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Employee creativity formation: The roles of knowledge seeking, knowledge contributing and flow experience in Web 2.0 virtual communities

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ABSTRACT

Knowledge seeking and knowledge contributing are two distinct types of behaviors, both of which must occur for the presumed benefits of knowledge sharing to be realized. Self-perception theory posits that individuals come to 'know' their own internal beliefs by inferring them partially from observations of their own overt behavior. Building on self-perception theory and adhering to the principle that knowledge sharing facilitates knowledge creation, we develop a research model to explore the consequences of both knowledge seeking and knowledge contributing behavior given the consideration that flow plays a lubricating role in the formation of creativity. Data collected from 232 users of Web 2.0 virtual communities were used to test the model. We found that both knowledge seeking and knowledge contributing can lead to a state of flow and can further result in creativity at work. These findings and their implications for theory and practice are discussed.

Keywords: Knowledge seeking; knowledge contributing; flow; creativity; Web 2.0 virtual communities

1. Introduction

Knowledge sharing has been the focus of research for more than a decade and has been widely recognized as contributing to the success of knowledge transfer and knowledge management initiatives (He & Wei, 2009). However, "knowledge is the information processing that takes place in human minds, as well as personalized information related to facts, procedures, concepts, interpretations, ideas, observations, and judgments" (Alavi & Leidner, 2001, p.109). Thus, the knowledge residing in human minds is unlikely to be transferred by simple copying processes and knowledge sharing requires a unique set of rules and behavioral patterns. The consequences of failing to share knowledge can be considerable, with the value of losses running as high as US$31.5 billion per year by Fortune 500 companies, even though tremendous energy and investments have been devoted to the development of sophisticated knowledge management systems (KMS) (Wang & Noe, 2010).

Web 2.0 applications such as weblogs, microblogs, wikis and the virtual communities created with these technologies, have exerted extensive and important influences on human society. Web 2.0 encourages the participation of users who can seek or contribute knowledge. Thus Web 2.0 is regarded as an efficient knowledge management tool (Yu et al., 2010). Meanwhile, "most organizations do not possess all the

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required knowledge within their formal boundaries and must rely on linkages to outside organizations and individuals to acquire knowledge" (Wasko & Faraj, 2005, p.36). We suggest that Web 2.0 applications provide a useful platform for knowledge sharing. Indeed, there is evidence to show that sharing knowledge is an important aspect of being a member of a virtual technological community (Bouty, 2000), and "many individuals participate in virtual communities, for seeking knowledge to resolve problems at work" (Chiu et al., 2006, p.1872).

As important Web 2.0 applications, virtual communities refer to "online social networks in which people with common interests, goals, or practices interact to share information and knowledge, and engage in social interactions" (Chiu et al., 2006, p.1873). A virtual community "sharply contrasts with traditional communities of practice and face-to-face knowledge exchanges where people typically know one another and interact over time, creating expectations of obligation and reciprocity that are enforceable through social sanctions" (Wasko & Faraj, 2005, p.38). Meanwhile, "members in virtual communities differ from general Internet users in that virtual community members are brought together by shared interests, goals, needs, or practices" (Chiu et al., 2006, p.1875). In this study, we focus on the Web 2.0 applications of virtual communities in China, where there are many popular virtual communities such as Baidu Know, Baidu Post Bar, Renren Network and Sina Microblog, which attract millions of users. These kinds of Web 2.0 applications have their own unique characteristics, inviting more research on knowledge sharing.

Knowledge contributing and knowledge seeking demonstrate two distinct types of behavior, yet are also closely related to each other, both of which must occur for the presumed benefits of knowledge sharing to be realized (He & Wei, 2009). However, knowledge contributing has long been regarded as a bottleneck since employees are reported to fear the consequent loss of knowledge power (Huang et al., 2008; Kankanhalli et al., 2005). Many previous studies have studied the precursors of knowledge seeking or knowledge contributing. Wang and Noe (2010) review and identify five domains of antecedents of knowledge contributing: organizational context, interpersonal and team characteristics, cultural characteristics, individual characteristics, and motivational factors. In this study, we adhere to the principle that knowledge sharing facilitates knowledge creation and focus on the consequences of knowledge sharing activity to explore the impact of both knowledge seeking and knowledge contributing behavior on employee creativity, which we believe provide a new view for knowledge sharing research and practice alike.

We introduce the concept of flow, which has been conceptualized as a kind of internal state with the most enjoyable and optimal experiences (Csikszentmihalyi & LeFevre, 1989), which we suggest plays a lubricating role in the formation of creativity. Many previous studies have focused on the impact of flow on behaviors such as online purchase behavior and web usage behavior (Hoffman & Novak, 2009). In this study, we reverse the causal sequence of flow and behavior and explore the impact of knowledge sharing behavior on flow and further on creativity. Given this reversal of causal sequence, we were inspired by self-perception theory, which posits that individuals come to 'know' their own internal states by inferring them partially from observations of their own overt behavior (Bem, 1972). We suggest that self-perception theory provides clear support for our theoretical reversal of the causal sequence, i.e. placing behavior before flow as opposed to previous flow studies which place flow before behavior. In this respect, we apply causal direction analysis to compare the fit of the model in our study which links behavior to flow with a competing model (from our base model) which links flow to behavior so as to illustrate the exact nature of the formation of creativity. We believe this is a critical issue, yet it has been overlooked in the literature.

Following this introduction, we review the theoretical background paying particular attention to

self-perception theory and flow, before developing our research model and hypotheses. We follow this with a description of the research methodology, the results of the research and a discussion of these results before concluding the paper.

2. Theory background and research model

2.1. Self-perception theory

The core of self-perception theory, which has received direct support from a number of experiments, lies in the fact that "individuals come to 'know' their own attitudes and other internal states partially by inferring them from observations of their own overt behavior and the circumstances in which it occurs" (Bem & McConnell, 1970, p.23). As suggested by Bem (1972, p.7), "an individual can behave just like hypothetical outside observers". For example, someone may respond to a question about his beliefs and attitudes toward using Web 2.0 by saying, "I often use this Web 2.0 to seek knowledge, so, I think using this Web 2.0 is fun (enjoyable, exciting, and interesting)". This inference process is the same as the "interpersonal perception" in which outside observers would infer his internal states from his behaviour: "I guess he thinks using this Web 2.0 is fun (enjoyable, exciting, and interesting), since he often uses it to seek knowledge." Thus, "an individual's observation of his own behavior has been shown to be the partial basis for his recall of previous events, for his feelings of shock-produced discomfort, as well as for his beliefs and attitudes" (Bem & McConnell, 1970, p.23) and indeed an "individual's own behavior will be used by him as a source of evidence for his beliefs and attitudes" (Bem, 1972, p.8).

