In Medias Res:
Fads, Trends, Bubbles and
Massively Scaled Analyses in RTW Fashion

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Highlights

• The importance and relevance of fashion
• Growth is king
• Watersheds in strategic thought
• Massively scaled analyses in the RTW fashion ecosystem
• Modeling of fads and trends: towards a protocol
• The bottom line
The Importance And Relevance Of Fashion

Fashion may be the world’s largest and most important creative industry

- A global business with recent annual U.S. sales of more than $250 billion -- ~2% of GDP -- larger than that of books, movies, and music combined
  - Has blended into the wider arena of “Entertainment”
- Greenhouse for the analysis of fads and trends
- Provides economists, sociologists and other cultural thinkers and critics with canonical examples of consumption, conformity and consecration
- RTW fashion data possess all the computational challenges inherent in any massive analysis

Non Gustibus Disputandum Est

Defining Fads And Trends

Some tentative definitions – a few terms with many synonyms

• A **fad** is a short-term burst in behavior usually starting with explosive growth that rises to a peak followed by slower ebbing -- analogous to froth from waves breaking on a beach
  – **Bubbles** are closely related to fads but are usually financial in nature and refer to unrealistic prices detached from intrinsic value -- can be both positive and negative

• A **trend** is a long-term or enduring influence on behavior -- analogous to open ocean waves
  – The Ancients had no concept of a “trend” viewing existence as eternal and static
  – Modern notions are typically credited as originating with Vico’s 1725 *Nuova Scienza*
  – Population demographics are among the most important structural drivers of trends

Wave Motion Does Not Change With Water Depth

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Growth Is King

In terms of the forces of history, we find ourselves *in medias res*…

- Exponential growth of everything since the Industrial Revolution – GDP to double by 2050
- A “Knowledge Society” emerged when the Service Sector eclipsed Manufacturing in size and growth of occupations
- The production and flow of ideas is a primary source of growth

**Wealth and Population**

1-2010 AD

**U.S. Occupational Change**

1800-2010

**Production of Ideas**

1500-2010


Watersheds In Strategic Thought

Swing towards greater uncertainty and disruptions to equilibrium in normative business practices

- Anomalies regarding Porterian assumptions of sustainability of competitive advantage
- Hypercompetition in a widened arena of business operations versus myopic industry silos
- Shift from moment-based, linear models rooted in “normality” and simple iid relationships to models exploiting nonlinearity, complex dependence, power law distributions, infinite moments, heavy tails

Quantifiable Risk, Unknowable Uncertainty and The Business Landscape

From Risk to Greater Complexity and Uncertainty

Low

| Linear forecasts drive strategy |
| Change is gradual and incremental |
| Behavior is deterministic and predictable |
| Sustainability |
| Six Sigma precision |
| Conformance with commonsense |
| Sandboxes |

Alternate Futures

| A few discrete outcomes define the future |

A Range of Futures

| A range of possible outcomes |
| No natural scenarios |

True Uncertainty

| Nonlinear systems dominate |
| Extreme shifts can occur abruptly, without warning |
| Behavior is deterministic but not predictable |
| Transience |
| Arbitrage in ignorance, diffidence, approximation |
| Expectancy violations |
| Sandpiles |

Rapidly Cycling Fads And Trends, Massive Classification Of Fashion Styles Drive Need for Massively Scaled Analysis

Visionaries Originate While Markets Imitate, Diffuse and Consecrate

From Uncertainty to Risk

Innovation-Development Pipeline

Sources and Tools

- Paris’ Premiere Visione
- Social Media OSIs
- Patents, Academic Papers
- Film, Books, Mags, Art, etc.
- VC Investments
- Demographics (Youth and Agelessness)
- Tech Conferences
- Blogs

R&D-Tacit Knowledge
Text and Image Mining
Prediction Markets
Continuous Tracking
Competitive Info from Online
Comparison Engines
Web Scraping
Hiring Trends
eBay

Execution

Manufacturing the Portfolio

Launch

Sales Curves and the Product Life Cycle

Evidence-Based Decision-Making

Go – No Go

Accelerating Sales

Decelerating Sales

Maturity

Growth

Introduction

From Uncertainty to Risk

Time

Scan, Monitor, Originate, Imitate

Performance

Sources and Tools

- RDBMS Sales Data
- Fast Fashion, e.g., Zara
- Marketing Spend
- Social Media OSIs
- Competitive Info from Online
- Comparison Engines
- Web Scraping
eBay

Data Mining
Predictive Modeling
Network and Diffusion Models
Agent-Based Models
Massively Categorical Models
Machine Learning Algorithms
Recommender Systems
Fads, Trends And Explosive Self-Generating Demand

Unrelated phenomena such as the explosive flow of water out of a breached dam versus “fad” behaviors in Google search activity can be seen as structural homologues.

- There are at least two challenges inherent in this:
  - Separating wheat from chaff or epiphenomenal flotsam and jetsam from emerging trends
  - Finding scalable computational solutions for massive numbers of “Biebers”

**Water Flow From A Breached Dam vs “Interest” in Justin Bieber**

Tracking Fads And Trends With Machine Learning Algorithms

Text and image mining of WOM*, social media OSIs* is an analytic “Wild, Wild West”

- Structuring unstructured information in the wilderness of data is difficult to do at scale
  
  - “Words slip and slide and never stay in place” and so do images

• The evolution of Chinese fashion styles based on algorithmic image mining of tens of thousands of pictures taken on the streets of Shanghai and Beijing suggests:
  
  - Tastes may have shifted from conspicuous status statements using big logo brands such as LVMH to niche brands
  
  - Slowing economic growth as well as crackdowns on corruption and pirating also contributed

