Science, design &

risk management

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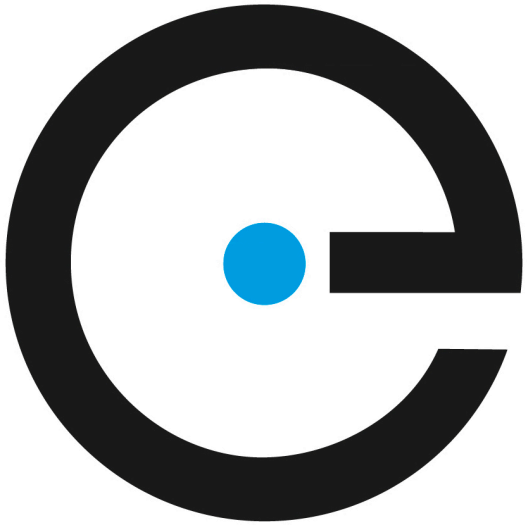


Two regulated investment managers
Three portfolios
Two machine-learning-based statistical arbitrage equity market neutral strategies
1000+ trades per day
Positions across our entire investment universe
Intermediate investment system contained dozens of thousands of lines of code
JV with group of 65 specialized engineers
1 academic partnership
2 part time machine learning/signal processing consultants

Overview

The scientific method

Two applied examples

Three emerging challenges in risk management

1. An introduction to industrial design

   5 applied principles derived from industrial design

2. An introduction to chaos/complexity

   5 applied principles derived from complexity

3. A discussion on declarative knowledge

Ending remarks

A **different** story

If you were to build
an investment management firm
from scratch today,
how would YOU do it?

What is risk management?

- Internal operational risk (competence, compliance, governance…)
- Legal risk
- Regulatory risk: investment and marketing
- Counterparty risk
- Financing risk
- Key man risk
- Capital stability risk
- Portfolio management. Analytics and reporting. Portfolio risk management *is* portfolio management.

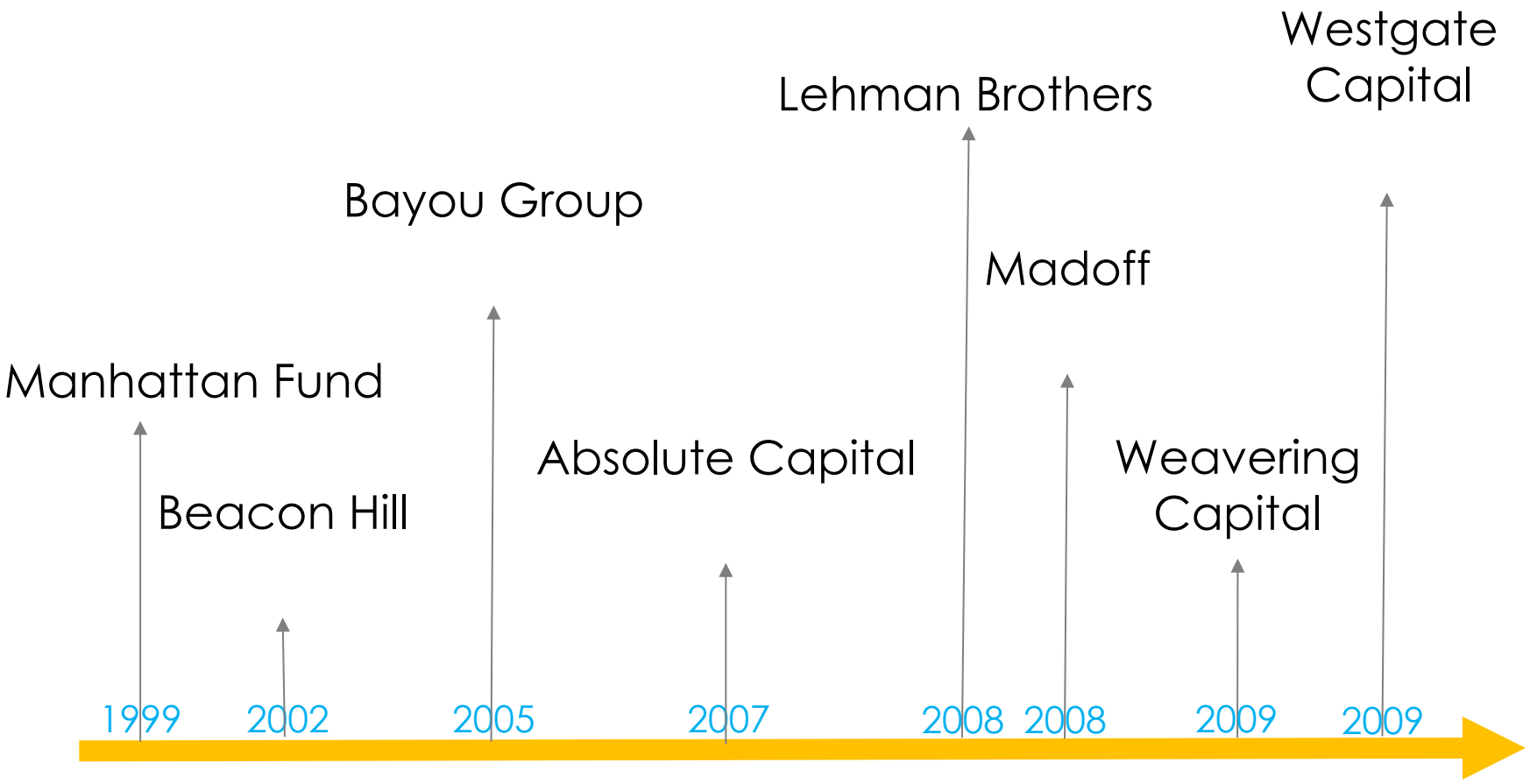
Challenges in designing risk management:

