Attention Trade-off between Two Types of User Contributions:

Effects of Pinterest-Style Infinite Scroll Layouts on Creating Original Sharing and Appreciating Others' Sharing

Completed Research Paper

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Abstract

User contributions are critical to social commerce sites. Prior studies mainly examined motivational factors influencing user contributions. In the current study, we examine effects of interface layouts on user contributions, from the perspective of attention allocation. We also distinguish between the two types of user contributions: creating original sharing and appreciating others' sharing. Since attention is a limited resource, we argue that interface layouts may lead to attention trade-off between the two types of user contributions.

Leveraging an opportunity of a popular social commerce site's transformation to Pinterest-style infinite scrolling layouts, we collected panel data. Empirical findings show that the new layouts design has opposite effects on the two types of user contribution: a positive effect on users' appreciation of others' sharing, but a negative effect on users' original sharing. Some user characteristics moderate the effects. The findings yield important implications for research and websites design practice.

Keywords: Human-computer interaction, attention allocation, interface design, user contribution, social commerce, Pinterest-style infinite scroll layouts

Introduction

The Internet has tremendously changed the way consumers gather product information. On sites such as Pinterest.com, Svpply.com, and TheFancy.com, users can share their favorite products, create collections, and interact with other users. Such sites connect users, and let them browse, share, recommend, and rate products. They are called social commerce or social shopping sites (Olbrich and Holsing 2011), and are growing at amazing rates. For example, Pinterest.com attracted 11.7 million unique U.S. visitors as of January 2012 since its launch in 2010, making it the fastest site ever to reach the 10 million unique visitor mark (Constine 2012).

Users' contributions, such as recommending products, posting reviews, reading other users' contribution and interacting with other users, are critical to the success of social commerce sites. In general, online communities have been trying to encourage users to contribute through various ways, such as implementing systematic feedback systems (Moon and Sproull 2008) and providing virtual co-presence features (Ma and Agarwal 2007). Another method is to engage users through interface design - manipulating the way contents are displayed. A popular interface layouts design recently emerged is Pinterest-Style Infinite Scroll Layouts. It is widely adopted, and is believed to have positive effects on user contributions.

Prior studies discuss user contributions in general. Yet closer examination reveals that user contribution has at least two different aspects: creating original sharing, and appreciating others' sharing. The underlying psychological mechanisms for the two contributions vary. Creating original sharing may relate more to personal identity verification (Ma and Agarwal 2007) and satisfying others' information needs (Bateman et al. 2011). Appreciating others' sharing may relate more to reciprocity and social relationship building (Butler et al. 2002). The two contributions also differ in the efforts required. Creating original content may require more cognitive resources and more efforts, comparing to appreciating others' sharing.

We note that there exist competitions for attention/cognitive resources between the two types of user contributions. The interface change from page-turning to Pinterest-style infinite scroll layouts may increase user engagement in browsing, and may lead to more appreciation of others' sharing. Yet, users' original sharing is likely to drop. In addition, different user characteristics, such as willingness to disclose personal information Ma and Agarwal 2007), experience with the website (Ma and Agarwal 2007), attention received from other users (as indicated by the number of followers one has) (Tsai and Ghoshal 1998), and attention given to other users (as indicated by the number of following one has) (Robert et al. 2008), interact with the change in user engagement to influence the two types of user contributions.

Leveraging an opportunity of interface change from page-turning to Pinterest-style infinite scroll layouts of a popular social commerce site, we collect field data to empirically test the theoretical arguments. We construct a panel dataset consisting of 1,250 users on two types of user contribution behaviors, i.e., users' creating original sharing and appreciating others' sharing, before and after the interface change. Prior studies on user contribution mainly collected data through survey. Self-reported data on contribution behaviors might be biased, influenced by factors such as social desirability. Using panel field data eliminates such concern.

The study is organized as follow. First, we present the research background. Then, we provide theoretical background and develop hypotheses. After describing the data set, we explain our empirical strategy and present results of data analysis. Finally, we conclude with discussions and implications for theory and practice.

Research Background

The linkage of online shopping and traditional communities initiate a new form of sites, namely social commerce sites. This new form of online social platforms allows consumers to share, recommend, rate, and purchase products (Olbrich and Holsing 2011). In this section, we first

describe the key features of social commerce sites. Then we introduce Pinterest-style infinite scroll layouts used in social commerce sites.

Key Features of Social Commerce Sites

Creating original sharing – sharing "treasure" A primary functionality of social commerce sites is sharing favorite products. Users can upload product images or post product links. Users can also add tags and descriptions to products, and organize products in collections.

Appreciating others' sharing – giving "like" Users can browse others' shared products, and give "like" if the product appeals to them. The total number of "like" a product receives is usually displayed together with the product's image. Giving "like" shows a reader's preference for the product and appreciation for the original poster. It servers a social function through offering positive feedbacks directly to the poster.

User profile Users can add information to their profile, and it will be displayed on their home page. They can add self-disclosure tags, about the styles they like, their hobbies and interests. They can also add personal statements and vision statements. .

