A Conceptual Framework for Viral Marketing

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Abstract

This research seeks to temper the enthusiasm surrounding viral marketing by claiming that there is no such thing as a pure viral marketing campaign and that the successes of many campaigns labeled ‘viral’ are due to many factors including traditional mass communication. The article presents a conceptual framework for viral marketing, inspired by epidemic modeling and the theory of branching processes, that enables a campaign to be separated into its viral and non-viral components. We then introduce a mathematical model for the viral process and develop three campaign performance metrics: overall campaign performance (reach), the dynamic performance of the viral component (dynamic criticality) and performance of the viral component relative to the non-viral component of the campaign (relative viral reach).
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Introduction

Bampo et al. (2008) focused on the effects of the digital network on the performance of viral marketing campaigns and demonstrated that the viral propagation process can be successfully modeled. However, researchers have yet to examine the fundamentals of the viral marketing process nor attempted to develop a mathematical model of the viral propagation mechanism. This study therefore seeks to develop a set of analytical tools that can be used in setting campaign objectives and budgets, to track campaign performance, to facilitate scenario testing (before or during a campaign), to provide diagnostic feedback in the early stages of a campaign and to guide intervention strategies and to be used in post-campaign evaluation.

This paper begins by introducing a conceptual framework that defines viral marketing and describes the viral and non-viral components. We then posit a mathematical model to characterise the viral marketing propagation process. Next, we present three metrics to measure viral marketing campaign performance. Finally, we consider both managerial and theory-building implications of our approach, and outline directions for future research.

Literature Review

The ‘discovery’ of viral marketing in the mid-1990s (Kaikati and Kaikati, 2004) captured the imagination of the industry and subsequently generated an array of monikers (“word-of-web”, “word-of-mouse”, “customer-to-customer” [C2C] or “peer-to-peer” [P2P] communication and “buzz marketing”). The term ‘viral’ arose from medical and health sciences literature (e.g. Mather, 2000), and is an apt metaphor for a marketing activity that encourages individuals to propagate a marketing message within their network(s), and thereby exponentially increase the potential reach of the message. Viral marketing is generally agreed to involve spreading a marketing message via ‘word of mouse’ and ensuring that the receivers have the interest to pass along the message to their acquaintances (Kaikati and Kaikati, 2004, p. 4).

Viral marketing campaigns have both advantages and disadvantages, which differentiate the viral approach from other more conventional communication strategies. Compared to mass communication, a significant advantage for viral marketing is the ‘self selection’ process within the message, affecting how the message spreads. As there is a greater degree of creative license afforded through the message delivery medium that is more intimate and personalized, the message can be more targeted and this increases the likelihood of the message effectively reaching interested individuals (particularly “hard-to-get” audience members) and reducing the likelihood of the message being spread to uninterested individuals. Whereas mass communication messages need to ensure that they are interesting, yet not offensive to the broader community, viral messages can afford to be provocative, sharper, edgier and even perhaps “darker”.

A digital viral process also increases the speed with which the message is disseminated and maintains the integrity of the message. Additionally, a receiver of a message is more likely to be amenable to the message because the sender of the message has implicitly endorsed the message by passing it on (Chiu et al., 2007). Whereas consumers are quick to delete messages from marketers, a message from a known person is less likely to be deleted (Phelps et al.,
2004), even if the sender is someone whom sociologist Mark Granovetter (1973) might call a ‘weak tie’. The level of trust in the relationship between the sender and the receiver transfers to the ‘advice’ that is being communicated in the form of the message (Keller, 2007). All of these factors combine to ensure that viral marketing can be highly cost effective. Quantifiably assessing the level of campaign success, through the behavioral responses, is also potentially easier, particularly if there is an embedded call-to-action.

Despite all the inherent advantages associated with viral marketing, we contend that viral campaigns are not necessarily easier or more effective than traditional media and that they do in fact require a significant level of management. For example, messages with built-in incentives, such as coupons or competitions, can become too successful – by spreading beyond the anticipated pool of consumers, by continuing long after the incentive competition has ended, or in cases where consumer demand exceeds the anticipated supply of the new products or samples that a viral campaign might be promoting. Conversely, viral campaigns can lose momentum, and ‘die’ before reaching a significant proportion of the intended consumer audience. These are potentially instances where managers have not exercised control of the campaign, due, possibly, to the lack of appropriate metrics and analytical models. In a similar vein, viral campaigns that do not grow exponentially or die prematurely may ‘bubble along’ but have very little effect within the marketplace. Branching theorists (Harris, 1963; Athreya and Ney, 1972; Stewart, 1976; Bampo et al., 2008) have defined such movement patterns as listed above as super-critical (viral explosion), sub-critical (viral death) or critical (viral campaign maintained, but with little effect). By understanding the underlying factors that contribute to, and direct the above processes, marketing managers will be better able to manage their viral campaigns.

