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RESEARCH ARTICLE

INCREASING ACCOUNTABILITY THROUGH USER-INTERFACE DESIGN ARTIFACTS: A NEW APPROACH TO ADDRESSING THE PROBLEM OF ACCESS-POLICY VIOLATIONS

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Appendix A

Comparing Accountability and Deterrence

In this appendix we compare and contrast accountability theory and deterrence theory, which have some conceptual and operational overlap and exhibit important differences. These similarities and dissimilarities are summarized in Table A1.

Table A1. Accountability Theory and Deterrence Theory Compared

Element	Deterrence Theory	Accountability Theory
Objective of theory	Explains how to reduce antisocial behaviors.	Explains how to reduce antisocial behaviors or increase prosocial behaviors.
Central mechanism	Sanctions.	Self-image preservation and social desirability.
External component	Externally imposed sanctions.	Person or organization to whom one must account.
Internal component	Cost-benefit analysis. Self-imposed sanction (shame).	Self-image preservation.
Partially operationalizable via monitoring?	Yes—used to increase certainty of sanctions.	Yes—used to evaluate employee performance.
Certainty	Greater certainty of sanctions is better than less certainty, but does not explain how certainty can be increased.	Explains submanipulations of accountability: • Identifiability (having one's actions linked to oneself). • Evaluation (having one's actions assessed by another person). • Justification (having to give reasons for one's behavior).

Deterrence theory is the most widely applied theoretical perspective in behavioral IS security, having been applied in more than 17 studies (see D'Arcy and Herath 2011). Deterrence theory, a classical theory of criminology first described by Cesare Beccaria (1738-1794) and Jeremy Bentham (1748-1832), predicts that an increase in the perception of severity, celerity, and certainty of sanctions for a potential offense increases the perceived costs of an act, thus decreasing its desirability (Gibbs 1975; Tittle 1980). In addition to externally imposed formal sanctions, modern conceptions of deterrence theory have included informal sanctions, such as disapproval from peers (D'Arcy and Devaraj 2012; Paternoster and Simpson 1996) and shame, which is considered a self-imposed sanction (Pratt et al. 2006; Siponen and Vance 2010).

Accountability Theory and Deterrence Theory Contrasted

Accountability is distinct from deterrence in several ways. First, accountability and deterrence theory differ in their objectives. Whereas both accountability and deterrence theory explain how to reduce antisocial behaviors (D'Arcy and Hovav 2009; Sedikides et al. 2002), accountability theory also explains how to increase prosocial behaviors (Fandt and Ferris 1990). The prosocial behaviors may include higher conformity to expected behaviors (Tetlock et al. 1989), enhanced employee empowerment (Wallace et al. Mathe 2011), facilitated trust (Ammeter et al. 2004; Tetlock 1985), and increased work performance (Wallace et al. 2011). That accountability can also be used to promote positive behaviors suggests that a mechanism distinct from deterrence is at work.

Second, accountability and deterrence theory differ in their central mechanisms. Deterrence involves a cost–benefit analysis of the benefit of committing a norm-breaking act weighed against the severity and certainty of a sanction (Becker 1974; D'Arcy and Herath 2011). Whereas accountability may also involve an element of certainty (i.e., the likelihood of having to give an account), its central mechanisms are self-image preservation and social approval (Gelfand and Realo 1999; Tetlock 1999). These mechanisms can be effective even when no defined relationship exists between the respondent and the other person to whom one may be expected to justify oneself (Guerin 1989). The expectation of having to give an account and be evaluated by another person has been shown to be sufficient to deter undesirable behaviors, even when sanctions are not involved (Sedikides et al. 2002). Thus, whereas sanctions are at the heart of deterrence theory, accountability is still effective even when sanctions are not involved.

Third, both accountability and deterrence have internal and external components, although these components are different. For deterrence theory, the external component is a sanction that is externally imposed. In addition to an internal cost–benefit analysis, modern deterrence theory includes shame as a self-imposed sanction that may be purely internal—that is, not initiated by an outside party (D'Arcy and Herath 2011). In contrast, for accountability theory, the external component is the person to whom one expects to give an account, whereas self-image preservation is an internal exercise (at least initially, before action is prompted) (Gelfand and Realo 1999).

Both deterrence and accountability are at least partially operationalizable via the use of sanctions. However, whereas deterrence suggests the use of monitoring to increase the certainty of sanctions (D'Arcy et al. 2009; Parker 1998), accountability advises monitoring as the basis for a possible future evaluation (Gelfand et al. 2004). Therefore, although the monitoring mechanism may be similar in both cases, the central mechanism that is facilitated is different (i.e., sanctions versus evaluation). For example, monitoring can be used as an accountability mechanism to encourage and award employee performance (Hall et al. 2003).

