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Application of Cascade Theory to Online Systems: A Study of Email and Google Cascades

April Mara Barton*

I. INTRODUCTION

It has happened to all of us. You are driving in your car, taking a road you have driven a thousand times before, confident in your ability to reach your destination. Suddenly you see construction signs and you are forced to turn off the road and take a detour. You vaguely recall driving on this detour road several years ago but you are not exactly sure where the road takes you. You see an intersection ahead and your first instinct is to turn right at the intersection. You see two cars ahead of you who were also forced to take the detour. You watch the first car make a left; you watch the second car also take a left. You reach the intersection, you stop, and what do you do? Which way do you turn?

The majority of us turn left, even though our initial hunch was to turn right. At times, following the lead of the cars in front of us proves to be a wise decision and we are thankful that those in front of us had a better sense of direction than we did. Other times, however, we all foolishly end up at a dead end and realize that because the driver of the first car turned left, all of us simply watched, assumed the driver knew something we did not, and followed. We understand in hindsight that the driver of the first car was simply guessing at which way to turn and did not possess a special knowledge of the road or a particularly keen sense of direction.

Why is it that most of us follow the cars in front of us, even if following requires us to ignore our own intuition? It seems that

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the human brain is hardwired with the proclivity to follow the lead of others.

Why did the U.S. housing market witness a phenomenal bubble, peaking in 2005 and waning to the point of near collapse in 2008?¹ Why does the movie “Blair Witch Project,” using nothing more than a rudimentary website for advertising, enjoy wild success, while hundreds of other equally original independent films fade away into obscurity?² Why does Harry Potter become a household name at the same time that thousands of other books linger on bookstore shelves? Why do teenagers *en masse* suddenly decide it is cool to wear hooded sweatshirts?³ Why do many college students have iPods, tattoos, a presence on Facebook, and know what it means to be “rickrolled?”⁴ Why, in the late 1990s, did a nation start obsessively drinking bottled water? Why do markets boom and crash? Why do fads and social norms start and end? One answer is found in a branch of social science literature called “cascade theory.”

Cascade theory explains the observable human behavior of imitation. Humans tend to follow the actions of others they have observed, even if it means disregarding their own intuition.

Cascades are of great import to lawyers and legal scholars alike. Law is about shaping human behavior, or in other words,

1. Edmund L. Andrews, *Fed Debates Pricking the U.S. Housing “Bubble,”* N.Y. TIMES, May 31, 2005, at C-1, available at <http://www.nytimes.com/2005/05/31/business/31housing.html> (discussing the possibility of a housing bubble in 2005).

2. Amy Wallace & Richard Natale, *Internet Powers Success of “Blair Witch Project,”* L.A. TIMES, Aug. 5, 1999, at A-1, available at <http://articles.latimes.com/1999/aug/05/news/mn-62830>.

3. *Targeting the Universal American Kid*, BUS. WK., June 7, 2004, available at http://www.businessweek.com/magazine/content/04_23/b3886100.htm.

4. Rick Astley, who fell into ‘80s pop rock oblivion after enjoying “one hit wonder” success with his song “Never Gonna Give You Up” suddenly skyrocketed in popularity, peaking during the spring and summer months of 2008, when, as a gag, his video was passed around repeatedly to millions of Internet users on YouTube. The premise of the joke was to send a link purporting to be relevant to the subject of the e-mail, but instead, the link was to the YouTube Astley video. See Emily Friedman, *“Rick Rolling” Ruins Mets Vote*, ABC NEWS, Apr. 11, 2008, available at <http://abcnews.go.com/Sports/Story?id=4628658&page=1> (describing how millions of fans flooded the Mets website to vote for a Mets theme song during the Rickroll gag and overwhelmingly chose “Never Gonna Give You Up”).

forcing people to act in a way that may be inconsistent with their usual tendencies. Cascades also shape human behavior, but in a suggestive and persuasive manner, rather than by force. Those who understand how cascades influence society can manipulate opinions and human behavior without the force of law. And in many cases, cascades are an important corollary to implementing effective law and policy.

This article discusses cascade theory in the context of online systems, particularly e-mail and Google, considers the unique attributes that these online cascades exhibit, and explains why online cascades are significant and remarkable. Accordingly, this article proceeds as follows. Part I discusses cascade theory generally and introduces the concepts of informational and reputational cascades. Part II also discusses how informational and reputational cascades lead to social norm formation, why social norms are of great import to legal scholars and lawmakers, and how certain members of society have learned to leverage cascades to their advantage in order to initiate norms that serve their interests.

Part III then moves online and examines “e-mail cascades” and “Google cascades” and explains the unique characteristics of each. While e-mail cascades closely parallel their offline cascade counterparts, they also demonstrate an amplified herd effect and an amplified proliferation of the cascade itself due to the technology involved. Google cascades demonstrate each of these qualities, while also possessing several unparalleled qualities of their own. Few, if any, cascades can compete with the tidal wave effect of Google cascades, due to the compounding effect of Google’s search algorithm, which itself actually perpetuates and embeds cascades into the ranking process and has no offline equivalent.

Online cascades deserve further scrutiny as much of life moves online. Within the span of merely one generation the distinction has nearly vanished between that which occurs offline and that which occurs online, as the two originally separate spheres of existence converge into the same space.⁵

5. See April Mara Major, *Norm Origin and Development in Cyberspace: Models of Cybernorn Evolution*, 78 WASH. U. L.Q. 59, 86–92 (2000) (describing a phenomenon termed the convergence effect, where offline society fuses with online society).

II. CASCADE THEORY

Cascade theory explains the observable human behavior of imitation: following the actions of someone else simply because one has observed that behavior, rather than following one's own intuition. The following sections present the prevailing concepts in the area of cascade theory and illustrate how this theory has been applied to social norm origin.

A. INFORMATIONAL CASCADES

Starting in the 1990s, social scientists began writing about an observed social phenomenon of imitation, aptly referred to as "informational cascades."⁶ Economists, political scientists, and legal scholars have since incorporated the term into their own scholarship, and thus the literature continues to grow in this burgeoning interdisciplinary field.⁷ The seminal article on the issue states that informational cascades occur "when it is optimal for an individual, having observed the actions of those ahead of him, to follow the behavior of the preceding individual without regard to his own information."⁸ In other words, an informational cascade is a situation in which every subsequent actor, based on the observations of others before him, makes the same choice as

6. See Sushil Bikhchandani, David Hirshleifer & Ivo Welch, *A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades*, 100 J. POL. ECON. 992 (1992)[hereinafter Bikhchandani et al.]. See generally David Hirshleifer, *The Blind Leading the Blind: Social Influence, Fads, and Informational Cascades*, in THE NEW ECONOMICS OF HUMAN BEHAVIOR 188 (Mariano Tommasi & Kathryn Ierulli eds., 1995); Sushil Bikhchandani, David Hirshleifer & Ivo Welch, *Information Cascades and Rational Herding: An Annotated Bibliography and Resource Reference*, <http://www.info-cascades.info> (last visited Feb. 22, 2008) [hereinafter *Annotated Bibliography*].

7. See Eric A. Posner & Cass R. Sunstein, *The Law of Other States*, 59 STAN. L. REV. 131 (2006); Lisa R. Anderson & Charles A. Holt, *Information Cascades in the Laboratory*, 87 AM. ECON. REV. 847 (1997); Boğaçhan Çelen & Shachar Kariv, *Distinguishing Informational Cascades from Herd Behavior in the Laboratory*, 94 AM. ECON. REV. 484 (2003); Steven Geoffrey Gieseler, *Information Cascades and Mass Media Law*, 3 FIRST AMENDMENT L. REV. 301 (2005); Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 686 (1999).

8. Bikhchandani et al., *supra* note 6, at 994; see also Robert C. Ellickson, *The Evolution of Social Norms: A Perspective from the Legal Academy*, in SOCIAL NORMS 35, 51 (Michael Hechter & Karl-Dieter Opp eds., 2001).

the others, independent of his own intuition.⁹ For example, imagine that you are at a large dining table, a wedding reception perhaps, and you are not sure which plate contains your dinner roll. Is it the plate to your left or to your right? Although you may suspect that the plate to your left is the correct choice, putting your hunger aside for a few minutes in order to observe whether others at your table reach for the plate to their left or to their right is a typical and rationally perceived method of solving this quandary.¹⁰ People often mimic or agree with what they see others do or say because they lack the information or cognitive ability to come to a decision themselves.¹¹ Furthermore, people often lack confidence in their decision-making ability and assume that the

9. The classic example of an information cascade involves a crossroads where B has a choice to go left or right. B has a hunch that the correct path is right, but watches A in front of her turn left. Less than fifty percent and sometimes thirty to forty percent of the time, people will choose the wrong path when they know the correct path. Then, C, after seeing A and B take the left path, is all the more likely to take the left path regardless of his internal disposition. Thus, because the first two people went left, everyone else from then on is likely to go left as well. *Annotated Bibliography, supra* note 6; see also Hirshleifer, *supra* note 6, at 193–96.

