

INDIVIDUALS' INTERNET SECURITY PERCEPTIONS AND BEHAVIORS: POLYCONTEXTUAL CONTRASTS BETWEEN THE UNITED STATES AND CHINA

Yan Chen

College of Business, Auburn University at Montgomery, 7071 Senators Drive,
Montgomery, AL 36117 U.S.A. {ychen3@aum.edu}

Fatemeh Mariam Zahedi

Sheldon B. Lubar School of Business, University of Wisconsin, Milwaukee, P.O. Box 742,
Milwaukee, WI 53201-0742 U.S.A. {zahedi@uwm.edu}

Appendix A

Literature Review on Security Behaviors in Non-Work Settings

Study	Sample	Country*	Method	Theory	Coping Behaviors
Anderson and Agarwal 2010	Study 1: 157 ISP subscribers, 94 students, and 343 from a purchased sample Study 2: 101 students	USA	Study 1: surveys Study 2: lab experiment	Study 1: PMT, Psychological Ownership Study 2: Message Goal Framing	Study 1: intention to perform security related behavior Study 2: security behavioral attitude
Liang and Xue 2010	152 students	USA	Survey	Technology Threat Avoidance Theory	Problem-solving coping behavior
Rhee et al. 2005	415 graduate students	USA	Survey	Social Cognitive Theory (Self-efficacy)	Use security technology, care behavior, and intention to strengthen the efforts
La Rose et al. 2008	206 students	USA	Experiment	PMT, Elaboration Likelihood Model, Social Cognitive Theory	Involvement, self-regulation, building good security habits
Dinev and Hu 2007	332 IS professionals and students	USA	Survey	Theory of Planned Behavior	Intention to use protective information technologies
Furnell et al. 2007	415 UK residents	UK	Survey	NA	Safe behavior, knowledge-seeking behavior
Lee and Kozar 2005	212 Internet Users	USA	Survey	Theory of Planned Behavior, IT Innovation	Adoption of an anti-spyware system
Liang and Xue 2009	NA	NA	Theory building	PMT, Cybernetic Process Theory	Problem-focused and emotion-focused coping behavior
Woon et al. 2005	189 students and faculty	Singapore	Survey	PMT	Have enabled/ have not enabled a firewall on home wireless network

*The sample country was deduced based on the content of the paper.

Appendix B

Constructs, Definitions, and Key References

Constructs	Definitions	Key References
Perceived susceptibility	Internet users' belief about the degree of vulnerability to Internet security attacks.	Liang and Xue 2009; Pechmann et al. 2003; Rogers 1975; Witte et al. 1996
Perceived severity	Internet users' belief about the significance or magnitude of potential harm caused by Internet security attacks.	Liang and Xue 2009; Pechmann et al. 2003; Rogers 1975; Witte et al. 1996
Perceived security threat	Internet users' degree of worry/fear about Internet security threats. It manifests as security concern.	Leventhal et al. 1965; Liang and Xue 2009; Maddux et al. 1986; Rogers and Mewborn 1976
Perceived security self-efficacy	Internet users' belief in their ability to take protective measures to avoid Internet security threats.	Compeau and Higgins 1995; Lam and Lee 2006; Liang and Xue 2009; Maddux et al. 1986; Maddux and Rogers 1983; Pechmann et al. 2003; Rogers 1975; Witte et al. 1996
Perceived security response efficacy	Internet users' belief about whether or not the recommended protective measure can effectively protect against Internet security attacks.	Compeau and Higgins 1995; Lam and Lee 2006; Liang and Xue 2009; Maddux et al. 1986; Rogers and Mewborn 1976; Witte et al. 1996
Protective actions	Internet users' one or more protective countermeasures to reduce or eliminate risk of Internet security attacks.	Lazarus 1993; Liang and Xue 2009, 2010; McCrae 1984
Seeking help	Internet users' interactions with others in seeking social support and assistance in dealing with Internet security threats.	Lazarus 1993; McCrae 1984; Tobin et al. 1989
Avoidance	Avoiding the use of the Internet in various degrees, especially avoiding sensitive activities such as online banking, in order to avoid online security threats.	Lazarus 1993; Liang and Xue 2009, 2010; McCrae 1984

Appendix C

Internet Security Attacks, Protective Actions, and Survey Instrument

Internet security attacks are malicious and intentional acts that would cause damages to **your computer** or illegally collect your information such as your personal and financial information or Internet behaviors.

