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Online Crowds – Extraordinary Mass Behavior on the Internet

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Abstract: In this paper a novel form of online users, the "Online Crowds", is described. "Online Crowds" gather virtually, behave and act collectively and produce effects and phenomena which would not be possible without the Internet [Hof 05]. A remarkable example is "The Million Dollar Homepage"[1] where a clever student made more than £ 100.000 only by offering a simple but unique online idea. He used the dynamics between online users and companies to make money with almost no effort. To understand these "social contagion" processes, an interdisciplinary conceptual and psychological model of "Online Crowds" is introduced. The model is based on the principles of "Other directedness", "Critical mass", "Positive feedback loops" and the accelerating impact of network effects on the Internet.
Some recommendations are sketched how such "Online Crowds" can be actively formed for promising online business models. If the behavior and the characteristics of "Online Crowds" are better understood, decision makers and providers will be better capable to predict and promote successful online communities and services.
Moreover a look at the positive and negative effects of these phenomena is taken and their challenges, as well as the implications for the affected society are analyzed. Especially the domain of New Media Technology (NMT) and the particular area of online recommender- and personalization technology are facing a potential for exploiting these Internet phenomena.
Finally, a list of related work in the field and an outlook on further improvements in the discussed approach are given.

Keywords: Internet phenomena, collective and extraordinary behavior, social contagion, societal and business implications
Categories: H.5.1, H.5.4, J.4., K.4

1 Introduction

Today's Internet is rapidly changing. Starting in the early years as a research project and later as web-based information system for company homepages and simple product catalogues, we can find today different variants of e-collaboration and communication on the web. Especially the upcoming consumer-to-consumer (C2C) and peer-to-peer (P2P) business models are a point of interest, because in these cases the online users themselves populate and facilitate their online platforms and form phenomena that have not seen before [Hof 05]. Typical examples are auction

[1] http://www.milliondollarhomepage.com/

overbidding at eBay.com, masses of video clips on YouTube.com, social buddy networks at MySpace.com, free social encyclicals like Wikipedia.org or unlimited social photo sharing with Flickr.com and many more. These "New Media" online business models use one unique and emerging principle of the Internet: The power of "Online Crowds".

The paper starts with an explanation of the origins of "Online Crowds" in the real world by collective behavior and "social contagion" [Gladwell 01]. Based on the model of crowd psychology [Pelzmann 00] and their major properties a simplified model of the "Online Crowds" is sketched, trying to understand why some Internet ideas are getting blockbusters while others are no-starters.

2 The roots: Social contagion of the "Real Crowds"

Mass phenomena are situations where a lot of people seem to overreact in similar ways and the collective result of these processes are often not known before. Typical examples can be mass movements, trends and fads, as well as hypes and panics [Shiller 00]. The outcome can have a positive or a negative nature and frequently mass media even amplifies this process in many ways. Occasionally sensitive people or organizations make use of such an emergent phenomenon and profit from it by offering information, products or services for and during this process. Furthermore politics and corporations are often cautious about this social behavior, because it can change and influence political situations and markets in a rapid and unpredictable way (see [Le Bon 82], [Kindleberger 78], [Bonabeau 04]).

The actors of such extraordinary mass behavior are termed here as "Real Crowds". These are participants (agents) of a social contagion process where a self-enforcing movement leads to unexpected results. The agents may not act and behave rational, they behave irrational and "other directed" ([Schelling 78], [Pelzmann 00]). This means, they do not take decisions on the basis of facts and experience, but they rather observe and follow the behavior of others and "run after" them like herds. The best examples are fashion trends which are heavily "other directed" and can change quickly depending on a common "Zeitgeist". Self-enforcing is defined as the reciprocal observation and acting of agents which can lead to information cascades of misguided behavior [Bikhchandani et al. 98]. This spiral phenomenon is accompanied by "Positive feedback loops"[2] and "Path dependence"[3] mechanisms where small changes at the beginning can lead to unpredictable outcomes at the end.