It is these top-down, market-initiated viral communications which are the subject of the present study. While there are, of course, bottom-up processes (often based on user generated content), word-of-mouth effects, and the synthesis between the two (Kirby, 2004), these aspects are beyond the scope of the present paper. Recent papers have also focused on the synergistic value in integrating online and offline marketing strategies (Graham and Havlena, 2007; Ewing, 2009). Instead, the focus of this paper is on firm-initiated marketing campaigns with an engineered viral component; that is where a marketing message, once seeded, is self-propagated by audience members.

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Defining the Viral Marketing Process

There are direct parallels between the customer-to-customer propagation of a marketing message with the transmission of a contagious disease through a population. As there is an extant rich body of literature on epidemic theory focusing on the transmission of viruses (Becker 1989; Fulford, Forrester, and Jones, 1997; Mather and Crofts, 1999) we begin by exploring the concepts used in epidemic theory that can be applied to a viral marketing context. We then introduce concepts that are specific to the digital viral marketing process. The commonly used terminology in epidemic theory to describe the transitional states of individuals as the contagion traverses the population of interest is ‘susceptible’, ‘infective’ and ‘immune’. Individuals are susceptible before receiving the virus, infective before passing it on, after which they are immune. This terminology carries directly over to a viral marketing context where a member of a target audience is initially susceptible (receptive) prior to
receiving the marketing message, infective (reached) upon receipt of the message and immune (removed) once they choose not play a further role in the transmission of the message or the campaign is terminated or expires.

Considering the transmission of the message from person to person through the life of the campaign, Bampo et al. (2008) used the concept of generations (rather than time), which is widely used in epidemic modeling, as a more appropriate index in a viral marketing context. For example, a lengthy campaign could be due to audience members taking a long time to pass the message on, rather than the message being passed on many times (generations). Thus, campaign duration is not necessarily an indicator of success. In viral contexts, the notion of generation better captures the transmission of the message from one individual to the next. Bampo et al. (2008) define generation by the number of transmissions required to reach a member along a chain of communication initiated by a single seed.

Let us now consider the parameters used to model the propagation process in epidemic theory, namely, the contagion parameter, the epidemic intensity and the epidemic threshold parameter. The contagion parameter \( p \) denotes the probability that an infective will transmit the virus. The epidemic intensity \( \lambda \) represents the average number of people reached, but not necessarily ‘infected’, as some may have been previously infected and are therefore immune. The product of these two parameters, \( p\lambda \) denotes the epidemic threshold parameter (ETP) and this parameter captures the progression of the epidemic by focusing on the ‘transmission’ (sending) of the contagion. Some of the epidemiology literature draws from the theory of branching processes (Becker, 1989) to describe the behavior of epidemics within a large population by defining it to be sub-critical (ETP < 1), super-critical (ETP > 1) and critical (ETP = 1).

Whilst there are many parallels between the modelling of epidemics and viral marketing there are also a number of fundamental differences: In a viral marketing context, the managerial objective is to facilitate the spread of the marketing message (contagion) among members of the target audience. Further, the efficacy of a viral marketing campaign can be assessed through the cost effectiveness of the campaign design and strategy that instigated the viral propagation thus focusing on the “contracting” (receiving) of the contagion. In order to develop a framework that encapsulates these differences, we now consider concepts that are specific to the viral marketing process.

Seeding

By definition, seeding is a non-viral activity that can happen through traditional or digital communication over the life of the campaign. If the seeding is carried out through a digital channel and the viral transmission mode adopted for the campaign is also digital, the campaign is designed to be purely digital. Whilst a campaign is always initiated by seeding, this does not preclude subsequent seeding. Seeding is a part of the campaign strategy and can be approached in two ways: first, selective seeding where the marketer explicitly identifies a select subset of the target audience (seeds), in accord with campaign strategy and communicates directly with that group in order to initiate the campaign; second, the marketer provides a platform for audience members to self-select as seeds and hence initiate the viral campaign. We refer to these two forms of seeding as marketer-selected seeding and self-selected seeding. In marketer-selected seeding, the selection is more strategic and influenced by marketing concepts such as ‘connectors’, ‘influentials’ and ‘market mavens’ (Gladwell, 2000). Self-selected seeding, whilst having the advantage of containing the campaign to the
target audience, has an extra element of uncertainty and therefore is more reliant on the platform having greater visibility in a traditional communication context.

