

## **Natural Information Systems: the Role of the Topos**

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Information and Communication Systems are part of process in the natural world. Natural as formally defined in category theory needs to be satisfied to provide a full and faithful representation of communication in information systems. Current approaches of translating Information and Communication Technologies into objects and arrows do not compose naturally as categories. Such categorification, that loses the naturality of the real world information systems, is a major case in point.

The early attempts by Ehresmann to devise types of Sketches and Diskin's later development of his Unified Modelling Language both relax the rigour of category theory. Categorification of the entity-relationship model by Rosebrugh and more recently of Codd's relational model by Spivak show that the real world does not fit a category of sets: rather the identification should be within the well-established natural category of the topos.

For information systems a taxonomic analysis comparing the facilities offered by current operational approaches and by theoretical advances in category theory confirms that only the topos can meet all the requirements. Indeed the topos of the Cartesian Closed Category with naturality provides a formal representation without loss of rigour for the necessary components of a modern information and communication system: formal structuring capability through the Cartesian Closed Category, searching through the subobject classifier and the Heyting logic, query symmetry through commutativity, query closure through the subtopos, transaction processing through monads, unifying interoperability through natural transformations comparing different paradigms and transparent networking through an open Heyting architecture.