

Chapter 76

Examining Trust in Collaborative Research Networks

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ABSTRACT

Ian McHarg's "The Theory of Creative Fitting" describes the collaborative integration of data into knowledge products for use in ecological architecture developments. In McHarg's system, the provenance of data layers and trust in their creators are vital to the creation of knowledge, ideas recently described as being "urgent and relevant." This chapter begins with these ideas and explores provenance propagation and data publication. Provenance propagation has been a topic under discussion by the World Wide Web Consortium, while data publication has been a focus of the global marine science community. From these projects, the issue of uniquely identifying individuals in a distributed, collaborative network has emerged. Possible implications of this problem are discussed, as are technical solutions to the problem. The principles described within this chapter are illustrated by examples of uncertainty propagation in chained Web Processing Service networks and data publication activities at the British Oceanographic Data Centre.

INTRODUCTION

In his 1976 lecture "The Theory of Creative Fitting" (Margulis, Corner, & Hawthorne, 2007), Ian McHarg lays forth the principles of collaborative Geographical Information Systems (GIS). In general terms, McHarg's theory comprises four main themes beginning with the acceptance that creativity is employment of energy and matter to

raise matter and energy to higher levels of order. Thus, creativity naturally finds an antithesis in reduction. The second element of this theory is the existence of criteria by which directionality and attributes of the creative process may be identified. By this definition, creativity always shows the tendency to move from greater to lesser randomness, from simplicity to complexity or from instability to dynamic equilibrium. McHarg

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identifies the verb to fit as being the vital criteria here as there is a requirement for any system, be it organic or artificial, to find the most fit of all environments, and to adapt both the environment and the system itself. This leads into the third pillar of McHarg's theory, the definition of creativity as this act of fitting. Finally McHarg looks at analysis of a creatively fitted system, using the idea of the health of the system, which is the ability of a system to recover from a negative perturbation, or the ability of the system not only to solve problems, but to seek them out.

In applying this general theory to his field of expertise, environmental architecture, McHarg introduces the concept of the "overlay map", that is a map with layers provided by various experts familiar to GIS users today. McHarg's overlay maps make a fundamental use of the collaboration of geologists, climatologists, hydrologists, limnologists and biologists to build a holistic ecological model for the purposes of designing architectural projects in harmony with the surrounding environment. In his discussion of McHarg's lecture, James Corner (Margulis et al., 2007) describes this collaborative network as innovative and urgent. Throughout the collaborative network he describes, McHarg was keen that trust is in built and that each data point used to create the information layers and to abstract the knowledge had provenance: identified by the name of the person who prepared the analysis; should be the best available data; and should be substantive.

Establishing trust in knowledge sharing networks has been well documented in the business domain for a decade (Abrams, Cross, Letter & Levine, 2003). In the quoted study, two main themes emerged in the development of trust between participants in a network: the competence of an individual and the belief that an individual is working towards the improvement of the collaborative network ("their benevolence"). These factors are deemed to be difficult to influence for the coordinators or managers of a network.

There are clearly identified lines of action, activity and behaviour which can build trust between individual participants within a collaborative network and this chapter will explore how these can be implemented within software tooling for distributed collaborations. However, this does raise the level of information tooling required in building the collaboration software (Cheshire & Cook, 2004).

Cheshire and Cook (2004) identify the need to exchange reputational information across networks as key to establishing and building trust. The propagation of trust is an important aspect of the scientific knowledge building network, not just on the social level - for example where an instrument make or model is known to produce results with less accuracy than another. At the social level, this could be seen as one researcher's methods being less trusted by the network than another's. Ziegler and Lausen (2005) introduced a trust model to the Semantic Web space, covering the domain of internet connected networks. More recently, the World Wide Web Consortium (W3C) has produced the PROV model (Groth & Moreau, 2013). Within the PROV model, provenance is defined as information about entities, activities, and people involved in producing a piece of data or thing, which can be used to form assessments about its quality, reliability or (and most importantly in the context of this chapter) trustworthiness. The goal of PROV is to enable the wide publication and interchange of provenance on the Web and other information systems. PROV enables one to represent and interchange provenance information using widely available formats such as the Resource Description Framework (RDF, Manola & Miller, 2004) and the eXtensible Markup Language (XML, Quin, 2013).

This chapter takes up McHarg's themes and examines the philosophical issues of building trust between participants in a collaborative research network, and explores the technical issues of propagating and encoding trust.

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