For the purposes of the present study, however, the most relevant difference between deterrence and accountability is that deterrence theory suggests that greater certainty is better than less certainty, even though the theory itself doesn't explain how certainty should be increased (Gibbs 1975). In contrast, accountability theory explains several theoretical submanipulations—including the presence of another, identifiability, evaluation, and reason giving—each of which can be directly manipulated (Lerner and Tetlock 1999). Because the goal of this research study was to develop UI artifacts that could influence access-policy violation behavior, accountability was chosen as a theoretical guide for the development of the UI artifacts.

Appendix B

Scenarios and Instruments

Table B1. Instructional Scenarios

# / Policy	Scenario Text
1–Against policy	Tom works in the university records office. A woman approaches his desk and asks for her husband's academic transcript. She explains that she is submitting her husband's graduate school applications today and that her husband is traveling, doing campus interviews. She needs to send the transcript today so it can be received before the deadline passes. Although Tom believes doing so may be a violation of university policy, he gives the woman a copy of her husband's transcript.
2–Against policy	Karen works in the advisement center of her college. She is approached by a friend who has a daughter attending the university. The friend is concerned about his daughter's performance in her classes. He says that she has been struggling with depression but won't talk about her problems. He is worried that she is not receiving the help she needs and may be failing her courses. He asks Karen to look up his daughter's grades for the last few semesters to see if things are okay. Although Karen believes doing so may be a violation of university policy, she accesses the daughter's records and relates how she is doing in her coursework.
3–Against policy	Janice is the administrative assistant for her college. She is approached by a professor in her college who is asking for her help. The professor is conducting a research study involving students in the college. The professor has collected the data, and now needs basic demographic information. He asks Janice for the age, GPA, and year in school for the students who participated in the study. Although Janice believes doing so may be a violation of university policy, she gives the professor the demographic information for the students who participated in the study.
4–Against policy	Ethan is a university employee with access to the university records system. He knows Jason, a sophomore who now attends the university. In high school, Jason was very successful academically. Ethan is curious to know how well Jason is doing now that he is at the university. Ethan routinely looks up student information for his work, so accessing Jason's record would not be unusual. Although Ethan believes doing so may be a violation of university policy, he accesses Jason's student record.
5–No policy stated	Tom works in the university records office. A woman approaches his desk and asks for her husband's academic transcript. She explains that she is submitting her husband's graduate school applications today and that her husband is traveling, doing campus interviews. She needs to send the transcript today so it can be received before the deadline passes. Tom gives the woman a copy of her husband's transcript.

Table B1. Instructional Scenarios

# / Policy	Scenario Text
6–No policy stated	Karen works in the advisement center of her college. She is approached by a friend who has a daughter attending the university. The friend is concerned about his daughter's performance in her classes. He says that she has been struggling with depression but won't talk about her problems. He is worried that she is not receiving the help she needs and may be failing her courses. He asks Karen to look up his daughter's grades for the last few semesters to see if things are okay. Karen accesses the daughter's record and relates how she is doing in her coursework.
7–No policy stated	Janice is the administrative assistant for her college. She is approached by a professor in her college who is asking for her help. The professor is conducting a research study involving students in the college. The professor has collected the data, and now needs basic demographic information. He asks Janice for the age, GPA, and year in school for the students who participated in the study. Janice gives the professor the demographic information for the students who participated in the study.
8–No policy stated	Ethan is a university employee with access to the university records system. He knows Jason, a sophomore who now attends the university. In high school, Jason was very successful academically. Ethan is curious to know how well Jason is doing now that he is at the university. Ethan routinely looks up student information for his work, so accessing Jason's record would not be unusual. Ethan accesses Jason's student record.

Table B2. Instrument Documentation

Construct	Item	Source of Item
Intention	1. What is the chance that you would do what the employee did in the described scenario? 0% chance to 100% chance, 11-point scale	Siponen and Vance (2010)
	2. I would act in the same way as the employee did if I was in the same situation. 0% chance to 100% chance, 11-point scale	Vance et al. (2012)
Accountability (pre-vignette)	1. I am held accountable for my actions in the ARS system.	Hochwarter et al. (2005)
	2. University administration/management holds me accountable for all of my actions in the ARS system.	Hochwarter et al. (2005)
	3. I believe that I am accountable for my actions in the ARS system.	New item
Accountability (post-vignette)	1. I would be held accountable for my actions in the ARS system.	Hochwarter et al. (2005)
	2. University administration/management would hold me accountable for all of my actions in the ARS system.	Hochwarter et al. (2005)
	3. I believe that I would be accountable for my actions in the ARS system.	New item
Moral intensity	1. The overall harm (if any) done as a result of what [the scenario character] did would be very small.	Singhapakdi et al. (1996)
	2. There is a very small likelihood that what [the scenario character] did will actually cause any harm.	Singhapakdi et al. (1996)
	3. What [the scenario character] did will not cause any harm in the immediate future.	Singhapakdi et al. (1996)
	4. What [the scenario character] did will harm very few people (if any).*	Singhapakdi et al. (1996)
Subjective norms	1 (reversed). If I did what [the scenario character] did, most of the people who are important to me would respond as follows: Strongly disapprove to strongly approve, 7-point scale	Peace et al. (2003)
	2. Most people who are important to me would look down on me if I did what the employee in the scenario did. Very unlikely to very likely, 7-point scale	Peace et al. (2003)
	3. No one who is important to me thinks it would be okay to do what the employee in the scenario did. Strongly disagree to strongly agree, 7-point scale	Peace et al. (2003)
Impulsivity	1. I act on impulse.	Pogarsky (2004)
	2. I often do things on the spur of the moment.	Pogarsky (2004)
	3 (reversed). I always consider the consequences before I take action.	Pogarsky (2004)
	4 (reversed). I rarely make hasty decisions.	Pogarsky (2004)
Organizational trust	1. I believe my organization has high integrity.	Robinson (1996)
	2. I can expect my organization to treat me in a consistent and predictable fashion.	Robinson (1996)
	3. My organization is open and up-front with me.	Robinson (1996)

