

An Influence of Self-evaluated Gender Role on the Privacy Management Behavior in Online Social Networks

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Abstract. The primary goal of this paper is testing a causal model of privacy management indicating the influence of gender on the user behavior of privacy management in OSNs. We adopted communication privacy management theory and the theory of planned behavior, developed a causal model showing the influence of self-evaluated gender role on the behavior of privacy management in online social networks, and tested a set of hypotheses using structural equation modeling (SEM). The results of SEM indicate that self-evaluation of masculinity and femininity did not have significant relationship with user's behavior of privacy management in OSN.

Keywords: privacy, privacy management, gender role, bem sex role inventory, online social networks, causal modeling, confirmatory factor analysis, structural equation modeling.

1 Introduction

The exponential growth of OSNs, while offering a greater range of opportunities for communication and information sharing, raises issues in privacy, especially, managing private information while communicating with others. Oftentimes, identity in OSNs is identical to the one in a real life because communication in OSN is based on experience of the real life. Many users consider OSNs as an extension of social interaction in real life. Unlike the real life, however, personal information in OSNs is extremely difficult to be under control of the information owner. The profile information in OSN can be collected by entities that are capable of endangering privacy, e.g., data miners and cybercriminals. It is not only the profile but also published communication that can reveal about a user. Sometimes form-free information can tell much more than profile information if the information is inferred correctly. Information can be revealed from what the user posts or from what others post on the user's page. Written communication in OSN, once published, can be read, copied, and reproduced by other users who have access to the published message. Since most OSN websites provide coarse categorization of social groups, it is difficult for users to control their privacy by posting messages only for intended audience. In other words, it is possible

that your boss can see conversation between you and your coworker gossiping about her in OSNs. Although some threats are unavoidable in order to register for and use the service, majority of threats are caused from user's voluntary disclosure.

According to Petronio [1], individuals manage privacy boundaries using a rule-based system that guide all facets of the disclosure process, including how boundaries are coordinated between individuals. CPM clearly delineates that people have distinct set of attributes when they make decisions about managing their privacy. CPM maintains that five factors play into the way we develop our own privacy rules: culture, gender, motivation, context, and risk/benefit ratios. In our study, we focus on the gender factor and investigate the causal relationship between gender and user's behavior of privacy management in OSNs.

Although there has been disagreement on which gender is more sensitive to privacy [2-5], generally, researchers believe that the gender is one of the primary factors influencing user's behavior of privacy management. In this study, we particularly examine the relationship between the self-perception of gender role and the user behavior of managing the amount of private information being shared.

This paper is organized as follows: In the background section, we discuss theories constituting the idea and construct structure of our model. In the methods section, we describe a general procedure of methods in studies utilizing SEM technique, and demonstrate our research problem using structural equation modeling technique. Primarily, we discuss creation of a model, survey implementation and data collection, and analysis of the models for our study. In analysis section, our discussion presents evaluations and potential revisions of the model while providing interpretations of the analytical results of the study. In the discussion section, we briefly discuss implications of the paper in theory development and application and in practical application to system design. Then we summarize our findings and identify future plans in the conclusion section.

2 Theoretical Background

Theories fundamental to this dissertation are Communication Privacy Management (CPM) theory [1] and Theory of Planned Behavior (TPB) [6-8]. First, we borrow the basic idea of CPM theory to show the backbone of our model. CPM theory identifies that people control their private information based on the use of personal privacy rules. Through developing, learning, and negotiating rules depending on culture, gender, motivation, context, and risk / benefit ratio, people coordinate boundary linkages, boundary permeability, and boundary ownership. The primary focus in this paper, however, is the influence of gender. Second, behavioral mechanism embedded in our model is borrowed from TPB. The theory explicates a mechanism of human decision-making process, i.e., a causal link constituting, "a person's salient beliefs and evaluations, attitude toward a behavior, and behavioral intentions." The theory also states that subjective norms, perceived behavioral control and attitude toward a behavior jointly determine the behavioral intention. In this section, we discuss how the two theories are used in constituting the models of privacy management in OSNs.

2.1 Communication Privacy Management Theory

The CPM theory emphasizes that it is necessary to consider communicative interactions between people to grasp disclosure of private information. The theory offers concepts and conceptual structures to help identify the way people coordinate the influencing factors on their privacy. According to Petronio [1], communication privacy management theory deals with how individuals make decisions to disclose private information to others and how this relational process is coordinated. She argues that “boundaries” serve as a useful metaphor illustrating that, although there may be a flow of private information to others, borders mark ownership lines such that issues of control are clearly understood by the communicating partners. CPM supposes that both the discloser and the recipient of the disclosure have a degree of agency during the process of revealing private information. Boundaries are coordinated by both parties, and once a successful disclosure is made, the individuals involved coordinate their boundaries so that the private information is co-owned and co-managed appropriately. When disclosures occur, the discloser is willingly giving up a degree of control and ownership over the private information. Consequently, people make choices to reveal or to conceal private information based on criteria and conditions that they perceive as salient.