10. There are two crucial requirements for an information cascade: the ability for sequential decisions while observing the previous actor's decisions and a limited action space that requires either an adopt or reject decision. *Annotated Bibliography, supra* note 6; see also Hirshleifer, *supra* note 6, at 193. See generally Richard H. McAdams, *The Origin, Development, and Regulation of Norms*, 96 MICH. L. REV. 338, 347 (1997). Proper etiquette is typically cited as a classic example of social norms. Most scholars agree that social norms are obligations, and therefore, etiquette is a norm. Norms are also enforced by some means other than legal sanctions. Bad table manners might be sanctioned by a disapproving stare, a snide remark, or simply a lowered opinion of that person. See Cass R. Sunstein, *Social Norms and Social Roles*, 96 COLUM. L. REV. 903, 914 (1996) (describing norms to be social attitudes of approval and disapproval, “specifying what ought to be done and what ought not to be done”).

11. Duncan J. Watts, *A Simple Model of Global Cascades on Random Networks*, 99 PROC. NAT'L ACAD. SCI. 5766, 5766 (2002).

In social and economic systems, decision makers often pay attention to each other either because they have limited information about the problem itself or limited ability to process even the information that is available . . . Even when we have access to plentiful information, . . . we often lack the ability to make sense of it . . .

Id.

For example, when shopping online, people will choose the most popular and best reviewed product rather than reading and comparing the technical details of the available products.

person they observe knows something they do not or simply benefits from a superior intellect.¹² Such behavior seems to be embedded in our human nature and is at times an effective decision-making shortcut method that can lead to sound results. However, because cascades lead to mass social imitation, they occasionally lead everyone (the “herd”) to the incorrect choice.¹³ Continuing the example above, assume that you suspect your roll is on the plate to your left, but in fact you watch another guest at your table reach for the roll on the plate to her right. Because you were unsure of your initial hunch, you also reach for the plate to your right and thus start the cascade as all others around the table disregard their own intuitions and reach for the plate to their right. The others around the table assume that since both of you reached for the plate to your right, right must be the correct choice. At last, the entire table is eating off what etiquette protocol deems the “wrong” plate, an example of an informational cascade leading to mass imitation of incorrect information.

Furthermore, cascades are “fragile” because little information is available in a cascade and because the herd’s opinion is based

12. See Antonio Bernardo & Ivo Welch, *On the Evolution of Overconfidence and Entrepreneurs*, 10 J. ECON. & MGMT. STRATEGY 301, 305–07 (2001) (explaining that norm individuals have less confidence and put less weight in their own private information than norm entrepreneurs who are more likely not to follow the herd).

13. This behavior is often seen in office meetings. Many people may share an opinion, but unless one person expresses that opinion, individuals of the group may be too nervous or shy to speak up. Thus, an incorrect majority opinion can be established if no one speaks up and presents the favored opinion. This initial speaker is the catalyst for a misinformation cascade. See *Annotated Bibliography*, *supra* note 6. (“One major consequence of *information cascades* is that you may get a million rational individuals walking ‘left’ just because the first two individuals walked ‘left’, even if the true best choice was ‘right.’ Cascades predict that you can get massive social imitation, occasionally leading everyone (the ‘herd’) to the incorrect choice.”); see also Hirshleifer, *supra* note 6, at 193–95 (explaining that a person will choose against their own instincts and take the incorrect path because those that went before choose the wrong path); Bikhchandani et al., *supra* note 6, at 994 (explaining that even a small amount of contrary information is enough to change someone’s decision); Randal C. Picker, *Simple Games in a Complex World: A Generative Approach to the Adoption of Norms*, 64 U. CHI. L. REV. 1225, 1275 (1997) (explaining that as more people take the incorrect path, it then becomes even more likely for the following actors to take the incorrect path); Posner & Sunstein, *supra* note 7, at 163 (some states will follow other states against their better judgment because of the state’s power and prestige).

on imitation, rather than sound information.¹⁴ Assume that in the middle of the cascade described above, that someone at the table speaks up and explains that the correct plate is to the left. Suddenly others at the table may speak up as well and agree, as this is what they originally thought to be the proper bread and butter plate. In the matter of seconds the cascade completely shifts direction because of additional information.¹⁵

B. REPUTATIONAL CASCADES

A reputational cascade is similar to an informational cascade, except that the reason person B follows the actions of person A is simply because person B seeks A's approval or esteem.¹⁶ In other words, A's reputation is such that B assumes that the actions of A are inherently correct, or at least does not want to appear out of sync with A. The cascade takes off as others follow the crowd, so as to appear in conformity.¹⁷

Consider a faculty meeting where a controversial issue is

14. Hirshleifer, *supra* note 6, at 196 (explaining that cascades are fragile because new alternative information has the ability to shift the entire cascade into the opposite direction); *see infra* notes 27-32 and accompanying text; *see also* Bikhchandani et al., *supra* note 6, at 994 (explaining that information cascades are fragile because decision-makers will rely on the previous decisions of others, but only to the extent that no counter-information is presented).

15. Watts, *supra* note 11, at 5766 (explaining that cascades are an example of the robust but fragile nature of many complex systems which "may appear stable for long periods of time and withstand many external shocks (robust), then suddenly and apparently inexplicably exhibit a large cascade (fragile)").

16. *See* Ellickson, *supra* note 8, at 51-52 (describing reputational cascades as distinct from information cascades); *see also* McAdams, *supra* note 10, at 355-56 (discussing an esteem-based theory of norm origin); Kuran & Sunstein, *supra* note 7, at 686 (explaining that a person joins a reputational cascade to earn esteem and not because of the previous actor's expertise); Timur Kuran, *Ethnic Norms and Their Transformation Through Reputational Cascades*, 27 J. LEGAL STUD. 623, 640 (1998) (explaining that ethnification occurs through reputational cascades when members of society want to conform to their individual groups).

17. *See* Ellickson, *supra* note 8, at 51-52 (describing how one knowingly may make the wrong the decision in an effort to conform); *see also* Kuran, *supra* note 16, at 637-40 (explaining that in order to increase their reputation, some members of society will increase their ethnic activities); Kuran & Sunstein, *supra* note 7, at 685-87 (explaining that a person joins a reputational cascade in order to conform and avoid ostracism); McAdams, *supra* note 10, at 356 (explaining that people will often suffer a material loss in an effort to conform with a norm and gain the esteem of others; thus, people are willing to follow an incorrect decision in order to follow the norm).

raised and a vote is going to be taken after initial discussion. One, then several, prestigious members of the faculty voice similar opinions on the matter. Assuming the voting process is transparent, junior faculty members are likely to follow the lead of the senior faculty in order not to fall out of favor.¹⁸ Even if the junior members of the faculty privately do not agree with the senior faculty members, the junior faculty votes likely follow the senior faculty opinion simply to follow the reputational cascade.

Individuals who follow reputational cascades disregard their own internal feelings, just as they do with informational cascades.¹⁹ One follows the cascade even if it is out of line with one's personal thoughts or intuition, simply as an act of social imitation.²⁰ Reputational cascades can lead to mass social imitation as well, and thus can lead to mass erroneous decisions. Informational and reputational cascades can occur in isolation, but many times they transpire in an interdependent fashion.²¹ Often, they occur together and display a symbiotic relationship to one another, both fueling the resulting cascade.²² For example, consider the dinner roll example above. Our informational cascade started when the first person at the table reached for the plate to her right. Because you were unsure of what plate contained your roll, you watched and imitated the first person at the table, thus starting an informational cascade. Now assume the person next to you knows that the correct plate is to her left, but rather than

18. An anonymous voting process would certainly affect the occurrence of a reputational cascade in this instance as an anonymous process would likely engender more honest responses. See Kuran & Sunstein, *supra* note 7, at 739 (1999) (explaining that anonymous political polls will deliver more honest answers because it will allow the voters to express unpopular views). *But cf.* Lior Jacob Strahilevitz, *Charismatic Code, Social Norms, and the Emergence of Cooperation on the File-Swapping Networks*, 89 VA. L. REV. 505, 557-63 (2003) (explaining that people will continue to cooperate in online anonymous settings because they feel as though they need to repay a debt to those that help them and interact with them).