Note: Unless stated otherwise, items were measured on a 7-point scale from “strongly disagree” to “strongly agree.”
*Dropped to improve factorial validity.

Appendix C

Our Research in Context of Design Science

Here, we further describe the design science contributions of our study in view of the latest literature. Although there is no single authoritative or required approach to design science, common among seminal frameworks of design science is the notion that some of the major contributions an IS design science paper can make include describing and defining both the problem space and a conceptual solution, which can be described in terms of proof-of-concept and proof-of-value (Gregor and Hevner 2013; Hevner et al. 2004; Nunamaker and Briggs 2011; Nunamaker et al. 2013; Twyman et al. 2015). Hence, to better understand our design science contribution in the context of the literature, it is first important to understand proof-of-concept and proof-of-value. *Proof-of-concept* is the point at which enough evidence exists to show that the described conceptual solution of design is feasible and promising, at least in a limited context (Nunamaker and Briggs 2011; Nunamaker et al. 2013). In contrast, *proof-of-value* is achieved when researchers show that an IT artifact actually works in reality (Nunamaker and Briggs 2011; Nunamaker et al. 2013). These are most recently demonstrated and described in Twyman et al. (2015).

Importantly, proof-of-concept should be established from an IT artifact and design-science perspective before proof-of-value is established, and both are necessary in science (Gregor and Hevner 2013; Hevner et al. 2004; Nunamaker and Briggs 2011; Nunamaker et al. 2013). Both contributions are important but are not the same in terms of advancing design science and theory (Gregor and Hevner 2013; Hevner et al. 2004; Nunamaker and Briggs 2011; Nunamaker et al. 2013).

We now explain these details in the context of our research and specify the key differences between and contributions of the present study and that of Vance et al. (2013). Hence, from a design science and a theoretical contribution perspective, we submit that the work in Vance et al. helps establish proof-of-concept whereas the present study helps establish proof of value.

Specifically, Vance et al. advance the idea that in a scenario-based study, highlighting four subdimensions of accountability, will cause respondents to develop a negative correlation with intention to commit access-policy violations. Despite their novelty, the findings of Vance et al. are limited in three important ways. First, they test the concept of accountability using hypothetical, text-based scenarios in which each participant imagined for her/himself what the accountability UI mechanisms might look like and how such mechanisms might make them feel. Therefore, the study by Vance et al. does not demonstrate how to actually incorporate accountability into UI designs, and their results do not necessarily accurately reflect how users respond to actual UI mechanisms of accountability.

Second, although Vance et al. find a negative association between the four accountability mechanisms and intentions to violate the access policy, they do not measure perceptions of accountability directly. Rather, the effect of the mechanisms on accountability is only implied. Therefore, it is not clear whether the mechanisms can actually increase perceptions of accountability as theorized. Without such evidence, the role and influence of accountability in their model continues to be unresolved.

Third, and building off of the point above, Vance et al. imply that accountability itself can reduce access-policy violations. However, they neither theoretically support nor empirically test this assertion. It is therefore unknown whether the construct of accountability itself influences intentions to violate the access policy. This is an all-too-frequent gap in the accountability literature—implicating the role of accountability but not measuring it directly (Lerner and Tetlock 1999). This also illustrates the importance of the "science" element in design science, in building toward proof-of-value.

Fourth, although Vance et al. speculate that accountability mediates the effects of the UI mechanism on intention, these relationships were also untested. This is a critical limitation, because if accountability is not tested as a mediator, we cannot be certain whether the UI mechanisms actually influence behavior through the lever of accountability or whether their impact is through some other construct, such as deterrence, fear, or uncertainty. If accountability theory holds in a novel UI context, then accountability itself should act in a key mediation role between manipulated UI artifacts designed to increase identifiability, monitoring, evaluation, and social presence. That is, accountability should act as the underlying causal-process mechanism that ties UI artifacts to changes in intentions and subsequent behavior. However, not only is this not addressed in Vance et al., but nowhere in the accountability literature has accountability itself been established empirically as a causal mediator.