Based on self-perception theory, Melone (1990) suggested that the attitude of an IS (information systems) user can be represented as a multi-attribute belief structure. In this respect, "attitude change takes place in reaction to self-observed behaviors combined with observation of external cues which indicate if the behavior is likely to be valid or truthful" (ibid., p.87). The theory of reasoned action (TRA) is one of the most fundamental and influential theories of human behavior, drawn from which, attitudes and beliefs, such as perceived ease of use and perceived usefulness, have been extensively studied in terms of their influence on IS acceptance and use behavior (Davis, 1989; Venkatesh et al., 2003). However, "attitude change often results from a person's behavior rather than causing the behavior" (Melone, 1990, p.86). Song et al. (2009) built on self-perception theory to examine the impact of usage behavior on perceived usefulness and perceived ease of use as opposed to numerous previous studies drawn from TRA. They argued that there was a bias among IS researchers who focus on the link from beliefs to behavior, even though the relationship between behavior and beliefs is one of mutual influence (cf. Melone, 1990; Song et al., 2009).

2.2. Flow

Flow has been conceptualized as an optimal experience, the best feelings, the most enjoyable experiences possible in human lives that stem from people's perceptions of challenges and skills in given situations (Csikszentmihalyi, 1975; Csikszentmihalyi and LeFevre, 1989). Flow is characterized by a match between perceived challenges and perceived skills (Csikszentmihalyi, 1975). "When in flow, the individual operates at full capacity. The state is one of dynamic equilibrium" (Nakamura & Csikszentmihalyi, 2002, p.90). "The balance is intrinsically fragile. If challenges begin to exceed skills,

one first becomes vigilant and then anxious; if skills begin to exceed challenges, one first relaxes and then becomes bored" (ibid.). Thus, "over time, the same activity may make a person feel anxious one moment, bored the next, and in a state of flow immediately afterward" (Chen et al., 1999, p.588).

Research using flow as a theoretical foundation has crossed many fields. For instance, some researchers focused on situations such as playing where there are salient intrinsic rewards (Nakamura & Csikszentmihalyi, 2002, p.89). Other researchers examined work contexts such as surgery "where the extrinsic rewards of money and prestige could by themselves justify participation" (ibid.). A picture of the general characteristics of optimal experience and its proximal conditions was formed, indicating that "the reported phenomenology was remarkable similar across play and work settings" (ibid.).

It was reported that a tiered membership works as an incentive for participation in many Chinese online virtual communities, which means members achieve higher status by contributing, thus obtaining more trust from other members (Liao et al., 2010). This kind of tiered membership can function as an extrinsic reward, but just like the surgery context above, we believe that in the activity of knowledge sharing in virtual communities, it is the optimal experience of flow that works as a salient intrinsic motivation.

2.3. Research model and hypotheses

Flow has been examined as antecedents of behavioral intentions and behaviors in many previous studies (Hoffman & Novak, 2009), such as the impact of flow on continued use of mobile instant messaging (Zhou & Lu, 2011), the impact of instant messaging flow experience on exploratory behavior (Zaman, et al., 2010). Based on self-perception theory, in this study we theoretically reverse the causal sequence of flow and behavior to examine the effect of knowledge sharing behavior on flow and further creativity, considering that flow plays a lubricating role in the formation of creativity.

We develop our research model in accordance with the principle that knowledge sharing facilitates knowledge creation, i.e. "knowledge sharing could be useful not only in better employing the existing knowledge, but also in creating new knowledge" (Huang et al. 2008, p.452). The use of Web 2.0 for knowledge seeking and knowledge contributing are the starting point of our research model. Usage in this study refers to the self-reported usage of Web 2.0 for knowledge seeking or knowledge contributing in respect to the frequency of use and the amount of time involved (Venkatesh et al., 2003; Kankanhalli et al., 2005). The complete research model is presented in Figure 1.

Insert Fig. 1 about here

2.3.1. Knowledge sharing and flow on the Web 2.0

The Web is reported to be a platform that can easily help people to enter a state of flow. Hoffman and Novak (1996) address the role of marketing in computer-mediated environments (CMEs), proposing a structural model of consumer navigation behavior in a CME that incorporates the notion of flow. In this study, they define the flow experience in a CME as "the state occurring during network navigation, which is characterized by a seamless sequence of responses facilitated by machine interactivity; intrinsically enjoyable; accompanied by a loss of self-consciousness; and self-reinforcing" (Hoffman & Novak, 1996, p.57). Chen et al. (1999) used three quotations devised by Csikszentmihalyi (1975) to directly elicit 304

Web users' perceived flow experiences on the Web. Through this study, they provide "baseline data on the existence of the flow phenomenon in the Web environment, such as factors and conditions associated with the flow experience, causes of Web users' perceived challenges and controls, and Web users' flow feelings and enjoyments" (Chen et al., 1999, p.585). In a separate study, they suggest that "using the World Wide Web is an activity that facilitates flow, which generates an optimal, extremely enjoyable experience with total involvement and concentration" (Chen et al., 2000, p.263). They reported the symptoms and dimensions of flow states on the Web directly from subjects' responses, such as "merging of action and awareness, a loss of self-consciousness, the sense of time distortion, enjoyment, and telepresence" (ibid.).

As an elusive and broad concept, there exist different viewpoints on the components of flow (Hoffman & Novak, 2009). Koufaris (2002) used three dimensions of perceived enjoyment, perceived control and attention focus in his research on online consumer behaviour. Guo and Klein (2009) suggested that flow includes six constructs: concentration, perceived control, merging of activity and awareness, transformation of time, transcendence of self, and autotelic experience. Lu et al. (2009) used two factors to conceptualize flow: perceived enjoyment and concentration. Among the components of flow, perceived enjoyment and attention focus are two of the most-often used factors (Finneran & Zhang, 2005; Hoffman & Novak, 2009). They are also directly used to conceptualize flow in recent researches (Zaman et al., 2010; Zhou & Lu, 2011). In this study, we used perceived enjoyment and attention focus to conceptualize flow experience accordingly. In this study, perceived enjoyment is defined as the extent to which the activity of using the Web 2.0 application is perceived to be enjoyable in its own right apart from any performance consequences (Chin et al., 2003). Attention focus is defined as the extent to which an individual is able to focus on Web 2.0 application only when using it (Lu et al., 2009).