Note: The term **your computer** in this questionnaire indicates your personal or home computer.

Table C1. List of Internet Security Attacks

Malicious code attacks (e.g. viruses, worms and Trojan horses)
Malicious email attachment (email attachments contain or hide malicious code)
Spoofing and phishing attacks (you believe you are receiving e-mail from a trusted source, or are connected to a trusted web site, when that is not the case)
Spyware attacks (software that is secretly installed on your computer and collects information about you without your knowledge)
Scareware/rogueware attacks (e.g., fake anti-virus and anti-spyware software)
Botnets attacks (e.g., your computer was controlled by malicious codes from the Internet to conduct malicious attacks)
Social engineering attacks (e.g., you were deceived to give out confidential information)
Unauthorized accesses to your computer from the Internet
Other—Please specify [A text input box followed to allow respondents to add other attacks]

Taking protective actions means taking one or more of the following security countermeasures to reduce the risk of Internet security attacks on your computer.

Table C2. List of Protective Actions

Installed antivirus software
Installed antispymware software
Installed spam-filter software
Have a firewall
Have enabled security settings for my browser (e.g., block cookies, scripts, and pop-ups)
Commonly use long and complex passwords
Regularly update my operating system manually or automatically (e.g., Windows)
Regularly update my Internet browser manually or automatically (e.g., Internet Explorer)
Regularly update my security software manually or automatically (e.g., Norton AntiVirus)
Have enabled scanning function of security software (e.g., antivirus software)
Regularly turn off the Internet connection when not using it
Other—Please specify [A text input box followed to allow respondents to add other attacks]

Source: www.cert.org

Table C3. Survey Instrument

Construct	Item Name	Item
Susceptibility		When it comes to the likelihood of Internet security attacks, I believe that
	sus1	my risks of getting Internet security attacks are (very low/very high)
	sus2	the likelihood that I would be a target of security attacks is (very low/very high)
	sus3	the extent of my vulnerability to security attacks is (very low/very high)
Severity		When it comes to severity of Internet security attacks, I believe that
	sev1	the consequences of security attacks for me is (not serious at all/very serious)
	sev2	in general, the severity of security attacks for me is (very low/very high)
Self-efficacy		When it comes to my ability in dealing with Internet security attacks, I believe that
	self1	my knowledge for taking preventive actions is (not adequate at all/very adequate)
	self2	my ability to get appropriate advice on how to take protective actions is (very low/very high)
	self3	my level of access to people who can help me is (very low/very high)
	self4	for me, taking protective actions is (very difficult/very easy)
Response efficacy		When it comes to the effectiveness of protective actions against Internet security attacks, I believe that
	reff1	the success rate of protective actions is (very low/very high)
	reff2	the chance of stopping security attacks by taking protective actions is (very low/very high)
	reff3	the likelihood to neutralize Internet security threats is (very low/very high)
	reff4	my confidence in effectiveness of protective actions is (very low/very high)
Perceived security threat		When it comes to my feelings and concerns about Internet security attacks, I believe that
	sc1	my fear of exposure to Internet security attacks is (very low/very high)
	sc2	the extent of my worry about Internet security attacks is (very low/very high)
	sc3	the extent of my anxiety about potential loss due to Internet security attacks is (very low/very high)
Seeking help		When it comes to increasing my knowledge about Internet security attacks, I believe that
	sh1	my frequency of asking for help has been (very low/very high)
	sh2	my frequency of seeking professional advice has been (very low/very high)
	sh3	my frequency of seeking support from others has been (very low/very high)
Action		My actions to protect me against Internet security attacks can be characterized as
	act1	no actions at all/frequent actions
	act2	no plan at all/well-planned
	act3	no precautions at all/many precautions
Avoidance		When it comes to avoiding the Internet environment where Internet security threats exist, I have
	avd1	not avoided using Internet at all/avoided using Internet
	avd2	not reduced my reliance on Internet at all/reduced my reliance on Internet
	avd3	not reduced frequency of my use of Internet at all/reduced frequency of my use of Internet
Collectivism		When it comes to my relationship with the groups I belong to, for me
	col1	compared to having autonomy, being accepted as a member of a group is (not important at all/very important for sure)
	col2	compared to individual success, group success is (not important at all/ very important for sure)
	col3	compared to individual freedom, belonging to a group is (not important at all/very important for sure)
	col4	compared to receiving personal rewards, taking care of group welfare is (not important at all/very important for sure)
	col5	compared to personal gain, being loyal to a group is (not important at all/very important for sure)

