

# Building Rammed-Earth Systems: Constructal Law and the Hierarchy of Energy in Earthen Architecture

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# 1 Introduction

Phantom lines between the engineering of structures through scientific intellect and the designing of structures through artistic intellect— a historical, disciplinary, semantic, and probably neurological divide reckoned by the capacity to reason in both domains— puts potential builders in a steep quandary. On one hand, the mathematical procession of theorems from a set of symbols and axioms refers to the external world with effective fidelity, but nay absolute certainty. On the other, the capacity to qualitatively reason about the world in all its chance and weirdness resists persistent quantitative evaluation. Why the differentiation in architecture? What constitutes grounds for building? How is building good?

## 1.1 Knowledge

Begin etymologically with *Architecture*: *arkhi-* implying principal, chief, as in *archetrieve*, *archegonium*, *Arch Linux* (a most skeletal Linux distribution); *tekhne* implying art, craft, means, as in *geotechnics*, *technology*, *tectonics*. The Aristotelean reasoning about “architecture” as an art in the Nicomachean Ethics is written in the context of “techne” as one of the chief intellectual virtues.

“Now since architecture is an art and is essentially a reasoned state of capacity to make, and there is neither any art that is not such a state nor any such state that is not an art, *art* is identical with a state of capacity to make, involving true reasoning. All art is concerned with coming into being i.e. with contriving and considering how something may come into being, i.e. with contriving and considering how something may come into being which is capable of either being or not being, and whose origin is in the maker and not in the thing made; for art is concerned neither with things that are, or come into being, by necessity, nor with things that do so in accordance with nature (since these have their origins in themselves). Making and acting are different, art must be a matter of making, not of acting. And in a sense chance and art are concerned with the same objects; as Agathon says, ‘Art loves chance and chance loves art’. Art then, as has been said, is a state concerned with making, involving true reasoning, and lack of art on the contrary is a state concerned with making, involving a false course of reasoning; both are concerned with the variable.” [1, p105]

Mere observation of the etymological roots of “architecture” shows that architecture, by definition, concerns a capacity to select (being and not being) and configure (consider and contrive) variables through true reasoning, but without explicitness concerning scientific knowledge about these variables (not concerning nature or necessity) *nor* empirical means of creation (making not acting). Scientific knowledge is reserved for the epistemic virtue of intellect, and practical means for the phronetic.

*Engineering*: from *engin* or *ingenium*, implying cleverness, stratagem; or implying ability, innate qualities, inborn characteristics. Reliant on applying *science*: from *scire*, knowing, classifying, but as an intellectual virtue, without action.

“Scientific knowledge is, then, a state of capacity to demonstrate, and has the other limiting characteristics which we specify in the Analytics, for it is when a man believes in a certain way and the starting-points are known to him that

he has scientific knowledge, since if they are not better known to him than the conclusion, he will have his knowledge only incidentally.” [1, p105]

## References

- [1] Aristotle, W. D. Ross, and Lesley Brown. *The Nicomachean ethics*. Oxford University Press, 2009.