Designing Virtual Organizations for Citizen Science

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1 Introduction

Ubiquitous computing technologies have enabled new options for distributed collaboration. A variety of phenomena that can be loosely described as massive virtual collaboration (e.g., social networking, open source software development, Wikipedia) prompt us to consider the potential of virtual organizations (VOs) for supporting large-scale, distributed and heterogeneous participation in scientific projects.

Citizen science is a phenomenon with this potential; the term refers to research projects involving "partnerships between volunteers and scientists that answer real-world questions"[1] (Clark & Illman 2001, Cohn 2008, Bonney & LaBranche 2004). Citizen science is related to long-standing programs employing volunteer monitoring for natural resource management (Cooper, Dickinson, Phillips & Bonney 2007). Informal science education is often a primary goal (Brossard, Lewenstein, R. & Bonney 2005), but citizen science projects are increasingly focused on benefits to the scientific research as well (Bonney & LaBranche 2004).The evidence is clear that in the right circumstances, citizen science can work on a massive scale and is capable of producing high quality data (Brewer 2002, Trumbull, Bonney, Bascom & Cabral 2000, Fore, Paulsen & O'Laughlin 2001) as well as unexpected insights and innovations.

This abstract presents a design-oriented conceptual model of massive virtual collaboration for scientific knowledge production. The model contributes a multi-level framework for organizing investigation into organizational, task, and technology design in citizen science VOs.

2 Conceptual Model

The preliminary framework for our study conceptualizes citizen science projects as a work team. Adopting this perspective allows us to draw from the extensive research on small groups for a theoretical starting point. Our initial conceptual framework incorporates concepts and relationships from the literature on organizational design, job design, volunteerism and virtual communities, at both individual and organizational/project levels. Figure 1 shows the initial version of our framework, organized as an input-mediator-output-input (IMOI) model (Ilgen, Hollenbeck, Johnson & Jundt 2005).

[1] from Citizen Science Central, http://www.birds.cornell.edu/citscitoolkit/

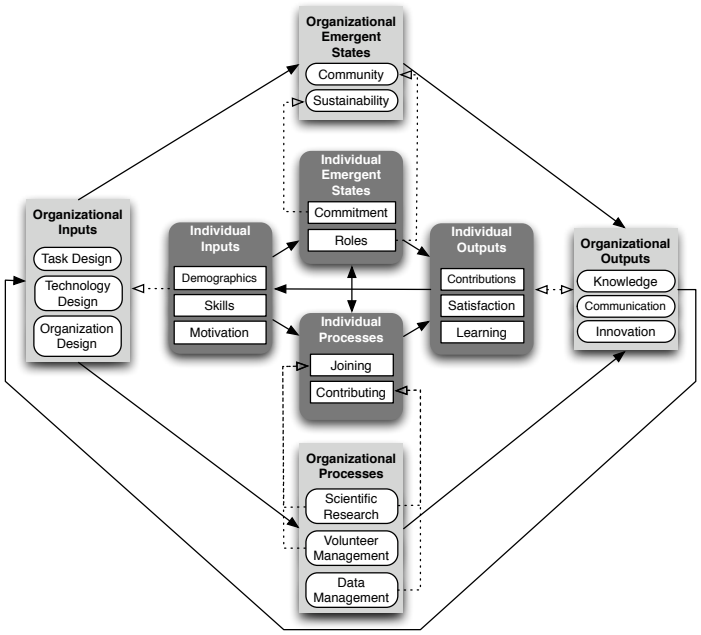

Figure 1: A conceptual model of citizen science virtual organizations.

Inputs Inputs are the starting conditions of a project; they include individuals, who bring diversity in demographics, skills, and motivations for participation (Pearce 1993). Organizational design is interrelated with task design, which encompasses research design for the study, job design for volunteers and staff, and task design in the form of protocols, which require careful attention for valid scientific results (Cohn 2008). Finally, technology design examines the cyberinfrastructure to support citizen science VOs

Processes Processes are dynamic interactions among group members leading to outputs. In this context, processes engaging volunteers can vary widely, and the organizational processes for scientific research and data management gain new salience with volunteer involvement. An unusual aspect of this context is the direct applicability of volunteer management processes often associated with nonprofit management.

Emergent States Potentially relevant emergent states include task-related factors affecting the scientific task, as well as social states of the group that enable their efforts (Lee, Dourish & Mark 2006, Markus, Manville & Agres 2000). At the individual level, the movement of volunteers through different roles in the group is relevant to organizational design. A related concern is volunteers' level of commitment, and its influence on task performance (Cnaan & Cascio 1999).

Outputs Finally, outputs represent task and non-task consequences of group activities, signaling effectiveness. Individual task outputs are contributions, while project level task outputs include the scientific knowledge created from the data. Effective groups also produce non-task outputs, such as individuals' satisfaction and project innovations.

3 Conclusion and Future Work

Synthesizing elements of prior research provides a theoretical foundation for further study of citizen science VOs, but several differences in context, particularly the potential for large-scale participation, suggests the need to both validate the applicability of this body of theory and consider extensions. This model is currently in use for an exploratory study, which has confirmed the relevance of the organizational inputs and processes identified in our model.

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