46	3.99	103	44.21	340
No Eye Contact	125	11.97	154	13.36	20	8.58	299
Pauses	87	8.33	165	14.31	21	9.01	273
Voice Stuttering	41	3.93	45	3.90	3	1.29	89
Repetitive Answers	17	1.63	56	4.86	6	2.58	79
Contradicting Oneself	37	3.54	32	2.78	7	3.00	76
Bragging	28	2.68	39	3.38	5	2.15	72
Uncertainty	59	5.65	0	0.00	0	0.00	59
Too Casual	49	4.69	0	0.00	2	0.86	51
Rehearsed	38	3.64	5	0.43	7	3.00	50
Short Answer	32	3.07	10	0.87	7	3.00	49
Laugh/Smile	32	3.07	13	1.13	0	0.00	45
Uncomfortable	17	1.63	0	0.00	18	7.73	35
Poor Grammar	21	2.01	12	1.04	1	0.43	34
Word Fillers	34	3.26	0	0.00	0	0.00	34
Wordy	14	1.34	9	0.78	5	2.15	28
Blinking	15	1.44	0	0.00	4	1.72	19
Exaggerating	12	1.15	0	0.00	5	2.15	17
Eye Brows Movement	3	0.29	12	1.04	0	0.00	15
Use of We Instead of I	7	0.67	0	0.00	0	0.00	7
Biting Lips	2	0.19	1	0.09	0	0.00	3
Total	1044		1153		233		2430

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