A Short History of Group Informatics

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ONTOLOGY

There are two ontological constructs that are referenced in our description of Group Informatics. First, the groups that form in these asynchronous environments are referred to as *small, naturally asynchronous groups* (SNAGs) to distinguish them from previous conceptualizations of physical groups, such as distributed teams, virtual organizations, distance work and computer supported cooperative work, broadly defined. The term SNAG reflects the unmet challenge of integrating qualitative and quantitative modeling to understand how interaction, leadership and social structure are represented in electronic trace data. [1; 3; 4; 6; 8-16; 24-28; 32-35; 39-41; 41-53; 55-59].

Second, we refer to the online contexts in which SNAG's interact as *socio-technical interaction places* (STIPs). A STIP is any system where people interact as groups, for a specific purpose and mediate consistent and meaningful aspects of their activity through technology that generates electronic trace data. Many STIPs create electronic trace data without reference to how these logs might be applied to represent group leadership, emergence or development, but for keeping track of basic notions of interactivity. Such logs can be conceptualized as log files, with records of interaction that include at least an actor, an artifact and a timestamp. Our Group Informatics methodological approach systematically allows for the analysis of raw log data from a STIP. The Group Informatics model is a component of the overall Group Informatics methodological approach.

FOUR PHASES: A PATH, NOT A PLAN

Our work analyzing electronic trace data includes contexts of online learning, software engineering, online political discourse, disaster relief and recreational sports discussion forums. Each empirical paper bridges electronic trace data with qualitative data analysis and demonstrate how online interactions are fundamentally different than physical interactions. The empirical foundation of Group Informatics has evolved through four phases, which we describe next.

Phase One

Phase one of our work originates with analysis of how users in an online course used daily digests of course activity, something we refer to as a "Context Aware Notification System" (CANS) [2]. Our first paper [18] reports on a qualitative study of the relationship between information foraging and group size in completely online graduate level courses. This analysis inspired questions at the small group unit of analysis, which we further developed by considering how Stahl's work on Group Cognition [54] could be applied to asynchronous small groups, which we now conceptualize as SNAGs.

Phase Two

In the second phase, we performed an in depth qualitative research study of a single small group in a completely online course. In the first paper in this phase we describe how a single small group develops a sense of groupness that is significantly influenced by the prior completely online group experiences of its members [21]. Participants in online groups are especially influenced by poor experiences in prior online group collaboration. The salience of poor group experiences led to our application of a construct called social ability, [31] to help frame a group's overall capacity to behave socially online [20]. Social ability presents the intersection of tools, tasks and technologies as a framework for understanding a group member's inclination to interact

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with others online. In the second phase, we make a fundamental shift towards viewing SNAGs as a unique, powerful new form of social organization instead of disadvantaged distortions of long standing social structures [7].

At the end of phase two, we experimented with data mining techniques including cluster and associative algorithms, as well as network analytic techniques to identify group behavior using electronic trace data alone. Our work integrated qualitative data analysis with each analytical approach, and we concluded that network analytic techniques provided the most insight in small group analyses, primarily because network analysis reveals whom the non-central, but significant actors are [23]. We then revisited the online course where we studied a single small group during phase one. Using social network analysis in concert with a first model of Group Informatics [22] we discovered patterns of leadership and group emergence with different collections of people and at different times throughout the course.

As happened in our studies leading to the development of a more scalable methodological approach, other information scientists describe difficulty understanding small groups that emerge in technologically mediated settings. Miksa et al. [38], for example, demonstrate a facet analysis system for identification of metrics of interaction in online learning. Their measure, called FIT, includes frequency, intensity and topicality indicators for online course participation. They applied FIT to eight different courses in an online learning system at Florida State University, and demonstrated contrasts in all three dimensions across the courses, but as with ethnomethodological approaches, found the research process labor intensive and unscalable. They conclude with a call for more systematic mechanisms for coding and quantifying online courses across a range of institutional and pedagogical boundaries.

We systematically integrated qualitative data with electronic trace data at the end of phase two. We transcribed and organized interview data according to group membership and connected member's reports on their identities with measures of group effectiveness, knowledge construction and information behavior. This qualitative data is used to inform our weighting of connections among group members in the electronic trace data produced by the STIP. Our weighting in phase two includes use of time decaying strategies – with less timely posts receiving a much lower connection weight – to reflect what we learned about member interaction practices. For example, we learned that any post made more than three to four days following the original post in this context represented a much weaker, "catch up connection". Our empirical work shows these connections to be much weaker than others.

Phase Three

We describe the context aware notification system and our work analyzing electronic trace data as a design focused approach to understanding SNAGs, framing the inquiry as design based research [30] to launch the third phase. Our design based research frame treats logging as a tool that can be used later to design awareness oriented interventions in the socio-technical experience of groups in the STIP. Next, we conduct a new study of a different completely online course, where we gather data to understand how users experience the transition from different forms of online social organization (individual, peer to peer and small group) in an online course [19]. We delivered and operated a systematic data warehouse and analytical system for understanding technologically mediated small groups at the end of phase three. The data warehouse and analytical system integrate electronic trace data with qualitative data. We then apply our system to a variety of contexts and technologies, including online political discourse on Facebook [35-37], open source and industrial software engineering practice [5] and disaster relief on government sponsored discussion forums [17].

Phase Four

The fourth phase is under way. We are now building standardized models and analytical frameworks for understanding groups across contexts more systematically, and are sharing the

methods and tools developed with other researchers to enable comparisons across socio-technical contexts. This is the Group Informatics methodological approach and it is generating new measures, including proximity [5] and lurking knowledge construction [19] that are based on a combination of qualitative data analysis and established SNA measures [22]. Group Informatics is framed for information scientists as a methodological approach for inquiry into SNAGs and STIPs.

Kling & Courtright [29] describe online community as an aspirational construct. Analysis of online communities has been correspondingly aspirational, and based on theory and practice from decades of research on physically situated groups. Group Informatics works toward models and representations of technologically mediated interaction that reflect the new, emergent forms of social organization embodied by SNAGs. We use models to represent how SNAGs are *experienced* through technology. We illustrate that identifying SNAGs from electronic trace data requires the development of new conceptual models that can then be implemented through a systematic, methodological approach that combines existing qualitative and quantitative methods with modeling.

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