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How Will Predictive Modeling Change the P&C Industry in the Next 5-10 Years?

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The Problem with Prediction

- A grand unifying theory of baseball, movies, and physics:

- "It's tough to make predictions, especially about the future."
  - Yogi Berra

- "Never make forecasts, especially about the future."
  - Samuel Goldwyn

- "It is exceedingly difficult to make predictions, especially about the future."
  - Neils Bohr

And Yet…

- Billy Beane and Paul DePodesta transformed the business of professional baseball by using predictive analytics to select players for the Oakland As.

- Key insight: the market for baseball players had been *inefficient* because the art of selecting players had been rooted in tribal wisdom and "professional judgment".
  - Analytic decision-making outperformed seasoned baseball scouts.
  - Despite low payroll, Beane was able to "run circles around taller piles of cash".
   - Michael Lewis, *Moneyball*
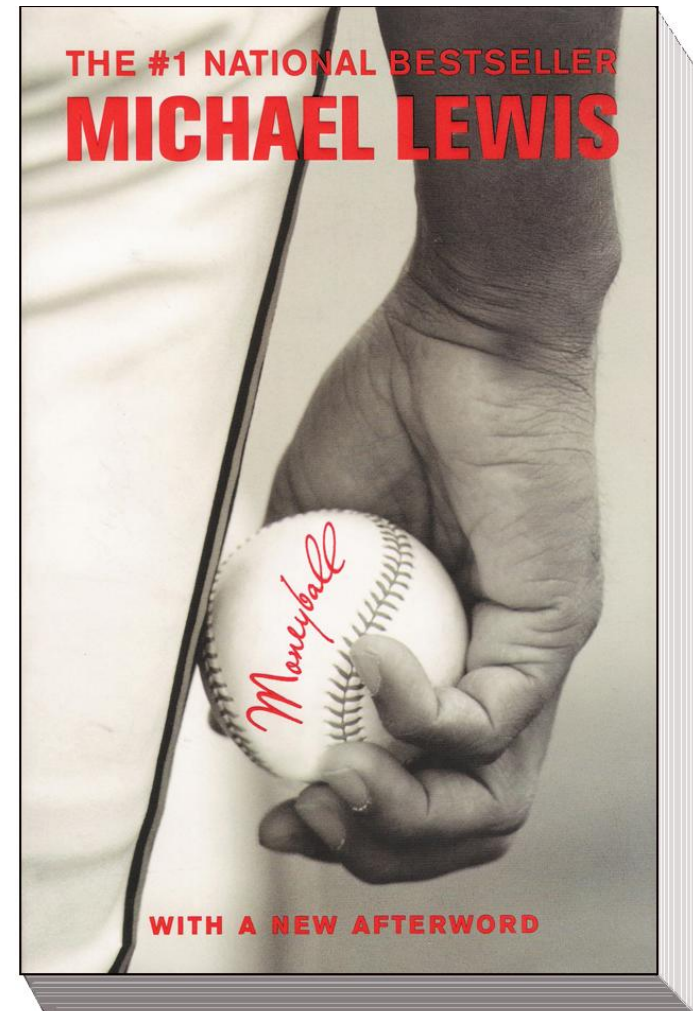
And Yet…

- "In Hollywood, nobody knows anything."
  - Samuel Goldwyn, *Adventures in the Screen Trade*

- But maybe the predictive modelers do.
  - Neural Net models have been built to predict box office receipts based on predictive variables derived from the scripts.
  - Are today's movie moguls like yesterday's baseball scouts?

Analyzing Analytics

- Growing recognition in cognitive psychology & behavioral economics: **Predictive models help human experts make decisions more accurately, objectively, and economically**.
  - Academic / psychological research dates back to the 1950's.
  - Now a growing consensus in the worlds of business, education, law, government, medicine, entertainment, … and professional sports.