19. See Kuran & Sunstein, *supra* note 7, at 685-87.

20. *Id.*

21. See Kuran & Sunstein, *supra* note 7, at 687.

22. See Kuran & Sunstein, *supra* note 7, at 683 (Sunstein and Kuran call the resulting cascade in this case an "availability cascade"); see also TIMUR KURAN, PRIVATE TRUTHS, PUBLIC LIES: THE SOCIAL CONSEQUENCES OF PREFERENCE FALSIFICATION 166 (1995); Cass R. Sunstein, *Cognition and Cost-Benefit Analysis*, 29 J. LEGAL STUD. 1059, 1072 (2000) (discussing how fear and paranoia fuel availability cascades).

speaking up and appearing out of harmony with your choice, she simply uses the plate to her right as well. Thus, some around the table are following the cascade due to lack of personal information and some simply do not want to appear in conflict with what appears to be the majority view. We see how informational and reputational cascades play off one another and lead to mass social imitation.

We can also adjust the faculty meeting example to demonstrate both an informational and reputational cascade interrelationship. Assume that the first few faculty members to speak start a reputational cascade and some junior faculty members follow their lead to avoid disapproval. However, other faculty members may follow the initial momentum not to gain approval, but because they simply lack the cognitive ability or information to come to an informed decision on their own, thus following the informational cascade. Together, both cascades lead to a unanimous vote on the issue.

We begin to see how informational and reputational cascades interrelate and affect our everyday lives. The next section discusses how cascades lead to social norm formation by offering two examples of recent cascades that have led to widespread social norms. The following section discusses how certain members of our society who are aware of this correlation leverage their knowledge of norm formation to start norms that are to their advantage.

C. SOCIAL NORM FORMATION

Norms are social regularities that impose informal standards and constraints on human behavior in deference to the preferences of others.²³ In the absence of legal rules or physical force, social norms are the sole impetus that causes someone to behave in a manner contrary to her own private desires. Legal

23. See William K. Jones, *A Theory of Social Norms*, 1994 U. ILL. L. REV. 545, 546 (1994) (explaining social norms as those rules and standards that define the limits of acceptable behavior); see also Robert Axelrod, *An Evolutionary Approach to Norms*, 80 AM. POL. SCI. REV. 1095, 1097 (1986) ("A norm exists in a given social setting to the extent that individuals usually act in a certain way and are often punished when seen not to be acting in this way."); Eric A. Posner, *Law, Economics, and Inefficient Norms*, 144 U. PA. L. REV. 1697, 1699 (1996) ("A norm can be understood as a rule that distinguishes desirable and undesirable behavior and gives a third party the authority to punish a person who engages in the undesirable behavior. Thus, a norm constrains attempts by people to satisfy their preferences.").

scholars study social norms because analysis and understanding of social norms is imperative when imposing formal constraints, such as laws, regulatory policies, and precedent.²⁴ Norms hold the key to a wealth of valuable information that lawmakers must consider to ensure that laws accomplish their proper objectives, do not disrupt social balances, and are accepted by the community upon which they are imposed.²⁵

1. Examples of Social Norms Evolving from Cascades

Cascades are undoubtedly responsible for establishing or altering social norms.²⁶ The bottled water phenomenon is a textbook example of a cascade leading to a social norm. It has become common to see people with water bottles in hand. Purses, bags, and car cup holders are even designed to hold this important necessity. This social norm developed in the late 1990s due to a spate of popular press reports that questioned the safety of tap water and heralded the health benefits of bottled spring water.²⁷ Advertising backed the perception that drinking bottled

24. See Robert D. Cooter, *Decentralized Law for a Complex Economy: The Structural Approach to Adjudicating the New Law Merchant*, 144 U. PA. L. REV. 1643, 1652–53 (1996) (explaining that the general principles of the common law and codes derive from community practices while regulations lack a foundation in such community practices because they are imposed from the top down).

25. See *id.* at 1655–56. Advocating a similar approach in regulating economic development:

I propose that modern lawmakers should respond to the new law merchant much like the alleged response of English judges to the old law merchant. Modern lawmakers, however, should take explicit account of insights from modern economics. First, lawmakers should identify actual norms that have arisen in specialized business communities. Second, lawmakers should identify the incentive structure that produced those norms. Third, the efficiency of the incentive structure should be evaluated using analytical tools from economics. Those norms arising from an efficient incentive structure, as ascertained by tests that economists apply to games, should be enforced. I call this procedure the ‘structural approach’ to adjudicating social norms.

Id.

26. Sunstein, *supra* note 10, at 909 (explaining that norm cascades occur with rapid shifts in norms while norm bandwagons occur when small shifts lead to large ones); see also Ellickson, *supra* note 8, at 51–52; Martha Finnemore & Kathryn Sikkink, *International Norm Dynamics and Political Change*, 52 INT’L ORG. 887, 895 (1998) (explaining that there are three stages in norm development: (1) norm emergence, (2) norm cascade, and (3) norm internalization); McAdams, *supra* note 10, at 394.

27. See John H. Cushman Jr., *U.S. Urges Users of New Well Pumps to*

water was healthy and fashionable,²⁸ and the bottled water industry enjoyed years of enormously large profits.²⁹ During a relatively short period, we have witnessed a social phenomenon begin entirely as the result of cascade behavior. Information folded upon information, imitation bred more imitation, further buttressed by reputational corroboration and, before long, bottled water was a dominant choice among many Americans.

Recently, however, information has come to light that the plastic containers may be leaching harmful chemicals into the bottled water that we are drinking.³⁰ Furthermore,

Drink Bottled Water, N.Y. TIMES, Apr. 19, 1994, at A-13, available at <http://query.nytimes.com/gst/fullpage.html?res=9F05E7DB1431F93AA25757C0A962958260&scp=5&sq=bottled+water&st=nyt> (discussing the dangers of lead poisoning in new well pumps and the safe alternative of bottled water); John H. Cushman Jr., *Federal Officials See Hazard For Some People in Tap Water*, N.Y. TIMES, June 15, 1995, at A-20, available at

<http://query.nytimes.com/gst/fullpage.html?res=990CE6DB1638F935A25755C0A963958260&scp=10&sq=bottled+water&st=nyt> (discussing the dangers in tap water especially to those afflicted with AIDS or other immune system diseases); Edward R. Lipinski, *Home Clinic; If in Doubt, Bottled Water or Filters*, N.Y. TIMES, June 23, 1996, available at <http://query.nytimes.com/gst/fullpage.html?res=9905E6D71539F930A15755C0A960958260&sec=&spon=&pagewanted=all> (discussing the need to test tap water and the solutions to dangerous water).

28. See *Behind Americans' Love of Bottled Water*, N.Y. TIMES, July 24, 1996, at C-1, available at <http://query.nytimes.com/gst/fullpage.html?res=9502E7D71639F937A15754C0A960958260&sec=&spon=&pagewanted=1> (explaining how bottled water became a popular beverage with each consumer having a preferred brand); see also Richard Wilk, *Bottled Water: The Pure Commodity in the Age of Branding*, 6 J. CONSUMER CULTURE 303, 316 (2006) (explaining the fear of natural tap water and the safety that bottled water represents).

29. See Wilk, *supra* note 28, at 306 (noting that companies profit tremendously from a commodity that falls from the sky, for example, the Pacific island of Fiji sells over \$90 million worth of bottled water a year); see also Richard W. Stevenson, *Market Place; Ionics: Pure Play in Pure Water*, N.Y. TIMES, Mar. 10, 1992, at D-10, available at <http://www.nytimes.com/1992/03/10/business/market-place-ionics-pure-play-in-pure-water.html> (discussing the drastic rise in profits for a water purification company).

30. See Amanda Gardner, *Heating Plastic Bottles Releases Potentially Harmful Chemical*, U.S. NEWS & WORLD REP., Jan. 30, 2008, available at <http://health.usnews.com/usnews/health/healthday/080130/heating-plastic-bottles-releases-potentially-harmful-chemical.htm> (explaining that exposing some plastic bottles to boiling water can increase exposure to harmful chemicals); see also Ian Austen, *Canada Bans Plastic Bottles Tied to Health Concerns*, N.Y. TIMES, Apr. 18, 2008, available at <http://www.nytimes.com/2008/04/18/business/worldbusiness/18cnd-plastic.html?scp=9&sq=plastic%20bottles&st=cse> (explaining the

environmentalists are reporting the devastating effect the discarded bottles have on the environment.³¹ This new information is causing a major shift in the original informational cascade where people now view drinking out of plastic bottles to be unhealthy and environmentally unfriendly. We are seeing the widely-accepted social norm of carrying the plastic water bottle diminish and the popularity of plastic-free options increase.³²

Likewise, consider the somewhat recent trend of parents questioning the need for infant and childhood vaccines.³³ Parents of autistic toddlers continue to report linkages between autism and the vaccinations that their children received as infants; the popular press reports these heartbreaking stories.³⁴ One can

Canadian ban on polycarbonate infant bottles because of harmful chemicals); Deborah Kotz, *Study of Chemical in Plastic Bottles Raises Alarm*, U.S. NEWS & WORLD REP., Apr. 16, 2008, available at <http://health.usnews.com/articles/health/living-well-usn/2008/04/16/study-of-chemical-in-plastic-bottles-raises-alarm.html> (explaining the danger in hard plastic bottles containing the chemical Bisphenol A).

