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.

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