- Predictive modelling is the ultimate "transferable skill" – it applies in domains where experts must make decisions by judgmentally synthesizing information.
  - **"Human judges are not merely worse than optimal regression equations; they are worse than almost any regression equation."**
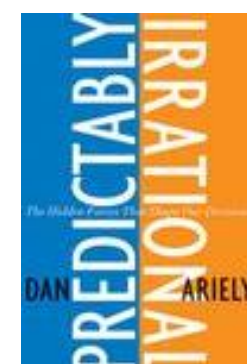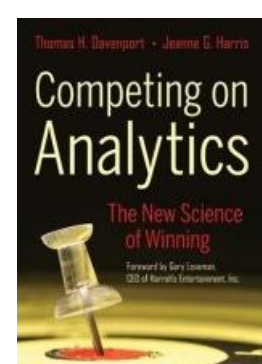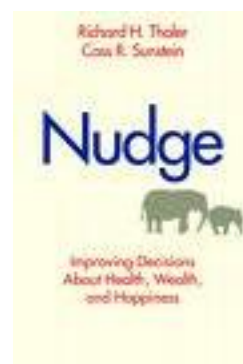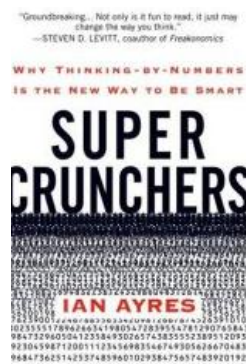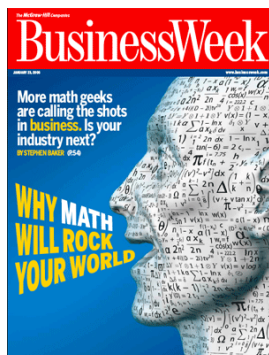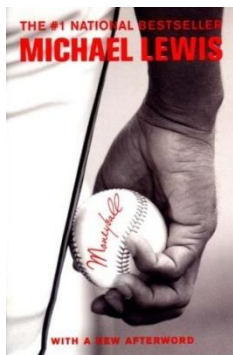
(Ir)rational Expectations

- Behavioral economists' assessment of *Moneyball*:

  "The problem is not that baseball professionals are stupid; it is that they are human. Like most people, including experts, they tend to rely on simple rules of thumb, on traditions, on habits, on what other experts seem to believe. **Even when the stakes are high, rational behavior does not always emerge.** It takes time and effort to switch from simple intuitions to careful assessments of evidence."

  – Cass Sunstein & Richard Thaler review of *Moneyball*

- Traditional insurance underwriting: analogous to baseball scouting.

- We have consistently been able to build underwriting models with significant segmentation power.

- Implication: **"rational behavior had not emerged"** prior to the success of underwriting models.
  - More grist for the behavioral economists' mill
  - … and motivation for future actuarial work.

Predicting Predictive Modeling

- In summary: Human decision makers are indispensable…
  but they do better jobs with predictive models in hand.
  - Baseball scouts   ~   traditional underwriters
  - Paul DePodesta   ~   "Super Crunching" actuaries
  - Note bene: the best underwriting models result when underwriters
    collaborate with actuarial modelers.

- In the next 5-10 years…
- Other areas in P&C where "equations can aid the experts":
  - Workers Comp premium audit
  - Claim triage
  - Fraud detection
  - Market-based pricing, consumer choice models, elasticity modeling, …
  - Cross-sell, target marketing
  - Individualized customer support
  - Hiring new agents (even more direct analogy with *Moneyball*)
  - Helping design ad campaigns (analogy with movie predictive model)

Specific Applications

Deepening of Actuarial Work
Broadening of Actuarial Work

Deepening of Actuarial Work: Pricing

- GLM-based modeling has put insurance pricing on a firm statistical footing.

- We will likely see continual improvements in this area through the introduction of new data sources and analytic techniques.
    - Hierarchical modeling
    - Data mining, data visualization techniques
    - Geospatial analysis
    - Text mining
    - …

- **Commercial Insurance**: We have had success applying predictive modeling to all of the major lines of commercial insurance.

- As we refine our techniques we will continue to push out the boundaries.
    - Lines like D&O, E&O
    - Small books of commercial insurance policies

Deepening of Actuarial Work: Reserving

- Much of today's practice is still "pre-statistical".
  - No single, commonly accepted stochastic reserving framework comparable to GLM ratemaking.
  - Spreadsheet-based projection methods like chain-ladder, BF still common.