31. See Editorial, *In Praise of Tap Water*, N.Y. TIMES, Aug. 1, 2007, available at http://www.nytimes.com/2007/08/01/opinion/01wed2.html?_r=1&scp=8&sq=bottled%20water&st=cse&oref=slogin (discussing the amount of oil required to produce bottled water and the fact that only 23% of bottles are recycled); see also *SF Mayor Newsom Bans City Bottled Water Purchases*, KPIX TV, June 22, 2007, available at <http://cbs5.com/local/newsom.bottled.water.2.456681.html> (explaining the San Francisco ban on use of city funds to purchase single-serving water bottles due to harmful environmental effects, including their clog on landfills).

32. See, e.g., Sigg Bottles, <http://www.mysigg.com> (last visited Feb. 24, 2008) (claiming to provide a safe permanent solution to the water bottle problem); see also *What's Next for Sigg*, finding Dulcinea, May 16, 2008, <http://www.findingdulcinea.com/features/feature-articles/2008/may/What-s-Next-for-Sigg-.html> (discussing Sigg's rise in popularity in the non-disposable water bottle market).

33. See Fran Silverman, *More Families Are Shunning Inoculations*, N.Y. TIMES, Mar. 2, 2008, at LI-3; see also Gardiner Harris, *Measles Cases Grow in Number, and Officials Blame Parents' Fear of Autism*, N.Y. TIMES, Aug. 22, 2008, at A-16; Jennifer Steinhauer, *Rising Public Health Risk Seen As More Parents Reject Vaccines*, N.Y. TIMES, Mar. 21, 2008, at A-1.

34. See Gardiner Harris & Anahad O'Connor, *On Autism's Cause, It's Parents vs. Research*, N.Y. TIMES, June 25, 2005, at A-1; see also Gardiner Harris, *Opening Statements in Case On Autism and Vaccinations*, N.Y. TIMES, June 12, 2007, at A-21; Gardiner Harris, *Court Hears More Claims of Vaccine-Autism Link*, N.Y. TIMES, May 13, 2008, at A-14; Gardiner Harris, *Deal in an Autism Case Fuels Debate on Vaccine*, N.Y. TIMES, Mar. 8, 2008, at A-9; *Vaccine Safety Panel to Include the Public in*

barely read a publication aimed at parents of infants and small children without coming across an article about the topic.³⁵ And because most parents lack the highly technical background necessary to evaluate medical journal articles and empirical studies that refute the connection between vaccines and autism, parents are left with anecdotal stories on which to come to an informed decision on their own about this issue.³⁶ Thus, many parents simply follow the informational and reputational cascades that have taken hold.³⁷

Years ago, very few parents expressed concern about infant and childhood vaccines and those that did were seen as outliers. However, as the cascade has taken off, an increasing number of parents are talking seriously to their pediatricians about the Center for Disease Control's recommended immunization schedule and deciding how to best handle the situation.³⁸ Some parents are even delaying certain vaccines or deciding not to give them altogether.³⁹ At this point in the cascade, a parent may even be

Setting Priorities, ASSOCIATED PRESS, Apr. 13, 2008; *Vaccines, Autism and Our Daughter*, Hannah, N.Y. TIMES, Apr. 5, 2008, at A-16, Jon Poling & Terry Poling, Letter to the Ed.

35. See Jessica Snyder Sachs, *Vaccines: Fact & Fiction*, Parenting, <http://www.parenting.com/article/Baby/Health/Vaccines-Fact-and-Fiction> (last visited Apr. 24, 2009); see also Margaret Renkl, *The Vaccine Debate*, Parenting, <http://www.parenting.com/article/Baby/Health/The-Vaccine-Debate> (last visited Apr. 24, 2009); Jessica Snyder Sachs & Nichole Cipriani, *Vaccine Safety: Recent Recalls and Rumors Have You Wondering Exactly What the Risks Are? Here's What You Need to Know Now*, PARENTING, Apr. 2002; Jessica Snyder Sachs, *Vaccines, The Real Risks and Benefits*, PARENTING, Mar. 1999.

36. See generally Generation Rescue, Jenny McCarthy and Jim Carrey's Autism Organization, <http://www.generationrescue.org> (last visited Apr. 24, 2009); *Immunization: Government Again Concedes Vaccines Cause Autism*, VACCINE WKLY., Mar. 11, 2009; Edward Wyatt, *ABC Show Will Go On, Over Protests By Doctors*, N.Y. TIMES, Jan. 29, 2008 (explaining that President of Pediatrics Academy warned that by airing episode of "Eli Stone" that deals with a case against a drug company on behalf of a mother who believes that a preservative in a vaccine caused her child's autism could influence people's health care decisions).

37. See Sachs, *supra* note 35; see also Renkl, *supra* note 35.

38. See Fran Silverman, *More Families Are Shunning Inoculations*, N.Y. TIMES, Mar. 2, 2008, at LI-3 (explaining that the issue is brought up in almost every prenatal visit and that an increasing number of parents are saying no to some inoculations).

39. See *id.*; see also, Harris, *Measles Cases Grow in Number, and Officials Blame Parents' Fear of Autism*, *supra* note 33 (noting that there is an increasing number of vaccine skeptics who object to the vaccines due to an unproven notion that vaccines are linked to autism and other disorders); Steinhauer, *supra* note 33.

viewed as naïve or uncaring if he or she does not express concern or awareness about the issue and go through some sort of decisional process.

2. Harnessing the Power Behind Cascades

Cass Sunstein postulates that “norm cascades” occur when rapid shifts in norms are seen.⁴⁰ He points to the fragile quality of cascades and draws a parallel to norms that many people may have adopted but to which they may not have much allegiance.⁴¹ Norms and expectations can create a division between the views that people outwardly display and the private opinions and desires they hold.⁴² This cleave is what allows broad and rapid changes in norms catalyzed by “norm entrepreneurs.”⁴³ According to Sunstein, norm entrepreneurs are those who are interested in altering existing social norms or starting new norms; he explains that norm entrepreneurs can exploit the fact that social norms are fragile in order to initiate change.⁴⁴ He dubs slower norm shifts as “norm bandwagons,” which ultimately lead to larger shifts as individuals join the “bandwagon.”⁴⁵

Ellickson takes a market-approach to norm formation while

40. Sunstein, *supra* note 10, at 912. Existing social norms are often fragile and easily changed. At those times, norm entrepreneurs or people interested in changing norms, can produce norm bandwagons and norm cascades which will effectively destroy the old norm and create a new norm. These norm entrepreneurs can help solve collective action problems. However, successful legal policy will often intervene and then accelerate or stop the norm entrepreneur’s efforts. *Id.* at 968.

41. *See id.* at 909 (explaining that social conditions depend on social norms which create fragility and disloyalty to the social condition).

42. *Id.* at 912 (explaining that people will often live a different private life from their public life in reaction to the different taxes and subsidies resulting from the various social norms and roles).

43. *Id.* at 909.

44. *Id.*; *see also* Ellickson, *supra* note 8, at 36 (describing that norm entrepreneurs act in new ways or provide new social patterns); Eric A. Posner, *Symbols, Signals, and Social Norms in Politics and the Law*, 27 J. LEGAL STUD. 765, 773 (1998) (explaining that a norm entrepreneur announces when a particular action will be a signal that requires responses from observers).

