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Influence of Content Layout and Motivation on Users' Herd Behavior in Social Discovery

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ABSTRACT

Social product discovery is an emerging paradigm that enables users to seek information and inspiration from peer-contributed contents. Researchers have observed herd behaviors in social discovery, i.e., basing beliefs and decisions on what similarly situated others have done. In this paper, we explore the effects of content layout and motivation on users' herd behaviors in social discovery. We conduct an eye-tracking study with 120 participants to compare goal- and action-oriented users' behaviors on a grid versus waterfall style social discovery site. The results show that users have a higher tendency to herd on a grid-style website, more so for goal-oriented users.

Author Keywords

Social discovery; herd; layout; grid; waterfall; motivation.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Social discovery is a rising paradigm that empowers exploration of desirable digital contents in user-generated online catalogues [11]. Social product discovery services such as Pinterest (pinterest.com) and Fancy (fancy.com) aim to “connect everyone through the ‘things’ that people find interesting” [7]. Thriving business in this area has attracted academia and industry to investigate factors that may affect how users behave during social discovery [22].

Social product discovery allows a user to seek information, recommendation, and inspiration from a peer-shared, peer-reviewed product inventory. Prior work has found that the number of “likes” is the strongest predictor of users' re-pin actions in Pinterest [7]. This indicates the existence of herd phenomenon in social discovery, i.e., basing beliefs and decisions on others' choices and actions [15, 18, 2, 3]. The question then arises as to whether and how interface design

Figure 1. Grid (left) and waterfall (right) content layout on social discovery sites.

of social discovery sites can influence users' tendency to herd, i.e., to what extent users are inclined to rely on informational social cues in their judgment process, whether or not they reach a final conclusion.

Although many social product discovery sites employ a tile-based interface to display user-contributed contents, the spatial arrangement of the tiles can vary. Some sites, such as fancy.com, wanelo.com, and shopcade.com, place contents in structured grids, i.e., fixed-size rectangle cells aligned both vertically and horizontally (Figure 1 left). Other sites, such as pinterest.com, mogujie.com, and meilishuo.com, have adopted a trendy waterfall layout, which consists of rectangle blocks that are only aligned in columns (Figure 1 right). Online retail research has shown that grid layout is favored for its ability to facilitate planned, goal-oriented users, whereas irregular item placement can engage action-oriented users in longer exploration [19, 9]. However, whether content layout can affect the herding tendency of users with different motives is still under-investigated.

In this paper, we explore the interplay between content layout and user motivation on potential herd behaviors in social discovery. We exploit eye tracking to capture goal- and action-oriented users' herding tendency through their attention allocation on various cues when visiting a grid-versus waterfall-style social discovery site. Different from prior work (e.g., [6, 18]) that merely used questionnaires to detect existence of herd behaviors in decisions, we are able to gain deeper insights into users' mental process from gaze behaviors. We find that goal-oriented users' attention to products with considerably more likings drops significantly when browsing a waterfall-style webpage than a grid-style one, which suggests a reduction in their tendency to herd.

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LITERATURE REVIEW AND HYPOTHESES

We first review herd behavior in online contexts, and then present related work on how environmental and personal factors may affect users' behaviors.

Online Users' Herd Behavior

Herd behavior reflects informational social influences on decision making [15]. Prior research has identified two primary triggers of the tendency to herd: "uncertainty about the decision" and "observation of others' actions" [18]. Herding tendency can be particularly prominent in social discovery because: (1) social discovery sites offer a wide range of contents that reflect contributors' diverse tastes and interests, which adds more uncertainty to users' choices; and (2) social discovery sites make information about predecessors' actions more easily accessible to their users, such as the number of "Like" or "Favorite". Researchers have discovered herding behaviors in social discovery of different contents, such as ebooks [2] and software [20], especially if financial concerns are involved in the final decision [3].