The present study addresses these four gaps and moves from proof-of-concept to proof-of-value in the following ways. First, we develop UI design artifacts that reify the four subdimensions of accountability within the user interface of a broad-access system. In this way, we can evaluate how users respond to the graphical UI manipulations to which they are exposed. Second, we measure perception of accountability to directly examine its effects on intention to violate the access policy. Third, we examine whether perceived accountability mediates the effects

of the UI design artifacts on intention to violate the access policy. Fourth, we use actual employees who employ the target system in their day-to-day work and who are prone to accountability violations because the system is an open-access system. Table C1 summarizes and describes the differences between the articles with respect to proof-of-concept and proof-of-value.

Table C1. Illustrating Proof-of-Concept and Proof-of-Value in the Research Stream

Key Design Element	Vance et al. (2013): Example of Proof-of-Concept	This Article: Example of Proof-of-Value	Additive Insights Gained from Proof-of-Value
UI design artifacts (RQ1)	Used accountability theory to identify four mechanisms to decrease access-policy violations. Did not instantiate the mechanisms.	Instantiated mechanisms as four UI design artifacts. Evaluated these artifacts within the context of system in use.	Offers a proof-of-value for the implementation of UI design artifacts.
Influence of UI design artifacts on accountability (RQ1)	Theorized that accountability mechanisms would increase perceptions of accountability. Did not test this relationship (perceptions of accountability were not measured).	Measured perceptions of accountability directly. Measured the impact of UI design artifacts on perceived accountability.	UI design artifacts effectively increase perceptions of accountability.
Influence of accountability on access policy–violation intentions (RQ2)	Theorized that perceived accountability can reduce intentions to violate the access policy. Did not test this relationship.	Showed that increases to perceived accountability reduce intentions to violate the access policy.	Perceived accountability is an effective mechanism to reduce ISP policy violations, and a viable alternative to deterrence approaches.
Mediation effect of perceived accountability (RQ3)	Tested the direct effects of accountability mechanisms on intention. Implied that perceived account-ability mediates the effects of accountability mechanisms on intention to violate. Did not theorize or test this relationship.	Theorized and empirically demonstrated that perceived accountability does mediate the effects of the UI design artifacts.	The UI design artifacts impact intention to violate through the operation of perceived accountability, rather than having individual effects on intention. Solidifies the theoretical and practical importance of accountability to reduce ISP violations.
Context	Less realistic and preliminary: (1) used textual, non-graphical scenarios; (2) used students; (3) system had no real-life relationship with participants	(1) used graphical screen manipulations from real system; (2) used employees who worked daily on the same open-access system.	These ideas work with the target audience in the field, not just in the lab.

Appendix D

Instrument Validation

To test the discriminant and convergent validity of our instrumentation items, we performed a principal components analysis (PCA) with Varimax rotation. Of critical interest was how the variables in each distinct stage of the causal model covary. This is because it was expected that the variables would correlate with their antecedents (Straub et al. 2004). Accordingly, we did not include items that belonged to the dependent variable in the PCA analysis. The results of the PCA analysis are reported in Table D1.

Factors with eigenvalues greater than 1 were extracted. This yielded five factors, which matched the number of theoretical factors expected (Gefen and Straub 2005). The results showed strong convergent validity: all items loaded above .60 on their intended construct (Hair et al. 2009). Similarly, all items demonstrated excellent discriminant validity: items did not cross load higher than .40 on any construct to which they did not belong (Hair et al. 2009).

Finally, we tested the reliability of the items using Cronbach's α. All constructs exhibited reliabilities of at least .70, indicating high reliability (Nunnally 1978). These results, along with the means, standard deviations, and bivariate correlations for the latent constructs, are reported in Table D2.

Table D1. Results of Principal Components Analysis

Items	Factors				
	1	2	3	4	5
Impulsivity 1				.82	
Impulsivity 2				.75	
Impulsivity 3				.64	
Impulsivity 4				.71	
Accountability 1			.93		
Accountability 2			.91		
Accountability 3			.73		
Organizational trust 1		.85			
Organizational trust 2		.93			
Organizational trust 3		.86			
Subjective norms 1					.71
Subjective norms 2					.78
Subjective norms 3					.81
Moral intensity 1	.83				
Moral intensity 2	.85				
Moral intensity 3	.84				

*$p < .01$. Cronbach's α in bold on the diagonal.