Web 2.0 applications encourage users to participate, hopefully facilitating the unconscious sharing of knowledge, especially tacit knowledge such as experience, technique, insight, etc. On the Web, "the interactivity between the virtual environment behind the computer screen (e.g. cyberspace) and human beings provides users with a route to experience flow" (Chen et al., 2000, p.265). As for seeking knowledge, much evidence supports the idea that it leads users to experience flow. Chen et al. (2000, p.268) indicate that "the most frequently reported activity which brought them into the flow state was information searching on the Web". They also note that "whether it is reading newsgroups or doing a search for a particular thing I tend to concentrate and lose myself" (ibid., p.272). Moreover, based on self perception theory, individuals can come to "know" their own internal flow state partially by inferring it from observations of their own overt knowledge seeking behavior. We thus make the hypotheses below:

H1: Knowledge seeking is positively related to perceived enjoyment.

H2: Knowledge seeking is positively related to attention focus.

Flow has been conceptualized as an optimal experience that stems from people's perceptions of challenges and skills in given situations. We argue that it is more challenging for users to contribute knowledge than to seek knowledge. As for challenges raised by contributing knowledge, we can find considerable evidence. For example, users reported that "engaging in a 'conversation' via a newsgroup challenged my ideas or way of thinking" (Chen et al., 2000, p.277). Challenges emerge when "offering help through answering questions where someone asked for assistance from me or when a question was posed that needed research" (ibid.). Writing brings challenge: "I sometimes feel challenged to get the wording exactly right" (ibid.).

With the development of Web 2.0 and increased use of advanced communication and information technologies, we argue that the amount of effort required to use Web 2.0 applications is most likely to

decrease since applications have been designed with ease of use in mind given the broad acceptance of ease of use as a key factor to determine users' usage behavior (Venkatesh et al., 2003). In this case, users are more likely to cope with the challenges brought by contributing as discussed above. When perceived challenges and perceived skills can be well matched to some extent, the flow state will be most likely to appear. Moreover, based on self perception theory, individuals can come to "know" their own internal flow state partially by inferring it from observations of their own overt knowledge contributing behavior. We thus make the hypotheses below:

H3: Knowledge contributing is positively related to perceived enjoyment.

H4: Knowledge contributing is positively related to attention focus.

2.3.2. Flow and creativity

Knowledge sharing can facilitate knowledge creation which is significantly related to employee creativity (Shalleya & Gilson, 2004). Employee creativity "refers to the extent to which employee develops ideas, methods, or products that are both original and useful to the organization" (Baera et al., 2003, p.577).

In organizations, employee creativity as a form of intellectual property can be a key factor in providing needed competitive advantage since it "can be conceptualized as a necessary first step or precondition required for innovation" at the individual, group, or organizational level (Shalleya & Gilson, 2004, p.35). "Creative performance emerges from key interactions between potential creators and their operating context" (Tierney et al., 1999, p.592) and individual creativity is said "to be a function of personality factors, cognitive style and ability, relevant task domain expertise, motivation, and social and contextual influences" (Shalleya & Gilson, 2004, p.36). Around these factors, prior researchers have investigated the role of leadership in facilitating creativity (Tierney et al., 1999), the influence of work support (including supervisors' support and coworkers' support) on employee creativity (Wang et al., 2010), and the possibility that the relationship between extrinsic rewards (e.g., pay and recognition) and employee creativity vary as a function of two conditions: employee job complexity and employee cognitive style (Baera et al., 2003). Intrinsic motivation has also been the focus of much research, and it is argued that "high intrinsic motivation (i.e., the individual is excited about an activity and engages in it for the sake of the activity itself) is a necessary ingredient for creative achievement" (Baera et al., 2003, p.569). This is consistent with Csikszentmihalyi (1988, p. 337) who suggested that "no matter how original one might be, if one is bored by the domain, it will be difficult to become interested enough in it to make a creative contribution". Likewise, Amabile (1988) indicates that the individual's orientation or level of enthusiasm for the activity is a necessary component of intrinsic motivation. An employee's decision to initiate and sustain creative effort over time is affected by intrinsic motivation which thus "has been cited as one of the most prominent personal qualities for the enhancement of creativity" (Tierney et al., 1999, p.594).

Flow is an experience of the activity as intrinsically rewarding, under which, "individuals tend to be curious, cognitively flexible, willing to take risks, and persistent in the face of barriers—characteristics that should facilitate the development of new and potentially useful ideas" (Baera et al., 2003, p.571). Moreover, "a key in the motivation of employees toward creativity is to ensure that they feel encouraged to take risks and break out of routine, safe ways of doing things" (Shalleya & Gilson, 2004, p.37). Intrinsically motivated individuals with flow tend to take exploratory behaviour such as take risks and "tend to experience positive mood states, such as excitement and enthusiasm, which enable them to make

more connections among stimuli and to integrate a variety of available resources, again contributing to higher creativity" (Baera et al., 2003, p.571). Thus, we hypothesize that:

H5: Perceived enjoyment is positively related to creativity.

H6: Attention focus is positively related to creativity.

3. Method and data collection

3.1. Measures development

All the constructs and the corresponding measure items are adapted from the previous literature to fit the context of this study. Specifically, the items measuring Web 2.0 usage for knowledge seeking and Web 2.0 usage for knowledge contributing were adapted from Kankanhalli et al. (2005) as well as Venkatesh et al. (2003); the items measuring Perceived enjoyment and Attention focus were adapted from Koufaris (2002); the items measuring Employee creativity were adapted from Tierney et al. (1999) as well as Ettlie and O'Keefe (1982). The complete instrument can be found in Appendix A. All the items were measured with a 7-point disagree-agree Likert scale.

3.2. Data collection

The research methodology and data collection process consisted of three stages, viz.: belief elicitation, a pilot survey and a large scale survey. In order to elicit employees' current beliefs towards knowledge seeking and knowledge contributing in the context of Web 2.0, we first undertook a qualitative investigation. In this process, we first registered as users in two famous Web 2.0 applications (Baidu Know and Tianji Network) and covertly conducted a series of structured observations. We identified and observed some active users and recorded the content such as date, name (some names seem to be pseudonym) and other basic information of these users, the content category in which these users contributed and the frequency at which these users contributed each day. This process lasted for 20 days and resulted in 176 records. Afterwards, in order to capture the beliefs concerning knowledge seeking and knowledge contributing by users in the context of Web 2.0, we conducted a qualitative interview with 11 current Web 2.0 users who were willing to participate. The main questions can be found in Appendix B.