Additional examples of "Real Crowds" are overheated finance bubbles and their inevitable bursts [Kindleberger 78], the Internet hype in 2000, pop stars and commercial blockbusters like the book Harry Potter or Apple's Smartphone called iPhone.

Although the emergent behavior of these social interactions varies from case to case, the overall development shows similar patterns and phases. An idealized

[2] Positive feedback loops are circular loops with no setback and which can act self-enforcing with exponential output ([Arthur 94], [Ossimitz and Lapp 06]).

[3] Path dependence is a past dependency, some random events, a customer grove-in or an early advantage of a product which can lead to market dominance [Arthur 94].

development model of the "Real Crowds" can illustrate the typical phases of these phenomena.

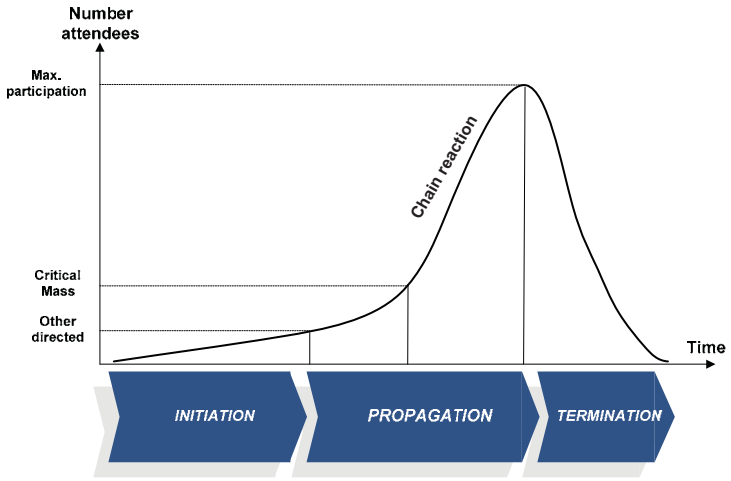

Figure 1: Idealized social contagion model of the "Real Crowds"

Figure 1 shows the most important phases of the social contagion process and their development, based on the number of new affected agents (in-flow). The first phase, called **"Initiation"** is triggered by some psychological attractors who focus the audience on some event or environmental change. It might be some cutting-edge technology, innovation or displacement in the social or economic world for instance. If the attention of the audience becomes keener then the psychological catalysts like media, opinion leaders, the government and others step in and accelerate the activation of these agents (initiated agents). Normally there are some additional restrictions in the general environment like limited knowledge of the targeted situation, uncertainty or some instability in the social relationship and the process starts to grow.

Those agents that are already involved, as well as new agents tend to step into the following phase termed **"Propagation"**. People evaluate the potential risks by observing involved agents and start to ignore facts more and more by imitating the actions they notice by others ("other directedness"[4]). The more agents are acting like this, the more will follow and take decisions based on others: The social contagion is started [Pelzmann 00]. But not all agents behave the same; it is the dominance of the super spreaders like trend setters, opinion leaders and pioneers who serve as an object for imitation at first, however later on more and more ordinary peers are imitated as well. This process could still drain or get stabilized by some external influence, however if the crowd grows and reaches the important point of **"Critical mass"**[5], the phenomenon may not be stopped any longer. When exceeding this threshold of "mind

[4] The behavior of "other directedness" is also known in the fauna, e.g. "Cleaner fish" are selected by clients by observing the choice of other clients [Bshary and Grutter 06].
[5] The term "Critical mass" was coined in nuclear chain reaction processes.

infected" agents, the whole process turns into a self-enforcing chain reaction of imitating agents. The emerging "Positive feedback loops" additionally boost the reactions and "Path dependence" factors start to become effective. At this stage the process can be compared with some nuclear chain reaction of colliding neutrons or some infectious diseases where a virus spreads through exposure with others. In this stage the "Real Crowds" are fully developed and spread rate can reach exponential increase. Because of this overreaction, it can produce irrational behaviors which are not foreseen nor are the consequences known.