In this paper, we aim to explore how environmental and personal factors impact users' reliance on informational social cues in social discovery. Since action-oriented users may not necessarily make a decision, we employ three measures as indicators of herding tendency in the viewing process: (1) the proportion of the number of popular items clicked to view details over the total number of items clicked based on system logs, (2) the proportion of time spent on viewing popular items over the total time on-site captured by eye tracking, and (3) the average amount of time spent on viewing a popular item. Based on the review of literature, we proposed a set of hypotheses.

Content Layout and Processing Fluency

Online retailing studies have examined the influence of content layout on users' purchase intent [19, 12, 4]. However, little work has looked into how interface design may affect users' selective attention to assorted information cues, which consequently causes or inhibits herd behaviors.

Inspired by environmental psychology, we conceptualize different content layouts by their physical characteristics of an environment, in particular visual access [13]. For example, tiles in a grid layout are identical in size, making the same type of information across different tiles in a row aligned horizontally. This improves the efficiency of visual scanning. On the contrary, the waterfall design is more visually complex and thus yields higher perceptual load.

Overall, the waterfall layout is more perceptually harder-to-process than the grid layout. The processing fluency of the informational social cue – the number of likes – is more severely impaired in a waterfall design than the more salient product images. Since people tend to weight fluent information more heavily in judgment making [1, 15]; hence, we hypothesize that: *H1. Users have a higher tendency to herd on a grid-style social discovery site than*

Figure 2. Research model and hypotheses (H1~H3).

on a waterfall-style site, i.e., (H1a) higher ratio of popular contents clicked, (H1b) higher ratio of time on popular contents, and (H1c) longer popular product viewing time.

Motivation and Cue Selection

Research on persuasion indicates that motivation also affects people's cue selection in information processing [14]. Goal-oriented users visit social discovery sites with plans in mind and thus primarily seek cues that can help compare and eliminate candidates [14], and thus they are more likely to use quantitative informational social cues that are intuitive indicators of product popularity such as the number of "Like". In contrast, action-oriented users do not have a specific target; instead, they explore matches to the desired end state based on more descriptive information [8]. These users tend to rely more on their own subjective responses to affective cues such as attractiveness of product images rather than other people's opinions [14]. Hence, we hypothesize that: *H2. Goal-oriented users have a higher tendency to herd than action-oriented users, i.e., (H2a) higher ratio of popular products clicked, (H2b) higher ratio of time on popular products, and (H2c) longer popular product viewing time.*

Interaction between Content Layout and Motivation

As discussed earlier, action-oriented users are more inclined to explore [19], and a less structured, perceptually disfluent interface design may further encourage them to look into affective, descriptive cues [8]. On the contrary, an orderly arrangement provides goal-oriented users easier visual access to diagnostic social cues which can facilitate quick judgment [19, 14]. Therefore, we hypothesize that: *H3. Interface layout and motivation have an interaction on users' tendency to herd, i.e., waterfall layout induces a more significant decrease in (H3a) the ratio of popular products clicked, (H3b) the ratio of time on popular products, and (H3c) length of time viewing each popular product for goal-oriented than action-oriented users compared to grid layout.*

RESEARCH METHOD

To test the proposed hypotheses, we conducted a controlled laboratory experiment with a 2×2 between-factorial design (Figure 2), i.e., two types of interface layout (grid versus waterfall) × two types of motivations (goal- versus action-oriented). We recruited 30 participants for each condition (a total of 120 people) to ensure sufficient statistical power of 0.8 for medium effect size ($f=.25$) [5].

		df	F	Sig.	η^2
Layout (L)	% Click on pop. item (1a)	1	3.98	0.04	0.04
	% Time on pop. item (1b)	1	5.45	0.02	0.05
	% Time on social cue	1	20.42	0.00	0.16
	Time on social cue	1	14.06	0.00	0.11
Motive (M)	% Time on pop. item (2b)	1	6.78	0.01	0.06
	Time on pop. item (2c)	1	4.90	0.03	0.04
	Time on social cue	1	4.87	0.03	0.04
	Reliance on social cue	1	8.01	0.01	0.06
L $\times$ M	% Click on pop. item (3a)	1	4.27	0.04	0.04
	% Time on pop. item (3b)	1	4.38	0.04	0.04
	Time on pop. item (3c)	1	24.06	0.00	0.18
	Time on social cue	1	11.90	0.00	0.10

Table 1. MANOVA results on the ratio of popular products clicked, ratio of time on popular products, ratio of time on social cues, average time on popular products and social cues, and perceived reliance on social cues.