A Mathematical Model

We now propose a mathematical model for the viral component of a campaign which captures the essence of the viral marketing phenomena in the case of marketer-selected seeding used to initiate the campaign only. This model is an adaptation of a deterministic model discussed by Frauenthal (1980, pp. 35–7). A version of the model also appears in Fulford, Forrester, and Jones (1997, pp. 164–9) and was used by Anderson and May (1982) in modeling measles epidemics. The model is defined by the following recurrence equation

\[ \pi_{g+1} = \min\{\mu \pi_g, 1\} \phi_g, \quad (g = 0, 1, 2, \ldots) \]

where the index denotes the number of generations following seeding, \( \pi_g \) denotes the proportion infected at the \( g \)th generation (so \( \pi_0 \) is the proportion seeded at the zeroth generation), \( \mu = p \lambda \) denotes the ETP, and \( \phi_g \) denotes the proportion susceptible at the \( g \)th generation. It follows immediately that

\[ \phi_g = 1 - \sum_{j=0}^{g} \pi_j. \]

The rationale for equation 1 is as follows: At generation \( g \) there are \( V_g \) infectives, each generating \( \mu \) transmissions, resulting in a total of \( \mu V_g \) transmissions. If this meets or exceeds the target population size (equivalently \( \mu \pi_g \geq 1 \)) then all remaining susceptibles will become infectives, and the process will terminate after generation \( g+1 \). Otherwise, the number of transmissions that result in infectives after generation \( g+1 \) should be (on average) proportional to the number of susceptibles remaining in the target population at generation \( g \).

Conceptually, there are two competing forces operating within the model. On the one hand, we have the number of transmissions growing at a rate of \( \mu \) per generation in the early stages of the process (when the remaining fraction of susceptibles is large). But in the “success” of this process lies its eventual demise, since the pool of susceptible members decreases in response to the “success”. This tension in the model is captured by the notion of dynamic criticality, which we now explain.

When \( \mu \pi_g < 1 \) for all \( g \) (the campaign never attains 100% reach) equation (1) can be rewritten:

\[ \frac{\pi_{g+1}}{\pi_g} = \mu \phi_g, \quad (g = 0, 1, 2, \ldots) \]

The behavior of the viral process is therefore dependent on the right-hand side of equation (3), which we term as the dynamic criticality, and denote by \( \psi_g \).

The proportion infective \( \{\pi_g\} \) will therefore grow provided \( \psi_g > 1 \). A necessary condition for this to occur is for the ETP, \( \mu \) to exceed 1. When this occurs, we refer to the viral campaign as being super-viral. Eventually though, a super-viral campaign will decline, once \( \psi_g < 1 \) (see below). In the case where \( \psi_0 < 1 \) (equivalently \( \pi_0 > 1-1/\mu \)), the number of infectives will decline at each generation. When \( \mu \leq 1 \), the percentage infective at each generation rapidly declines. When this occurs, we refer to the viral campaign as being sub-viral.

Now consider the case where \( \psi_0 > 1 \) and \( 1 < \mu \leq 2 \). Using Microsoft Excel it can be shown that the percentage of infectives will grow at each generation until it reaches a maximum and then
it will decay (once $\psi_g < 1$). The resultant reach of the target market exhibits an S-shaped curve. Eventually, the viral process $\{\pi_g\}$ decays at a geometric rate of order $\psi = \mu \phi$, where $\psi$ and $\phi$ are the corresponding limiting values in the series $\{\psi_g\}$ and $\{\phi_g\}$ as $g \to \infty$.

**Metrics for Measuring Campaign Performance**

Based on our conceptualization of the viral marketing process, and the mathematical model, we present three metrics for measuring campaign performance. First, the eventual reach of the target market (given by $1 - \phi$) which depends on both the ETP and the number of seeds. A highly successful viral marketing campaign would be characterised by achieving a high level of reach within the target market (Bampo et al., 2008). Second, in assessing the effectiveness of the strategies adopted in the campaign it is useful to measure the relative contribution of the viral and non-viral components. The Relative Viral Reach (RVR) is defined by

$$ \text{Relative Viral Reach (RVR)} = \frac{(1 - \phi) - \pi_0}{\pi_0}, $$

where the numerator represents the eventual proportion receiving the message through non-viral means, and the denominator is the non-viral proportion seeded. We advocate the use of the RVR in campaign objective setting. For example, an RVR objective may be that a campaign attains an RVR of 1.5 (i.e. the viral reach is 50% greater than non-viral reach).

Third, dynamic criticality is a relative performance measure. Beyond the initial value, $\psi_0$, it is entirely focused on the viral component of the campaign. The initial value is itself of interest as it indicates the efficacy of the seeding in establishing the first generation of the viral process. By monitoring dynamic criticality, the campaign manager can assess whether the campaign is retaining its momentum or waning, and perhaps in need of an injection of funds.

**Future Research**

Further research should include applying the mathematical model and metrics presented here to empirical viral marketing campaigns to demonstrate their utility to campaign managers. In addition, variants of the mathematical model should be developed to broaden the areas of application to self-selected seeding, and seeding that is dependent on campaign performance.

**References**