- extremely multi-disciplinary topic
- mix of hard and soft challenges i.e. numbers and people
- underlying metrics are poorly understood by industry
- aged decentralized systems
- fast evolving
- …

« Risks related to operational weakness clearly outweigh the levels of financial risks. »

EDHEC study

Time scale of operational failures



Industry context:

- Opaque industry
- No manuals
- Mysticism: “passion,” “pedigree”
- Outsourced shamans: no comment.

The Scientific Method

- Formulate a question
- Break down the problem into as many misunderstood components as you can
- Understand each of them
- Create a solution
- Experiment until you have a working result
- Analyze your results

How can we have a middle office in line with best practices?

How can we achieve an automated technology firm with as little human intervention and discretion as possible?

At Empiric…

Sub parts of system

- Pre trade compliance
- Post trade compliance
- National regulations compliance

Solution to create:

- Build an in house portfolio management system.

All **pre trade compliance** points are hard coded into it. Net limits and gross limits hard coded into it.
FIX connection **DMA** with strict limits per order, per geographic zone, and per total daily amount. Limits replicated on our side and prime broker side. Zero human interference.
All **post trade compliance** is automated.
EMIR reconciliation checks automated.
ESMA national regulations: major shareholding disclosures and short selling disclosures checks automated.

Entire system that manages this:

- Portfolio reconciliation versus prime broker in the morning. Two data feeds used for this.
- Order generation
- Pre trade checks
- Orders sent to market
- Post trade compliance checks
- Full portfolio checks versus prime broker and administrator and versus national regulations over the full lifetime of the positions.
- Everything logged and archived on site and on the cloud automatically as well.
- We hold all universe in the portfolio and do several hundred trades a day.

What about other areas?

What about what can't be automated?

Counterparty risk

- Automate everything possible and then do the opposite here.
- You get your own house in order so that you can focus on external risks.
- Speak several times a week. Double check everything and anything whenever it comes up.
- In depth quarterly reviews.
- Sit down next to our account manager and we build monthly report together. Ask plenty of questions throughout. Take note of manual processes on their side. Ask about changes to processes, to team.
- This is the real purpose of automation. Focusing most of your attention on the aspects that need close human monitoring.