Each of those overheated "Real Crowds" end up at some point of time; it is just a question when and how. Typically, if all energy of the drivers is burned out, the process dramatically swaps to the final phase called **"Termination"**. In this phase the euphoria breaks off and panic may step in. Sometimes the agents can save themselves and a controlled exit is feasible, but many times it is a crash which ends up the irrational exuberance. The best known and investigated examples for such social contagion processes are the finance markets with their booms and their crashes signifying the "Termination" phase (see [Kindleberger 78], [Shiller 00])

3 A simplified model of "Online Crowds"

More and more users are populating the World Wide Web and they have accepted this virtual space as a part of their personal living. It is used as a coexisting environment for everyday tasks, like communicating and collaborating with friends, colleagues or business partners, for e-Commerce, e-Learning and e-Government or just for fun and entertainment.

With this new medium, the old limits of time and space do not exist any longer. People can inform and communicate with others, hence ideas and messages can be spread within seconds all over the world. Even more, the nature of digital content assist the "copy cat effect" [Bonabeau 04] and concepts like "Creative Commons"[6] stimulate the imitation nature of humans and the economical model of increasing returns[7]. Moreover, new computer techniques like information retrieval, collaborative filtering and personalization technology support online users in their information gathering and utilization process. So social software like Wiki's, social tagging and web logs are offering information and opinions directly and unfiltered to a broad audience, giving prior unknown communities a voice or breaking down established institutions (see [Hof 05]).

The leverage lies in the effect of the "Online Crowds" which acts behind the scene as facilitator of these Internet phenomena. The origin of the "Online Crowds" can be found in the laws and mechanisms of the "Real Crowds", but varies in speed, size and scope. Every day new online services are published and others disappear from the online space. New technologies like Web 2.0 are emerging and offering ordinary online users an easy "click-and-go" way to make their ideas and activities

6 Creative Commons: Share, reuse, and remix — legally, http://www.creative-commons.org/

7 Increasing returns: Instead of classical economic theory of perfect markets with returns (e.g., profits) that decrease and tend toward equilibrium, "increasing returns" offer several unpredictable equilibria but can scale dramatically in growth and range [Arthur 94].

work [Rollett et al. 07]. In addition online users are overloaded with web information and they are searching for orientation and affiliation.

Sensitive business actors and innovators have recognized this emerging trend and took the advantage on their side. They set up online platforms where seeking online users can flock together in order to cultivate their social ties and lifestyle. Spectacular examples are Google.com, eBay.com, MySpace.com, YouTube.com and many more. Some of them evolved by luck and coincidence, but some others knew how to design "Online Crowds" readiness. They noticed the new laws of the "Online Crowds" as an enhancement of the "Real Crowds" because of the supporting network effects of the Internet.

Transforming the building blocks of the Real Crowds into the Internet, there are three major phases of an "Online Crowd" development process (Figure 2). One can recognize that the first two are identical with the "Real Crowds", but the model is extended with a third one called the "Amplification". "Online Crowds" can possibly emerge if an online service or an Internet phenomenon endorses the following phases, but they are not completely sufficient:

- *Initiation (best content):* Similar to "Real Crowds" psychological attractors are needed, so that many get noticed about the service. The most important factor of this phase is the valuable content. Without any useful seed content or attractor nobody will be willing to spend time on the online service, neither will he or she come back. Some years ago there was the slogan "Content is king", but this is here only partially true. Additionally usability and simplicity of the user interface are essential to open the online service to interested visitors.
- *Propagation (best members):* In this phase users start to populate the online platform and the decision on whether somebody else is joining depends on the existing members. The phase transition is triggered by the "other directedness" threshold. So the most important factors in this phase are the best active "core members" who are attracting others. Moreover they deliver new content (user generated content), minimize risk for others (trust) and assist newcomers on daily problems on the platform (confidence). But the core members are not enough to grow big; the virtual word of mouth must spread further.
- *Amplification (best social facilitation):* In the last stage of growth it is important to offer the online agents not only a stable and scalable online platform, but also an environment where they can almost live their social lives. The phase transition is marked by reaching the "critical mass". Hence social facilitation features which support their daily practices and social behaviors are essential to keep the service expanding. The facilitation mechanisms can be divided into technical features like tagging, annotating, blogging, collaborating content and social features like adding collective context and emotion to the content. If available and applied, positive feedback loops and the path dependence become operative and the viral diffusion is fully accomplished.
- *Termination:* Last but not least there is also the final stage in which some online services end or break up. Normally this happens because of saturation

or a substitution with a new service or because the hype evaporates and the agents hop off or switch to another trend.

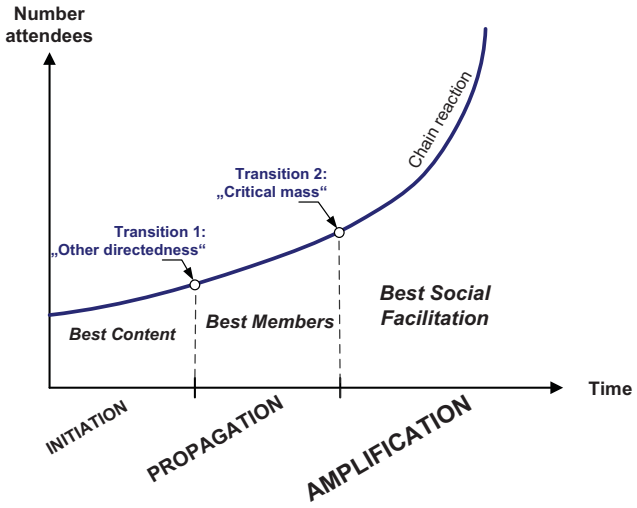

Figure 2: Simplified phase model of "Online Crowds"[8]

So the structure of social networks and the Internet are excellent surroundings to foster the emergence of "Online Crowds". For sure not all presented amplification effects are cumulated 100%, there are also attrition rates and forces that countervail the leveraging effect [Dodds et al. 03]. But this generalized model could help to reinterpret some Internet phenomena seen over the last years and could outline a bit more what is happening behind the scenes.

4 Consequences and changes for online business models

Earlier online business models relied on a classical supplier and consumer relationship where online users consume products and services of an online company. These business models normally can not scale beyond phase two (Propagation) of Figure 2, because it is limited to the number of customers power 2 (N^2). If online ideas are focusing on new types of businesses, which involve the customer more directly into the sales and the value adding processes, then C2C and P2P models are the right choice. In this case phase three (Amplification) is capable to enhance the online business and improve valorization dramatically.

Therefore an "Epidemic Online Model" (EOM) is introduced, which is based on the "User centric innovation" concept of [Hippel 05], where the user himself plays the role of consumer, innovator and producer (co-creator) of the business. Here this concept is extended to the needs of the online world with their digital assets.

[8] The "Termination" phase, which is less important at this point, is dimmed out for now.

Like presented in Figure 3 there are two main components in the EOM which feed each other and speed up the growth process (reciprocal acceleration by contagion):

- *New and existing content:* Existing content can be consumed by the present users and can attract new users who contribute additional ideas and content.
- *New and existing users:* On the other side, existing users can create new content, connecting existing user and content, as well as attract new users.

