Models are metaphors. They compare something you don’t understand very well to something you understand better.

“Sleep is the interest we have to pay on the capital which is called in at death; and the higher the rate of interest and the more regularly it is paid, the further the date of redemption is postponed.”

Arthur Schopenhauer

Periodicity of sleep and coupons is the common element of the metaphor.

Recursion is the common element in analytic continuation from the factorial to the gamma function.
Models are *analogies* and *relative*. Theories are the **real thing**.

The Dirac equation for the electron:

- theory ➔ metaphor of the Dirac sea ➔ theory.

Theories are *absolute*: “I am what I am.”

Theories tell you what something **is**. Models tell you what something is **more or less** like.
An Example of a Theory: Spinoza on Emotions as Derivatives

Spinoza’s treats emotions like Euclid treats geometry: emotions are derivatives

- Primitives are Desire, Pleasure, Pain
- Also: Vacillation, Wonder

Good is everything that brings pleasure, and Evil is everything that brings pain.

Love: Pleasure associated with an external object

Hate: Pain associated with an external object

Envy: Pain at another’s Pleasure

Hope: Expectation of future Pleasure tinged with doubt

Fear: Expectation of future Pain

Cruelty: Desire to inflict Pain on a someone Loved
Spinoza’s Theory of Emotions as Derivatives

Good = every kind of pleasure
Evil = every kind of pain

- Cowardice: Desire checked by fear of danger which equals dare
- Daring: Desire to face a danger which equals fear
- Courage: Desire to act so as to please men and refrain from displeasing
- Regret: Desire to possess something tinged by awareness of other things which prevented the possession

- Contempt: Feeling when contemplating something characterized by its lack of quality
- Emulation (inauthenticity): desire engendered by another’s desire

- Fear: expectation of pain trigged with doubt
- Self-abasement: undervaluing oneself by reason of pain
- Suffering: localized pain of body and mind

- Compassion: pain engendered by another’s pain
- Benevolence: desire to do good arising from compassion
- Devotion: love towards one we admire

- Despair: expectation of pain with little doubt
- Melancholy: globalized pain of body and mind
- Jealousy: Vacillation between hatred and envy towards an object of love = rival

- Humility: pain from contemplating one’s weakness
- Humor: expectation of pleasure with little doubt
- Hope: pleasure from thinking too little of someone

- Stimulation: localized pleasure of body and mind
- Joy: pleasure from hope unexpectedly fulfilled
- Pride: pleasure from thinking too highly of oneself

- Indignation: hate towards an injured
- Anger: Desire to injure hated one
- Love: pleasure accompanied by idea of external cause

- Cowardice: Desire checked by fear of danger which equals dare
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The point is usually divination, which rarely works

A typical valuation model: apartment pricing & calibration

Models transform intuitive linear quantities into nonlinear dollar values
- Price per square foot to apartment price
- Future yield to bond price
- Future volatility to option price

Models in finance calibrate the future, predict the present

Models are used to ranks securities by value on a 1-D scale

Models interpolate from liquid prices to illiquid ones
The Right Way to Use Valuation Models

Models aren’t theories

There is no “right” model. (There is no “right” model airplane – the model depends on the purpose.)

Assume the bare minimum: static replication, dynamic replication, risk replication, utility

Avoid axiomatization

In physics it pays to drop down deep, formulate a principle, then come back up again. In finance, shallow is better. Use vulgar variables in a sophisticated way. (Vanna Volga)

Sweep dirt under the rug, but tell people about it.

Avoid idolatry:

There is no TOE; you’re lucky if there’s a TOA. To confuse the model with the world is to embrace a future disaster driven by the belief that humans obey mathematical rules.

A little hubris is OK. Then look over your shoulder.

Somewhere north of common sense but south of hubris lies the appropriate use of models.