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Determining the Role of Geospatial Technologies for Stigmergic Coordination in Situation Management: Implications of the wireless grid

By Janet Marsden

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What is Stigmergy?[1]

In its most generic formulation, stigmergy or sematectonic coordination is the phenomenon of indirect communication mediated by modifications of the environment. Although first described in observations of animal behavior, human stigmergic collaboration in open source software development and other contexts has been described. Stigmergic or sematectonic coordination refers to how an individual behaves as part of a collaborative team engaged in a complex task, such as emergency response (i.e. where the task is of such complexity that a coordinated team effort is required to accomplish it). Human stigmergic coordination emerges on the basis of how tasks and goals are structured and understood between the members of the team.

Socio-Technical Systems Model of Virtual Coordination[2]

Social Factors	Definition
Trust	the willingness of a party to be vulnerable to the actions of another party irrespective of the ability to monitor or control that other party"
Leadership	ability of a person or persons to promote and engage in practices that establish team norms, facilitate relationship building and develop trust.
Collaborative Learning	the ability of a group to engage actively in a discovery process and collaboratively construct meaningful and worthwhile knowledge
Social System	The way in which individual members within an organization relate to each other and to the organization as a whole.
Culture	The collective programming of the mind common among groups of people that *creates context*, facilitates communication and knowledge sharing, and which distinguishes one group or category of people from another.
Motivation	The factor leading people to engage in a particular behavior
Social Presence	the extent to which one feels present in the mediated environment, rather than in one's immediate physical environment
Technical Factors	**Definition**
Digital Literacy	Individuals' ability to recognize when information is needed and to locate, evaluate, and use it effectively via digital technology.
Support Technologies	Technologies that provide a mediated environment for shared activities
Technology Scaffolding	Training method based on engaging trainees in a task above their skill level with demonstration and help when necessary
Accessibility	Cyberinfrastructure designed to provide access to information, resources and other people to a geographically distributed group

Remote Sensing and Virtual Collaboration

Theory and Methodology

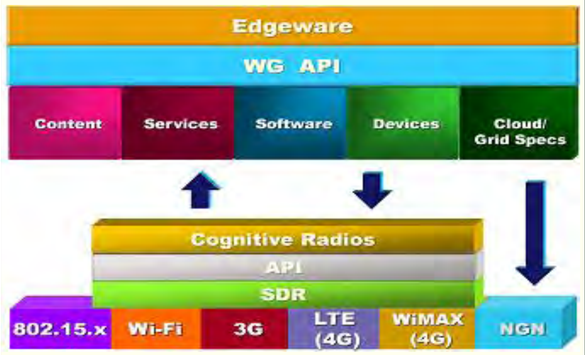
The theoretical foundation is based on activity theory for system design as discussed by Kuutti and Nardi, and further explained by Odum and Grasse's [7] work on spontaneous and unplanned yet purposeful coordination in biology (sematectonic communication or stigmergy). Polanyi's theories of tacit and explicit knowledge creation and transmutation, internally and externally through learning, experience and collaboration form the basis for understanding how knowledge is generated through action. Collaborative activity operates as a medium for collaborative knowledge creation in context. Geospatial technologies provide an interactive visual representation of the dynamic, complex situation environment, thereby becoming the context for virtual collaboration [8]. Social networking and telecommunications media, deployed using the wireless grids technology, enhance intrinsically human coordination skills and attributes to significantly improve team response and effectiveness. Strong digital literacy and spatial thinking skills, an important and necessary component of training, form a significant part of the gateway for comprehension and coordinated participation in complex, dynamic situations [2].

Virtual Collaboration and the Wireless Grid

Method: Critical Incident Technique [4]

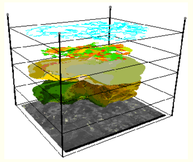
Critical incident technique (CIT) is a set of procedures used to identify and analyze critical incidents from a behavioral-cognitive perspective. The technique was developed during WWII by Col. John C. Flanagan to better understand effective and ineffective behaviors for aviation training. The technique is essentially a semi-structured interview or questionnaire which asks the participant to describe a critical incident in detail, defined by Flanagan as "any observable human activity that is sufficiently complete in itself to permit inferences and predictions to be made about the person performing the act. CIT is a research method that is useful for this study because it was developed to investigate effectiveness as well as points of failure through the retrospective, in-depth analysis of a singular event. In the context of the sort of incidents mentioned as examples, it reveals multiple viewpoints and experiences to build multi-dimensional pictures of how events unfold.

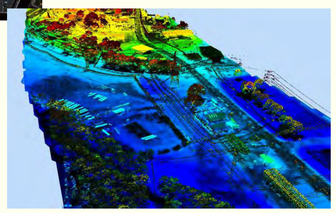
WiGiT: Wireless Grid Innovation Testbed[3]



Syracuse University (SU) and Virginia Tech (VT) are creating the Wireless Grid Innovation Testbed (WiGiT) with support from the National Science Foundation (NSF) Partnership for Innovation program grants #0227879 and #0917973. Initial WiGiT open specifications work will use IEEE 802.11 (WiFi). Software Defined Radio (SDR) systems and cognitive radio networks will be incorporated to enable wireless grid applications over a wide range of wireless technologies. These systems will efficiently make use of resources based on environmental and user/application constraints and preferences. WiGiT will refine transformative technologies to bridge the gap between wireless network middleware and grid application layers, creating new markets and realigning existing ones. WiGiT's open specifications will enable "edgeware" applications over a dynamic wireless (and/or wired) environment. Edgeware applications are a new class of applications that can dynamically make use of content and resources present in devices - phones, pc's, cameras, printers, screens, etc. - connected by a wireless grid. The two great benefits of WiGiT are first, that it will result in open standards for wireless grid technology, and second, that it will enable far more extensive utilization of mobile, ad hoc resources. The kinds of research that will benefit from this technology include any fieldwork activities that could utilize mobile data collection; such as environmental data recorders in remote or difficult to access locations, audio, visual or video records of unique events, or GPS data and fieldnotes taken in any location where wireless connectivity is available.

Using Geospatial Technology to Create Context for Action





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