45. Sunstein, *supra* note 10, at 912. Norm bandwagons occur when people gradually shift to the new norm as the cost of doing so diminishes. This continues up to the “tipping point” where the old norm becomes socially defunct and the new norm becomes socially acceptable. *Id.* (citing examples such as the fall of communism, the election of Ronald Reagan, and the use of the term “liberal”).

considering the implications of cascade theory.⁴⁶ What he terms as “change agents” are members of society that motivate creation of new norms or change in existing norms.⁴⁷ He distinguishes between three subcategories of “change agents:” (1) self-motivated leaders, (2) norm entrepreneurs, and (3) opinion leaders, all of whom motivate norm change and thus are the catalysts that trigger cascades, but each for different reasons.⁴⁸ Opinion leaders are those with the highest social intelligence and are those who realize that those promoting the new norm, either the self-motivated leaders or the norm entrepreneurs, are to be esteemed and these opinion leaders are the first to hop on the “bandwagon.”⁴⁹ Finally, ordinary members of the group observe all these shifts to the new norm and “eventually infer[] that it is prudent to join the cascade and conform to the new ideals.”⁵⁰

In short, certain members of society understand cascade theory and perceive the nuances that effectively further cascades and ultimately lead to widespread social norms. Rather than serving as one of the imitating masses, these individuals harness the power of cascades to start social norms that act to their advantage. The next section considers the general elements of cascade theory outlined above and applies cascade theory to human behavior online.

III. ONLINE CASCADES

Cascade theory can be applied to human actions online as well as offline. Online cascades deserve further scrutiny since several notable variations present themselves due to the technology involved. The following subsections specifically explore “e-mail cascades” and “Google cascades,” their parallels to offline cascades, and the distinctions these online cascades bring to cascade theory.

46. Ellickson, *supra* note 8, at 40.

47. *Id.* at 41.

48. *Id.* at 42.

49. *Id.* at 45.

50. *Id.* at 52. An ordinary member of society will adopt a new norm because the technical experts of society are approving the norm as a good change for the group and the social experts are following the norm. These two occurrences decrease the risk of norm shifting for the ordinary person and allow both the informational and reputational cascades to crash to completion. *Id.*

A. E-MAIL CASCADES

I submit that an e-mail cascade occurs when an individual receives an e-mail message and follows the actions of the sender by forwarding it onto others, while perhaps disregarding her own intuition not to send the message. Mass-forwarded e-mail messages are a textbook example of online information cascades. In particular, consider the mass-forwarded messages that purport to elucidate some previously obscure fact or ask you to pass along the message to ten of your friends to “keep the chain going.”⁵¹ While some of these mass-forwarded messages contain legitimate information, many are simply untrue e-mail hoaxes.⁵²

An e-mail forwarder likely has good intentions when passing along what he or she believes to be helpful information. Consistent with information cascades, the forwarder knew little, or at least was unsure, about the topic of the e-mail before receiving it.⁵³ Finally, the forwarder assumes that all the previous

51. Three classic examples of e-mail hoaxes are the first name chain letter in which the e-mail claims to be a survey to collect all first names, the good luck chain letter in which good luck is promised to those who forward the e-mail to others within five minutes and bad luck to those who do not, and the birthday chain letter that asks you to add your name and birthday to a list before sending it on to all your friends. See Hoax Slayer, Email Chain Letters, <http://www.hoax-slayer.com/email-chain-letters.html> (last visited Aug. 1, 2008); see also Snopes.com, PINned Hopes, <http://www.snopes.com/business/bank/pinalert.asp> (last visited Aug. 8, 2008) (explaining that some e-mail chain letters simply contain incorrect information, such as entering your pin backwards at an Automated Teller Machine will summon the police).

52. See Hoax Slayer, <http://www.hoax-slayer.com/> (last visited Aug. 1, 2008) (archives and explains all kinds of e-mail hoaxes: phishing scams, e-mail chain letters, financial scams, and many others); see also Michelle Delio, *Meet the Nigerian E-mail Grifters*, WIRED (2002) <http://www.wired.com/culture/lifestyle/news/2002/07/53818> (explaining and discussing the Nigerian e-mail scams); Dot Earth, <http://dotearth.blogs.nytimes.com/> (Nov. 11, 2007, 20:16) (discussing an e-mail climate hoax that rapidly rose in popularity and then died, all within seventy minutes); David Emery, How to Spot an Email Hoax, <http://urbanlegends.about.com/cs/nethoaxes/ht/emailhoax.htm> (last visited Aug. 1, 2008) (explaining how to spot an e-mail hoax); Snopes, <http://www.snopes.com/> (last visited Aug. 5, 2008) (discussing and commenting on the authenticity of various rumors, legends, myths, and pranks).

53. See Sunstein, *supra* note 10, at 909 (explaining that cascades are fragile because they rely on social norms that may have little allegiance, and thus new information can easily shift the norm); see also McAdams, *supra* note 10, at 368 (explaining that a little bit of information in the other direction can create a norm shift); Watts, *supra* note 11, at 5766

people that forwarded the message before her could not be wrong, or she at least assumes that they must know something that she does not.

Reputational cascades also occur under these circumstances when the forwarder of the message is someone from whom the recipient seeks esteem, perhaps a senior colleague or somebody in a particularly noteworthy position.⁵⁴ Thus, the recipient may be inclined to forward the message simply to appear in line with the thoughts of the other e-mail forwarders even if she does not necessarily agree with the contents of the message.

E-mail cascades take off and continue, in some cases for years. And in many cases, these e-mail cascades are the culprit behind mass erroneous information. For example, an e-mail that has been circulating since at least 2005 claims that cell phones are about to be assaulted by telemarketing callers as the result of a new cell phone database being released.⁵⁵ In fact, the Federal Communications Commission has promulgated clear regulations prohibiting automated dialer programs from calling cell phone numbers.⁵⁶ And since automated dialers are standard in the telemarketing industry, the vast majority of telemarketers are unable to call consumers on their cell phones.⁵⁷ As a result of this

(explaining that cascades are fragile because the same kinds of norm shifts that created the cascade can create a new cascade that will replace the old cascade).

54. Depending on how the sender forwarded the message, e-mail messages can retain a string of previous forwarders in the message header. Thus, the recipient may not only consider the immediate forwarder, but can also consider the list of many previous forwarders when deciding whether to forward the message to others.

55. Press Release, Fed. Trade Comm'n, *The Truth About Cell Phones and the National Do Not Call Registry* (Apr. 15, 2005), <http://www.ftc.gov/opa/2005/04/dnc.shtm>. The FTC website chronicles several of the e-mail messages that, as of the writing of this article, are still circulating via e-mail. For example, one e-mail says:

JUST A REMINDER. . . In a few weeks, cell phone numbers are being released to telemarketing companies and you will start to receive sale calls. YOU WILL BE CHARGED FOR THESE CALLS. . . To prevent this, call the following number from your cell phone: 888/382-1222. It is the National DO NOT CALL list. It will only take a minute of your time. It blocks your number for five (5) years. PASS THIS ON TO ALL YOUR FRIENDS. . .

Id.

Another version claims "The Federal Trade Commission has set up a 'do not call' list. It is called a cell phone registry. To be included on the 'do not call' list, you must call from the number you wish to register." *Id.*

56. See 47 C.F.R. § 64.1200(a).

57. See Telephone Consumer Protection Act, 47 U.S.C. § 227 (1991);

erroneous e-mail cascade, both the Federal Trade Commission and the Federal Communications Commission have posted websites directly addressing the content of these false e-mails and providing consumers with the facts.⁵⁸

Thus we see that e-mail cascades certainly parallel their offline cascade counterparts as information and misinformation is spread from person to person. However, e-mail cascades also exhibit two unique and remarkable features: an amplified herd effect and an amplified proliferation of the cascade itself. As the next two subsections explain, these qualities bear somewhat of a relation to one another, although each is undeniably characteristic of an e-mail cascade.

1. Amplified Herd Effect

When faced with receiving an e-mail chain letter, online users could easily verify the information contained in the message by toggling over to an Internet browser, launching Google or any other search engine, and typing in a few key words. With little effort, the user would be able to immediately see whether the contents of the e-mail message are posted on a site that reports e-mail hoaxes⁵⁹ or conversely, if, in fact, the content was reported on and validated by a trustworthy website.⁶⁰ In the offline world, one can more readily understand mass erroneous information

see also Press Release, Fed. Trade Comm'n, *supra* note 55; Press Release, Fed. Trade Comm'n, The Truth About Cell Phones and the National Do Not Call Registry (Oct. 12, 2007), <http://www.ftc.gov/opa/2007/10/dnccellphones.shtm>.

58. See Press Release, Fed. Trade Comm'n, *supra* note 55 ("If you've received an email telling you that your cell phone is about to be assaulted by telemarketing calls as a result of a new cell phone number database, rest assured that this is not the case."); see also Federal Communications Commission, Unwanted Telephone Marketing Calls, <http://www.fcc.gov/cgb/consumerfacts/tpca.html> (explaining the history and current legislation on telemarketing).