Social networking Most social commerce sites already embed social networking functions. A user can subscribe to another user's sharing by "following" him/her. The following relationship does not need mutual consent, nor to be reciprocal. The number of followings a user has indicates his/her immersion in the community and attention paid to others' sharing. The number of followers a user has indicates his/her popularity in the community and others' attention paid to his/her sharing.
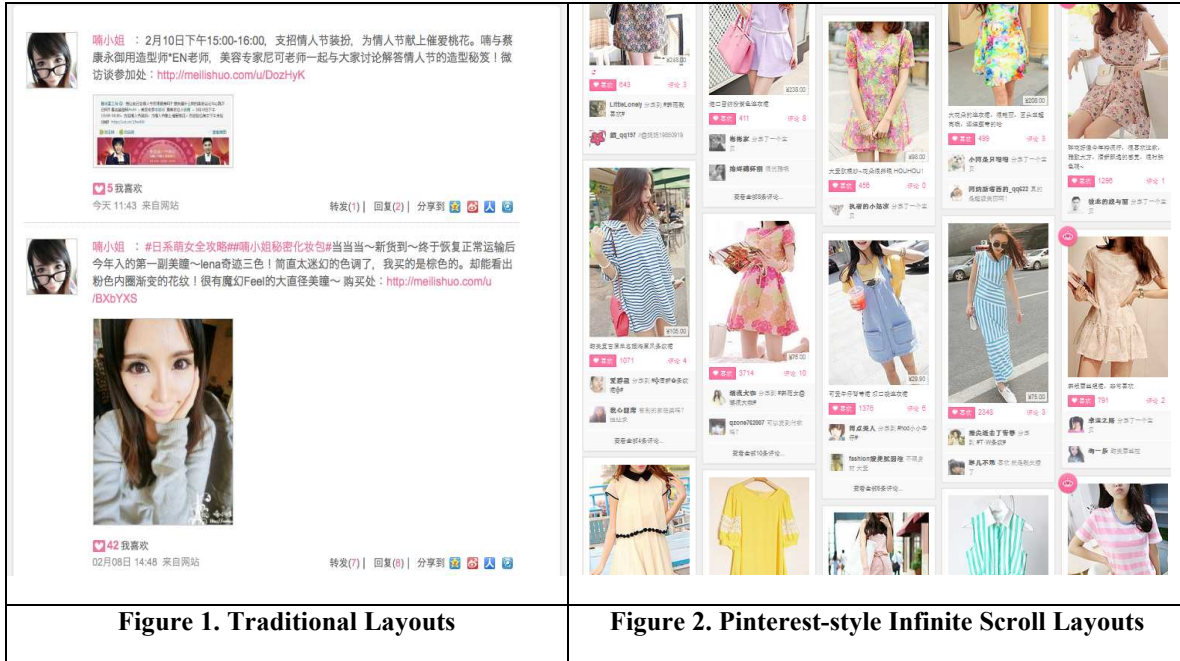
Pinterest-Style Infinite Scroll Layouts

The Pinterest-style infinite scroll layouts have two major components: dynamic grid layouts and infinite scrolling. The main characteristic of dynamic grid layouts is that each grid has dynamic size in width and height, and all grids are arranged to fill in every blank space available. Dynamic grid layouts crams as much content as possible onto a single page, which is presumably justified by a statement like, "the more we show users, the more likely they are to find something they like."

Infinite scrolling, also known as "endless scrolling", is a technique where additional content for a web page is appended dynamically to the bottom of the page as the user approaches the end. Users are less likely to continue on to the next "page" if they have to click something versus it being delivered automatically to them. Infinite scrolling will increase average time spent on website by users.

Figures 1 and 2 present traditional layouts and Pinterest-style infinite scroll layouts.

Theoretical Background and Hypotheses Development

This study is related to attention allocation and user contribution in online communities, or social commerce communities in specific. In the following, we first explain the effects of the interface change from page-turning to Pinterest-Style infinite scroll layouts on attention allocation using the capacity theory of attention. We then review the literature about user contribution and hypothesize about the effects of the interface change on user contribution.

Figure 1. Traditional Layouts	Figure 2. Pinterest-style Infinite Scroll Layouts

Effect of Interface Change on Attention Allocation

We adopt the capacity theory of attention (Kahneman 1973) to explain the effects of interface change from page-turning to Pinterest-Style infinite scroll layouts on attention allocation. Since various observations show that humans' ability to perform multiple tasks at the same time is limited, the capacity theory of attention assumes that the total amount of attention which can be used at a specific time is limited. Parallel performing multiples tasks is possible (e.g., driving and talking), while the attention capacity is divided among the activities. When two activities demand more attention capacity than is available, only one activity can be completed.

The interface change, from page-turning to Pinterest-style infinite scroll layouts, may have the following impacts on attention allocation.

First, the Pinterest-style infinite scroll layouts make users more engaged in reading others' sharing. This layouts design will keep on displaying contents when users scroll down. Users will not reach an "end" of a page and there is no need to click "next page" for new contents. Turning for the next page can be a distraction to the browsing experience, because users need to explicitly click a button or an arrow, and then wait for the next page to load. Content loading is also more efficient with infinite scroll. When users read contents displayed on the screen, contents below are being loaded in the background. Once users scroll down or press "page down", contents will be displayed immediately. The Pinterest-style infinite scroll layouts remove disturbances from the browsing experience, and users are more likely to experience flow.

Second, attention is a limited resource (Kahneman 1973, Norman and Bobrow 1975) and different activities compete for attention. When users spend more attention on reading others' sharing, the attention they spend on creating original sharing will be reduced.

Third, though the Pinterest-style infinite scroll layouts increase the total attention users spend on reading others' sharing, it dilutes the attention paid to a specific sharing. With the Pinterest-style infinite scroll layouts, users can easily view hundreds of sharing through only several scrolling down's. If we consider that a specific sharing post needs to compete with other sharing to attract

users' attention, the Pinterest-style infinite scroll layouts make the competition fiercer. It is more difficult for a specific sharing post to stand out and attract readers' attention.