Based on the qualitative investigation, we developed a survey instrument. We collected pilot data from current Web 2.0 users in China (40 usable questionnaires). We also had the opportunity to interact with some of these respondents when they experienced problems completing the survey. Based on our experiences in administering the pilot survey, we adjusted wordings in several items. We then conducted a large scale survey.

The main study targeted employees in organizations who are also users of Web 2.0 virtual communities. Drawing on alumni from two Chinese universities, we attempted to locate organizations that would be willing to participate in the research. We contacted organizations through email and telephone and invited them to participate in the survey. Some could not be successfully contacted, while others indicated that they do not participate in this kind of research. Finally we obtained consent to participate from 10 organizations. In each of these organizations, employees were randomly invited to participate in the survey. Data collection was undertaken on a voluntary basis. This process lasted for 6 weeks. The

average response rate was approximately 60%. We received 232 valid questionnaires in this fashion. The t-test of the demographic characteristics of the participants who responded in the first week did not significantly differ from those who responded in the last week. On this basis, response bias was not considered to be a concern. Table 1 documents the demographic information of these 232 respondents.

Insert Table 1 about here

In the survey questionnaire, we first defined Web 2.0 and listed the most popular Web 2.0 applications of virtual communities in China, such as Baidu Know, Renren Network, Baidu Post Bar, Baidu Experience, Sina Microblog, Sina Blog and Baidu Document. We indicated that the basic premise of Web 2.0 is that people are encouraged to participate in the shared creation of content, with knowledge seeking and contributing being a major activity. Due to the ubiquitous Web 2.0 virtual communities, we indicated in the survey questionnaire that the respondent should respond according to the one Web 2.0 virtual community he/she uses most frequently. All data was collected through printed paper questionnaires in Chinese and translated into English for this paper.

4. Data analysis and results

4.1. Measurement model validation

We employed SmartPLS[1] to verify our measurements and theoretical model since the PLS (Partial Least Squares) algorithm is a components-based structural equation modeling technique, "allowing each indicator to vary in how much it contributes to the composite score of the latent variable", thus being "preferable to other techniques" (Chin et al., 2003, p.197). Meanwhile, PLS is in essence exploratory (Gefen et al., 2011), thus being appropriate for this research since we have new relationships in the research model.

Before testing the hypothesized relationships, we first assessed measurement validity, including content validity, convergent validity and discriminant validity (Straub et al., 2004). With regard to content validity, since all constructs and items are based on the previous literature, subjected to minor improvements in wordings after the pilot survey, we thus believe they are accurately expressed and have clear meanings.

The whole measurement model consists of 5 reflective constructs. After running the model, we obtained results that support the convergent validity and discriminant validity. Factorial validity such as loadings and cross loadings can also be used to help assess convergent validity and discriminant validity (Straub et al., 2004).

Table 2 shows the Average Variance Extracted (AVE), Composite Reliability (CR) and Cronbach's Alpha of each construct. We can see that all the values of CR are greater than 0.914 and all the values of Cronbach's Alpha are greater than 0.859 which suggests a high degree of reliability and convergent validity of all the reflective constructs (Straub et al., 2004).

Insert Table 2 about here

[1] Ringle, C. M., Wende, S., Will, A. (2005). SmartPLS 2.0. www.smartpls.de, accessed May 20, 2009.

The left section of Table 3 shows the Mean and Standard Deviation (SD) of each construct. The right section shows the correlations between constructs and square roots of AVE. It can be seen that the square root of each construct's AVE is larger than its correlations with other constructs, suggesting sufficient discriminant validity (Straub et al., 2004).

Insert Table 3 about here

Table 4 shows the loadings and cross loadings where all items load much higher on their specified constructs than on other constructs, further suggesting sufficient discriminant and convergent validity for all the constructs (Straub et al., 2004).

Insert Table 4 about here

4.2. Common method bias

The influence of common methods biases which result from multiple sources such as social desirability has been a widely concern in the behavioral sciences (Podsakoff et al., 2003; Liang et al., 2007). It is suggested that using single source, self-reported data may have a potential for common method bias, while obtaining data from different sources can help reduce common method variance (CMV). The data in our study were collected from different sources, which is helpful for reducing CMV. Meanwhile, Harman's single-factor test was performed with the complete data set by conducting a principal components factor analysis in SPSS since this test is arguably the most extensively applied approach for assessing CMV (Podsakoff et al., 2003). The factor solution resulted in 5 factors with eigenvalues greater than 1.0, accounting for 80.84% of variance. At the same time, the first factor accounted for 27.11% of the variance, indicating that this factor does not account for the majority of the variance (Podsakoff et al., 2003).

Furthermore, following Podsakoff et al. (2003) and Liang et al. (2007), we included in the PLS model a common method factor whose indicators included all the principal constructs' indicators. "For each single-indicator construct, we examined the coefficients of its two incoming paths from its substantive construct and the method factor" (Liang et al., 2007, p.87). As shown in Appendix C, among all the 22 items, most method path coefficients are not significant. Meanwhile, the path coefficients of substantive constructs are substantially greater than their method path coefficients, thus explaining substantially greater variance of items than method. We thus contend that common method bias is not a concern in this study.

4.3. Structural model with results

The structural model with results is presented in Figure 2. Tests of significance were performed using the bootstrap resampling procedure with 1000 samples, following the recommendation that the sample size should be at least 500 (Wetzels et al., 2009), so as to obtain the t values of the estimates. The explained variances of Perceived enjoyment, Attention focus and Employee creativity are 0.367, 0.400 and 0.318 respectively, showing a good predictive validity of the model (Straub et al., 2004).

Insert Fig. 2 about here

From Figure 2, we can see that all the hypotheses are supported. We included all the sample characteristic data in the model and found that only Gender had a significant impact on Employee creativity. We thus verified our theoretical model only treating Gender as a control variable. In the data analysis, male is coded as 1 and female is coded as 2. The impact of Gender on Employee creativity is negative, suggesting that female employees are likely to have low levels of creativity while male employees are likely to have high levels of creativity.