- Predictive modeling concepts will continue to be brought to bear ➔ the body of stochastic reserving theory will continue to develop.
  - Loss reserving will increasingly be seen as a type of statistical modeling.
  - Better point estimates
  - Reserve ranges – simulation, Bayesian techniques

- Predictive modeling will enable loss reserving with **claim-level data**.
  - Loss triangles are an artifact of paper-and-pencil statistics.
  - Use of claim-level data enables the use of **predictive variables**.
  - Can better analyze trends, books of business that have shifted over time.
  - (Is a loss triangle a "sufficient statistics" for estimating outstanding losses?)
  - More natural application of bootstrapping: with claim-level data, we can bootstrap the data rather than model residuals.

Broadening of Actuarial Work

- Predictive modeling is the ultimate "transferable skill".

- Many of the models be build are essentially the same as the models discussed in the marketing science literature.
  - Customer segmentation, profiling, "clustering"
  - Profitability modeling
  - Retention
  - Elasticity
  - Price optimization
  - Cross-sell
  - Customer lifetime value (CLTV)

- Certain actuaries will increasingly work as "marketing science" experts.
  - Increasing focus on modeling **market-based prices** in addition to **cost-base prices**.

- Marketing science: a consumer-centric rather than product centric view.

Modeling and Consumer Behavior

- Another aspect of the "marketing science" aspect of future insurance modeling work:

- Insurers will continue to find ways of modeling consumer *behavior*.

- Why is gender predictive?

- Why is credit predictive?

- What other behavioral data sources are out there?
    - Driving behavior
    - Bill payment behavior
    - Up-sell behavior
    - Web site activity
    - …

Other Emerging Applications for P&C Insurers

- Premium audit

- Claims analytics

- Premium audit models

- Agency analytics

- Target marketing

- Designing/evaluating ad/marketing campaigns

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Closing Thoughts

What's It All About?

- Predictive modeling will increasingly be regarded as a **core competency** around which forward-thinking P&C companies will fashion their competitive strategies.

- *Moneyball* and *Super Crunchers* are lessons in **behavioral economics**.
    - Markets are often inefficient to a surprising degree due to systematic biases in human decision making.
    - Predictive models are the necessary corrective.
    - Underwriting is a classic case study.

- This suggests a form of competitive strategy for P&C insurers.
    - Find innovative ways to replace intuition-based decision-making with predictive model-enhanced decision making.
    - Exploit market inefficiencies through the use of analytics.

Some Predictions

- More P&C insurers' competitive strategies will be tied to analytics.
  - The lessons of behavioral economics will be taken on board.

- Data will be explicitly recognized as an <u>asset</u>.
  - Perhaps even on the balance sheet?

- Analytics will be applied to better understand **consumer behavior** and market-based (not merely cost-based) pricing.
  - Customer-centric views will supplant siloed or product-centric views.

- Analytics will also be used to better understand **employee behavior**.
  - Workforce Analytics
  - Agency analytics

- Technical actuaries will find many new opportunities beyond the pricing department.
  - Increasing emphasis on concepts from marketing science.
  - Analytical work will no longer be regarded as "back room" in nature.

Parting Thought

"Of course these predictions may only be worth what the CAS paid me for presenting them."

-- Paraphrase of David Skurnick, "The Underwriting Cycle" [1993]

Relevant Reading

Dan Ariely (2008), *Predictably Irrational*, Harper Collins

Ian Ayres (2007), *Super Crunchers*, Bantam Books

Thomas Davenport and Jeanne Harris (2006), *Competing on Analytics*, Harvard Business School Press

James Guszcza (2008). "Analyzing Analytics: The debate Between Intuition and Statistical Thinking," *Contingencies*

Michael Lewis (2003), *Moneyball: The Art of Winning an Unfair Game*, W.W. Norton & Co

Richard Thaler and Cass Sunstein (2007), *Nudge: Improving Decisions about Health, Wealth, and Happiness*, Yale University Press