Application of OOGIS and ITMA in Archaeological Studies

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In practical applications, object-oriented GIS (OOGIS) enables handling of complex information by classifying it using the concept of geographic features. This system has great information management capabilities; however, two main problems arise when applying it to cultural phenomena studies, including archaeological studies. The first is how to design data models for OOGIS and encode data for it. The second is understanding which kinds of analysis can be applied to OOGIS.

An effective means of resolving the former problem is the ISO 191xx series, which are series of standards for digital geospatial information. These series adopt the concept of OOGIS. ISO 19109 (Application Schema) specifies of designing geospatial phenomena for geospatial phenomena and ISO 19118 (Encoding Rules) defines the method for encoding documents from the designed application schema as XML. These means provided by the standard for OOGIS data modelling and encoding rules are available not only for purposes of standardization but also for the individual use.

For the latter problem, 'Ideal Type Modelling and Analysis (ITMA)' will be an effective means of analyzing cultural phenomena. ITMA is a methodology in 'Culture and Information Science (CIS)'. In general, because cultural phenomena are wide ranging and hard to identify, they cannot be defined without scholars' recognition structures, 'ideal types'.

However, these structures will not completely fit research subjects in reality; the ideal types of each scholar are purely abstracted and separate from reality. If the ideal types are pictured as classes, subjects of research may be positioned as instances of them. Using this characteristic of cultural phenomena studies, ITMA aims at analyzing cultural phenomena through scholars' ideal types described by the information modelling language. I call the modelled ideal types the 'Ideal Type Model'. Although ITMA is simply a methodology and is not limited to a particular platform, it can be implemented as an analytical system on a computer by integration with OOGIS.

Currently, two analytical methods using the Ideal Type Model are under development: Character Structure Analysis and Temporal Topology Analysis. This study introduces Character Structure Analysis, which provides a means to compare each subject and ideal type model or hypothetically implemented instances as norms. This method is applied to techniques for constructing a phylogenetic tree. In general, a phylogenetic tree is calculated based on differences from each alignment of gene sequence. However, Character Structure Analysis examines the alignments of tags, which can be obtained from XML documents if the Ideal Type Model is constructed and encoded according to the ISO 191xx series. In each alignment, there may be some (or many) missing tags, and the number of such tags indicates the distance from the ideal type or instance used as a norm. Thus, subjects of research are compared, the distance is calculated and finally a phylogenetic tree is constructed.