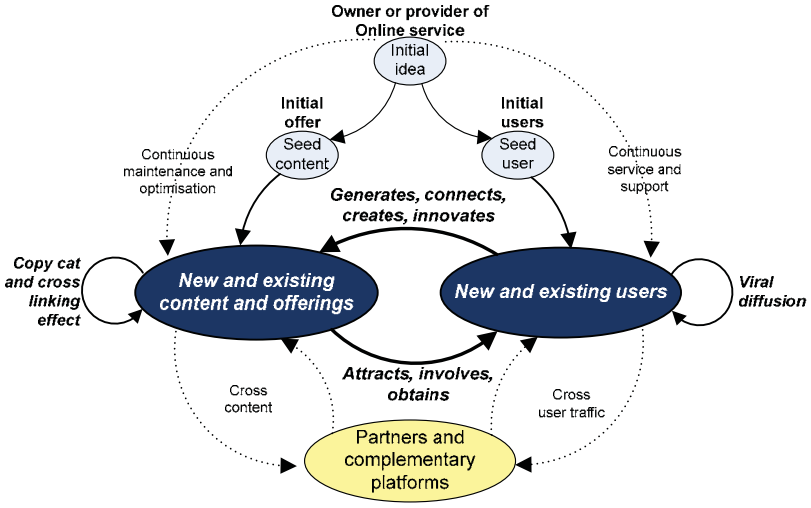

Figure 3: The "Epidemic Online Model" as a driver of online business models[9]

Moreover, at the "Initiation" phase some kind of seed is needed, which helps to start up the spin and can be separated into the two areas:

- *Seed content:* The seed content attracts the first users (early adopters) and stimulates them to produce further content and activity.
- *Seed users:* The initial agents can be seen as pilot or beta users, who verify the functioning and the usability of the system. In addition they signalize safety for successors, because they minimize the risk for late adopters and doubters.

Furthermore for many online ideas it makes sense to think about syndication and integration of content and services from partners and complementary online platforms. Current Web 2.0 technologies help to foster and resolve this attempt in a promising way [Rollett et al. 07]. This amplifies once again the number of users and the evolving value which increases the overall business value of the system. All in all the online models must change from a push concept, like typical online shops to a pull concept, driven by the self enforcing undertow of the "Online Crowds".

A vivid example is the online auctioning system eBay. It started as small online marketplace for used goods and grew dramatically because eBay offered online users

[9] Basic concepts of Causual Loop Diagramms based on [Ossimitz and Lapp 06] are used.

a platform to deal and sell in a C2C style. eBay was only the enabler of interaction and collaboration for their communities, who "reproduced" themselves with content and new participants. Additionally psychological attractors like the auctioning concept, fast auction profits and extraordinary auction stories initiated and resumed the hype.

5 Chances and challenges of "Online Crowds"

New and emerging phenomena create opportunities as well as challenges for the society, for the government and for the business world. As discussed in the previous chapter, "Online Crowds" can accelerate a business and generate remarkable online growth rates. But on the other side, uncontrolled and elusive online phenomena can create Internet fads, rumors, misguided collective behavior and forces which also influence everyone's daily life [Shiller 00].

Some opportunities of Online Crowds (OC):

- Applied on appropriate online business models they can increase usage, publicity and size of the service.
- Even if products or services are not clearly block busters at the beginning, OC can initiate and facilitate buzz on them.
- OC can build up emerging online platforms with high traffic without big marketing budgets; minimizing costs for content and customer support because of some kind of self-organization.
- OC are promising applications and research domains for the next generation of "Social Software", recommender technologies and personalization.

As mentioned in the last items, OC open new potential on the technical utilization of their behaviors. As people tend to make decisions based on others, this knowledge can be used to better design interactive selling tools ([Adomavicius and Tuzhilin 05]) which can benefit from the "collective patterns of the crowds". The future of proactive and more intelligent online sales systems for products and services will supply hybrid recommendation technologies, offering online customers advise and help during the whole purchase process. Combinations of content-based, user-based [Zanker et al. 07] and knowledge-based [Felfernig et al. 06] reasoning systems will help to better fulfill the customers' requirements and ease the maintenance of the sales systems themselves [Burke 02]. Furthermore Folksonomies[10] and social ontologies can help to improve product categorization- and description tasks [Rollett et al. 07]. In all these areas "Online Crowds" can provide useful and aggregated sales-, behavioral- and customer related data. If accessible and canalized in an appropriate way this can be valuable knowledge created by the collective "intelligence" of the crowd.

