Extending the LISP model: from cons cells to triples, from trees to hypergraphs

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Arxana is a higher-dimensional variant of LISP, based on nested semantic networks instead of cons cells. In contradistinction to LISP where the fundamental building block is a cell '`(a . b)`', Arxana's fundamental building block is a triple, '`(a c b)`'. Furthermore, in the language of the Semantic Web, every triple is 'reified'. Links and their constituent positions can contain further structure or be augmented with offset annotations: for example, we distinguish between '`((a d e) c b)`' and '`(a c b)` $\oplus_1$ `(a d e)`'. The first form models an assertion about the link '`(a d e)`', and the second models an assertion about the atom '`a`' within '`(a c b)`'. These facilities allow us to build, reason about, query, and program with hypergraphs rather than trees or networks. This representation strategy is useful for building runnable conceptual models of complex and recursive structures. Modelling informal mathematical discourse is a motivating application: this requires a different approach from the strictly deductive style of formal mathematics. Other programming languages which support a similar annotative style include Kurzweil's *Flare* and Nelson's *ZigZag*. Our Arxana prototypes are implemented in Emacs Lisp.