User Contribution in Social Commerce Communities

User contribution to online communities has been widely studied in IS (Butler et al. 2002, Ma and Agarwal 2007, Wasko and Faraj 2005). In the last decade, a stream of studies focused on user contribution in social commerce context. Users share their opinions about the product, recommend or critique products, and such activities are termed as electronic word of mouth (Dellarocas et al. 2010). Most of the existing studies explained this behavior from a motivational perspective with an emphasis on perceived benefits and perceived costs. For example, Hennig-Thurau et al. (2004) identified five motivational categories of customer information sharing (i.e., eWOM), including focused-related utility, consumption utility, approval utility, moderator-related utility, and homeostase utility. We conduct a review of studies investigating user participation and opinion sharing in social commerce communities. We search key terms such as "online word of mouth", "customer knowledge sharing" in leading IS journals and some marketing journals to identify relevant studies. Table 1 summarizes the studies.

Existing studies has some commonalities. First, researchers examined user contribution in general, especially focusing on knowledge sharing. Though some studies noted social relational activities influence knowledge sharing (Liang et al. 2011, Butler et al. 2002), few studies explicitly investigate social relational activities. In the current study, we distinguish between creating original sharing and appreciating others' sharing. Creating original sharing relates to knowledge sharing, while appreciating others' sharing relates to social relational aspects. Second, extant studies mainly tried to explain user contribution from motivational aspects, or perceived benefits and costs (e.g. Cheung and Lee 2012, Cheema and Akaikati 2010). We examine impacts of layouts design on user contributions through attention allocation. Third, most studies relied on subjective data collected through survey, case study, and focus groups to explore how and why customers participate in online social communities. Straub et al. (1995) argued that actual usage and perceived usage are not always congruent. Instead of using self-reported contribution, we use field data to measure actual contribution.

Table 1. Summary of Studies Related to User Contribution in Social Commerce Settings				
Author (Year)	Theoretical Background	Factors/ Antecedent	Data Collection	DV
Berger and Schwartz (2011)	Motivation theory		Field Experiment, Secondary data	Immediate and ongoing WOM
Cheema and Akaikati (2010)	Social exchange theory	High- uniqueness consumers, Publicly consumed products	Experiment Survey	Positive WOM
Cheung and Lee (2012)	Social exchange theory, Social identity theory, Social cognitive theory	Reputation (marginal significance), Sense of belonging, Enjoyment of helping, Reciprocity, Moral obligation, Knowledge self-efficacy	Survey	WOM intention
Hennig-Thurau et al. (2004)	Motivation theory	Platform assistance, Venting negative feelings, Concern for other consumers, Positive self-enhancement, Social benefit, Economic incentives, Helping the company, Advice seeking	Survey	eWOM behavior

Kelleher and Anu (2010)		Beneficiary's knowledge, Expert passionate beneficiary, Novice passionate beneficiary, Expert dispassionate beneficiary, Novice dispassionate beneficiary	Narrative analysis	eWOM behavior in Blog
Lee et al. (2006)	Social exchange theory	Personal interest, Social context, Technological attributes	Survey	Knowledge sharing among customers in web-based discussion boards.
O'Reilly and Marx (2011)	Grounded theory	Self-worth, Avoid risk, Enact negativity bias	Interview	Making and taking eWOM
Palka et al. (2009)	Grounded theory	Social conditions, Resource-based condition, Consumption-based conditions, Attitudinal conditions, Personal conditions	Interview	Mobile word-of-mouth
Sandars and Walsh (2009)		Help other users, influence the authors of the module, Develop an online community of learners	Survey	Online word of mouth opinion (user feedback)
Xia et al. (2012)	Reciprocity	Getting from network, Giving to network	Panel data	Users' continued-sharing behavior
Wu and Sukoco (2010)	Motivation theory	Achievement motive, Affiliation motive, Power motive	Survey	Knowledge sharing

Effect of Interface Change on the Two Types of User Contributions

As explained, the interface change to Pinterest-style infinite scroll makes reading experience more engaging, through removing steps such as clicking for the next page or waiting for page loading. Contents are displayed as users scroll down, without reaching an end. Eliminating interruptions, users are more likely to experience flow and be cognitively absorbed (Agarwal and Karahanna 2000) in reading others' sharing. As users read more, they are more likely to encounter sharing they like, and the number of "like" they give to others' post may increase.

Hypothesis 1 (H1) The interface change to Pinterest-style infinite scroll will positively affect the user contribution of appreciating others' sharing.

Attention is a limited resource. "The total amount of attention which can be deployed at any time is limited" (Kahneman 1973, P.9). Since the total amount of attention which can be deployed in a certain time period is limited, when a user spends more attention on reading others' sharing, the attention resource that can be spent on creating one's own sharing is reduced (Kahneman 1973, Norman and Bobrow 1975). As a result, the number of "treasure", i.e., original sharing, drops after the interface change to Pinterest-style infinite scroll.

Hypothesis 2 (H2) The interface change to Pinterest-style infinite scroll will negatively affect the user contribution of creating original sharing.

Interaction Effect of Willingness for Self-disclosure with Interface Change

We have identified the different main effects of the interface change to Pinterest-style infinite scroll on the two types of user contributions. As we note users have different characters and properties, the interface change may influence them to various extent.

We thus examine the impact of the interface change together with certain user personal characteristics. The first factor we examine is user's willingness for self-disclosure. Some users might be more willing to let other users know their identity or taste. They are willing to express their opinions, and when they read sharing that match their preferences, they will give out "like" (Derlega et al. 1993). Some users might be reluctant to share their identity or taste. Users who are relatively reserved might be more cautious when giving "like". Thus, the increase in the number of "like" they give after the interface change may not be significant comparing to users who are more willing to disclose personal information.