Table C3. Survey Instrument (Continued)

Construct	Item Name	Item
Power distance		When it comes to my views on power distribution in the society, for me, having people in higher positions
	pd1	making all decisions on their own is (not acceptable at all/highly acceptable for sure)
	pd2	not consulting those below them is (not acceptable at all/highly acceptable for sure)
	pd3	having all decision-making power is (not acceptable at all/highly acceptable for sure)
	pd4	not allowing those below them to question their decisions is (not acceptable at all/highly acceptable for sure)
Uncertainty avoidance		When it comes my tolerance of uncertainty and ambiguity in my workplace, for me
	ua1	having rules and regulations telling me exactly what are expected from me is (not important at all/very important for sure)
	ua2	compared to having less structure that allows for flexibility, having a highly structured work environment with clarity of job description is (not important at all/very important for sure)
	ua3	compared to having general directions, having detailed instructions on how to do my job is (not important at all/very important for sure)
	ua4	compared to an ambiguous environment that allows for personal innovation, having standardized job description is (not important at all/very important for sure)
Experienced loss due to security attacks		The extent of damage you have suffered due to the above [listed in the survey] security attacks has been
	loss1	time and efforts spent to get rid of problems (none/very high)
	loss2	psychological tension, stress and anxiety (none/very high)
Marker variable		In general, compared to my short-term plans, my long-term plans for my future are (not important at all/very important). (This variable was used for purification of data to check if possible common method variance could change the results. It did not.)

All items were measured on a continuous semantic differential scale from 1 to 10.

Appendix D

Participant Profiles

Profile Variables	United States (n = 480)		China (n = 238)	
	Mean	STD	Mean	STD
Age	34.1	15.0	25.2	9.9
Education*	3.7	1.3	3.7	1.7
Time spent on Internet daily (hours)	3.7	1.3	4.0	1.5
Years of experience using the Internet (years)**	12.6	4.9	7.4	4.6
Gender	Male (%)	Female (%)	Male (%)	Female (%)
	46.3%	53.8%	73.9%	26.1%

*Education scales: 1 = Some school, no degree; 2 = High school graduate; 3 = Some college, no degree/college students; 4 = Professional degree/two-year associate degree; 5 = Bachelor's degree; 6 = Master's degree; 7 = Doctoral degree.

**The large difference between the years of experience in the United States and China samples supports our argument that the Chinese users have less experience with the Internet.

In the U.S. sample, the mean age was 34.1, with 33 percent of respondents above and 67 percent at or below 45 years of age. Although younger

respondents still dominated our sample population, the age distribution was relatively close to the age distribution of the U.S. adult Internet users, in which 46 percent are above and 54 percent at or below 45 years of age (Pew Internet 2009). Males and females were almost equally distributed in this sample, with percentages of 46.3 and 53.8, respectively.

In the China sample, the mean age was 25.2, with 24 percent of respondents above and 76 percent at or below 30 years of age. This age distribution is close to the published report that only 29 percent of the Internet population is above 30 years old in China (CNNIC 2010). Male and female distributions were 73.9 percent and 26.1 percent, respectively. Although the percentage of males is higher, CNNIC (2010) reports a similar gender disparity.

