Patterns of Herding and their Occurrence in an Online Setting

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Available online 26 September 2013

Abstract

When groups of consumers share information or express their opinions about products and services, their attitudes or behavior sometime align without centralized coordination, a phenomenon known as herding. Building on pattern-based explanations of herding from the cognitive science literature, we propose a framework to elucidate herding behavior based on three dimensions: the *speed of contagion*, i.e., the extent to which the behavior spreads in a given time, the *number of individuals*, i.e., the proportion of the whole population expressing the behavior, and the *uniformity of direction*, i.e., the extent to which the mass behavior is increasingly uniform with one variant becoming dominant. Based on these dimensions, we differentiate eight patterns of herding behavior from slowly diffusing, small and disparate groups through to rapidly spreading, massive herds expressing a convergent behavior. We explore these herding patterns in an online setting, measuring their prevalence using over four thousand streams of data from the online micro-blogging application, Twitter. We find that all eight patterns occur in the empirical data set although some patterns are rare, particularly those where a convergent behavior rapidly spreads through the population. Importantly, those occurrences that develop into the pattern we call "stampeding," i.e., the rapid spread of a dominant opinion expressed by many people, generally follow a consistent development path. The proposed framework can help managers to identify such noteworthy herds in real time, and represents a first step in anticipating this form of group behavior.
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Keywords: Consumer behavior; Social contagion; Diffusion; Social influence; Social media; Twitter

Introduction

This paper explores dynamic patterns of mass consumer behavior, leading to the phenomenon known as "herding." In this paper, we will focus in particular on herding behavior via online media.

A better understanding of online herding is needed if we are to understand the link between widespread online opinion formation and marketing outcomes, such as sales or reactions to promotion campaigns. Obviously, not all herding in the online setting is positive for firms, with a classic example being the bank run (Gu 2011). In 2008, there was a run on the Icelandic bank, Landsbanki, which had offered high interest online savings accounts in the UK and The Netherlands under the brand, IceSave. Rumors quickly circulated online that the bank had run into financial difficulty and the speed with which online withdrawals were made prompted the Icelandic government to step in to save the nation's banking system.

This paper has two objectives: first, to design a framework to distinguish between different patterns of herding behavior; second, to assess which of these patterns can be witnessed in practice using a large database of online behavior, and to investigate the dynamics of the development of large herds. For example, does a particular sequence of patterns indicate an impending rush of consumer sentiment or behavior? In short, we propose a framework to distinguish between different patterns of mass behavior and identify these patterns using online data.

There is as yet no accepted way of scientifically assessing whether a change in the pattern of online mass behavior is important. One change may prove to be insignificant whereas another may lead to a sudden explosion of consumer reactions.

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Hype cycles can be assessed by tracking the number of news items regarding a specific topic, for example, but the resulting pattern with peaks in news items over time is usually erratic and hard to diagnose (Jun 2012). Despite the availability of real-time, online data, there is a lack of well-grounded instruments for modeling changes in mass consumer attitude and behavior.

Besides this scientific motivation, this study is also clearly relevant to managers. Current marketing practice is to track certain characteristics of mass consumer behavior, without combining individual indicators in a coherent framework as a basis for efficient intervention. Firms are able to measure the number of page views of a new campaign, the prevailing sentiment in an online discussion, and they can see when a relevant topic is trending on Twitter. However, it is important to know which metrics to follow simultaneously, and to be able to identify different patterns of mass behavior so that irrelevant noise can be confidently ignored and time and energy can be devoted to situations which signify noteworthy developments. Consumer complaints can occasionally lead to considerable reputational damage, although firms may overreact if they devote too much attention to every minor complaint. The compliments of satisfied customers can influence others and lead to a boost in sales for the company's products, but when and how can a firm make use of such positive comments? A major task for sales and communication managers is to monitor, predict and influence this kind of mass consumer reaction and this paper goes some way to offering an alternative approach based on patterns of herding behavior. Once the patterns are understood and can be followed, further research can investigate the consequences of different marketing actions on how the herd changes from one pattern into another. Interesting marketing information is provided not just by the current herding pattern, but also by transitions between patterns. Marketers are also increasingly adapting promotion campaigns day-by-day, depending on consumers' reactions. It is not uncommon for a brand campaign to launch two slightly different versions of a campaign to test which version works best. By adding data about changes in herding patterns to this approach, marketers can not only adapt the campaign based on individual reactions or click-through rates, but also on effects on herding transitions. Campaigns can then be seen as being successful if they bring the herd into a more desirable pattern. Many companies install web teams to track online communication around their products and services and to intervene when possible. Our approach of tracking pattern transitions adds to this strategy by allowing managers to state and track the goal of a campaign more precisely. We return to this point in the discussion, to examine how our framework of herding patterns can be applied by marketing managers.

The rest of this paper is organized as follows. First we relate this study to relevant literature and describe the basis on which we build. We then propose a conceptual framework of three dimensions along which changes in mass consumer behavior are important, leading to eight different herding patterns. Following that, we describe a method for assessing the prevalence and dynamics of these patterns in the online setting, using empirical data from Twitter. We conclude with a discussion of theoretical and managerial implications and we address limitations of this study and propose avenues for further research.

Related Literature

Herding from a Marketing Perspective

There is a lack of clarity in the literature about what the term "herding" means from a marketing perspective. In an early paper on this subject, Banerjee (1992) shows herding behavior in a population of hypothetical agents who make choices between assets based on their own information and also on the observed behavior of other agents. Following this, Bikhchandani, Hirshleifer, and Welch (1998) assess convergent behavior that does not follow principles of traditional economic models and postulate that informational cascades, sanctions against defectors, network externalities, and preference effects combine to produce herding. These studies do not formally define herding but see it as a phenomenon through which people tend to converge on similar behavior, resulting in a situation with "everyone doing what everyone else is doing" (Banerjee 1992, p 798). However, this may be an oversimplified definition as it suggests that if a proportion of a population expresses the same behavior, it cannot be called a herd. It may be more useful for marketers to define herding as a process whereby a herd can develop in size and possibly in other ways too. Despite the subsequent attention to herding in the marketing literature, a formal definition has not emerged.

Looking to the cognitive science literature, we find a definition which suits our purpose of describing the patterns and dynamics of herding behavior. Following Rafaat, Chater, and Frith (2009, p 420) we see herding as "a form of convergent social behavior that can be broadly defined as the alignment of the thoughts or behaviors of individuals in a group (herd) through local interaction and without centralized coordination." These authors present an overview of approaches that addresses herding in humans and they distinguish between two main types of research. Pattern-based explanations of herding behavior assume that individuals can be modeled (often mathematically) as simple decision-making units and that the patterns of relationships between people are dominant in forming group behavior (Cucker and Smale 2007; Dyer et al. 2008). In contrast, transmission-based explanations assume that the complex intra-personal cognitive mechanisms play a major role in the mental processes that govern how people receive and process information and then transfer it to others (Frith and Frith 2006). In this paper we build on the first of these, pattern-based explanations of herding behavior.

Comparing Herding to Diffusion, Influence and Contagion

During the last few decades, marketing scholars have investigated mass consumer behavior using a number of related concepts. Besides herding, various studies investigate processes of diffusion, influence and contagion and it may therefore aid the reader to consider the similarities and differences between these terms so as to understand the potential that herding has for