Hypothesis 3a (H3a) The positive effect of interface change on appreciating others' sharing will be stronger for users who are more willing to do self-disclosure.

Similarly, users who are relatively reserved might be more cautious when share "treasure". After the interface change, as the attention allocated for treasure sharing decreases, such users will experience an even sharper falling down in the number of treasures they share.

Hypothesis 3b (H3b) The negative effect of interface change on creating original sharing will be stronger for users who are less willing to do self-disclosure.

Interaction Effect of Prior Experience with Interface Change

Experience with the traditional interface may influence users' adaptation to the new interface. The more experience one has with the traditional systems, the more efforts one need to spend to adapt to the new systems (Oreg 2003, Polites and Karahanna 2012). Adaptation shall influence both types of user contribution in a negative manner. For giving "like", the increase after change shall be higher for those who have less experience with the old interface as adaption to the new interface is easier for them.

Hypothesis 4 (H4a) The positive effect of interface change on appreciating others' sharing will be stronger for users who have less experience with the old interface.

For sharing "treasure", the drop after change shall be more for those who have more experience with the old interface. They need to spend more cognitive resources to adapt to the new interface, so the cognitive resources for sharing "treasure" are further reduced.

Hypothesis 4b (H4b) The negative effect of interface change on creating original sharing will be stronger for users who have more experience with the old interface.

Interaction Effect of the Number of Followings with Interface Change

The number of followings users have indicates the extent to which users prefer to read others' sharing. Users with more number of followings tend to read more of others' sharing (Mossholder et al. 2005). Since the interface change greatly eases reading others' sharing, such users may read more. As users get more exposure to others' sharing; they are more likely to find out sharing catering their tastes.

Hypothesis 5 (H5) The positive effect of interface change on appreciating others' sharing will be stronger for users who have more followings.

Interaction Effect of the Number of Followers with Interface Change

Before the interface change, users who have more number of followers receive more attention from others. They have an advantage over those who have fewer followers, in terms of attracting readers' attention (Stephen and Toubia 2009). The Pinterest-style infinite scroll interface mitigates this relative advantage. More sharing posts are displayed in each screen shot, and the sharing posts from different contributors are mingled together. Readers can view many sharing posts from more posters at once. Users who have more number of followers may perceive that the attention paid to their sharing is diluted by the interface change, and hence they may reduce their sharing more significantly.

Hypothesis 6 (H6) The negative effect of interface change on creating original sharing will be stronger for users who have more followers.

The hypotheses are summarized in in Figure 3.

Figure 3. Research Model
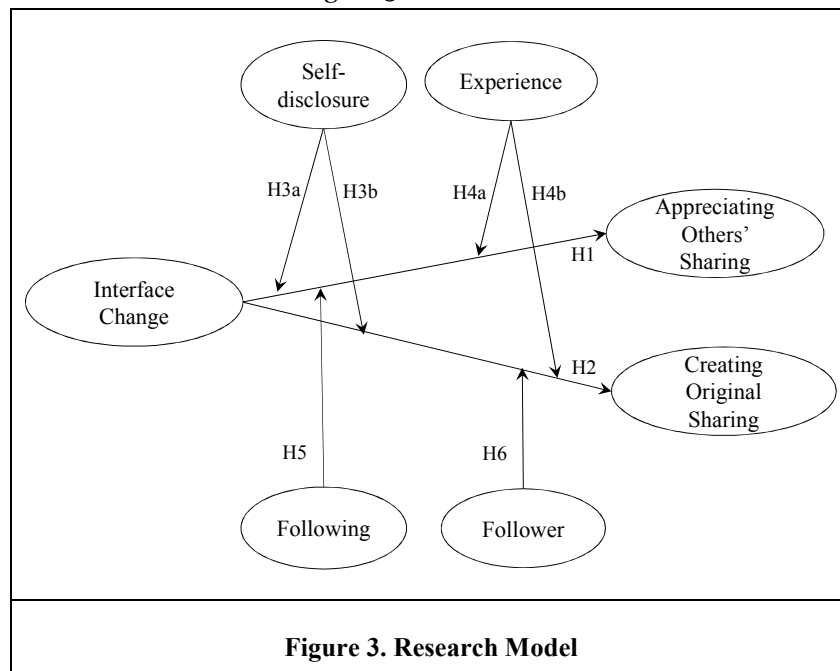
Research Method and Setting

Research Setting

The data for this study were collected from Meilishuo (www.meilishuo.com), a popular social fashion shopping community in China. Meilishuo provides an online platform where users can share their favorite products and interact with others. The Sharing focuses on fashion and lifestyle products. Launched in Nov 2009, Meilishuo now is one of the most popular websites in mainland of China. Based on Alexa.com report, it has a traffic rank of 995 globally and 144 in China, as of April 2013. It currently has more than 32 million registered members. The daily user sharing volume is 3.4 million and the daily number of page views is 164 million.

 Meilishuo has conventional direct sharing features, and users can post their favorite products by providing a picture or a link, and a brief description of the product. Users can include detailed product information, such as product price, tags, and information about the online shops that sell the product. Purchases can be made through the link to the online store. Social sharing features are integrated into the platform. Users can give "like" to others' sharing, and the product will appear on their "my likes" page. The site provides social networking features as well. Users can "follow" other users, and they can easily read sharing from users they follow. In addition, users have their profiles; they can disclose personal information, upload profile photos and add self-disclosure tags.

Figure 4. Screenshot of a Product Post

Figure 4 depicts a product "red sweater" on Meilishuo. This product was created by a user named Jingbao Mummy and received 1712 "like" from other users.