Table D2. Cronbach's α, Means, Standard Deviations, and Construct Correlations								
Latent Construct	**Mean**	**SD**	**1**	**2**	**3**	**4**	**5**	**6**
Intention (1)	2.19	4.05	**.97**					
Accountability (2)	17.37	3.41	-.11*	**.84**				
Impulsivity (3)	9.21	3.15	.14*	-.04	**.72**			
Moral intensity (4)	10.15	4.11	.44*	-.11*	.16*	**.87**		
Organizational trust (5)	17.74	3.11	-.07*	.29*	.004	-.10*	**.87**	
Subjective norms (6)	17.19	2.88	-.3*	.09*	-.11*	-.35*	.12*	**.71**

Appendix E

Testing of the Control Variable Base Model

We collected data for six demographic variables for use as control variables: gender, age, years of work experience, years worked at the present organization, education level, and employment status (full- or part-time). Of the respondents, 61% were female and 38% were male (approximately 1% of respondents declined to report gender). This breakdown was close to the gender split of the sampling frame (54% female, 46% male). The average age range was between 40 and 49; the average years of work experience was 18 years, with an average of 10 years of experience working for the university. The average respondent had either a bachelor's or master's degree. Of the respondents, 62% were full-time employees; 38% were part-time employees. Consequently, the respondents represented an experienced professional sample. We also captured two characteristics of the scenarios as controls: (1) the particular scenario given to the respondent, and (2) whether the scenario explicitly indicated that the behavior involved was a violation of university policy.

Moreover, instead of collecting data only for accountability, we did so for four psychometric constructs we believed would be rival predictors of the intention to violate the access policy: (1) *subjective norms*, the extent to which a behavior described in the instructional scenario represented a social norm in the organization (Peace et al. 2003); (2) *moral intensity*, the degree of moral wrongness that a respondent perceived in doing what the scenario character did (Singhapakdi et al. 1996); (3) *impulsivity*, the respondent's tendency to act on impulse (Pogarsky 2004); and (4) *organizational trust*, the level of trust that the respondent placed in the organization's management (Robinson 1996).

To select rival predictors and control variables for our baseline model, we followed a method analogous to stepwise regression in which we programmatically (1) ran a model with each control variable and rival predictor predicting *intention to violate the access policy* individually. The most significant variable was added to the baseline model. We then (2) ran a model with each individual variable paired with the most significant variable identified in step 1. The most significant variable pair was included in the baseline model. This process was repeated until no more significant variables were identified. The resulting final baseline model of significant controls and rival predictors consisted of the following: *subjective norms*, *education level*, *instructional scenario received*, and *moral intensity*, as Table E1 details. The inclusion of the statement that the request was a violation of university policy did not significantly influence intention. Accordingly, it was not entered into our baseline model.

The results show that of the four instructional scenarios, only Scenario 3 significantly increased the intention to violate the access policy. This finding can be explained as follows. Scenario 3 describes a professor who requests an administrative assistant to provide the age, GPA, and year in school of the students who participated in his research. Although the request appears to have a legitimate business purpose, it actually violates FERPA, because this information can be released only if students give their permission. Nevertheless, this was a point of confusion at the target university, and the FERPA coordinator specifically suggested this scenario because this violation is poorly understood. In fact, the FERPA training video at the target university features a similar situation to help increase understanding of this particular violation. Consistent with the FERPA coordinator's expectation, we found that respondents reported the highest average intention to violate in Scenario 3 out of the four scenarios.

Table E1. Baseline Model: Effects of Rival Predictors and Controls on Intention to Violate the Access Policy

Effect	β	Standard Error	*t*-Value
Intercept	6.768	1.308	5.17***
Risk beliefs	-0.241	0.045	5.40***
Subjective norms	-0.571	0.057	7.614***
Education level	-0.350	0.112	3.110**
Scenario 1	0.051	0.498	1.076 n.s.
Scenario 2	-0.107	0.504	.211 n.s.
Scenario 3	1.208	0.501	2.41***
Scenario 4	0	0	0
Moral intensity	0.241	0.049	4.94***

Fit statistics: AIC = 5363.85; BIC = 5371.30
Degrees of freedom: intercept = 311; all others = 954
***p < .001; **p < .01; *p < .05; n.s. = not significant

The baseline model yielded fit statistics of 5363.85 for Akaike's information criterion (AIC) and 5371.30 for Schwarz's Bayesian information criterion (BIC). Both statistics are functions of the log likelihood for a given model. Moreover, both statistics penalize a model for including terms that do not substantially contribute to model fit. The statistics differ in the size of the penalty. For both statistics, a lower value indicates a better-fitting model with fewer unnecessary terms. Therefore, the goal is to minimize either the AIC or BIC when comparing rival models (Ramsey and Schafer 2013). These scores consequently established baseline fit statistics that our theoretical model needed to improve on to demonstrate predictive ability over the baseline model.

Appendix F

Mediation and Moderation Analyses

Table F1 presents the full mediation model. Note that the direct effect of the *identifiability* UI element on *intention*, although previously significant, becomes insignificant in the mediated model. This is because, as demonstrated previously, the effect of *identifiability* was mediated fully by *Δaccountability*. In contrast, the direct effects of the other three UI elements on *intention* remained significant, indicating partial mediation. Also of note is that the AIC and BIC scores for the mediation model improved significantly over the *Δaccountability* model presented in Table 2 ($p < .001$), indicating that the mediation model exhibits superior model fit.