*Word-of-mouth, open source indicators


Personal communications: Svante Jerling, P1.cn; Karen Moon, Trendalytics.co; Josh Clark, BoazandClark.com; David Wolfe, Doneger Group

IARPA.gov papers on OSIs, in Google search window enter “D12PC00337 OR D12PC00285 OR D12PC00347”
Modeling Fads And Trends

Fads and trends can be quantified using models of tech and new product innovation, diffusion, adoption and evolution rooted in the analysis of nonlinear logistic growth

- Classic models focused on univariate time series and diffusion processes based on *cumulants* of new adopters or sales, e.g., Gompertz and Bass-Anderson models, Fisher-Pry transforms
  - Aggregates of individual decisions give a normative description of the adoption life cycle
  - S-shaped curves identify inflection points and carrying capacities (ceilings or asymptotes)
- Recent research generalizes this framework to more complex, disaggregate, multi-level and multivariate growth processes leveraging, e.g., pooled time series, marketing mix or multi-level regression potentially with multiple DVs, network analysis, information theoretic frameworks, etc.

**Classic Diffusion and S-Shaped Curves**

*Eight Generations of DRAM Chips, 1970-2000*

**Social Networks**

Peres, Muller, Mahajan, *Innovation diffusion and new product growth models: A critical review and research directions*, 2009

“Small World” social networks, e.g., “I shook Frank Sinatra’s hand,” Six Degrees of Kevin Bacon, Six Degrees of Francis Bacon
Differentiating Fads From Trends: Towards A Protocol

It is possible to distinguish fads from trends using a hybrid, generalized approach:
- Based on pre-determined “burn-in” periods, partition products by phases of the life cycle:
  - **Fads** – “go, no go” phase for new products with time “zero” origin and data of short duration
    - Use automated, cumulant diffusion models for insight into growth, ceilings or cancellation
    - Early stages of an emergent fad have the least information and are the hardest to predict
    - How much information (# data points) is needed for “go, no go” decisions?
  - **Trends** – left-censored, pre-existing products with established sales curves
    - Use actual sales, not cumulative, for insights into growth rates (slope, 1st derivative) and acceleration or momentum (Hessian, 2nd derivative, the rate of change in the slope)

### Product Sales for “Fads” and “Trends”

*Left Aligned, Past 12 months*

- **Cumulative**, **“Trend” Product Sales**
- **Actual**, **“Fad” Products Cumulative Sales**
- **“Zero” Time Origin**, **Left-Censoring**
- **“Go”**, **“Go?”**, **“No Go”**
Classifying Trajectories Based On Growth And Acceleration

A comparison of growth rates (slope or 1st derivative) with the rate of acceleration in those slopes (Hessian, 2nd derivative) suggests strong association but qualitatively distinct information.

- Model accuracy may not be improved but are the insights greater from adding momentum?
Challenges In Developing Generalized Growth Models

Is the trend really your friend?
- Univariate diffusion models are too simplistic
  - Don’t capture important factors such as competition or the marketing mix (ex Extended Bass)
  - *Prima facie* issues with HAC* and nonstationarity (cf. Box-Jenkins, “p’s and q’s”)
  - Designed and built for successful new products -- but most new products fail(!)
- Hybrid, generalized models leverage multi-level, pooled, marketing mix, etc., robust regression
  - Handle extreme value data in the original units of the dependent variable(s)
  - Incorporate information related to competitive effects, marketing spend, market or consumer heterogeneity, social media, social networks, etc., as appropriate and available
  - Find nonlinearities in momentum of growth rate (slope, 1\textsuperscript{st} derivative) based on the rate of change or acceleration in that slope (Hessian, 2\textsuperscript{nd} derivative)
  - Exploit endogenous and combinatoric interactions inherent in massively categorical data to estimate, e.g., the impact of on sales of trends in a color or button size
- Random forests, Divide and Conquer, BLJs (bags of little jacknifes) compiled on massively parallel CPUs are among the approximating workarounds for scalable statistical modeling
- Another session could cover the advent of featureless, pattern matching, machine learning, complexity-based algorithms, e.g., permutation distribution clustering or “data smashing”

\*Heteroscedasticity, autocorrelation consistent

How can the analysis of fads, trends and bubbles be used to enhance business performance?

- Models are calibrated on a known world and projected into an unknown, uncertain future
  - Model performance can be benchmarked several ways: 1) improvement over an incumbent method, 2) % correct prediction in a portfolio over and above random guessing and 3) prospective (not historic) predictive accuracy
    - As in Vegas, beating the house 3%-4% of the time is pretty darn good
      - That is, if one beats the house at all
    - Relate to key corporate metrics such as YAG sales, stock price, financial ratios, etc.

- Stronger strategic planning, analysis and inventory control of new and existing products from the insights available in hybrid, generalized growth and diffusion analysis
  - Widened set of strategic, evaluative and validator y metrics of prospective performance that go beyond purely data-based, historic predictive accuracy
  - Evaluation of impact of marketing mix and other activities on product evolution
  - Use in inventory control as an aid to answering questions related to potential market size, depth of purchase, duration and timing for when to get in or out
  - Early warning for explosive product growth, negative revenue surprises
  - Track cross-product elasticities and interdependence for cross-sell

- Extreme value, power law nature of information suggests changing emphasis from predicting averages to predicting quantiles or points on a heavy-tailed distribution

- Shifting views of growth as smooth and linear to recognition that it is inherently discontinuous, nonlinear, inefficient, lumpy, messy
Next Steps

Exploring deeper mathematical metaphors for fads and trends in models of chaos and turbulence

- “Big whirls have little whirls that feed on their velocity, and little whirls have lesser whirls and so on to viscosity” – Lewis Frye Richardson
Thank You!

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