Starting from the week of March 23, 2012, Meilishuo introduced a new interface, adopting Pinterest-style infinite scroll layouts. The interface change provides field data to examine the effect of Pinterest-style infinite scroll layouts design on two different types of user contribution: creating original sharing and appreciation of others' sharing.

Data

To determine the length of the time window, we balance two factors. First, the time window could not be too short or it would not truly reflect user behavior changes. Second, it could not be too long or it would accumulate too many unrelated activities. Therefore, we choose a time span starting from March 3, 2012 to April 4, 2012, dropping the week of March 23 which is when the change happens[1]. The resulting time span includes three weeks before the change (March 3 to March 17, both dates inclusive) and three weeks after the change (March 24 to April 14, both dates inclusive).

We randomly sample 1,250 users from the Meilishuo community. To ensure the sample include only active users, we select users who has posted before March 3 and has at least one share or one like during the first half of 2012[2]. For each of the user in the sample, we collect the two types of

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[1] Excluding this week because it was when the change just happened and users' behaviors were not yet stabilized. Including this week's data does not influence the results.
[2] Including the inactive users in data analysis would actually make the results stronger.

user contribution, i.e. sharing "treasure" and giving "like", throughout the time window. We also collect users' profile information on April 30, 2012. Table 2 presents the summary statistics of the variables.

Table 2. Summary Statistics				
Variable	Mean	Std. Dev.	Min	Max
weekly # of likes	6.91	20.73	0	495
weekly # of treasures	4.45	20.09	0	754
# of self-disclosure tags	1.90	2.59	1	20
# of days since first post	232.40	1145.95	1	15446
# of followers	5656.68	191388.60	0	6767508
# of followings	69.60	586.81	0	19582

Analysis and Results

There are two major analysis procedures for panel data: Fixed Effects Model (FEM) and Random Effects model (REM). In the current study, we use REM for the following reasons. First, though FEM can control for omitted variables, it "only controls for time-invariant variables with time-invariant effects (Allison 2009, p. 10)." Since the study setting involves an interface change, the effects of the variables may vary across time. Second, we performed Hausman test (Hausman 1978) to compare FEM and REM which produces more consistent and efficient estimates, and the results indicate REM is preferred to FEM in our case[3].

To test H1, we examine the change in users' appreciation of other's sharing before and after the interface change in a regression framework:

$$
(1) \quad
\begin{aligned}
LikeOthers_{it} = {} & \beta_0 + \beta_1 AfterChange_t + \beta_2 SelfDisclosure_i + \beta_3 Experience_{it} \\
& + \beta_4 Follower_i + \beta_5 Following_i + w_{it}
\end{aligned}
$$

Where $w_{it} = \varepsilon_i + u_{it}$. i indexes the users and t indexes the weeks. The dependent variable, $LikeOthers_{it}$, is the weekly number of likes a user gives to others' sharing. $AfterChange_t$ is a dummy that equals 1 if the timer period is after the block, and 0 otherwise. To control for individual heterogeneity, we include: the number of self-disclosure tags the individual has, the prior experience the individual has with the site, measured as the number of days from

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[3] Hausman test results: for Treasure, Prob=0.3736, null hypotheses cannot be rejected, random effects model is preferred to fixed effects model. For Like, Prob=0.0545, null hypotheses cannot be rejected, random effects model is preferred to fixed effects model.

individual's first post date to the specific time. We also include the number of followers, and the number of followings. To reduce data skewness, the explanatory variables are standardized.[4]

The results are in Table 3 (Table 3 summarizes all regression results). The results indicate that the interface change has a significant positive effect (β = 0.761, *p-value* = 0.048) on the number of likes users give to others' sharing. The results support H1. After the interface change, users spend more attention to appreciate others' sharing, and hence they have higher chance to find out their favorites and they give more "like".

To test H2, we examine the change in users' original sharing:

$$
\text{(2)} \quad \begin{aligned} ShareTreasures_{it} &= \beta_0 + \beta_1 AfterChange_t + \beta_2 SelfDisclosure_i + \beta_3 Experience_{it} \\ &+ \beta_4 Follower_i + \beta_5 Following_i + w_{it} \end{aligned}
$$

The regression results suggest that the interface change has a significant negative effect (β = -3.10, *p-value* = 0.000) on the number of original sharing users create. The results support H2. As the interface change attracts users to spend more attention to appreciate others' sharing, they have less cognitive resources to create original sharing. There is a clear drop in the weekly number of original shares individuals post after the interface change.

To test H3a and H3b, we examine the interaction effect of self-disclosure with change.

$$
\text{(3a)} \quad \begin{aligned} LikeOthers_{it} &= \beta_0 + \beta_1 AfterChange_t + \beta_2 SelfDisclosure_i \\ &+ \beta_3 SelfDisclosure_i \cdot AfterChange_t + \beta_4 Experience_{it} + \beta_5 Follower_i + \beta_6 Following_i + w_{it} \end{aligned}
$$

$$
\text{(3b)} \quad \begin{aligned} ShareTreasures_{it} &= \beta_0 + \beta_1 AfterChange_t + \beta_2 SelfDisclosure_i \\ &+ \beta_3 SelfDisclosure_i \cdot AfterChange_t + \beta_4 Experience_{it} + \beta_5 Follower_i + \beta_6 Following_i + w_{it} \end{aligned}
$$

Table 3. Summary of Results								
Model	1	2	3a	3b	4a	4b	5	6
Dependent variable	Like	Treasure	Like	Treasure	Like	Treasure	Like	Treasure
Change	.761*	-3.10***	.761*	-3.1***	.761*	-3.11***	.761*	-3.1***
	(0.385)	(0.565)	(0.385)	(0.564)	(0.385)	(0.567)	(0.385)	(0.564)
Self-disclosure	-0.157	0.411	-0.461	0.0471	-0.158	0.411	-0.158	0.411
	(0.473)	(0.262)	(.363)	(0.293)	(0.473)	(0.263)	(0.473)	(0.263)
Experience	-.464***	1.36	-.464***	1.36	-.457***	2.25	-.464***	1.36
	(0.087)	(1.46)	(0.087)	(1.461)	(0.086)	(2.34)	(0.087)	(1.461)
Follower	-.402***	1.24***	-.402***	1.24***	-.402***	1.24***	-.402***	1.57***

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[4] Standardize the explanatory variables only influence the scales of the coefficient estimates, not the directions of the influence (i.e., the sign of the coefficients) or the significance levels of the coefficients.