The primary idea of CPM is that people have a desire for privacy and the dynamic process of revealing and hiding private information constitutes the process of fulfilling the desire. Whenever we share a portion of that information with someone, we are reshaping a privacy boundary. Having a mental image of protective boundaries is central to understanding the five core principles of Petronio’s CPM.

Gender criteria potentially influence the way different gender perceives the nature of their privacy. Hence, research argues that men and women use different sets of criteria to define ownership of private information and how they are managed [9, 10]. Therefore, based on the research, we can infer that men and women develop distinct rules for managing privacy boundaries.

Sex role and sex role identity has been studied resulting in more complex analyses of gender influence on the management of privacy boundary. Derlega et al [11] discusses relationship between sex typing and disclosure topics. They argue that men, than women, are more willing to disclose about private information generally perceived as masculine, while women are more willing to reveal about private information in relation to feminine topics than men. Particularly, in US culture, men are characterized in terms of achievement, competition, and success, whereas women are viewed in attributes of emotionality and sensitivity [12-14].

2.2 The Theory of Planned Behavior

Intentions to perform behaviors of different kinds can be predicted from attitudes toward the behavior, subjective norms, and perceived behavioral control; according to Ajzen and Fishbein [6] and Fishbein and Ajzen [7], these intentions, together with perceptions of behavioral control, account for considerable variance in actual behavior. It can be briefly represented in a mathematical function as;

$$BI = (A_B)\omega_1 + (SN)\omega_2 + (PBC)\omega_3 \tag{1}$$

where BI refers to behavioral intentions, AB is attitude towards the behavior, SN denotes subjective norm, PBC represents perceived behavioral control and ω_1 , ω_2 , ω_3 indicate weights for each component. Including background factors and actual behavioral control, the model of TPB can be presented as in Figure 1 below.

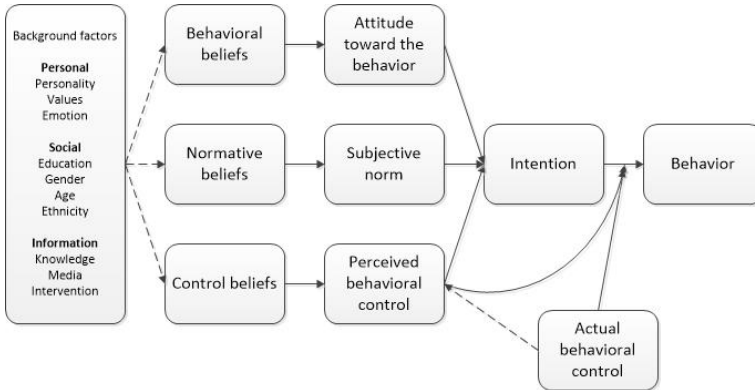


Fig. 1. The theory of planned behavior as illustrated in Fishbein and Ajzen [8]

Although there is not a perfect relationship between behavioral intention and actual behavior, intention can be used as a proximal measure of behavior. This observation was one of the most important contributions of the TPB model in comparison with previous models of the attitude-behavior relationship. Thus, the variables in this model can be used to determine the effectiveness of implementation interventions even if there is not a readily available measure of actual behavior.

3 Methods

The method of this study follows generic steps suggested by most studies that facilitate SEM techniques as their analytical approach. First, using a qualitative approach, a conceptual model is created. Then, measurement items for research variables and constructs are created and/or adopted and modified depending on availability. Using the identified model and measurement items, a user survey is designed and implemented to collect user responses. Lastly, the conceptual model is redrawn using AMOS software with the connection to the collected user responses.

3.1 Research Questions

Research questions are formulated in order to examine models of user experience regarding their privacy management in OSNs. Questions are organized to identify salient research constructs, develop models based on the research constructs and test

them for fitness to user data, and define and test statistical significance of interrelationship among the research constructs. Two primary questions are formulated as below;

RQ1: Can we identify quantitative models of user’s privacy management in OSNs?

RQ2: What are the significant relationships among research constructs within the model?