Table F1. Effects of Mediation Model on Intention to Violate the Access Policy

Effect	β	Standard Error	*t*-Value
Intercept	6.114	1.327	4.61***
Subjective norms	-0.554	0.076	7.28***
Education level	-0.335	0.114	2.94**
Scenario 1	0.058	0.503	1.11 n.s.
Scenario 2	-.073	0.510	.14 n.s.
Scenario 3	1.282	0.507	2.53*
Scenario 4	0	0	0
Moral intensity	0.245	0.049	4.96***
Δaccountability	-0.145	0.018	7.84***
Identifiability	-0.128	0.083	1.53 n.s.
Awareness of monitoring	-0.301	0.097	3.11**
Expectation of evaluation	-0.220	0.083	2.66**
Social presence	-0.202	0.079	2.56**

Fit statistics: AIC = 5235.0; BIC = 5242.5
Degrees of freedom: intercept = 311; all others = 949
***$p < .001$; **$p < .01$; *$p < .05$; n.s. = not significant

Evaluating a Mediated Moderation Model

A key characteristic of our model is that the constructs affecting accountability can be represented within the UI in conjunction with each other—none are mutually exclusive. As a result, these constructs may exhibit interaction effects beyond the sum of their individual effects. To examine the possibility of interaction effects between the UI artifacts, we performed an exploratory post hoc analysis. Specifically, we tested (1) whether identifiability will interact with the other UI artifacts, (2) whether awareness of monitoring will interact with expectation of evaluation and awareness of social presence, and (3) whether any of these interaction effects will be mediated by *Δaccountability*. First, identifiability should strengthen the effects of the other UI artifacts, because it is a person's belief that his/her actions may be linked to him/herself (Williams et al. 1981). Identifiability therefore represents a critical element of the functioning of accountability.

Second, we expected that awareness of monitoring will enhance the effects of expectation of evaluation and awareness of social presence. This is because a record of behavior is necessary for an effective evaluation to occur. Likewise, the "mere presence" of another is unlikely to have an effect if one's actions are not observable by others. The awareness that one's behavior is monitored and recorded is thus likely to increase the effects of expectation of evaluation and awareness of social presence as well.

Finally, we expected that the interaction effects will also be mediated by *Δaccountability*. To test these effects, we bootstrapped the mediation model (presented in Table F1) with the addition of the following interactions: (1) *identifiability* × *awareness of monitoring*, (2) *identifiability* × *expectation of evaluation*, (3) *identifiability* × *awareness of social presence*, (4) *awareness of monitoring* × *expectation of evaluation*, and (5) *awareness of monitoring* × *awareness of social presence*. As before, 5,000 resamples were obtained. Table F2 summarizes these results.

Table F2. Bootstrapped Confidence Interval Tests for Full and Partial Mediation

	Mediation Test (*ab*)			Full/Partial Mediation Test (*c*)			
Variable	2.5% lower bound	97.5% upper bound	Zero included?	2.5% lower bound	97.5% upper bound	Zero included?	Type of effect
Identifiability × awareness of monitoring	-.168	.059	Yes	-.794	-.068	No	Direct
Identifiability × expectation of evaluation	-.006	.197	Yes	-.238	.335	Yes	None
Identifiability × awareness of social presence	-.065	.121	Yes	-.490	.012	Yes	None
Awareness of monitoring × expectation of evaluation	-.042	.147	Yes	.126	.753	No	Direct
Awareness of monitoring × awareness of social presence	-.124	.101	Yes	-.509	.158	Yes	None

The results show that of the five hypothesized interactions, two are significant. First, *identifiability* X *awareness of monitoring* and *awareness of monitoring* X *expectation of evaluation* have significant direct interaction effects on *intention*, but are not mediated by *Δaccountability*. That is, although their individual effects are mediated by *Δaccountability*, their combined effects are not—suggesting that a psychological process aside from accountability is triggered by the interaction effect. The other hypothesized interactions are not significant.

Next, we added the two significant interactions with direct effects to our theoretical model to assess whether their addition improved the model fit, presented in Table F3. The results show that AIC and BIC significantly decreased from the simple mediation model presented in Table F1 ($p < .01$), indicating superior model fit.

