

Critical Mass and Self-Sustaining Activity

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INTRODUCTION

Recent studies of community networks (CNs) have provided optimistic views of the potential of information and communication technology (ICT) to support and enhance community life in various ways, in a variety of urban settings (di Maggio, Hargittai, Neuman & Robinson, 2004; Hampton & Wellman, 2001; Kavanaugh & Patterson, 2001). Consequently, there is growing interest from the community sector and ICT professionals in facilitating the social appropriation of ICT, and a growing interest from academics in the performance and evaluation of CN technologies.

There are clearly many difficulties for community sector and IT practitioners in implementing a CN, and many complications for academics in understanding the nuances and implications of CN performance. One such difficulty is the extent of adoption and use of the CN, such that the interaction it supports becomes self-sustaining. Achieving a self-sustaining level of activity is obviously a key indicator that a network has been appropriated by a community, but is not as straightforward to achieve or to understand as it may at first seem. In this article, we use *critical mass* as a metaphor to explicate the contributing factors that underpin self-sustaining levels of CN activity. Critical mass and the sustainability of a CN are addressed through a case study of an Australian residential CN called *The Range*.

CRITICAL MASS

Many formalisms, theories and models have migrated from the Natural Sciences to take on new life in the Humanities. This reliance on nature to provide an explanation of society is sometimes literal (e.g., evolutionary psychology) but is more often metaphorical. Critical mass is a concept that has made this migration, and is now called upon to do explanatory work in the fields as diverse as software engineering, marketing, macroeco-

nomics and biology. The term was developed in nuclear physics to describe a situation in which a chain reaction is self-sustaining. In this case study, we use critical mass as a generative metaphor, rather than as a proximate cause, to understand the conditions under which participation in a CN might become self-sustaining.

The factors that contribute to self-sustaining atomic chain reactions are now well-known (though not easily achieved) and have been established empirically and theoretically through decades of experimental work, modelling, and abstraction from first principles. These factors include the mass of fissionable material available to the reaction, the shape of that material, its purity, its initial density, the geometry of the material's casing, and the casing's performance in absorbing or reflecting neutrons.

The factors that contribute to self-sustaining CNs are not well-known, and have not been established empirically or theoretically (Arnold, Gibbs & Wright, 2003). In a small move to redress this situation, we identify five factors that have contributed to low adoption rates of *The Range*. These factors are:

- a. The aggregation of users and of content;
- b. The affordances of networking technology;
- c. The shape of community and its relations;
- d. The response to community engineering; and
- e. The recognition of the technology.

Each of these factors offers a partial account for the low uptake of *The Range*, and we speculate that these same factors are also implicated in CNs that have achieved self-sustaining levels of activity (Arnold et al., 2003).

THE RANGE

Williams Bay is a housing development of 51 houses. It is part of a relatively new housing estate of several

hundred dwellings called The Rifle Range in northern Williamstown, an old, well-established, affluent suburb of Melbourne, Australia.

In 1998, The Stonehenge Group won a government tender to purchase and develop the Williams Bay parcel of land. Important in their bid for the land was a vision that ICT would play an increasingly prominent role in Australian residential and community development. Acting on this vision, Stonehenge developed and implemented The Range, a CN for the residents of Williams Bay and, shortly after, the whole of The Rifle Range estate.

On the face of it, there were good reasons to be optimistic about The Range's prospects for success (Arnold, 2003). The residents of the neighbourhood were generally well-educated, middle-class and typically had professional careers as "symbolic analysts" (Reich, 1991) and should have been "natural matches for online communities" (Rheingold, 2000, p. 46). In addition, Williams Bay was advertised and sold, in part, on the basis of the technology. Residents indicated on numerous occasions that community relations were important to them, and they expressed a generally positive view of the role The Range could play in fostering their local community. The property developer played the role of "product champions" (Rogers, 2003) and made concerted effort to promote, maintain and subsidize the technology. Finally, while Williams Bay and The Rifle Range are new housing developments, they are located within a suburb with a strong history of community interaction and identity. In all of the earlier mentioned, The Range fulfilled many criteria for successful community development using ICT (Pigg, 2001).

However, after nearly two years of operation, the online responses from residents to The Range were disappointing: interactions were concentrated among a handful of residents and traffic volumes were low and decreasing. Residents had taken few initiatives to commence online discussions, post announcements, form groups, and establish their own newsletters. Most of the functional capacity of the system remained unutilized, especially the capacity for residents to customize and shape the system to suit their own purposes. As 2003 ended, The Range, as a CN, was not self-sustaining.

ACCOUNTING FOR RATES OF ADOPTION

Our research indicates that five factors contributed to sub-critical levels of activity. These factors are discussed in the following sections.

The Network's Aggregation of Users and Content

C

A self-sustaining nuclear reaction cannot occur without a certain quantity of radioactive material, of certain purity, amassed in a certain concentration. Similarly, a self-sustaining CN cannot occur without a certain quantity of participation, and a certain quality of content, brought together on the site in a certain concentration. To bring together the requisite mass of participation, quality of experience, and concentrations of activity, The Range interpolates its community in geographic terms, defined by a boundary.

If the boundary is too large, quantities of network activity may also be large, but the "purity" of the CN may be lost. Two possibilities flow from this. Firstly, the larger scale of the network may lead to greater, total levels of participation, but an aggregation of people that is too disparate and diverse dilutes the "quality" of the network activity for all, and participation may decline to sub-critical levels over time. Secondly, the large but diverse aggregation may fracture into smaller, more cohesive clusters. More will be said about this shortly.

Alternatively, if the boundaries of the CN are drawn too tightly, the network will have severe difficulty in attaining and then maintaining the energy levels required to keep the site active, regardless of its purity. This problem was recognised early by Stonehenge when they expanded the "community catchment" zone from the 51 houses of Williams Bay, to the Rifle Range's several hundred adjoining households, then later to include the whole suburb of Williamstown.

At the time of writing, membership of The Range is steadily increasing, but an increase in the aggregate of potential participants is only part of the story. Key community groups—such as local scout troops, churches, schools, the police and sporting clubs—have been actively pursued and enrolled in the network. Over many decades, these community groups have developed strategies to bring and hold together their respective members. By drawing on these experienced and expert community networkers, The Range is increasing its quality, as well as its mass, and the interpolation of "community" by The Range now more closely follows the natural fault lines or contours of the community.

Determining where these contours lie can be very difficult. People living in the same district group and regroup in shifting aggregations on the grounds of locale, personal subjectivities, family traditions, perceived objective interests, occupation, gender, religious practice, socio-economic status, ethnicity, and so on. Self-sustaining community groups are able to reach into

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