	(0.026)	(0.061)	(0.026)	(0.061)	(0.026)	(0.061)	(0.026)	(0.050)
Following	1.96*** (0.181)	0.46 (0.362)	1.96*** (0.181)	0.457 (0.363)	1.96*** (0.181)	0.457 (0.363)	2.17*** (0.242)	0.457 (0.363)
*SelfDis * Change*			0.607+ (0.321)	.729* (0.333)				
*Experience * Change*					-0.0132 (0.058)	-1.76 (1.76)		
*Following * Change*							-.436* (0.174)	
*Follower * Change*								-.672*** (0.048)

Standard errors in parentheses, + p<0.1; * p<0.05; ** p<0.01; *** p<0.001

For the number of likes users give to others' sharing, the interaction effect of self-disclosure with interface change is marginally significant (β =0.607, *p-value* = 0.059). H3a is partially supported. The positive regression coefficient indicates that, the increase in the number of "like" users give to others is stronger for users who are more likely to disclose their personal information, comparing to those who are less likely to do so. The interaction revealed in model 3a is graphed in Figure 5.

Figure 5. Moderation Effect of Self-disclosure on Likes
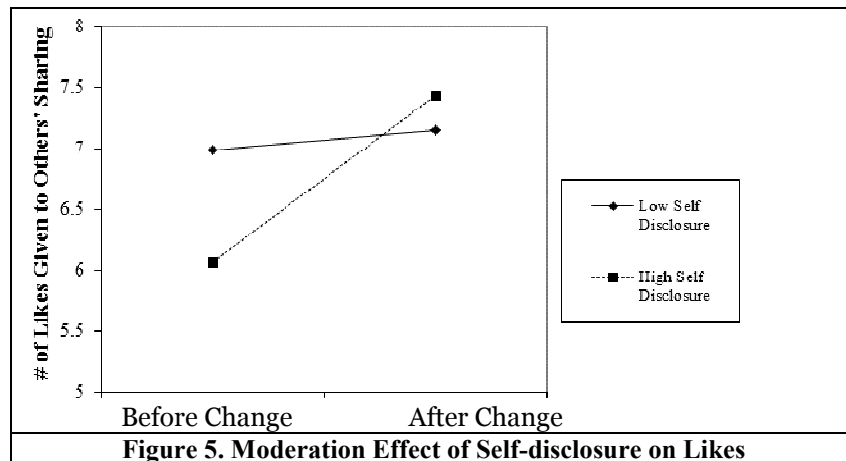
For the number of original treasure sharing users create, the interaction effect of self-disclosure with interface change is significant (β =0.729, *p-value* = 0.029). H3b is supported. The positive regression coefficient indicates that, the decrease in the number of treasures shared is stronger for those who are less likely to disclose their personal information, comparing to those who are more likely to disclose their personal information. The interaction revealed in model 3b is graphed in Figure 6.

Figure 6. Moderation Effect of Self-disclosure on Treasures
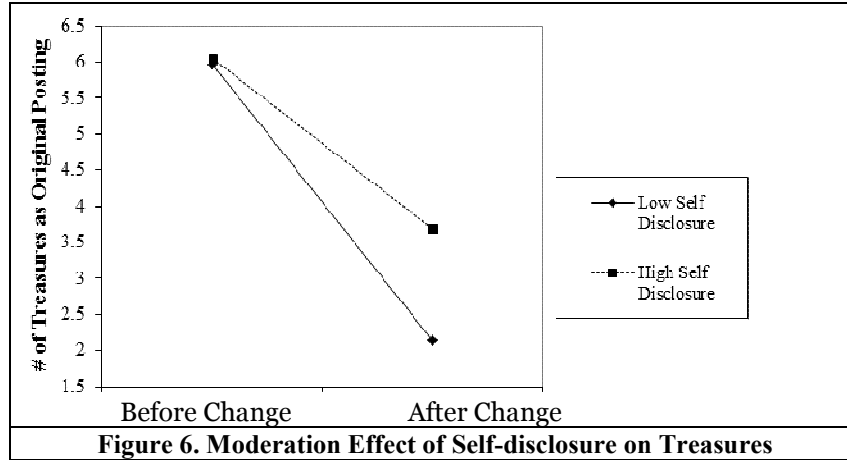
To test H4a and H4b, we examine the interaction effect of experience with change.