With regard to flow experience, we can see that the explained variance of Perceived enjoyment and Attention focus each primarily comes from different behaviors. Knowledge contributing has a larger impact on Attention focus with the effect being 0.461 compared with Knowledge seeking, while Knowledge seeking has a larger impact on Perceived enjoyment with the effect being 0.494 compared with Knowledge contributing. We suggest that this is concordant with the exact situation in practice where Knowledge contributing is more likely to lead to Attention while Knowledge seeking is more likely to lead to Enjoyment. More importantly, both knowledge seeking and knowledge contributing in the context of Web 2.0 virtual communities can lead to a flow state which further leads to employee creativity at work.

5. Discussion and implications

5.1. Causal direction analysis

Cohen et al. (1993) proposed using the total squared error (TSE) as the criteria to compare and evaluate the goodness of the proposed model and other competing models. The rationale and criteria underlying this method is that the estimated correlations based on path analysis should be as close as possible to the actual correlation (Sun and Zhang, 2006), namely, for the model whose estimated and actual correlations accord relatively well, it would have smaller TSE and thus become the most competing model to fit the data (Cohen et al., 1993).

Self-perception theory (Bem, 1972) is applied in this study to explore the impact of knowledge sharing behavior on flow experience. Considering that the relationship between behavior and belief is one of mutual influence in social psychology (Melone, 1990), and that flow has been examined as a multi-dimensional antecedent of behavior in many previous studies (Hoffman & Novak, 2009), we set up another competing model from our base model to explore the causal direction between knowledge sharing behavior and flow experience, viz. from flow experience to knowledge sharing behavior and then to creativity (see Figure 3). The TSE are calculated to compare this model and the original one. The results (Appendix D) show that the proposed theoretical model (original model) has a smaller TSE than this competing model. So, this causal direction analysis supports the theoretical model in this study that both knowledge seeking and knowledge contributing can lead to flow state which further leads to creativity.

Insert Fig. 3 about here

The role of flow in our research model is very similar to the mediating effect, but not exactly, since we use the TSE as the criteria to compare and evaluate the goodness of the proposed causal model and the competing model in the way as suggested by Cohen et al. (1993) rather than the test of mediating effect.

Our research model shows knowledge sharing (knowledge seeking and knowledge contributing) is not directly linked to creativity but with the specific effect of flow. We suggest the term "lubricating" can exactly describe the role of flow in this model, i.e., knowledge sharing can facilitate knowledge creation with flow playing a lubricating role in the formation of employee creativity.

5.2. Implications for Theory

Self-perception theory is applied in this study and we believe that the current research usefully contributes to the theoretical development of the structural model exploring the consequences of both knowledge seeking and knowledge contributing in the specific context of Web 2.0 and other context more generally. Our causal direction analysis indicates the exact nature of the effect of knowledge sharing on creativity at the level of individual employee. Our findings that knowledge sharing in the context of Web 2.0 contributes to creativity further quantitatively attest to the principle of knowledge sharing.

5.3. Implications for Practice

"Knowledge is an organization's most valuable resource because it represents intangible assets, operational routines, and creative processes that are hard to imitate" (Wasko & Faraj, 2005, p.36). Consequently, "managing knowledge has long been a significant topic for contemporary organizations" (He & Wei, 2009, p.826). Anyway, many factors can influence knowledge contributing intention and knowledge sharing efficiency, and "merely having a knowledge repository does not guarantee successful knowledge management" (Watson & Hewett, 2006, p.143).

We believe that Web 2.0 provides an informal yet efficient platform for knowledge sharing activity, compared with the formal (and expensive) knowledge management systems used in organizations. The common characteristic of Web 2.0 applications is that people can not only seek information and knowledge through the application but also contribute their knowledge and experience, with knowledge sharing among users being a major activity. In this study, creativity refers to self-reported creativity by employees, i.e. the self-reported "production of novel and useful ideas" (Amabile, 1988, p.126). From Figure 2, we can see that knowledge sharing in the context of Web 2.0 can lead to a flow state and thus further employee creativity, which suggests the least likeliness of the loss of knowledge power after contribution as perceived by contributors. This is consistent with previous studies which suggested "organizational members benefit from external network connections because they gain access to new information, expertise, and ideas not available locally, and can interact informally, free from the constraints of hierarchy and local rules" (Wasko & Faraj, 2005, p.36). Indeed, employees are most likely to feel strong freedom and flow in the context of Web 2.0 application. Just as one respondent in our qualitative interview commented, "both knowledge seeking and contributing in this Web 2.0 application is very interesting". According to knowledge sharing principle, knowledge sharing should be voluntary and can't be forced. In the context of freedom, users are more likely to voluntarily share knowledge according to their own interests and willingness which would not only guarantee the quality of knowledge but also lead them to the state of flow and further creativity. Web 2.0 applications provide an efficient platform through which employees can acquire knowledge beyond organization through sharing with other users whom he\she may not know at all. Just as another respondent in our qualitative interview commented "I often participate in some virtual communities to look for knowledge and information I need. Also, I often contribute my experience and knowledge to these communities, because sharing with others is enjoyable and can also enrich and

perfect my thoughts and ideas". We thus recommend organizations especially the small and medium ones should firstly be conscious of the status quo of knowledge sharing in the context of Web 2.0 and its facilitating role on employee creativity. Secondly, informed by our findings and one respondent who commented "with the development of Web 2.0, more and more users would depend on it and desire to share knowledge with other users urgently", we recommend that organizations should adjust their knowledge management strategy accordingly, i.e. not necessarily searching for the development of formal knowledge management systems inside the boundary of the organization. Rather, they can seize the opportunity and encourage informal knowledge sharing activity in the context of Web 2.0 applications beyond the organizational boundary. Only in this way, will organizations especially the small and medium ones in China have the opportunity to initiate knowledge management practice and facilitate knowledge sharing to contribute to knowledge creation.

5.4. Limitations

There are several limitations in this study. First, we only focus on perceived enjoyment and attention focus to conceptualize flow experience according to previous literature. However, in the context of Web 2.0 usage for knowledge sharing, other dimensions of flow such as transcendence of self and perceived control should have been considered. With these dimensions considered and included in the model, this study could have presented a richer picture on what roles the "flow" plays in the knowledge sharing activity in Web 2.0 as well as in the formation of employee creativity.

