Chapter 31
Methods for the Measurement and Visualization of Social Networks in Multi-User Virtual Worlds

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ABSTRACT

Virtual communities that allow many users to interact in a virtual world, often called multi-user virtual worlds (MUVWs), allow users to explore and navigate the virtual world as well as interact with other users. The communicative interaction within these virtual worlds is often text-based using Internet relay chat (IRC) and related systems. IRC has posed a difficulty for researchers looking to evaluate the interaction by analyzing and interpreting the communication since data is stored in the form of chatlogs. The current chapter explicates methodological procedures for the measurement and visualization of chat-based communicative interaction in MUVWs as social networks. A case study on an educational MUVW, the SciCentr programs sponsored by Cornell University, is used to elaborate methods and related findings.

INTRODUCTION

Although the graphical quality of MUVWs has been increasing in quality, and variety of applications that these worlds have been used for is rapidly expanding, the interaction within these virtual worlds has remained primarily Internet relay chat (IRC). There has been an increase in the use of Voice over IP (VoIP) in MUVWs, but the larger, community oriented MUVWs still use mainly IRC. Users generally appear as avatars (visual representation of an individual in-world) in the virtual worlds along with communicative fields, such as a text box where they can post comments and track the discussion of other users. Text boxes displaying IRC has been a successful tool at allowing for communicative interaction. However, IRC poses a difficulty for researchers seeking to analyze and interpret the communicative interaction since data is stored in the form of chatlogs that can often be in the thousands of pages. The current chapter discusses and applies methodological procedures for the representation and analysis of chat interaction in MUVWs as

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social networks. Literature on the social network approach to human communication is presented followed by a discussion of virtual worlds for education. A review of parallel methodological techniques leads to the elaboration of methods proposed in the current chapter. A case study on two project worlds from the SciCentr program is used to elaborate methods and related findings. Finally, research limitations and future research possibilities are offered.

BACKGROUND

The Social Network Approach

Social network perspectives focus on the structure of social systems and how the elements of a social system come together. Individual characteristics are only part of the story, the people influence each other, and ideas and materials flow throughout the network. From the network perspective, the social environment can be expressed as patterns or regularities in relationships among interacting units. These patterns are often called structure. The current section elaborates some of the network concepts and terminology used in the subsequent methods for the analysis of MUVWs.

The form of social network that will be utilized in this chapter is a communication network, defined as the patterns of contact that are created by the flow of messages among communicators through time and space (see Monge & Contractor, 2003; Rogers & Kincaid, 1981). Communication network analysis identifies the communication flow, or communication structure. Relation ties (linkages) between actors are channels for the transfer (flow) of either material or nonmaterial resources, or for an association between actors, such as a friendship tie. The ties that exist between the nodes can vary along several elements, including strength, direction, and reciprocity.

Links between actors can be measured as being either non-directional or directional. If the link is directional but there is not the same value of relation the link is asymmetrical and lacks reciprocity. Non-directional links simply indicate an association of two actors in a shared partnership, such as two students being part of the same class. Links that are directional indicate the movement from one point to another, such as the number of phone calls one person makes to another, or the degree of liking one person has for another. Additionally, these links can also be symmetrical or asymmetrical. There are several measures of how connected individual nodes are, as well as how connected the entire network is, discussed below

Degree Centrality

The degree measure of centrality is calculated by counting the number of adjacent links to or from an actor in a network (Brass & Burkhardt, 1992). Freeman (1979) conceptualized this measure as an indicator of individual activity, representing the number of alternatives available to an individual in the network.

Degree centrality may also be appropriate for capturing such power-enhancing behaviors that happen via direct interaction, such as integration and reciprocation. Likewise, degree centrality can also indicate other direct interactions such as coalitions and the avoidance of relying on mediating actors for indirect access to resources (Brass & Burkhardt, 1992). While a relatively straightforward measure, degree centrality provides insight into individual contributions to the interconnectedness of the overall network (Rogers & Kincaid, 1981).

Strength of Ties

Strength of the ties between actors, indicating quantity of the relation, can vary greatly and has profound impact of the nature of the network. Strength of the tie can be measured as dichotomous, indicating simply the presence or absence of a link, or valued, indicating the degree of the