$$(4a) \quad LikeOthers_{it} = \beta_0 + \beta_1 AfterChange_t + \beta_2 SelfDisclosure_i + \beta_3 Experience_{it} \\ + \beta_4 Experience_{it} \cdot AfterChange_t + \beta_5 Follower_i + \beta_6 Following_i + w_{it}$$

$$(4b) \quad ShareTreasures_{it} = \beta_0 + \beta_1 AfterChange_t + \beta_2 SelfDisclosure_i + \beta_3 Experience_{it} \\ + \beta_4 Experience_{it} \cdot AfterChange_t + \beta_5 Follower_i + \beta_6 Following_i + w_{it}$$
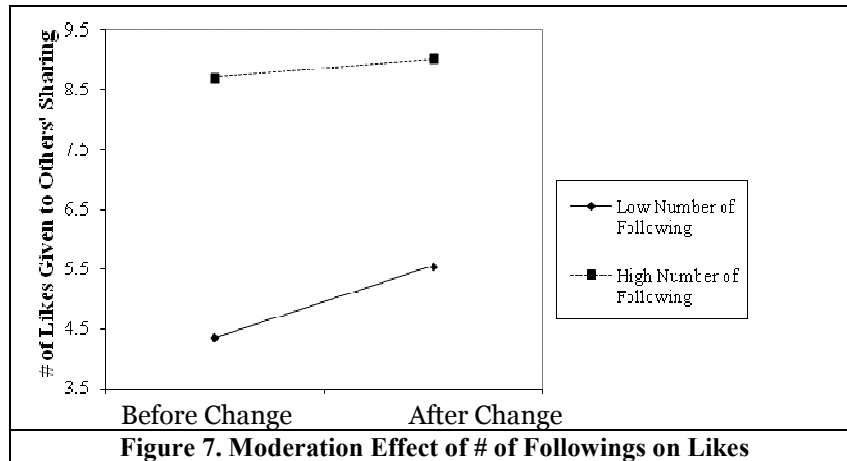
The interaction of prior experience with change is insignificant in both cases (for like, β = - 0.013, *p-value* = 0.820; for treasure, β = - 1.762, *p-value* = 0.317). H4a and H4b do not receive support.

To test H5, we examine the interaction effect of following with change on the number of likes.

$$(5) \quad LikeOthers_{it} = \beta_0 + \beta_1 AfterChange_t + \beta_2 SelfDisclosure_i + \beta_3 Experience_{it} \\ + \beta_4 Follower_i + \beta_5 Following_i + \beta_6 Following_i \cdot AfterChange_t + w_{it}$$

The negative interaction coefficient (β = - 0.436, *p-value* = 0.012) indicates that, the increase in the number of likes are stronger for users who have fewer number of followings, comparing to users who have more number of followings. The result does not support H5, and is in the opposite direction to H5. Figure 7 depicts this interaction.

The results suggest that, those who have more number of followings may have already spent a lot attention reading others' sharing before the interface change, and the change cannot induce them to spend more attention. This seems to be an "attention ceiling" effect. Hence, the number of likes they give does not increase much. In contrast, those who have fewer numbers of followings may not spend much attention reading others' sharing before the interface change. The change may attract them to read more of others' sharing, and then they are more likely to find out something they appreciate. As a result, the number of likes they give increases significantly.

Figure 7. Moderation Effect of # of Followings on Likes

To test H6, we examine the interaction effect of follower with change on the number of treasures as original sharing.

$$(6) \quad \begin{aligned} ShareTreasures_{it} &= \beta_0 + \beta_1 AfterChange_t + \beta_2 SelfDisclosure_i + \beta_3 Experience_{it} \\ &+ \beta_4 Follower_i + \beta_5 Follower_i \cdot AfterChange_t + \beta_6 Following_i + w_{it} \end{aligned}$$

The results support H6. The negative interaction coefficient (β = - 0.672, *p-value* = 0.000) indicates that, the drop in the number of treasures shared is stronger for users who have more number of followers, comparing to users who have fewer number of followers. Those who have more number of followers may perceive that the attention paid to their sharing is diluted by the interface change. Their relative advantage over those who have fewer followers is shrinking; hence they reduce their sharing more significantly. The interaction is graphed in Figure 8.

Figure 8. Moderation Effect of # of Followers on Treasures
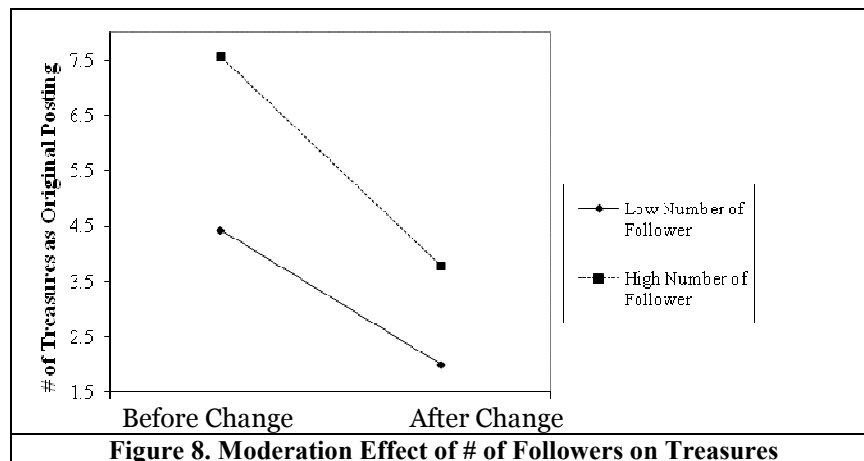
Discussion and Implications

General Discussion

A considerable number of HCI studies examined the effect of animations and website layouts on users' attention, recall, and intention to purchase in e-commerce settings (e.g., Hong et al. 2004, Zhang 2006). Following this HCI research stream, our study examines effects of Pinterest-style infinite scroll layouts on user contribution. Despite the widely use of Pinterest-style infinite scroll

layouts by content sharing websites, there lacks a systematic understanding of the layouts design's influence on user contributions. Our study can be considered an initial endeavor.