Appendix E

Reliability Checks

Constructs	United States			China		
	Cronbach Alpha	CFR	AVE	Cronbach Alpha	CFR	AVE
Susceptibility	0.87	0.88	0.71	0.85	0.84	0.63
Severity	0.90	0.92	0.85	0.85	0.85	0.74
Self-efficacy	0.88	0.88	0.64	0.87	0.88	0.64
Response efficacy	0.92	0.92	0.73	0.90	0.90	0.70
Perceived threat	0.95	0.94	0.85	0.88	0.87	0.70
Action	0.91	0.92	0.79	0.93	0.92	0.80
Seeking help	0.89	0.89	0.73	0.90	0.87	0.70
Avoidance	0.94	0.94	0.84	0.94	0.94	0.85

Notes: CFR=composite factor reliability, AVE=average variance extracted

Constructs	United States			China		
	Cronbach Alpha	CFR	AVE	Cronbach Alpha	CFR	AVE
Collectivism	0.87	0.87	0.57	0.94	0.94	0.76
Power distance	0.90	0.90	0.71	0.86	0.86	0.62
Uncertainty avoidance	0.87	0.87	0.64	0.91	0.91	0.71
Loss due to security attacks	0.90	0.90	0.82	0.84	0.84	0.72

Notes: CFR=composite factor reliability, AVE=average variance extracted

Table E3. Exploratory Factor Analysis							
Constructs		United States			China		
Level 1	Item	1	2		1	2	
Susceptibility	sus1	.882	.269		.876	.205	
	sus2	.860	.261		.838	.287	
	sus3	.837	.246		.779	.330	
Severity	sev1	.271	.922		.278	.893	
	sev2	.278	.920		.287	.888	
Level 2	Items	1	2	3	1	2	3
Self-efficacy	self1	.295	.764	-.016	.203	.844	.031
	self2	.316	.844	-.043	.273	.867	.077
	self3	.232	.816	-.091	.152	.741	.044
	self4	.383	.765	-.036	.389	.778	.089
Response efficacy	reff1	.825	.339	-.048	.818	.371	.083
	reff2	.855	.310	-.067	.862	.237	.033
	reff3	.838	.264	-.005	.827	.121	.126
	reff4	.823	.348	-.147	.809	.332	.057
Perceived threat	sc1	-.031	-.067	.938	.157	-.017	.867
	sc2	-.061	-.050	.958	.106	.110	.902
	sc3	-.088	-.028	.941	-.033	.087	.907
Level 3	Items	1	2	3	1	2	3
Protective action	act1	.866	.888	.220	.034	.932	.155
	act2	.051	.919	.196	.091	.902	.151
	act3	-.001	.905	.147	.046	.931	.093
Seeking help	sh1	.128	.227	.880	.290	.123	.850
	sh2	.160	.131	.876	.234	.200	.839
	sh3	.068	.215	.877	.200	.106	.873
Avoidance	avd1	.926	.050	.091	.920	.065	.232
	avd2	.951	.036	.113	.899	.082	.231
	avd3	.940	.017	.143	.928	.033	.252

Table E4. Exploratory Factor Analysis of Constructs for Controls									
Constructs	Items	1	2	3	4	1	2	3	4
		United States				China			
Collectivism	col1	.852	-.013	.105	.008	.870	.270	.055	.061
	col2	.816	-.049	.115	.061	.866	.314	.032	-.013
	col3	.805	.166	.122	-.001	.844	.299	.056	.038
	col4	.752	-.069	.228	.112	.839	.243	.118	.107
	col5	.751	.150	.139	-.045	.823	.295	.076	.102
Power distance	pd1	.029	.923	-.011	.024	.312	.837	.054	.079
	pd2	.043	.889	.015	.013	.263	.831	.192	-.045
	pd3	.012	.867	-.025	-.006	.403	.799	.114	.040
	pd4	.070	.829	.146	.011	.382	.781	.124	-.020
Uncertainty avoidance	ua1	.143	.039	.871	.015	-.050	.105	.870	.080
	ua2	.222	.038	.838	.007	-.020	-.013	.858	.088
	ua3	.170	.168	.824	.058	.114	.158	.844	.037
	ua4	.109	-.096	.796	-.004	.239	.151	.752	.039
Experienced loss due to security attacks	loss1	.048	-.002	.024	.950	.120	.021	.063	.921
	loss2	.039	.036	.030	.949	.045	.006	.131	.918