Of interest in Table F3 are the coefficients for *identifiability* × *awareness of monitoring* (.347) and *awareness of monitoring* × *expectation of evaluation* (-.416). In the case of *monitoring* × *expectation of evaluation*, the effect is in the negative direction, as expected. However, in the case of *identifiability* × *awareness of monitoring*, the coefficient is positive—initially appearing counter to our hypothesis. However, as in the case of all moderation analyses, careful interpretation is required (Muller et al. 2005). A closer examination shows that both *identifiability* and *awareness of monitoring* have negative effects on intention (-.310 and -.218, respectively). The significant interaction effect indicates that the effect of having both design elements present is not additive, but is somewhat less than the combined effects of each. This is mathematically demonstrated by adding the individual effect coefficients, less the interaction effect (-.310 + -.218 + .346 = -0.182). Thus, the interactive effect of *identifiability* × *awareness of monitoring* represents a net -0.182 decrease in attention—less than the sum of the parts but still significant and substantive. In contrast, the combined effects of *awareness of monitoring* × *expectation of evaluation* are synergistic, in that the interaction effect (-.425) is greater than the sum of the parts (-0.218 and -0.033 for *awareness of monitoring* and *expectation of evaluation,* respectively). In summary, of the five hypothesized interactions, two are significant. First, *identifiability X awareness of monitoring* and *awareness of monitoring X expectation of evaluation* have significant direct interaction effects on intention, but are not mediated by *Δaccountability*. That is, although the individual effects are mediated by *Δaccountability*, their combined effects are not—suggesting that a psychological process aside from accountability was triggered by the interaction effect.

Finally, for exploratory purposes, we performed a post hoc analysis to investigate whether a four-way interaction occurred in our data along with all the other two-way interactions. We found that a four-way interaction is significant ($p < .05$). In addition, AIC and BIC again decreases significantly ($p < .05$). However, compared to the improvement of the other models, we determined that this small improvement was not worth the added complexity of the model. We therefore prefer the simpler mediated model. We present the results of our post hoc analysis in Table F4. To examine the four-way interaction using a hierarchical approach, one generally includes all lower order interactions (Ramsey and Schafer 2013). Thus, we included all the two-way interactions. However, we felt that including the three-way interactions would make the model too complicated. Also, this analysis was purely exploratory, and we were not theoretically interested in the three-way interactions. As a result, the four-way interaction includes the effects of the four three-way interactions as well as the single term for the four-way interaction. This means that the four-way interaction in our model has five terms that are estimable. In Table F4, the terms for these estimable parameters are given such that they indicate when the variables are turned off (0) or turned on (1) for the parameter being estimated.

Table F3. Effects of the Mediated Moderation Model on Intention to Violate the Access Policy

Effect	β	Standard Error	*t*-Value
Intercept	6.132	1.326	4.62***
Subjective norms	-0.553	0.076	7.28***
Education level	-0.336	0.114	2.96**
Scenario 1	0.052	0.503	.10 n.s.
Scenario 2	-0.068	0.510	.13 n.s.
Scenario 3	1.281	0.506	2.53*
Scenario 4	0	0	0
Moral intensity	0.245	0.049	4.96***
Δaccountability	-0.143	0.018	7.76***
Identifiability	-0.308	0.102	3.01**
Awareness of monitoring	-0.230	0.201	1.14 n.s.
Expectation of evaluation	-0.036	0.103	.35 n.s.
Awareness of social presence	-0.210	0.081	2.59**
Identifiability × Awareness of monitoring	.347	.161	2.15*
Awareness of monitoring X Expectation of evaluation	-.416	.168	2.48*

Fit statistics: AIC = 5225.2; BIC = 5232.8

Degrees of freedom: intercept = 311; all others = 947

***p < .001; **p < .01; *p < .05; n.s. = not significant

Table F4. Effects of the Four-Way Interaction Model on Intention to Violate the Access Policy

Effect	β	Standard Error	*t*-Value
Intercept	5.617	1.365	4.11***
Subjective norms	-0.548	0.077	7.14***
Education level	-0.347	0.114	3.03**
Scenario 1	0.098	0.506	.19 n.s.
Scenario 2	-0.063	0.513	.12 n.s.
Scenario 3	1.306	0.508	2.57*
Scenario 4	0	0	0
Moral intensity	0.246	0.050	4.94***
Δaccountability	-0.146	0.018	7.91***
Identifiability	-1.04	0.529	1.97*
Awareness of monitoring	-0.733	0.540	1.36 n.s.
Expectation of evaluation	-0.632	0.529	1.20 n.s.
Social presence	-1.213	0.505	2.40*
Identifiability × Awareness of monitoring	.967	.569	1.70 n.s.
Identifiability × Expectation of evaluation	.502	.897	.56 n.s.
Identifiability × Social presence	1.218	.560	2.17*
Awareness of monitoring × Expectation of evaluation	.234	.569	.41 n.s.
Awareness of monitoring × Social presence	1.309	.547	2.39*
Expectation of evaluation × Social presence	1.545	.872	1.77 n.s.
Identifiability 0 × Awareness of monitoring 0 × Expectation of evaluation 0 × Social presence 0	-3.679	2.398	1.53 n.s.
Identifiability 0 × Awareness of monitoring 0 × Expectation of evaluation 0 × Social presence 1	-.490	.959	.51 n.s.
Identifiability 0 × Awareness of monitoring 0 × Expectation of evaluation 1 × Social presence 0	-1.585	.958	1.65 n.s.
Identifiability 0 × Awareness of monitoring 1 × Expectation of evaluation 0 × Social presence 0	-1.106	.936	1.18 n.s.
Identifiability 1 × Awareness of monitoring 0 × Expectation of evaluation 0 × Social presence 1	-1.693	.802	2.11*

