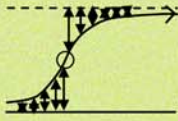# READING GROWTH

FOR EMERGING COMPLEX NETWORKS

Growth displays evolving cells of interactions forming self-defining systems that explore an environment, and exhibit feedbacks that switch as the cell evolves.

Various features can be mapped as networks

- Growth & stabilization display network elaboration and refinement (a.k.a. duplication & divergence or multiplication & selection)
- Growth phases indicate reversals of feedbacks
- The physical system topology is 'improper' or 'heterarchical'
    - o physical parts, types of events, relationships or pathways may be projected and 'reduced' to 'proper' network maps by applying that defining category.
    - o such nets might intersect by having common physical elements than participate in different maps with structures and behaviors that are largely independent
    - o links are commonly adventitious, through mediums of exchange where 'messages' are abandoned and discovered with vanishingly small probabilities of connection.

Identification methods

- Backwards calculus
    - o reconstructing complex flows from data so the evolving dynamics show through more clearly, rather than forcing an unchanging formula to fit using regression
- Backwards modeling
    - o using a simple model to help observe and understand the individual discrepancies
        - ▪ discrepancies between a model and an individual event is behavior
        - ▪ discrepancies between a model and a collection of events is noise
- Identify growth & decay as periods when all derivatives switch sign and locate the events that correspond. Use cybernetic principle that divergences are corrected to locate circuits and the instabilities that develop to flip the feedback switches.

A possible way to reconstruct the evolving network of an idea

Sustainability - in the NYTimes
Average News & other Items/day for 10 years
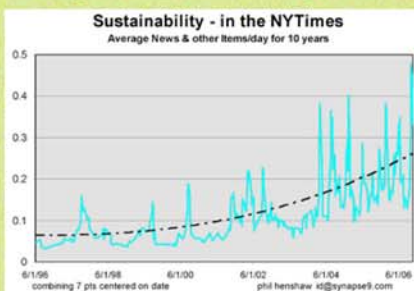
NY Times counts of articles using the word 'sustainability' trace the emergence of the idea. The shape of the model curve indicates what to look for in the flurries of interest. The articles can be considered as nodes appearing in a network of readers and writers.   The individual flurries can be explored by reading the articles to see if they reflect a common issue, and linked with data from mining other media and the authors' sources. When interest in a broad subject is exploding it may be worth the effort to look and see what all the noise is all about!

NetSci Conf. 5/24/07   Phil Henshaw / HDS