Three emerging challenges in risk management

I see three problems creeping up in contemporary asset management:

1. Interface risk stemming from technology and automation
2. The exponential rise of complexity
3. The loss of declarative knowledge

1. Systems risk and automation

« The professional service of creating and developing concepts and specifications that optimize the function, value, and appearance of products and systems for the mutual benefit of both user and manufacturer. »

Industrial Design Society of America

« Design is concerned with how things work, how they are controlled, and the nature of the interaction between people and technology. »

Donald Norman

5 applied examples

1. Nuclear power plants: Three Mile Island Committee
2. Aviation industry: Air Force F-22 reports of 2012/2013
3. US nuclear aircraft carriers
4. Air traffic control centres
5. Hospitals

5 applied principles derived from industrial design

1. Systems error model versus personal one
2. James Reason's Swiss cheese model
3. Testing
4. Independent checks
5. Designing systems for humans

2. the exponential rise of complexity

a. Systems becoming more and more complex.

b. Environment becoming more and more complex.

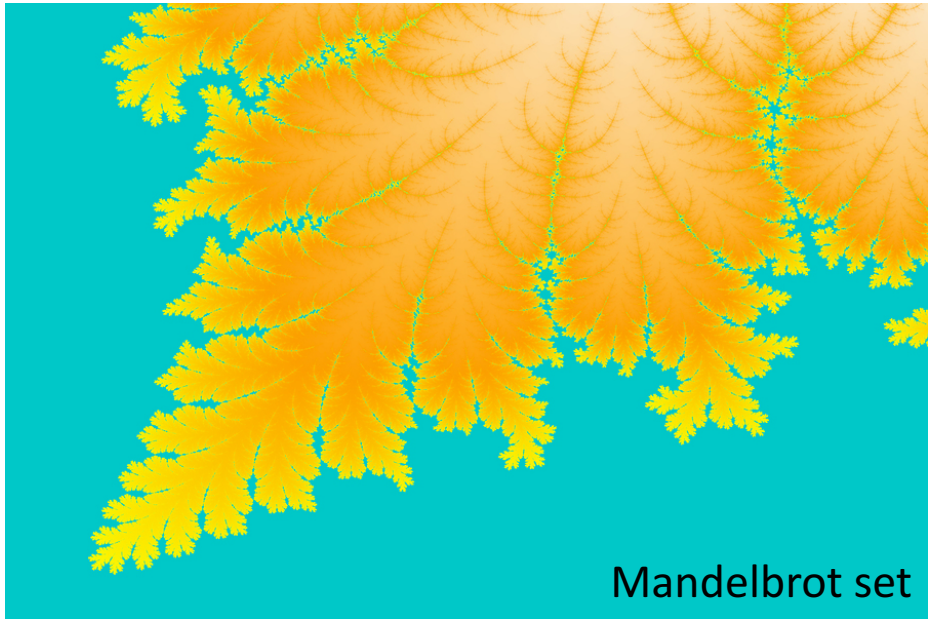
A brief history of chaos/complexity

«The modern study of chaos began with the creeping realization in the 1960s that quite simple mathematical equations could model systems every bit as violent as a waterfall.»

James Gleick

«The mathematical intuition so developed ill equips the student to confront the bizarre behaviour exhibited by the simplest of discrete nonlinear systems… Not only in research, but also in the everyday world of politics and economics, we would all be better off if more people realized that simple nonlinear systems do not necessarily possess simple dynamical properties.»

