

7 Conclusion

I have argued that attributing complexity only to models and not natural systems and by relativising its conception to the chosen framework (composed of language of modelling, identification of parts and overall behaviour and the type of difficulty that concerns one), one arrives at an analytically useful conception of complexity. This conception not only captures much of the intuitive idea of complexity it also allows the meaningful comparison of many different formulations of complexity as well as throwing some new light on some philosophical problems.

In particular I have met the five goals set out in the introduction (section 1.3 on page 19), which were.

1. *To lay bare assumptions and relativisations involved in the usage of the term.*
2. *To allow a meaningful comparison between different formulations of complexity across different fields of study.*
3. *To lay the foundations for formalisations of complexity, in different circumstances.*
4. *To aid the formulation of deeper insights into possible causes of complexity.*
5. *To allow the development of systematic approaches to simplification.*

Additionally I have focused on a particular measure of complexity to capture the difficulty of decomposing expressions and sketched a possible formal structure to relate different formal languages to the analysis of the sources of complexity in specific systems, which also provides a framework for the study of systematic methods simplification. Ancillary work has included a short survey of the vast number of formulations of complexity (section 8 on page 136) and a software tool for the exploration of syntactic structures (described in section 11 on page 188).

7.1 Further Work

This work is foundational in that it could form part of a new “science of complexity” [89]. Much more can be done in this regard, including:

- Further investigation into the relation between syntactic structures and the complexity of expressions.
- The development of automatic, or semi-automatic methods of simplification.

- The integration of this work into other's work in the field of "complex systems", especially with regard to identifying possible *causes* of complexity.
- The further development of measures of complexity for different purposes.
- The use of this work as the synthesis of many formulations of complexity, including their categorisation and generalisation from similar families.

Perhaps the most important way this work could be extended is towards a model of the process of modelling itself. This would involve extending and formalising the semantic picture of modelling presented in section 2.3 on page 33, and could be seen as an extension of measure theory to non-numeric structures. As Badii and Politi put it in their conclusion to their book on complexity:

"The natural extension of the study of complexity... seems, therefore, to point inevitably to a theory of model inference." [36] p.280