Second, this study targeted employees in organizations who are also users of Web 2.0 virtual communities in the large scale survey. Following Zhou (2011) who collected data from students based on their favorite online community usage experience, we similarly indicated in the survey questionnaire that the respondent should respond according to the one Web 2.0 virtual community he/she uses most frequently. Even though different Web 2.0 applications have different characteristics and features, especially in terms of interface design, the basic premise of Web 2.0 is that people are encouraged to participate in the shared creation of content, with knowledge seeking and contributing being a major activity. We thus suggest that these shared characteristics/features of Web 2.0 provide the opportunity to conduct data collection across different Web 2.0 applications. However, focusing on one specific Web 2.0 application would definitely help to eliminate the possible influence of different characteristics/features such as different interface designs in different Web 2.0 applications.

Third, the measure of creativity is self-reported by employees in this study. However, creativity is a very complex construct and there are many different approaches for measuring it. Self-reported measures can only present a limited facet of this construct, suggesting a limitation of this research.

6. Conclusion

Chinese government policy strongly encourages knowledge sharing and knowledge creation in contemporary organizations across all industries and fields. However, knowledge management initiatives in practice are relatively fewer in China than in Western countries. With the development of Web 2.0 applications, we see a useful platform for knowledge sharing. Self-perception theory is applied in this study to explore the effect of knowledge sharing behavior on knowledge creation at the level of individual employee. We found that both knowledge seeking and knowledge contributing in the context of Web 2.0 virtual communities contribute to flow and further to employees' creativity. This is critical since many

employees especially in the Chinese culture hold a strong belief that knowledge contributing means losing knowledge power. In the Chinese business culture, information and knowledge are key sources of power. Fundamentally, they are treated as personal assets rather than an organizational resource and personal power is maintained by carefully controlling key information and knowledge (Martinsons & Westwood, 1997). Consequently, knowledge sharing is likely to happen within a group. Further, the amount of information and knowledge shared among employees depends on guanxi which is specific to the Chinese context and defined as 'the existence of direct particularistic ties between two or more individuals' (Davison et al., 2012). So, it is not surprising to see that for Chinese employees, fearing the loss of knowledge power is the key factor that negatively impacts the attitude towards knowledge contributing and further the intention to contribute knowledge (Huang et al., 2008). This helps explain why knowledge sharing activities often encounter challenges and may eventually fail in the context of Chinese organizations.

In the context of Web 2.0 virtual communities, where people typically don't know one another or don't necessarily expect to meet face-to-face, we suggest employees are likely to feel free from the shadow of fearing the loss of knowledge power. Given the difference between the context of virtual communities and traditional communities of practice and face-to-face knowledge sharing inside organization, we recommend that Chinese organizations encourage their employees to go beyond the organization to exchange knowledge on Web 2.0 applications with people who share common interests, goals, needs, or practices with them. When employees take the first step to contribute their knowledge in Web 2.0 virtual communities, they are likely to see the beneficial consequences brought by their contributions. Our study indicates that when employees frequently contribute knowledge in Web 2.0 virtual communities, this can lead to flow and further facilitate the formation of their creativity. When this finding becomes a strong belief held by employees and when the current belief that knowledge contributing means losing knowledge power is diminished, the bottleneck in the knowledge sharing may disappear. Moreover, even though our study is limited to knowledge sharing in Web 2.0 virtual communities, we argue that our finding that both knowledge seeking and knowledge contributing can lead to flow and further to employee creativity is likely to have traction beyond the Web 2.0 virtual context, potentially facilitating knowledge sharing initiatives in the organizational context, thus benefiting the whole organization. Furthermore, we suggest that further study is needed to explore the consequences of knowledge seeking and contributing in the organizational context so as to make a comparison between different contexts. We believe this further study would lead to more interesting findings which would usefully complement the current study.

Acknowledgements

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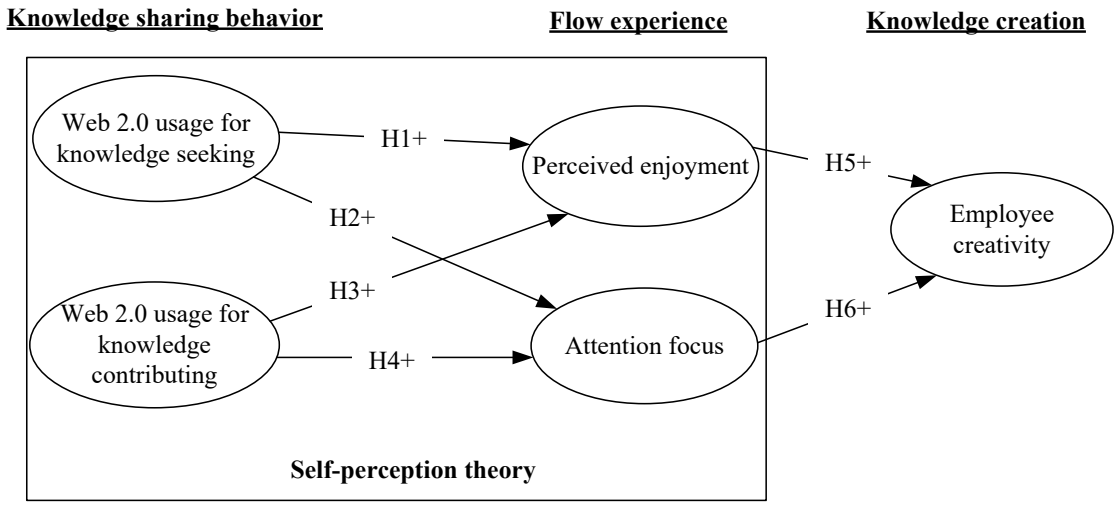
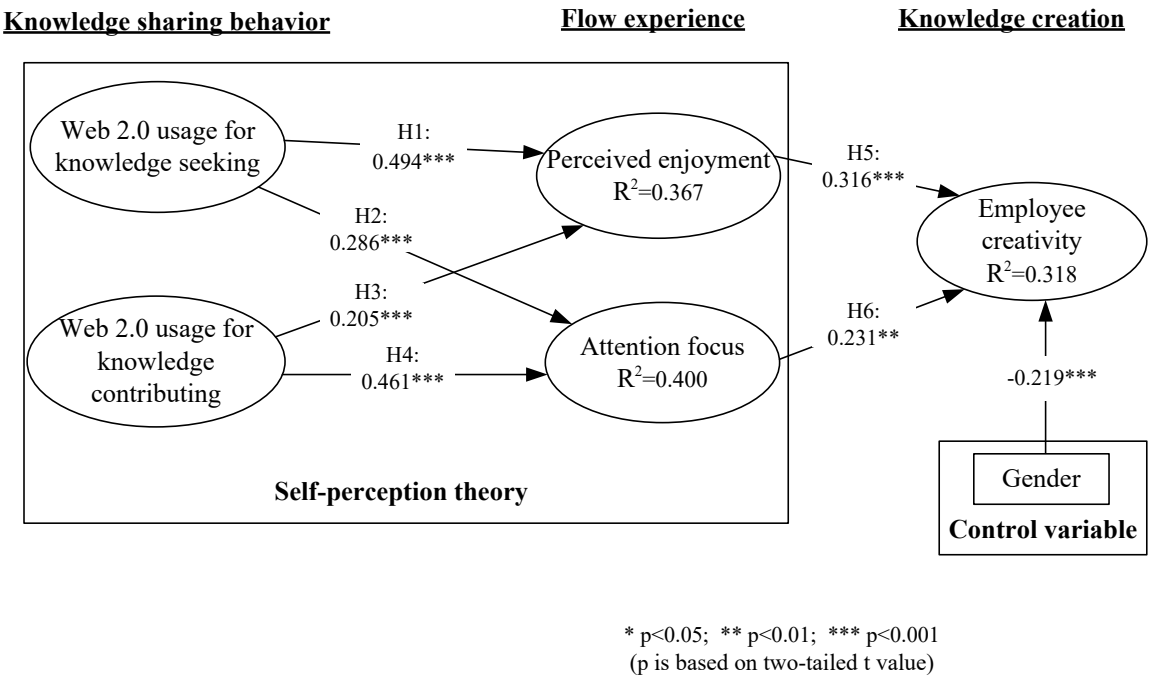