Fit statistics: AIC = 5209.3; BIC = 5216.8

Degrees of freedom: intercept = 308; all others = 941

***$p < .001$; **$p < .01$; *$p < .05$; n.s. = not significant

Appendix G

Testing for Social Desirability Bias

Social desirability bias is "the tendency on the part of individuals to present themselves in a favorable light, regardless of their true feelings about an issue or topic" (Podsakoff et al. 2003, p. 881). This bias can influence empirical results by causing "spurious correlations between variables as well as the suppression or moderation of relationships between the constructs of interest" (King and Bruner 2000, p. 80). Social desirability bias is relevant to this study because the identifiability UI design artifact presented respondents with their actual employee photo. Although respondents were promised that their survey answers would be kept anonymous, it is possible that showing respondents their own photo may have led them to feel de-anonymized. This in turn could cause the identifiability UI design artifact to have a much stronger effect than it would have if a photo of a person other than the respondent had been displayed.

A common approach to gauging the existence of social desirability bias is to include a social desirability bias scale in a survey and then measure the extent to which the social desirability items correlate with other constructs in the study (King and Bruner 2000). Although we did not collect a social desirability measure in this study, we nevertheless tested for the existence of social desirability bias in two ways: (1) by excluding the identifiability variable from our data, and (2) by comparing our results with those of a previous study that measured identifiability without showing respondents their own photos.

First, we dropped identifiability from our model and re-ran all of our statistical tests. The results showed little difference in the parameter estimates and no difference in our hypothesis tests. Therefore, we conclude that the presence of identifiability in our model did not adversely affect the other constructs in our model.

Second, we compared our results with those of Vance et al. (2013), who measured identifiability and the other accountability mechanisms in a design similar to our own. However, rather than showing participants their own photos as part of the identifiability treatment, we measured their identifiability treatment using a text-based factorial survey. In Table G1, we reproduce Table 4 from Vance et al. (2013, p. 278), which shows a direct, unmediated model of the effects of the accountability mechanisms on intention.

Table G1. Results of Theoretical Model Testing from Vance et al. (2013)

Effect	β	Standard Error	*t*-Value
Intercept	2.769	1.286	2.15
Realism	.312	.155	2.010*
Identifiability	-.764	.136	5.610***
Awareness of Logging	-.853	.132	6.450***
Awareness of Audit	-.782	.132	5.920***
Electronic Presence	-.406	.134	3.020**

Fit statistics: AIC = 3499.1; BIC 3503.8.
Degrees of freedom: Intercept = 79; all others = 725.
***$p < .001$; **$p < .01$; *$p < .05$

We did not collect the variable "realism" in our dataset. However we used the dataset from Vance et al. (2013) to verify that after omitting realism from their model, the results remained essentially the same.

Next, we present in Table G2 the same model results using the data collected in this paper. Note that the names of the constructs are kept parallel to those in used in Vance et al. (2013) for ease of comparison.

Table G2. Results of Applying the Vance et al. (2013) Model to Data Collected in this Study

Effect	β	Standard Error	*t*-Value
Intercept	1.400	.115	12.19***
Identifiability	-.121	.043	2.840**
Awareness of Logging	-.226	.049	4.580***
Awareness of Audit	-.201	.041	4.870***
Electronic Presence	-.128	.041	3.140**

Fit statistics: AIC = 3672.6; BIC 3680.1.
Degrees of freedom: Intercept = 317; all others = 950.
****p* < .001; ***p* < .01; **p* < .05

The results are not identical—nor should they be—because of differences in the designs of each study (the Vance et al. (2013) study used student participants, ours used professionals; they used text-based vignettes for a hypothetical system, we used graphical vignettes for a system used by the professionals on a daily basis; and so on). However, it is useful to note two key similarities in the results: (1) identifiability has a significant negative effect on intention to violate the access policy in both studies, and (2) the size of the effect of identifiability relative to the other accountability mechanisms is similar in both studies. If there is a notable difference between the two, it is that the effect of identifiability is larger in the Vance et al. (2013) dataset, even though their manipulation did not include the participants' individual photos.

If social desirability bias were introduced by the photos, then one would expect that the beta coefficients and the effect sizes in the present study would be larger than the other accountability mechanisms in the same dataset, and even larger than those in the Vance et al. (2013) dataset. In fact, they are not. Identifiability has one of the lowest beta coefficients and effect sizes of any pathway—whether in the Vance et al. (2013) study or the present study. With no empirical or theoretical evidence that social desirability bias changed the identifiability results, it can be concluded that such bias is unlikely to have had undue influence in our study.

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