Our results indicate that distinguishing between the two types of user contribution, i.e., appreciating others' sharing and creating original sharing, is crucial. The interface change has opposite effects on the two types of user contribution: a positive effect on users' appreciation of others' sharing, i.e., giving more "like", but a negative effect on users' original sharing, i.e., sharing fewer "treasure".

We also consider the influence of user character related factors. For users who are more willing to do self-disclosure, the increase in giving "like" is stronger, and the decrease in sharing "treasure" is weaker, comparing to users who are less willing to do self-disclosure. Prior experience does not interact with the interface change to influence user contributions. Prior experience only has negative direct effects on giving "like"; suggesting users give fewer "like" as they have more experience with the site. In addition, users who have more followers decrease their sharing significantly more than those who have fewer followers. They probably perceive the interface change dilute users' attention to their sharing and mitigate the relative advantage they have toward those with fewer followers.

An unexpected finding is that the increase in giving "like" is stronger for users who have fewer followings. They seem to read significantly more sharing from others after the change. Users who have more followings may experience a ceiling effect for attention spent on reading. They already read a lot of others' sharing and give out many "like", and the interface change does not increase their attention to others' sharing as significant as for those who have fewer followings.

Theoretical Implications

Our findings have several theoretical implications. First, to the best of our knowledge, we are the first to study the effects of the Pinterest-style infinite scroll layouts on user contributions. As the Pinterest-style infinite scroll layout design becomes widely used, it is worthwhile to conduct academic studies to examine the effect of this layout design on user attention allocation and user contributions.

Second, we distinguish between the two types of user contribution, appreciating others' sharing and creating original sharing. Most prior studies in online community contribution mainly discuss knowledge contribution (Wasko and Faraj 2005, Ma and Agarwal 2007), i.e., a specific type of original sharing, but did not discuss appreciating others' sharing. Scholars did recognize that appreciating others' sharing is an important type of user contribution (Butler et al. 2002, Kraut et al. 2008). In addition, giving "like" can serve as a systematic feedback. Systematic feedbacks may improve the quality of sharing and help retain contributors in the community (Moon and Sproull 2008). Hence, it is important to examine the effects of interface change on the two different types of user contribution. The results clearly demonstrate that the interface change has different effects on the two types of user contribution, increasing the number of giving "like" users give, but decreasing the number of sharing "treasures" users post.

Third, this study investigates changes in user contributions from the attention allocation perspective. Prior studies mainly explain user contribution from social psychological perspective, such as identifying motivational factors. Instead, the attention allocation perspective is related to cognitive aspects. In addition, attention allocation can be voluntary or involuntary (Kahneman 1973), and this suggests users may not even realize that they are induced to pay more attention to certain aspects.

Practical Implications

Increasingly, innovative and eye-catching display layouts (including Pinterest-style infinite scroll layout) are being adopted in various IS applications to compete for people's limited attention. However, adoption of the layout techniques needs to be handled with care to reduce potential undesired effects, such as reducing a certain type of user contribution, or discouraging active content contributors.

Though many websites, including Fortune 500 sites such as Ebay.com, followed Pinterest and changed their layouts design, the effects of the Pinterest-style infinite scroll layouts are not clear. In fact, some sites decided to switch back and display only a certain amount of contents in a page (Corwin 2013). Dan McKinley, principal engineer at Etsy.com says, "My point is not that infinite scroll is stupid. It may be great on your website. But we should have done a better job of understanding the people using our website." (McKinley 2012)

Indeed, our empirical findings indicate that the impact of the Pinterest-style infinite scroll layouts is mixed. Though users read more from others' sharing and give more "like", their original sharing drops. Decrease in users' original sharing can be detrimental to websites which rely on user generated contents.

We suggest social commerce websites designers have in mind that users' attention or cognitive resources are limited. Sites shall not deplete the attention of their users, but better channel user attention to generate specific outcomes. This suggests that layouts design decision shall be made in consideration of business models. To simply attract traffic and increase users' browsing time spent on the site, Pinterest-style infinite scroll layouts might be preferred, as more contents can be displayed and users can easily get engaged in browsing. To encourage users to create original sharing, design layouts may emphasize users' personal contribution and the appreciations they received. To turn users' visit into purchase, the web design shall help users easily identify things important to them. Design layouts which highlight recommended or filtered content may be adopted. Designers need to carefully balance the advantages and disadvantages before adopting Pinterest-style infinite scroll layouts.

We also suggest the social commerce sites think about more effective procedures to encourage users who tend to create original sharing. Creating original sharing is valuable to the sites, and creating such posting requires considerable efforts, especially in comparison to simply viewing or appreciating others' work. It is not surprising that users spend fewer efforts in creating original sharing when they feel that the attention their sharing may receive is being diluted. Contributors need to be supported and rewarded to continue sharing.

Limitations and Future Research

In the current study, we use field data to examine the effects of Pinterest-style infinite scroll layouts on different types of user contributions: appreciating others' sharing and creating original sharing, through the attention allocation perspective. Specifically, we use the number of "like" given to others and the number of "treasure" shared to indicate the two types of contribution. Each methodology has its pros and cons, so does empirical analysis using field data. Lab experiment may be conducted to measure the layouts' effects on users' recall, fatigue level, and intention to purchase. Researchers may try to collect data about the time users spent on browsing and creating original sharing to quantify attention and efforts. It might also be interesting to examine users' actual purchasing in an e-commerce setting. Eye tracking technique can be used to measure the attention users paid to a specific post, and better capture the way users browse the "infinite" amount of contents. As the infinite scroll design is becoming more and more popular with the proliferation of touch screen smart phones, HCI researchers may further examine the influence on mobile phone users and social commerce in mobile settings.

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