Gartner's Hype Cycle: A Simple Explanation

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1. Gartner's Hype Cycle

- In the ideal world, any good innovation should be gradually accepted.
- It is natural that initially some people are reluctant to adopt a new largely un-tested idea.
- However:
  - as more and more evidence appears that this new idea works,
  - we should see a gradual increase in number of adoptees –
  - until the idea becomes universally accepted.
- In real life, the adoption process is not that smooth.

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2. Gartner's Hype Cycle (cont-d)

- Usually, after the few first successes:
  - the idea is over-hyped,
  - it is adopted in situations way beyond the inventors' intent.
- In these remote areas, the new idea does not work well.
- So, we have a natural push-back, when:
  - the idea is adopted to a much less extent
  - than it is reasonable.
- Only after these wild oscillations, the idea is finally universally adopted.
- These oscillations are known as *Gartner's hype cycle.*

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3. Gartner's Hype Cycle (cont-d)

- A similar phenomenon is known in economics:
  - when a new positive information about a stock appears,
  - the stock price does not rise gradually.
- At first, it is somewhat over-hyped and over-priced.
- And only then, it moves back to a reasonable value.

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4. Our Explanation

- Any system is described by some parameters

$$x_1, \ldots, x_n.$$

- The rate of change $\dot{x}_i$ of each of these parameters is determined by the system's state, i.e.:

$$\dot{x}_i = f_i(x_1, \ldots, x_n).$$

- In the first approximation, we can replace each expression by the first few terms in its Taylor expansion.
- For example, we can approximate it by a linear expression:

$$\dot{x}_i = \sum_j a_{ij} \cdot x_j.$$

- A general solution of such systems of linear differential equations is known.

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5. Our Explanation (cont-d)

- In the generic case, it is:
  - a linear combination of terms $\exp(\lambda_k \cdot t)$,
  - where λ_k are (possible complex) eigenvalues of the matrix a_{ij},
  - i.e., roots of the corresponding characteristic equation
$$P(\lambda) = 0.$$
- When the imaginary part b_k of $\lambda_k = a_k + \mathrm{i} \cdot b_k$ is non-zero:
  - we get:
$$\exp(\lambda_k \cdot t) = \exp(a_k \cdot t) \cdot (\cos(b_k \cdot t) + \mathrm{i} \cdot \sin(b_k \cdot t)),$$
  - i.e., we get oscillations.

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6. Our Explanation (cont-d)

- Why do we see oscillations practically always?
- The more parameters we take into account, the more accurate our description; thus:
  - to get a good accuracy,
  - we need to use large n.
- Any polynomial can be represented as a product of real-valued quadratic terms.
- Some of these quadratic terms have real roots.
- If p_0 is the probability that both roots are real, then:
  - for a polynomial of order n,
  - the probability p that all its terms have real roots is:

$$p \approx p_0^{n/2}.$$

- For large n, this is practically 0.

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7. Our Explanation (cont-d)

- Thus, practically all polynomials have at least one non-real root.
- So, almost all systems show oscillations.
- This explain why Gartner's hype cycle is ubiquitous.

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