Robert May



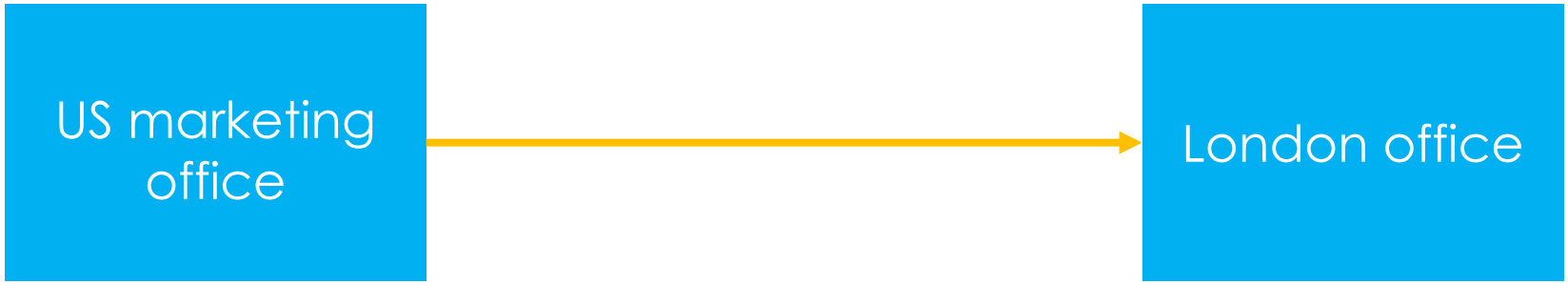
Three fundamental life lessons:

1. Simple, nonlinear inputs lead to complex, dramatic outputs.

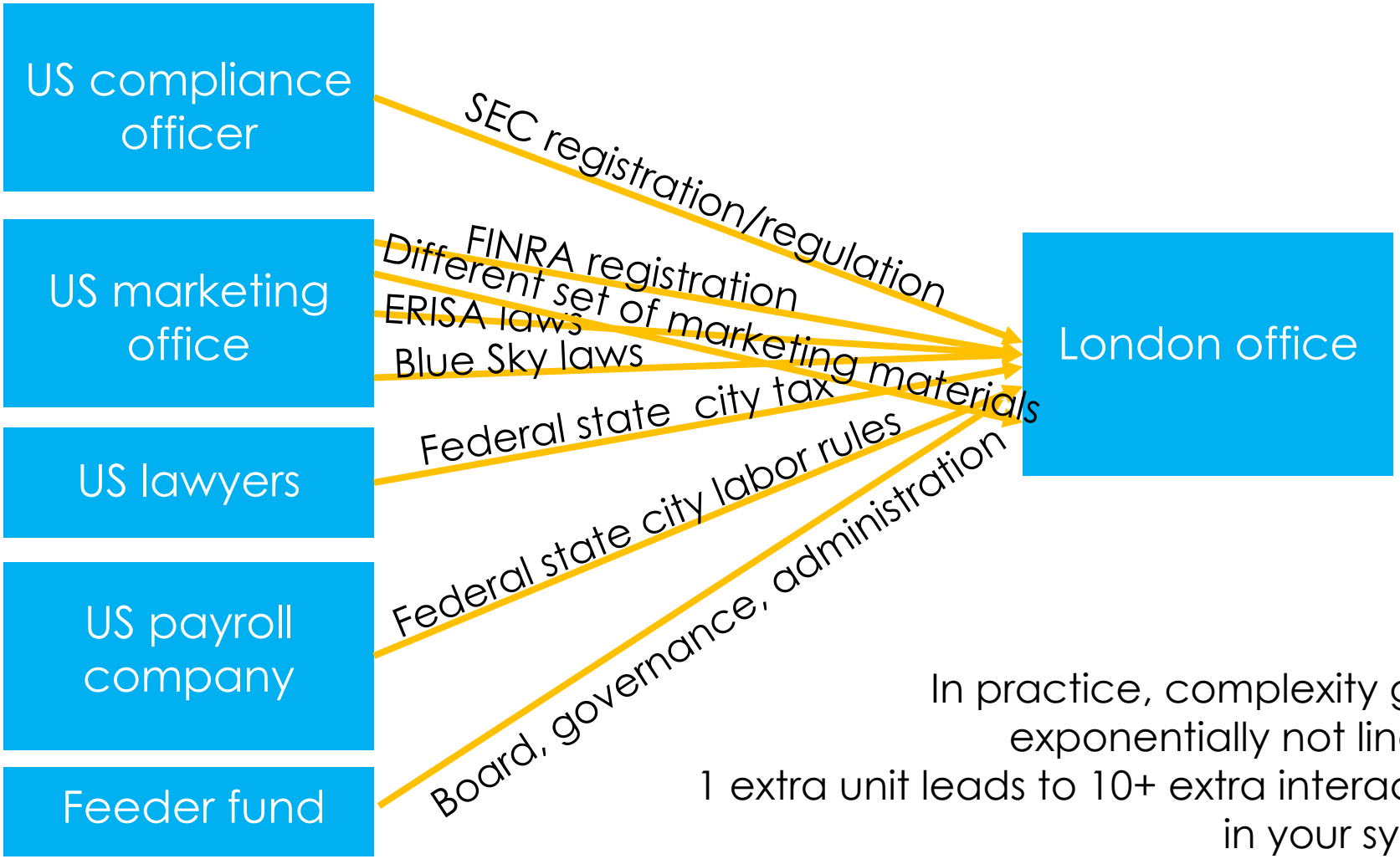
2. When change happens, you cannot predict accurately the direction nor magnitude of that change.