Experimental Website Design

We developed two experimental websites for the two layout designs respectively (Figure 1). Regardless of the style, each content tile contained the same amount of information, including a product image, a short product description, the number of “Likes”, and snippets of two user reviews. In the waterfall layout, we randomly adjusted the height of product images within a threshold adopted from Pinterest. Viewers can scroll up and down in the product catalogs, and click on a product tile to open a separate product page with detailed information. Both experimental websites applied the same design to the product pages.

We presented the same set of 147 products coming from the gift category of Pinterest on both sites. To alleviate the potential gender bias, we included equal samples of gender-specific and gender-neutral products. Among all the products displayed on the interfaces, we picked 10% as popular products with over 100 likings, which cover a wide range of merchandise types, e.g., clothes, shoes, digital products, accessories, books, etc. The number of likes for the rest of products followed a normal distribution (Max. = 64), based on our investigation of the popularity ratings on Pinterest and several rounds of pilot studies. Pilot participants suggested that it felt unnatural when the liking difference between popular and ordinary products was too big and hard-to-distinguish when it was too small.

Participants, Procedure, and Data Collection

We recruited 120 participants with diverse academic backgrounds from a public university. Among these participants, 65.8% were female, 93% were between 19 to 23 years old ($M=21.30$, $SD=2.76$). All the participants had over seven years of Internet experience, and 92% had online shopping experiences.

We randomly assigned the participants to one of the four experiment conditions, i.e., goal-oriented versus action-oriented $\times$ grid versus waterfall layout. The order of the products and the location of the popular items were randomized for each participant. We gave different instructions to manipulate the shopping orientation, similar

Figure 3. Comparison of the ratio of clicks (left) and time (right) on a popular product between goal- and action-oriented users given grid versus waterfall design.

to [6]. More specifically, we asked goal-oriented users to purchase a birthday gift for their friend and write down the selected product in the post-study questionnaire. Different from the conventional visual search task of locating a predetermined target among distractors e.g., [8, 16], we only provided a scenario and there was no right or wrong regarding participants’ final decision [21]. On the contrary, we told action-oriented users to visit the social commerce website for personal enjoyment.

After reading the instruction, participants are free to browse the given experimental website on a Dell Precision T1700 desktop computer (Win 7 OS, 19-inch screen size). When participants feel that they have sufficiently fulfilled the task, they can stop viewing. After rating perceived herding tendency and perceived reliance on social cues on a 7-point Likert Scale, the participants receive a compensation of \$ 6.

A backend script logs every user interaction with the experimental websites. Furthermore, participants’ gaze movement was recorded by a Tobii Eyetracker TX60. Hence, we can identify products attended by viewers and specify the particular regions within each tile that have been scanned, and compute the duration of each fixated attention.

RESULTS AND ANALYSIS

In general, there is no significant difference in gender, age and other demographic distributions across the four experimental conditions. We used ratios in our analysis to eliminate individual differences.

Hypotheses Testing on Tendency to Herd

We conducted MANOVA analysis on the three measures of herding tendency with Bonferroni correction, i.e., the ratio of popular products clicked, the ratio of time on popular products, and average time on popular product (Table 1).

Waterfall Layout Suppresses Herding Tendency

There is no significant difference between grid and waterfall layout in terms of the average time that users spent on a popular product ($H1c$ rejected). However, MANOVA results indicate significant main effects of content layout (Table 1) on the percentage of popular items among all the products clicked (Figure 3 left, $M = 18\%$ for grid and 12% for waterfall, $H1a$ accepted) and the ratio of time spent on popular products (Figure 3 right, $M = 12\%$ for grid and 10% for waterfall design, $H1b$ accepted). We conducted a Chi-square Goodness-of-Fit test comparing the

Figure 4. Comparison of the average time (left) on a popular product and on the social discovery site (right) between goal- and action-oriented users given grid versus waterfall design.

occurrence of popular products among all the ones clicked with the hypothesized 10% under equal chance. Significant deviation from the hypothesized value is found in grid condition ($\chi^2(1)=7.11$, $p<0.05$) but not in the waterfall condition, suggesting that waterfall design in general effectively encourages users to allocate their attention more evenly across all products.