Table E5. Construct Correlations, AVE, Means, and Standard Deviations of Constructs

United States	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Mean	Std
1. Loss	0.90															3.21	2.93
2. Susceptibility	0.58	0.84														4.03	2.33
3. Severity	0.56	0.34	0.92													4.36	2.84
4. Self-efficacy	-0.04	-0.03	-0.05	0.80												6.23	2.57
5. Response efficacy	-0.12	-0.07	-0.07	0.09	0.86											6.54	2.18
6. Perceived threat	0.44	0.53	0.50	-0.03	-0.05	0.92										4.26	2.53
7. Protective action	0.07	0.11	0.09	0.50	0.23	0.23	0.89									5.50	2.29
8. Seeking help	0.19	0.23	0.22	-0.01	-0.02	0.43	0.32	0.86								4.25	2.47
9. Avoidance	0.10	0.12	0.11	-0.09	-0.02	0.22	0.10	0.30	0.92							3.64	2.50
10. COL	0.09	0.05	0.09	0.06	0.11	0.06	0.06	0.02	0.01	0.75						6.47	1.75
11. PD	0.04	0.06	0.10	-0.14	-0.10	0.06	-0.07	0.03	0.02	0.09	0.84					3.62	2.03
12. UA	0.07	0.03	0.10	0.01	0.10	0.05	0.04	0.02	0.01	0.41	0.09	0.80				6.51	1.83
13. Gender	0.00	-0.06	0.02	-0.22	-0.22	-0.02	-0.15	-0.01	0.01	0.00	0.00	0.00	na			1.54	0.50
14. Age	0.00	0.08	0.07	-0.19	-0.08	0.06	-0.10	0.03	0.03	0.00	0.00	0.00	0.04	na		34.10	15.02
15. Education	0.00	0.09	0.08	-0.01	0.04	0.07	0.02	0.03	0.02	0.00	0.00	0.00	0.00	0.33	na	3.74	1.34
China	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
1. Loss	0.85															4.17	2.84
2. Susceptibility	0.70	0.80														4.09	2.32
3. Severity	0.58	0.43	0.86													5.08	2.63
4. Self-efficacy	0.17	0.11	0.14	0.80												5.44	2.53
5. Response efficacy	0.05	0.02	0.09	0.14	0.84											5.81	2.23
6. Perceived threat	0.52	0.55	0.62	0.10	0.05	0.84										4.95	2.49
7. Protective actions	0.17	0.13	0.18	0.62	0.38	0.19	0.90									5.68	2.33
8. Seeking help	0.34	0.36	0.41	0.07	0.03	0.66	0.20	0.83								4.71	2.40
9. Avoidance	0.24	0.26	0.29	-0.05	0.01	0.48	0.10	0.57	0.92							4.06	2.42
10. COL	0.18	0.13	0.26	0.30	0.39	0.17	0.30	0.11	0.05	0.87						6.77	1.94
11. PD	0.21	0.25	0.24	0.10	0.18	0.20	0.13	0.13	0.09	0.20	0.78					5.02	1.81
12. UA	0.09	0.03	0.18	0.22	0.43	0.10	0.26	0.06	0.02	0.72	0.31	0.84				6.53	1.79
13. Gender	0.00	0.12	0.07	-0.13	-0.15	0.08	-0.11	0.05	0.05	0.00	0.00	0.00	na			1.26	0.44
14. Age	0.00	0.09	0.06	0.07	0.00	0.06	0.04	0.04	0.02	0.00	0.00	0.00	0.05	na		25.20	9.87
15. Education	0.00	0.00	0.04	0.07	-0.01	0.02	0.04	0.01	0.00	0.00	0.00	0.00	0.15	0.44	na	3.73	1.72

Notes: The boldface values on the diagonal are the square roots of AVEs. na = Single item variable.