3. What appears chaotic at a systems level often hides order/patterns at subscale.

Traditional linear thinking



Complex reality



In practice, complexity grows exponentially not linearly.
1 extra unit leads to 10+ extra interactions in your system.

5 principles to manage complexity

1. Design firm flexibly
2. Applied policies, governing specific processes around the firm
3. The checklist
4. Benchmarking your work
5. Obsessing with failure

3. about the loss of declarative knowledge at industry level

- The parable of the professional HF investors who could not calculate a Sharpe
- Statistics behind risk analytics widely misunderstood
- Industry regularly focuses on low information ratios instead of higher information measures
- …

Spec of an ops analyst

Example 1:

- Good IT skills (notably Excel)
- excellent attention to detail.

Example 2:

- Numerate with good IT skills (minimum strong Excel skills).
- Experience of at least 3 years in financial services
- Knowledge of equities, equity swaps, futures, options are a must

The future:

Systems engineer with an advanced degree, fluent in python and with 10+ years of software engineering experience.

Spec of an ops analyst (continued)

The core of the role is:
- trade matching and confirmations
- daily recs
- setting up instruments and locating stock borrows
- daily P&L monitoring and reporting
- assist with compliance/risk monitoring and reporting

DDQ examples

(a) Have there been any material trading errors or breaches in the past two years?	☐ Yes ☒ No, and, as a consequence, Operations and Risk Management Table 9.9B has been left blank.
(b) For each material trade error in the past two years, please provide the information requested in Operations and Risk Management Table 9.9B.	☐ Operations and Risk Management Table 9.9B has been completed in response to this question. ☐ Discussion for onsite review only.

(a) Does the investment manager allow trading by telephone?	☐ Yes ☒ No, and, as a consequence, (b)-(f) below have been left blank.
(b) What percentage of trades are executed via telephone?	XX.XX%
(c) What controls are in place relating to executing trades via the telephone?	Click here to enter text.
(d) Does the investment manager record trade desk telephone lines?	☐ Yes, reliance placed on brokers to record lines. ☐ Yes, investment manager's own recording software. ☐ No
(e) Are trades ever executed via mobile phone?	☐ Yes ☐ No, and, as a consequence, (f) below has been left blank.
(f) Are mobile phone lines recorded?	☐ Yes ☐ No

(a) Are any staff members authorised to trade when out of the office?	☐ Yes ☐ No, and, as a consequence, (b)-(c) below have been left blank. We trade directly via DMA, as such this nuance is not as relevant.
(b) What limits have been set on out of offsite trading?	Click here to enter text.
(c) Describe the process used of ensuring offsite trades are booked or captured on a timely basis and the front office confirmation process.	Click here to enter text.

Closing comments

If we take certain precautions when flying people from NY to London, why not take them when custodying their pensions as well ?

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