We further analyzed the impact of layout on cue selection. Overall, participants spent 9.88 seconds in total (8.1% of total time on site) on informational social cues on the grid-style social discovery site; in comparison, they spent significantly less time 4.52 seconds in total (3.8%) on social cues on a waterfall design (Table 1, Figure 4 left). This confirms that processing disfluency caused by a visual design can reduce social cue weighting in judgment.

Goal-oriented Users are more Inclined to Herd

Although motivation does not seem to affect the proportion of popular items among all the products clicked (H2a rejected), Chi-square Goodness-of-Fit Test suggests a significant deviation between the actual ratio of popular products clicked and the hypothesized 10% in goal-oriented condition ($M=17\%$; $\chi^2(1)=5.44$, $p<0.05$) but not for action-oriented users ($M=13\%$). In addition, MANOVA results show that motivation has a significant effect (Table 1) on the percentage of time looking at popular items (Figure 3 right, H2b accepted) and the amount of time people spent on each popular product (Figure 4 left, H2c accepted). More specifically, goal-oriented users on average spent 12% ($M=16$ seconds) of their time (10%, $M=13$ seconds for action-oriented users) on products with over 100 Likes.

Both subjective ratings and eye-tracking data suggest that goal-oriented users pay more attention to the social cues than action-oriented ones (Table 1, Figure 5). The formal group also rate their herding inclination marginally higher than the latter group (MANOVA $p = 0.07$), indicating that motivation can influence users' reliance on social cues, which ultimately affect their likelihood to herd.

Significant Interaction Effect between Layout and Motivation

We find significant interaction effects in all three measures (Table 1, H3 accepted). In particular, the decrease of the ratio of time on popular products from grid to waterfall design is more dramatic for goal-oriented than for action-oriented users (Figure 3 right). It is because unplanned

Figure 5. Comparison of the time (left) and perceived reliance (right) on informational social cues between goal- and action-oriented users given grid versus waterfall design.

users generally rely less on the social cues (Figure 5 right), and thus their judgment process is rarely affected when such information becomes hard to locate in the waterfall design (Figure 5 left).

We notice that in the waterfall condition, the average time that an action-oriented user spent on looking at a popular product increases compared to the grid condition, while that of a goal-oriented user drops considerably. This may be introduced by the significant interaction effect on the total time on site (Figure 4 right, MANOVA: $F(1,55)=21.17$, $p<0.05$, $\eta^2=0.16$). Consistent with existing online retailing literature e.g., [19], irregular layout can retain shoppers for a longer period, and thus the absolute time on checking each item, whether popular or not, is likely to be increased. The relative popular product viewing time however remains rather constant as H1a is rejected (Figure 3 right). Overall, grid layout can better facilitate systematic search, whereas waterfall design is good for unplanned exploration.

CONCLUSION AND FUTURE WORK

In this paper, we present an eye-tracking study with 120 participants to explore the influence of interface design (grid versus waterfall) and motivation (goal-oriented versus action-oriented) on users' potential herd behavior in social product discovery. The results show that users have a higher tendency to herd on a grid-style website, and the effect is stronger for goal-oriented users.

Our study had some limitations. We did not collect the participants' personal interests among the product categories beforehand. It would be nice to compare such information to their viewing behaviors to rule out the potential confounding factor of interest. Also, paying attention to social cues does not necessarily mean that users would ultimately base their belief on them. In the future, we will further analyze the scanpath and combine eye-tracking with other measures to detect actual herd behaviors. We also plan to investigate how other product, user, interface, and contextual factors may influence users' perceptions and actions in social discovery.

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