59. See Hoax Slayer, *supra* note 52; see also Snopes, *supra* note 52.

60. An e-mail chain letter claimed that a seventeen pound baby was born in Russia. This turned out to be true, unlike many other e-mail hoaxes. See *Seventeen Pound Russian Baby Photographs*, Hoax Slayer, <http://www.hoax-slayer.com/giant-russian-baby.shtml> (last visited Mar. 19, 2009); see also *Russian Mother Has "Giant" Baby*, BBC NEWS, Sept. 27, 2007, <http://news.bbc.co.uk/2/hi/europe/7015841.stm> (last visited Aug. 1, 2008); *Russian Woman's 12th Baby Weighs in at Massive 17 Pounds*, FOX NEWS, <http://www.foxnews.com/story/0,2933,298232,00.html> (last visited Aug. 1, 2008).

cascades. In the offline world, and particularly before the Internet, when one came upon information, either from a book, an article, or another person, much more effort was needed to verify that piece of information before passing it along to another individual. Thus, sharing misinformation with another person would seem to be more likely in an era where Internet access was not so readily available.⁶¹

However, it appears that more misinformation spreads via e-mail cascades than via word of mouth or any other communications medium; in fact, I submit that the tremendously powerful cascade effect of e-mail forwarding is unmatched in the offline world.⁶² Given that verifying the contents of an e-mail message could not be simpler, why do so many users choose not to investigate and just blindly forward the message? I propose that two reasons explain this phenomenon of an amplified herd effect for e-mail communications. First, the ease with which online users are able to forward a message to ten, twenty, or fifty friends or acquaintances is unmatched in the offline world. Second, the preservation of the original written e-mail message allows for a more compelling declaration as compared to someone attempting to paraphrase the original thought to another via spoken word.⁶³

E-mail forwarding involves little thought or effort. Within seconds, a recipient of an e-mail message, can forward an exact replica of the message to thousands of other online users. No other communication medium allows for this type of prolific replication.

The second reason for the phenomenon is that the original

61. See generally Lorraine Hope et al., "With a Little Help from My Friends...": The Role of Co-Witness Relationship in Susceptibility to Misinformation, 127 ACTA PSYCHOLOGICA 476 (2007) (discussing how witnesses can convince each other of misinformation).

62. See Peter M. Yellowlees, *Healthcare on the Internet: Buyers Beware*, 173 MED. J. AUSTL. 629, 629 (2000) (explaining how medical misinformation is spread via e-mail and chat rooms); see also Dot Earth, <http://dotearth.blogs.nytimes.com/> (Nov. 11, 2007, 20:16 EST) (discussing how quickly and easily an e-mail climate hoax rose to popularity and then died).

63. See Hung-yi Lu, College Students' Information Seeking and Media Credibility During the Crisis of SARS in Taiwan 14-15 (May 27, 2004) (unpublished manuscript), available at http://www.allacademic.com/meta/p_mla_apa_research_citation/1/1/2/4/1/p112415_index.html (explaining that during the SARS outbreak, the Chinese people believed television and print media far more than other available sources); see also Gieseler, *supra* note 7, at 328 ("Print, radio, and television media make widespread belief formation possible.").

persuasive message is preserved word-for-word. This is a far cry from our offline equivalent having to paraphrase or explain to someone else the content of the message in her own words. Carefully drafted content in print is more persuasive than information obtained via word-of-mouth. Most individuals are not as articulate or persuasive when speaking, than when carefully drafting text. The original creator of the eventual cascading message has the advantage of carefully weaving an argument that persuades thousands if not millions of e-mail readers who know little about the topic in the first place and are inclined to be easily persuaded.

Thus, both of these qualities of e-mail forwarding compound the herd effect and ultimately cause e-mail cascades to proliferate at an accelerated rate as compared to offline cascades.⁶⁴ E-mail cascades lead the herd at an alarmingly accelerated rate as is demonstrated time and time again with messages that repeatedly make their way to your inbox from those who mean well but fail to verify before forwarding.

2. Amplified Cascade Proliferation

As touched on in the previous section, e-mail also possesses the unparalleled ability to propagate information easily and with little thought or effort. E-mail is quickly forwarded to as many recipients as the sender wishes within a matter of seconds. I submit that this leads to an exponentially higher rate of cascade propagation in the online world as compared to the offline world. In other words, the cascade proliferation is amplified due to the sheer number of potential recipients.

While closely related to the e-mail cascades' ability to amplify the herd effect, the e-mail cascades ability to reach unparalleled masses is likewise remarkable. One is simply unable to replicate e-mail's propagation ability with an offline example. Let us assume that our original message is sent from person A to ten of her acquaintances. Then each of A's ten acquaintances sends to ten acquaintances of their own and so on. Within nine forwards, the message has reached more than twice the population of the

64. An intriguing experiment would test the propagation speed of online information as compared to offline information, and evaluate the resulting cascade effects. I submit that if one attempted to spread the same piece of information offline as online, the online message would propagate at an exponentially faster rate and to a vastly larger audience.

United States; within ten forwards, the message has reached more than our entire world population. Given the ease and speed with which messages are forwarded, it is easy to imagine a scenario where nearly the entire nation has received the same e-mail message within the span of a few days.

Thus while e-mail cascades exhibit all of the qualities of traditional offline cascades, e-mail cascades also present an amplified herd effect and an amplified cascade proliferation. These interrelated but notable characteristics are entirely due to the technology involved with e-mail sending and forwarding. The next section considers “Google cascades”⁶⁵ and the distinctive characteristics that set these cascades apart from offline and other online cascade occurrences.

B. GOOGLE CASCADES

Google cascades occur when an individual, having searched for something on Google, follows the behavior of the Google results without regard to his own information. Just as with an offline cascade, an individual is faced with a decision and disregards his own intuition, instead observing what another individual has done in the similar circumstance.⁶⁶ Recall our earlier dinner roll example. Let us assume that in preparation for the reception, you query Google about which plate contains your dinner roll. You likely observe the first one or two results in Google, assume that the websites offering the expert etiquette advice are correct, and follow the recommended protocol with confidence—exactly as if you were at the wedding reception and following the lead of others at your table.

What sets Google cascades apart from conventional offline

65. In the course of writing this article, the term “Google cascades” came to me rather naturally as I was considering how the technology involved with the Google ranking algorithm could, in fact, affect the cascade itself. Somewhat early on, it occurred to me to Google the term “Google cascades” to discover that someone in fact had already coined the phrase in a single blog posting in 2004. I do not believe it has been used elsewhere. See Julian Sanchez, <http://www.juliansanchez.com/2004/06/24/Google-cascades> (June 24, 2004) (explaining that a “Google cascade” is when the Google algorithm further pushes the same sites to the front page while not allowing for new sites to gain popularity).

66. Kuran & Sunstein, *supra* note 7, at 717 (“Because it is costly to gather pertinent information, individuals ordinarily seek to free ride on knowledge that is publicly available through sources ranging from gossip and rumors to scientific reports.”).

cascades is Google's searching and ranking algorithm. Google's algorithm further reinforces cascade behavior since it is based on the number of sites that point to the particular site in question as well as the relative popularity of the linking sites.⁶⁷ In order for Google to rank my site, Google considers the number of other web pages that link to my site.⁶⁸ The more pages that link to my site, the higher my site rises on the Google search results page.⁶⁹ Furthermore, Google also takes into account the perceived quality of the sites that are linking to my site.⁷⁰ For example, if a page that links to my site is also highly ranked by Google (i.e., has been deemed highly reputable by Google's standards), that link counts more than another site that is lower in Google's ranking opinion. Thus, *Google's algorithm itself appears to follow and perpetuate both informational and reputational cascades.* When ranking my site, Google is not only taking into consideration the informational cascade of other sites that link to my site, but is also considering the reputational cascade by considering the status of the sites

67. Google assigns a numeric weighting from 0-10 for each webpage on the Internet. This "PageRank" denotes a site's importance in the eyes of Google. The PageRank is derived from a theoretical probability value on a logarithmic scale like the Richter Scale. The PageRank of a particular page is roughly based upon the quantity of inbound links as well as the PageRank of the pages providing the links. Thus, there are two main factors contributing to the page rank: (1) how many other webpages are directly linking to your webpage, and (2) the popularity of the websites that are linking to your webpage. This creates a complex system. A website can receive a high page rank with many links from unpopular pages or from just one or two links from a popular page. See Google.com, Technology Overview, <http://www.Google.com/corporate/tech.html> (last visited Mar. 30, 2009); see also Verlyn Klinkenborg, Editorial Observer, *Behind the Rise of Google Lies the Rise in Internet Credibility*, N.Y. TIMES, Feb. 27, 2004, at A-26 (discussing the manipulation of the Google algorithm for financial gain through advertising).