3.2 Model Composition

Combining the CPM theory and TPB, a model of our interest can be represented as below in Figure 2. The diagram shows the overall model including all factors from CPM and TPB. The rectangle on the left shows foundations for privacy rule management (derived from CPM), while the rectangle on the right contains factors that are related to behavioral decision (originated from TPB). Behavioral component of endogenous measure is analyzed as a set; for example, “intention to control boundary permeability” is analyzed along with “attitudes towards controlling boundary permeability”, “subjective norm about controlling boundary permeability”, and “behavioral control of controlling boundary permeability”. Controlling permeability is operationally defined in the later section as “Controlling how much private information to reveal”

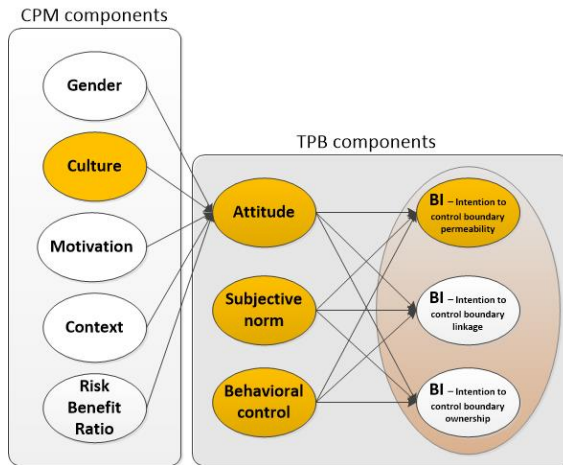


Fig. 2. A combined model of CPM theory and TPB represented in a model

3.3 Data Collection

The survey was implemented using a paid service from Surveygizmo.com. The sample (N=400) was collected mostly from United States (93.2%). Caucasian was the most participated race (65.2%, African American 11.3%, and Asian 8.5%), and

gender proportion was male, 54.7%, and female, 45.3%. Also, more than 80% of participants had higher than college education. Ages between 30 and 39 were the most frequent age group (27.5%) and twenties and forties followed in the proportion of 24.3% and 19.8%, respectively.

3.4 Questionnaire Construction

The impact of gender on privacy rule management is based on the idea that different degree of gender orientation is accounted for idiosyncratic patterns of boundary management for each gender. For example, ownership of private information can be defined by different sets of criteria by different gender [9, 10]. Consequently, they have distinct understanding of advantage and disadvantage in concealing and revealing. Other studies [11, 15] seek difference in the pattern of disclosure from sex role. This is more complex line of research than simple comparison between the amount of disclosing between men and women in that the mechanism of privacy is explained in relation to types of disclosing information as well as social evaluation and expectation of gender role.

There are number of measurements for sex role [12, 14, 16]. Gender is a frequently discussed topic of research when it comes to social characterizations and behavioral decisions consequential to such biological dichotomy. One controversial issue in such research is classification based on biological characteristics of gender. In this project, gender is measured in terms of continuous score based on existing measure, Bem Sex Role Inventory [12, 13], i.e., BSRI. The BSRI is a self-report measure of sex role orientation. We especially adopted short form BSRI [14, 17]. The short form of the BSRI contains 30 items. The Masculinity scale consists of 10 traits traditionally viewed as more desirable for a man than for a woman. The Femininity scale consists of 10 traits traditionally viewed as more desirable for a woman. Sample items from the Masculinity scale include independent, competitive, and aggressive; sample items from the Femininity scale include compassionate, sympathetic, and sensitive to the needs of others [14]. To measure gender traits, survey participants are asked to rate a set of gender characterizing words from BSRI, e.g., aggressive or tender, in a 7 point Likert scale spanning from Almost never true (1) to Almost always true (7). Note that the context of this self-evaluation is interaction on online social networks. A simple equation can be identified to show that the gender criteria can be combination of two sub-factors;

$$GC = (MSE)\omega_1 + (FSE)\omega_2 \quad (2)$$

where MSE represents self-evaluation of Masculinity, and FSE represents self-evaluation of Femininity.

4 Analysis

In this section, we discuss results of statistical analyses manifesting research questions and hypotheses. A two-step process is described in terms of analyzing measurement models and structural models.

In order to analyze measurement models, a series of factor analyses are conducted. In our approach, we use both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). The two statistical techniques serve different purposes. First, EFA is used for finding hidden construct out of a set of variables. Using this analysis, we identify factor structures (a grouping of variables based on strong correlations), compare them with foundational theories and models, and interpret emerged structures. During this process, we also detect "misfit" variables. In general, an EFA prepares the variables to be used for cleaner structural equation modeling. In contrast, the purpose of CFA is validating the identified structure of theoretical components. Therefore, models are defined first and then tested whether the data support them. However, we use it for both exploratory and confirmatory purposes since our research is somewhat exploratory in the sense that we develop a quantitative model based on an interpretive theory by examining quantitative measures to best describe behavioral models. Based on the structures identified as a result of EFA, in the second step, we conduct CFA to see how observed variables are related to latent variables and how appropriate the measurement models are.

In the second step of analysis, structural models are identified and estimated. In this step, a set of causal relationships are hypothesized in the models and tested against the collected data while the models are evaluated for their fitness to the data.

4.1 A Measurement Model of Gender Criteria

To measure and analyze privacy rule development of gender criteria, we used short form Bem Sex Role Inventory (BSRI), a measurement scale of self-reported sex role perception. The original sample (N=400) was treated for univariate and multivariate outliers. For the analysis of gender criteria, sample size was N=348 after screening.

