



Predicting Topographical and Sociological Information Patterns from Building Access Logs

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Abstract

Building design is not just a matter for architects, engineers and planners but also for sociologists and behavioral scientists. Once completed and occupied, buildings adopt unique mannerisms based on their design, occupancy form, organizational culture and operational systems contained within their boundaries. Architects and planners base their building layout on a set of rule-based tools which assist them in their interpretation of an organization's needs, both normal usage and under extreme circumstances, such as emergencies or evacuations. Previous researchers such as Penn et al. [2] have examined the mechanisms by which patterns of spatial structure affect interactions within a work environment and it is these patterns and the affect on the occupants of the building, that this research wishes to explore.

1. Introduction

Modern building architects employ modeling techniques based on expectations of relationships between the organizational entities and the systems that the building is being designed to contain. Network modeling is used to represent the expected interaction between entities (nodes) such as Sections or Departments and the projected human traffic between them (edges). Lee [1] examined Geometric Network Models which represent both geometric and topologic relationships during a building's design stages. These models are "rule-based" and apply numerous assumptions about the nature of the spatial units in habiting the building. Adapting a realistic understanding of the interaction between the separate but intertwined organizational entities and the systems that they operate within, can benefit from the study of relationships between organizational entities. Our study is uniquely placed because of our affiliation with an industry partner who can supply a dataset to measure the collaboration between organizational entities. We have been provided with the security door access logs for a large hospital facility spanning a three year period, logging every door access from over 354 doors during that period. Additional qualitative data regarding employee functions will provide further context to research questions.

2. Problem Statement and Hypothesis

Our main question is to explore whether the analyses of door access security logs can be used to determine interactions between organizational entities within a mature building and provide a profile of the participants' interactions to be used for future architectural design? Our hypothesis is that the analyses of door security logs can provide topographical and sociological information that can be used in the design of micro-systems within an organization's facility, new or mature.

3. Research Question

The main research question is in the arena of social science, investigating the relationships within a mature building. Can historical door access logs identify the formal and informal relationships between entities in an organisation, while examining the spatial separation between them.

4. Motivation

Historically, ergonomic consideration within the confines of maximizing available space were the motivational factors for building design. Modern philosophies recognize the role of the individual and the informal sociological systems that mature within a facility over time. We wish to examine using graph technologies and social network analysis techniques, how door traffic and individual user category patterns in a temporal space can identify high density clusters and traffic patterns that will reveal a realistic interaction between entities and social systems.

6. Related work

Extensive research in the domains of building design modeling and the importance of sociology considerations in that design, has been documented. The research of Lee J.[1] , Penn, A., J. Desyllas, et al.[2] and J Nannariello, et al[4] are good reference points.

7. Proposed solution

A large selection of raw data provided by our industry partner will be used as the basis for a study, which will examine digital signatures, determined by user and usage patterns of doors within a mature building complex.

References

- [1] Lee J. (2001), "3D Data Model for Representing Topological Relations of Urban Features' ", Proceedings of the 21st Annual ESRI International User Conference, San Diego, CA, USA
- [2] Penn, A., J. Desyllas, et al. (1999). "The space of innovation: Interaction and communication in the work environment." *Environment and Planning B* 26(2)
- [3] J Nannariello, BArch, MDesSc (hons)., F R Fricke, BE, PhD Introduction to neural network analysis and its application to building services engineering Source:2014 Journal Citation Reports® (Thomson Reuters, 2015)