Appendix F

Standardized Factor Loadings in the Measurement Model Including Latent Control Variables

Constructs	Items	United States		China	
		Loading	t-value	Loading	t-value
Susceptibility	sus1	0.89	50.80	0.84	28.68
	sus2	0.83	41.12	0.82	29.76
	sus3	0.80	36.18	0.72	23.89
Severity	sev1	0.90	49.18	0.87	36.03
	sev2	0.94	65.78	0.86	32.07
Self-efficacy	self1	0.75	36.59	0.78	31.03
	self2	0.87	55.85	0.90	64.03
	self3	0.77	38.17	0.70	27.90
	self4	0.82	46.55	0.82	38.73
Response efficacy	reff1	0.88	61.80	0.88	45.14
	reff2	0.89	68.42	0.85	39.64
	reff3	0.79	37.59	0.77	30.60
	reff4	0.87	59.04	0.84	49.84
Perceived threat	sc1	0.89	77.53	0.80	32.56
	sc2	0.95	91.26	0.87	39.19
	sc3	0.92	84.93	0.84	37.76
Protective action	act1	0.88	56.36	0.92	65.41
	act2	0.92	81.12	0.89	44.56
	act3	0.86	53.31	0.89	52.54
Seeking help	sh1	0.88	61.86	0.87	40.78
	sh2	0.84	44.24	0.79	30.09
	sh3	0.85	43.86	0.84	30.50
Avoidance	avd1	0.86	48.07	0.92	72.25
	avd2	0.95	85.45	0.89	44.63
	avd3	0.94	90.61	0.95	107.72
Collectivism	col1	0.81	43.65	0.91	70.83
	col2	0.74	38.11	0.84	45.61
	col3	0.77	38.14	0.87	48.65
	col4	0.74	29.88	0.88	58.95
	col5	0.76	36.81	0.73	23.65
Power distance	pd1	0.84	33.10	0.82	32.38
	pd2	0.92	75.00	0.83	36.68
	pd3	0.82	32.76	0.76	27.52
	pd4	0.72	24.81	0.82	34.94
Uncertainty avoidance	ua1	0.83	41.03	0.88	52.04
	ua2	0.84	44.30	0.84	34.22
	ua3	0.80	40.56	0.83	26.06
	ua4	0.86	42.15	0.81	34.97
Loss due to security attacks	loss2	0.89	50.80	0.84	28.68
	loss3	0.83	41.12	0.82	29.76

Appendix G

Test of Mean Differences in the Espoused Cultural Dimensions for the United States and China

Espoused Cultural Dimension	Means		t-value	p-value (2-tailed)	Mean Difference	Std. Error Difference
	United States	China				
COL	6.466	6.774	-2.137	.033	-0.308	.144
PD	3.617	5.019	-9.027	.000	-1.402	.155
UA	6.506	6.532	-0.180	.857	-0.026	.144

Notes: Calculations are based on mean value of items in each dimension.

The tests indicated the statistically significant mean differences in espoused COL and PD dimensions between the China and U.S. samples. Hofstede (2001) does not report statistical differences between national cultural dimensions across countries. However, the differences in mean values of espoused culture were in the same directions as those in Hofstede's (2015) latest data for cultural dimensions for the United States and China—Individualism: U.S. = 90, China = 20, PD: U.S. = 40, China = 80. The mean difference of espoused culture UA in the United States and China was not statistically significant. The difference between the United States and China in the Hofstede's national dimension of UA is far less than that of COL and PD (U.S. = 46, China = 30). This difference may not be large enough to result in statistical significance for individual espoused culture.

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