[10] Folksonomies are evolving superimposed structures which are created collectively by online users e.g. with social tagging [Rollett et al. 07].

Some challenges and perils of "Online Crowds" are:

- Misguided online bubbles and fads, initiated by dubious initiators
- Susceptibility of online users to follow trends and phenomena which are disadvantageous for themselves
- Misuse and intrusion of user privacy because of careless "Online Crowds"
- Simulated pseudo-democracy and mob behavior on the Web

The listed shortcomings are becoming more and more evident these days. "Online Crowds" are hard to predict and even harder to control if they are fully developed. So anti-democratic movements, cyber-crime, character assassination in politics and business are already present in the online space [Groebel et al. 01]. In some cases the "collective intelligence" seems to end up in irrational exuberance and misguided results. Moreover intensive user-tracking and profiling is performed by leading online enterprises without any objections of the affected online users. It is absolutely open what will happen with this sensitive information in the future. Indicating examples are global search engines and their privacy philosophies [Russ 07].

6 Related Work and Conclusion

Mass phenomena are nothing new, they have already been investigated in the 19th century by scientists like [Le Bon 82] and in the last century by [Drucker 87] and others. This sociological research concentrated on individual and collective behavior, political movements and protest waves. The origin of this research can be found in the social psychology and the crowd research [Marx and McAdam 94].

The differences today are mainly the quality and the speed how collective behavior emerges. The Internet and the attached properties like speed, real-time, virtuality, interactivity, duplication and low communication cost help to grow such phenomena in a much more aggressive and unpredictable way [Bonabeau 04].

One facet of this topic is discussed by many researchers who work on building strategies of online communities. They mainly try to identify the interrelationship of users and contextual characteristics which facilitate this process [Preece 01]. But normally communities grow more slowly and are more predictable than Online Crowds. Another view on crowds was defined by [Henein and White 06] with the "Swarm Information Model", which focuses on intrinsic factors of individuals as main drivers of simple crowds effects.

Agent based systems and virtual crowd simulations are additional fields which share some similarities with "Online Crowds". In detail, the structure of crowd phenomena and their composition, as well as its visualization, are research topics in this area [Goldstone and Janssen 05], [Pettre et al. 06]. Positive as well as negative effects of self-structuring social organization through technology mediated behavior are discussed by [Rheingold 03] and others.

This paper presented an interdisciplinary approach how some "social contagion" and extraordinary mass phenomena can emerge on the Internet. Based on the concepts and theories of the crowd psychology (Real Crowds) a model of "Online Crowds" has been developed. Real people as well as online users take decisions based on the rationale of others (other directedness), if the situation is unpredictable or new. Because communication and collaboration technologies of the Internet are fertile

environments to develop extraordinary waves of collective behavior, it can sometimes end up in irrational herd behavior [Huang and Chen 06].

Based on this knowledge it is possible to design and set up new online business models which increase the user traffic as well as the profitability of online ideas. The "Epidemic Online Model" may help C2C-, P2P- and related platforms to build up online inductees in an economical and low cost way. This is also a chance for new and small innovators to take over market shares and to outdate today's online giants of the Web if they facilitate "Online Crowd"-enabled strategies.

For sure the model is only a simplified approach to tackle the complexity of a multi-dimensional social phenomenon and more work has to be done to validate this concept. In particular the question about computability of the "Critical mass" still remains open and a mathematical tool set to predict the probability of prevailing online ideas is far away from being available. Consequently additional research has to be done on the factors to ensure sustainability and robustness of an "Online Crowd" over some time. Finally it has to be clarified, whether the suggested model is also applicable on other NMT like mobile, digital TV and so forth. This remains to be done in future work.

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