68. For an overview of how Google's search engine works, see generally, Frank Pasquale, *Rankings, Reductionism, and Responsibility*, 54 CLEV. ST. L. REV. 115, 117-25 (2006); see also, Greg Lastowka, *Google's Law*, 73 BROOK. L. REV. 1327, 1337 (2007). Lastowka's article also provides a history of search engine industry and Google's rise to popularity. See generally Danny Sullivan, What is Google Page Rank? A Guide for Searchers & Webmasters, <http://searchengineland.com/what-is-google-pagerank-a-guide-for-searchers-webmasters-11068> (last visited Apr. 24, 2009).

69. Sullivan, *supra* note 68.

70. See James Grimmelman, *The Google Dilemma*, N.Y.L. SCH. L. REV. (forthcoming) (manuscript at 3), available at <http://ssrn.com/abstract=1160320>.

that link to my site. It is precisely this unique compounding effect that sets “Google cascades” apart from typical cascade behavior.

We see the cycle perpetuate yet further as websites that are considering linking to other sites accordingly search Google and likely link to sites that are highly ranked by Google. People are constantly looking for mental shortcuts, and rather than manually finding and evaluating all of the potentially relevant websites that are available on the web, the most efficient method of culling and “evaluating” sites is to search Google. Thus, the Google cascade advances one step further as yet additional sites rely on the original Google cascade search results in order to determine whether to link to my site. And, of course, because even more sites now link to my site, my ranking appears higher in Google. The effect folds onto itself and perpetuates ad infinitum.

The cascades in these instances have a compounded effect further perpetuating and reinforcing the top-place ranking of my site and concurrently making it more difficult for any other site to attain this number one placement. Thus, this ranking algorithm simultaneously follows and reinforces cascading behavior, something that is not seen in typical informational cascades.⁷¹

Kuran and Sunstein write of “availability cascades” and describe such as “self-reinforcing process[es] of collective belief formation by which an expressed perception triggers a chain reaction that gives the perception of increasing plausibility through its rising availability in public discourse.”⁷² In other

71. Digg is another example of an online system that reinforces cascading behavior. Digg is a social bookmarking site that encourages cascades. A user will submit an article of interest, and other users will then either “digg” the page up or down in popularity. Most often, the article will either fail to gain any notice by the Digg community, or it will rocket in popularity to the front page. See Digg, <http://www.Digg.com> (last visited Mar. 9, 2009); see also Shmula, <http://www.shmula.com/197/digg-as-a-game> (Sept. 8, 2006) (explaining how Digg is another example of an online system that reinforces cascading behavior). Social cascades can be compared to infectious diseases in that they both pass a threshold in which they cease to decline and begin to grow tremendously. This is said to happen at a point when the reproduction number passes one. AIDS has a value of two-five, and measles has a value of twelve-eighteen. The reproduction value of flickr.com is forty-eight for the studied time period. Meeyoung Cha et al., *Characterizing Social Cascades in Flickr*, (2008), <http://www.mpi-sws.mpg.de/~gummadi/papers/Cascades-WOSN.pdf>.

72. Kuran & Sunstein, *supra* note 7, at 685 (defining availability cascades as cascades “through which expressed perceptions trigger chains of individual responses that make these perceptions appear increasingly plausible through their rising availability in public

words, availability cascades are driven by people sharing their opinions with “others” and “others” mimicking these opinions to yet more people because these “others” lack the information to come to an informed decision on their own.⁷³ The more people that repeat the perception, the greater the seeming truthfulness of the perception appears.⁷⁴ Google cascades share some parallels with availability cascades, albeit Google availability cascades occur entirely online and through websites, not people. More importantly however, because of the way in which Google’s algorithm operates, the Google cascade demonstrates an inherent compounding effect upon itself, something not also seen with availability cascades.

Along with e-mail cascades, Google cascades certainly exhibit the amplified herd effect and amplified cascade proliferation described above due to the ability of online information to spread with unmatched speed and ease. The next two subsections explore two additional side effects of systems such as Google that propagate cascading behavior: (1) occasional mass erroneous misinformation and (2) homogeneity of opinions. I submit that Google cascades may potentially exhibit these consequences but to an even greater degree than offline counterparts.

1. Mass Erroneous Information

As stated earlier, Google cascades occur when an individual, having searched for something on Google, follows the behavior of the Google results without regard to his own information. Just like offline information cascades, in many instances this leads to acceptable results. Conversely however, Google cascades could lead to mass misinformation if an erroneous website makes its way to the top of the Google search results.⁷⁵

I submit that few, if any, cascades can compete with the tidal wave effect that Google cascades possess. First and foremost, the compounding effect of Google’s search algorithm described earlier,

discourse”).

73. *Id.* at 685–86.

74. *Id.* at 685.

75. See Kuran & Sunstein, *supra* note 7, at 721 (“The key precondition for an erroneous informational cascade is thus that *most citizens have little reliable information of their own about the claim in question.*”); see also *Annotated Bibliography*, *supra* note 6 (emphasizing that people exhibit herd behavior that can many times lead to wrong decision).

which embeds informational and reputational cascades into the ranking process, has no offline equivalent. Furthermore, similar to the reasons given above for e-mail's amplified herd effect, online information possesses three unique qualities.⁷⁶ First, the pervasive information flow of online data is unmatched in any other communication mechanism. The speed and ease with which any user can look up and gather information instantaneously is simply unparalleled.⁷⁷ Second, the vast number of people information reaches simultaneously is unique to the Internet. No other communications mechanism, even radio broadcast or cable television can reach a worldwide audience the way Internet information can.⁷⁸ Finally, the information is preserved and not diluted through word of mouth. Thus, readers are able to read the true source of information, rather than having it filtered through others.

Instances exist where misinformation is purposefully moved to the top of Google's search results by people exploiting their knowledge of the Google search algorithm, a practice known as Googlebombing.⁷⁹ In the process of Google calculating the pages that link to my site, Google also considers the descriptor language

76. See Major, *supra* note 5, at 102 ("There are two ways in which information exchange and availability differ in cyberspace. First, the speed at which information is exchanged is unparalleled. Second, information travels greater distances with remarkable ease. These two qualities have created a pervasiveness of information that has not previously existed in society . . .").

77. See Hannibal Travis, *Wi-Fi Everywhere: Universal Broadband Access as Antitrust and Telecommunications Policy*, 55 AM. U. L. REV. 1697, 1699-1701 (explaining the ease of obtaining high speed Internet as cities build city-wide wireless networks); see also Gina Piccalo, *Fads Are So Yesterday*, L.A. TIMES, Oct. 9, 2005, at E1 (explaining that the Internet has caused the speed of fads to increase tremendously so that by the time a fad is identified, it is gone).

78. See generally Leiner et al., *The Past and Future History of the Internet*, 40 COMMUNICATIONS OF THE ACM 102 (1997).

79. See James Grimmelmann, *The Google Dilemma*, N.Y.L. SCH. L. REV. (forthcoming) (manuscript at 3), available at <http://ssrn.com/abstract=1160320> (describing a Googlebomb as when the Google algorithm mistakenly gives the wrong search result to a keyword search); see also Posting of Danny Sullivan to Search Engine Land, <http://searchengineland.com/070125-230048.php> (Jan. 25, 2007, 23:00 EST) (describing an occurrence of a Googlebomb involving President G.W. Bush); Posting of Danny Sullivan to Search Engine Land, <http://searchengineland.com/070406-175030.php> (Apr. 6, 2006, 17:50 EST); Posting of Danny Sullivan to Search Engine Watch, <http://searchenginewatch.com/showPage.html?page=3296101> (Jan. 6, 2004).

those sites use to describe my site. In other words, if the sites that link to my site use the phrase, “dirty rotten scoundrel,” then when one searches for “dirty rotten scoundrel” in Google, Google lists my site as one of the search results, even if that phrase is not used on my site.⁸⁰ In 2004 several hundred websites conspired, and under the descriptor “miserable failure,” pointed to the official George W. Bush biography on the U.S. White House website.⁸¹ The result was that if one typed the phrase “miserable failure” into Google, the first result was a link to Bush’s official biography on the White House website.⁸² Other examples of Googlebombing existed in the past, but this instance proved to a much larger audience that ordinary users could manipulate Google’s search algorithm to their advantage.⁸³

Another example of Googlebombing, and consequential counter-Googlebombing, involved the search results that were returned after typing the word “Jew” into Google.⁸⁴ In 2004 the number one result that appeared when typing the word “Jew” into Google was “jewwatch.com,” a site clearly anti-Semitic in nature.⁸⁵ When one considers that typically anti-Semitic groups refer to those of the Jewish faith as “Jew,” rather than “Jewish,” the placement in the Google ranking makes sense.⁸⁶ However, a Jewish activist noticed this result and lobbied others to counter this placement.⁸⁷ He encouraged people to link to the Wikipedia

80. Grimmelman, *supra* note 79.

81. Posting of Marissa Mayer to The Official Google Blog, <http://googleblog.blogspot.com/2005/09/googlebombing-failure.html> (Sept. 16, 2005, 12:54 EST).

