Complex Adaptive Systems Modeling

Monkeys, trees, and the right abstraction!

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"A mathematician who can only generalise is like a monkey who can only climb up a tree, and a mathematician who can only specialise is like a monkey who can only climb down a tree. In fact neither the up monkey nor the down monkey is a viable creature. A real monkey must find food and escape his enemies and so must be able to incessantly climb up and down. A real mathematician must be able to generalise and specialise."

George Polya quoted in D MacHale, Comic Sections (MacHale 1993).

Seventh of September marks the death anniversary of the famous mathematician George Polya. Polya is famed for his specific problem-solving techniques given in the bestseller "How to Solve it" (Polya 2004). Polya rightly notes the importance of abstraction.

Complex adaptive systems involve the interaction of numerous components or agents. To be able to effectively model these systems, it is extremely important to use abstraction.

Abstraction, however, is not limited to a particular domain. We use abstraction in our everyday lives and in social interactions. The sciences are filled with examples of abstraction—double-helix/staircase model for the DNA molecule (Watson 2012), Maxwell's demon in Physics (Maxwell 1891) or rules in Medical diagnosis systems (Iantovics 2012; Iantovics et al. 2018).

Not lacking behind are the humanities with concepts such as truth, liberty, or freedom among others.

Perhaps the importance of abstraction can be highlighted by the fact that the way humans learn is by means of mechanisms entirely based on abstraction—e.g. a child once affected by something "hot" can later be guided to stay away from other dangerous items by means of a suitable simile. Perhaps being able to easily abstract and frequently use abstraction in our cognitive and thought processes is what separates us from the machines that we design—this being true, at least to-date.

Authors' contribution
MAN concieved the idea of the manuscript. Both authors read and approved the final manuscript.

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