In order to identify factor structure, first, EFA was conducted. However, EFA produced factor structure that is difficult to interpret. Some items were cross loaded and other items were loaded on factors that are not claimed in the original theory. In order to keep the factor structure identified in Bem's theory, we conducted a CFA using all observed variables. As a result of the CFA, 5 items from male and 5 items from female were removed. From the female factor, "Affectionate", "Warm", "Gentle", "Tender", and "Loves children" were removed while, from the male factor, "Aggressive", "Independent", "Forceful", "Dominant", and "Assertive" were removed. Fit indices indicated a good fit of the model to the data because most of the indices were within the recommended thresholds. Fit indices of the measurement model of gender construct ($\chi^2(25) = 91.868, p < .001$) were as follows: CMIN/DF = 3.68, RMSEA = .09, NFI = .96, CFI = .97, GFI = .95, AGFI = .90, TLI = .95. With this result, we conducted CFA again on the gender factors with behavioral constructs from TPB. Fit indices of the measurement model of gender construct with TPB constructs ($\chi^2(206) = 420.617, p < .001$) were as follows: CMIN/DF = 2.04, RMSEA = .05, NFI = .96, CFI = .95, GFI = .90, AGFI = .88, TLI = .94.

Two hypotheses are formulated in operational level;

H1: In OSNs, self-reported measure of user’s masculinity has influence on the attitude towards controlling the amount of private information being shared.

H2: In OSNs, self-reported measure of user’s femininity has influence on the attitude towards controlling the amount of private information being shared.

4.2 A Structural Model of Gender Criteria

We tested the causal model using the SEM technique. Figure 3 reports the results of SEM analysis. Fit indices indicate that the model ($\chi^2(214) = 573.866, p < .001$) is a good fit to the data; CMIN/DF = 2.68, RMSEA = .065, NFI = .90, CFI = .94, GFI = .89, AGFI = .86, TLI = .92. We found that influence of masculinity on attitude towards a behavior was not statistically significant. ($\beta = .06, N/S$, Hypothesis 1 not supported). Also, effect of femininity on attitude towards a behavior was not statistically significant. ($\beta = .17, N/S$, Hypothesis 2 not supported). In the population, whether a user has female trait or male trait does not have influence on the attitude towards controlling the amount of private information being shared.

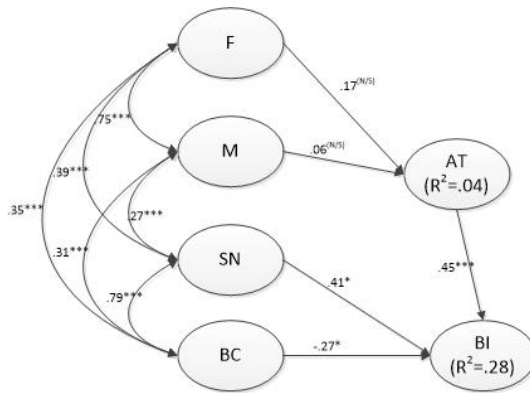


Fig. 3. A structural model of gender criteria

5 Discussion and Conclusion

This study explores how gender role influence processes and patterns of user’s behavior of privacy coordination in OSNs. A causal model is identified so that; 1) causality functions between criteria of privacy rules, i.e., gender, and user behavior of privacy coordination, i.e., information sharing behavior in particular, are measured and analyzed, and 2) user traits and perceptions are examined and tested in relation to privacy management in OSNs. The findings indicate that whether a user has female trait or male trait does not have influence on the attitude towards controlling the amount of private information being shared.

Messy structure of factors implies that some items in original BSRI may not be suitable for representing gender roles in OSNs. Also, causal links from gender roles to

behavioral components resulted statistically not significant. It needs more investigation to see whether measuring gender role is appropriate (rather than measuring simply gender), whether BSRI is appropriate in the research context, and whether the size difference, between masculinity and femininity, of the effects on the behavioral components mean anything substantial.

Implications of this paper can be discussed in the perspective of theory in terms of “quantification” and “systemization”. First, quantitative measurements and metrics are applied to get a grasp of privacy in OSNs. Communication privacy management (CPM) theory, with its interpretive nature, describes fundamental idea of which rules are developed and how they influence the mode of communication and decision of private boundary. While CPM offers a solid view for understanding and interpreting social interactions, this paper, based on the CPM, tests hypotheses, looks at cause and effects, and identifies models of prediction. Second, the paper provides systematic investigation of user's privacy behavior based on widely accepted theories. In particular, foundations of privacy rule and coordination behavior investigated in CPM are applied in the framework of the theory of planned behavior (TPB) for reliable prediction model. Therefore, the model will serve as basis for further examination of user behavior in regards to their privacy management in OSNs.

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