82. Saul Hansell, *Foes of Bush Enlist Google To Make Point*, N.Y. TIMES, Dec. 8, 2003, at C-8.

83. See Grimmelman, *supra* note 79 (“Land a bomb like this and you can convince the world that Google agrees with your position. A successful Googlebomb doesn’t just *reflect* the consensus of web users; it can help *construct* that consensus.”).

84. See Adl.org, Google Ranking of Hate Sites Not Intentional, http://www.adl.org/rumors/google_search_rumors.asp (last visited Mar. 9, 2009) (explaining the unintentional high ranking of hate sites on Google); see also Google.com, An Explanation of Our Search Results, <http://www.google.com/explanation.html> (last visited Mar. 9, 2009) [hereinafter Explanation] (explaining Google’s algorithm and the occurrence of anti-Semitic search results).

85. See Laurie J. Flynn, *Google Says It Doesn’t Plan to Change Search Results*, N.Y. TIMES, Apr. 13, 2004, at C-2; see also, Grimmelman, *supra* note 79, at 4.

86. See Explanation, *supra* note 84.

87. See Judit Bar-Ilan, *Web Links and Search Engine Ranking: The*

article dealing with the Jewish faith with the descriptor “Jew,” so that Google robots would return the Wikipedia article as the top search result, rather than the anti-Semitic site.⁸⁸ Ultimately the campaign succeeded and the Wikipedia article was the top-ranked result. However, as anti-Semitic groups started noticing the success of this Googlebomb, the counter-Googlebomb campaign was started to place “jewwatch.org” back to its number one ranking.⁸⁹ This counter effort was ultimately unsuccessful (although jewwatch.org was the third result that was returned in September, 2008), but proved the ability of online users to manipulate Google’s search results in a back and forth battle.⁹⁰

The above examples demonstrate the ability of online users to purposefully manipulate Google search results. One can likewise easily imagine a scenario where misinformation is inadvertently popularized by Google’s search engine and mass erroneous behavior based on that misinformation ensues. For example, Google’s robots cannot distinguish sarcastic descriptor phrases from genuine fact. Furthermore, consider the likely event of the emergence of an offline *mis*-information cascade, followed by several website operators posting erroneous links and descriptors. Google’s algorithm counts the links to the misinformation while also considering the reputation of those sites. Once a tipping point

Case of Google and the Query “Jew,” 57 J. AM. SOC’Y INFO. SCI. & TECH. 1581 (2006); see also, Joe Berkofsky, *Jew Watch and the Internet*, available at <http://www.christian-identity.com/jewwatch.htm>; David Becker, *Google Caught in Anti-Semitism Flap*, CNET NEWS, Apr. 7, 2004, http://news.cnet.com/Google-caught-in-anti-Semitism-flap/2100-1038_3-5186012.html.

88. A search for the word “Jew” returns two Wikipedia articles followed by the anti-Semitic website, JewWatch.com. See Google, <http://www.google.com/search?client=safari&rls=en-us&q=jew&ie=UTF-8&oe=UTF-8> (last visited Sept. 10, 2008).

89. See Bar-Ilan, *supra* note 87.

90. Political commentators are even employing Googlebombs to further their agendas. Bloggers from both sides of the political spectrum are not above the fray. See Open Left, <http://www.openleft.com/showDiary.do?diaryId=4098> (Feb. 22, 2008, 15:04) (“It is time to start bomb bomb bomb, bomb bombing again. No, not Iran, but John McCain’s Google ranking.”); see also Posting of John Hawkins to Right Wing News, http://www.rightwingnews.com/mt331/2008/02/googlebombing_obama_first_wave.php (Feb 26, 2008, 07:00) (“Once again, keep in mind that if the election turns out to be as close as it was in 2000 and 2004, Googlebombs could, if they work, conceivably peel off enough votes to not just make a difference—they could be the difference between the winner and the loser.”).

is reached, the misinformation could make its way to the top of the search result page leading to a Google cascade of misinformation.

One should not criticize Google for this potential consequence. Simply stated, Google is a tremendously powerful tool that has led to a better informed society. However, Google search results can lead to inaccurate information since they are based entirely on other people's perceptions. Online users should be aware of this potential anomaly in Google's algorithm and analyze Google cascade results with this understanding in mind.

2. Homogeneity of Opinions

As stated earlier, the majority of online users are not norm entrepreneurs or opinion leaders, but rather "ordinary" online users.⁹¹ The first inclination of such users, when faced with a question or project, is to search Google immediately for an answer to their quandary, especially if the user is already sitting behind a computer. This practice is so simple that it literally takes seconds to perform. The original thought process is replaced by active typing and reviewing of others' ideas that immediately shape the user's perceptions about the given issue. One can certainly understand that, because of our busy lives, the eternal quest for personal and workplace efficiency dictates our actions. Our online user is faced with two choices: reinventing the wheel, so to speak, or quickly educating herself about how someone else approached a project or decided an issue. While acting in a rationally efficient and beneficial manner is understandable for each individual user, individual users constitute the masses. Thus, the concern is that mass online users will stop thinking for themselves and reflexively develop copycat behavior resulting in a society that is left with little original thought and a consequent homogeneity of ideas.

How does this differ from offline society? Norm entrepreneurs and opinion leaders exist online just as they do offline. However, the ability to spread their ideas and propagate social norms offline is limited by the speed with which information travels in offline space. But moving this paradigm to online space increases the speed and audience scope exponentially, as well as the net effect norm entrepreneurs and opinion leaders have on popular opinion and social norm formation. With the tremendous popularity of

91. Compare ordinary online users with Ellickson's offline "ordinary group members." See Ellickson, *supra* note 8, at 52.

Google, it is significantly easier to find their thoughts and opinions on any given topic. Blogs, listserves, wikis, Facebook pages, and other Web 2.0 tools offer the ability for change agents and norm entrepreneurs to communicate their ideas more efficiently than ever before. Ordinary online users (“ordinary group members” as Ellickson refers to them), who are apt to question their own independent judgment, are inclined to search Google to help form their opinion or make a decision due to the ease with which one can gather information on any given topic.

Google has the ability to affect opinions all over the world instantly and simultaneously. In the offline world, ideas are filtered from one person to another, or even spread through mass media channels. Even with the mass media playing an important part in shaping public perceptions, we still see pockets of opinions and group norms,⁹² but rarely global conformity on the understanding of a single norm or concept. One wonders whether mass use of Google will eventually lead to homogenous patterns of thought and action when few are pressed to think for themselves anymore. I have written before about how norms originate and evolve much more quickly online and how norms spread to a much wider audience than ever before.⁹³ We are a society that is learning to Google any question that pops into our minds and the first few results lead the herd. Certainly Google cascades have led to a better informed society, but they can simultaneously lead to a society bereft of original thoughts or ideas. As a society we must consider this potential side effect of a tremendously powerful tool and think about how we want to use this tool to our best advantage.

IV. CONCLUSION

Cascade theory explains a great deal about human nature. We understand why humans tend to imitate others even if it means acting in a manner that contradicts one’s own intuition, and thus how fads and social norms evolve. Once one has a grasp of how cascades function to influence society, one has a formula, of sorts, to how society operates. Norm entrepreneurs and opinions leaders use this formula to further their agendas. But

92. McAdams explains that people are more closely tied to group norms than societal norms especially when the group norm is in conflict with the societal norm. The group norm allows them to rebel against society within their close-knit group. McAdams, *supra* note 10, at 386-91.

93. Major, *supra* note 5, at 103.

even an ordinary member of society can understand cascade theory and see it played out in all aspects of everyday life.

The study of online cascade theory is particularly salient because online cascades affect a greater number of people at any given time. In fact, as described in this article, we see that online cascades proliferate at an exponential rate compared to their offline cascade counterparts. E-mail, Google, and online Web 2.0 technologies such as blogs, YouTube, and social networking sites are the way of the future and are how more and more people are finding and exchanging information. People will always talk to one another, read print media, and watch television; nevertheless, these models of information dissemination and exchange are increasingly moving online as technologies converge and the distinction between offline space and online space diminishes, consequently emphasizing the enormous import and potential implications that online cascades bear on our society.