Fig. 1. Research model.



* p<0.05; ** p<0.01; *** p<0.001
(p is based on two-tailed t value)

Fig. 2. Research model with results.

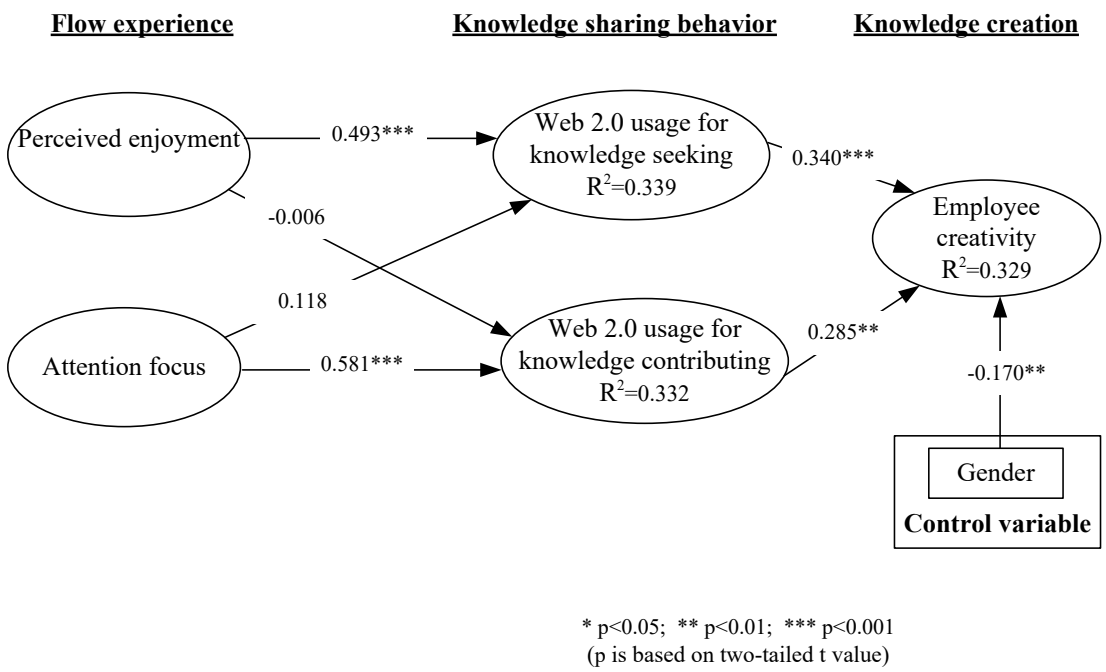


Fig. 3. Competing model.

Table 1

Demographic information of survey respondents.

Measure	Items	Frequency	Percent
Gender	Male	115	49
	Female	117	51
Age	< 20	0	0
	20-30	134	58
	31-40	77	33
	41-50	14	6
	>50	7	3
Education	Secondary school or less	4	2
	Post-secondary study	31	13
	Bachelor level	125	54
	Master level or higher	72	31
Organization size (# of employees)	< 100	85	36
	100-1000	65	28
	1001-2000	27	12
	> 2000	55	24
Ownership nature	State Owned	105	45
	Privately Owned	71	31
	Joint Venture	22	9
	Foreign Owned	34	15
Current position	Junior	79	34
	Middle	114	49
	Senior	39	17
Overall work experience (number of years)	<5	77	33
	5-10	92	40
	11-20	47	20
	>20	16	7

Table 2

Overview of measurement model.

Constructs	Items	AVE	CR	Cronbach's Alpha
Attention focus (ATTF)	4	0.829	0.951	0.931
Employee creativity (ECREA)	8	0.709	0.951	0.941
Perceived enjoyment (PEREN)	4	0.809	0.944	0.921
Web 2.0 usage for knowledge contributing (USAKC)	3	0.903	0.966	0.946
Web 2.0 usage for knowledge seeking (USAKS)	3	0.781	0.914	0.859

Table 3

Descriptive statistics, correlations between constructs and square roots of AVE.

	Mean	SD	ATTF	ECREA	PEREN	USAKC	USAKS
ATTF	4.19	1.55	**0.910**				
ECREA	4.91	1.20	0.467	**0.842**			
PEREN	4.89	1.35	0.706	0.491	**0.899**		
USAKC	3.42	1.74	0.576	0.446	0.404	**0.950**	
USAKS	4.90	1.49	0.471	0.470	0.576	0.403	**0.884**

***** Diagonal elements are the square roots of the AVE of each construct.

Table 4

Loadings and cross loadings.

	ATTF	ECREA	PEREN	USAKC	USAKS
ATTF1	**0.914**	0.443	0.671	0.515	0.443
ATTF2	**0.920**	0.463	0.669	0.491	0.467
ATTF3	**0.920**	0.399	0.605	0.553	0.388
ATTF4	**0.888**	0.395	0.625	0.540	0.417
ECREA1	0.392	**0.813**	0.438	0.376	0.408
ECREA2	0.432	**0.841**	0.435	0.328	0.428
ECREA3	0.343	**0.824**	0.394	0.278	0.434
ECREA4	0.414	**0.834**	0.430	0.413	0.389
ECREA5	0.378	**0.871**	0.424	0.347	0.406
ECREA6	0.358	**0.852**	0.382	0.405	0.358
ECREA7	0.398	**0.863**	0.405	0.378	0.398
ECREA8	0.421	**0.839**	0.392	0.471	0.345
PEREN1	0.590	0.411	**0.876**	0.343	0.495
PEREN2	0.696	0.478	**0.901**	0.441	0.541
PEREN3	0.646	0.452	**0.931**	0.374	0.517
PEREN4	0.597	0.419	**0.889**	0.283	0.517
USAKC1	0.541	0.427	0.423	**0.945**	0.398
USAKC2	0.568	0.456	0.379	**0.974**	0.390
USAKC3	0.532	0.387	0.346	**0.932**	0.361
USAKS1	0.301	0.390	0.493	0.184	**0.853**
USAKS2	0.409	0.430	0.533	0.312	**0.939**
USAKS3	0.517	0.423	0.500	0.537	**0.857**

Appendix A. Constructs and items

Constructs	Items
Perceived enjoyment (adapted from Koufaris, 2002)	1. I feel that using the Web 2.0 application is fun. 2. I feel that using the Web 2.0 application is exciting. 3. I feel that using the Web 2.0 application is enjoyable. 4. I feel that using the Web 2.0 application is interesting.
Attention focus (adapted from Koufaris, 2002)	1. When using the Web 2.0 application, I am absorbed intensely in the activity. 2. When using the Web 2.0 application, my attention is focused on the activity. 3. When using the Web 2.0 application, I concentrate fully on the activity. 4. When using the Web 2.0 application, I am deeply engrossed in the activity.
Web 2.0 usage for knowledge seeking (adapted from Kankanhalli, et al., 2005; Venkatesh et al., 2003)	1. I often use the Web 2.0 application to seek knowledge. 2. I frequently use the Web 2.0 application to seek knowledge. 3. I spend a lot of time using the Web 2.0 application to seek knowledge.
Web 2.0 usage for knowledge contributing (adapted from Kankanhalli et al., 2005; Venkatesh et al., 2003)	1. I often use the Web 2.0 application to contribute my knowledge. 2. I frequently use the Web 2.0 to contribute my knowledge. 3. I spend a lot of time using the Web 2.0 application to contribute my knowledge.
Employee creativity (adapted from Tierney et al., 1999; Ettlie, & O'Keefe, 1982)	1. I demonstrate originality in my work. 2. I take risks in terms of producing new ideas in doing job. 3. I find new uses for existing methods or equipments. 4. I solve problems that caused others difficulty. 5. I try out new ideas and approaches to problems. 6. I identify opportunities for new products/processes. 7. I generate novel, but operable work-related ideas. 8. I serve as a good role model for others in creativity.

Appendix B. Interview questions

1. Which Web 2.0 application do you use most frequently?
2. Do you often visit this Web 2.0 application to seek knowledge? Why?
3. Do you often contribute your experience and knowledge to this Web 2.0 application? Why?
4. Do you think it is enjoyable to visit this Web 2.0 application? Which one is more enjoyable, seeking or contributing? Why?
5. Does this Web 2.0 application help you come to have more good ideas in your work? Please give an example.
6. What role do you think you can (or plan to) play in the development of this Web 2.0 application?
7. Are there any other issues that you would like to tell us about?

Appendix C. Common method bias analysis in PLS

Construct	Indicator	Substantive path coefficient	Method path coefficient
ATTF	ATTF1	0.881***	0.040
	ATTF2	0.875***	0.055
	ATTF3	0.988***	-0.083*
	ATTF4	0.898***	-0.013
ECREA	ECREA1	0.737***	0.081
	ECREA2	0.794***	0.051
	ECREA3	0.888***	-0.074
	ECREA4	0.773***	0.069
	ECREA5	0.919***	-0.054
	ECREA6	0.917***	-0.073
	ECREA7	0.894***	-0.032
	ECREA8	0.808***	0.040
PEREN	PEREN1	0.920***	-0.053
	PEREN2	0.775***	0.150**
	PEREN3	0.949***	-0.021
	PEREN4	0.955***	-0.079
USAKC	USAKC1	0.922***	0.030
	USAKC2	0.963***	0.016
	USAKC3	0.967***	-0.047
USAKS	USAKS1	0.957***	-0.124**
	USAKS2	0.976***	-0.047
	USAKS3	0.714***	0.176***

Notes: *p<0.05; **p<0.01; ***p<0.001

Appendix D. Causal direction analysis

Original Research Model (Figure 2)		**Total Squared Error:** 0.319	
Causal Relations	Estimated Correlation	Actual Correlation	Squared Error
USAKS→ PEREN	0.494	0.576	0.007
USAKS→ATTF	0.286	0.471	0.035
USAKS→ECREA	0.222	0.470	0.062
USAKC→ PEREN	0.205	0.404	0.040
USAKC→ATTF	0.461	0.576	0.013
USAKC→ECREA	0.171	0.446	0.076
PEREN→ECREA	0.316	0.491	0.031
ATTF→ECREA	0.231	0.467	0.056
Gender→ECREA	-0.219	-0.250	0.001
Competing Model (Figure 3)		**Total Squared Error:** 0.518	
Causal Relations	Estimated Correlation	Actual Correlation	Squared Error
PEREN→USAKS	0.493	0.576	0.007
PEREN→USAKC	-0.006	0.404	0.168
PEREN→ECREA	0.166	0.490	0.105
ATTF→USAKS	0.118	0.466	0.121
ATTF→USAKC	0.581	0.577	0.000
ATTF→ECREA	0.206	0.466	0.068
USAKS→ECREA	0.340	0.469	0.017
USAKC→ECREA	0.285	0.447	0.026
Gender→ECREA	-0.170	-0.250	0.006