Marketing of Monte Carlo

Faldo’s Folly or Monty’s Carlo

14th April 2010
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- **Monte Carlo at Capgemini Consulting**
  - Faldo’s Folly or Monty’s Carlo
  - Figure It Out Blog
  - Green, Gold and Red Knights
Introductions…

Stefan Sadnicki
Senior Consultant
Operational Research
Capgemini Consulting

- Recent projects include:
  - Network Distribution Study with French Retail Bank
  - Financial Forecasting for NHS Hospital
  - Systems Dynamics modelling with the Ministry of Justice
- BA in Mathematics and an MSc. in Computer Science and University of Oxford.
- PGC in OR from the University of Strathclyde
Capgemini is one of the top international consultancies with a strong presence in more than 30 countries.

Group Revenue €4,376 million

Group Workforce: 89,278
Working offshore: 25,027

North America: 7,943

South America: 1,444

North America: 7,943

UK & Ireland: 8,087

France: 19,935

Nordic Countries: 3,790

Eastern Europe: 4,005

South Europe: 6,491

Central Europe: 3,691

India: 20,432

Morocco: 226

Benelux: 11,509

Asia Pacific: 1,725

Group Headquarters: Paris, France

64% of Fortune Global 500 as clients

as of June 30, 2009

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Within the Capgemini Group, Risk Analysis is carried out by the specialist Operational Research (OR) team within Capgemini Consulting.

Improving investment decisions, maximising delivery of benefits and increasing understanding of the drivers of business performance
- SAFER

Optimising operational effectiveness and efficiency of business operations, processes and workforce
- Information intelligence
- Forecasting back office workload
- Fact-based performance improvement
- NHS service redesign

Understanding and quantifying risk exposure and developing effective strategies for minimising the impact on the business
- Business resilience planning
- Managing risk in large transformation programmes

Understand and quantify the impact of alternative business options, economic assumptions and industry scenarios
- Business games
- Policy modelling
- Health strategy modelling
Working as an OR Consultant within a large management consultancy has both positive and negative aspects…

- An OR group within a large management consultancy will be made up of individuals equipped with a comprehensive toolkit of OR techniques together with softer consulting skills.

- Our capabilities are quite distinct from colleagues elsewhere in the organisation.

- Our group is always in demand and there is a steady stream of good interesting OR work.

- Our peers sometimes struggle to understand our capabilities.

- Our work is not always recognised by client senior management. We solve the problem but others get the credit.

We have to stop people thinking we just build colourful dashboards in Excel.
So how do we market ourselves both internally and externally to promote our capabilities (e.g. Monte Carlo Simulation)?

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Sir Nick Faldo
Captain 2008
European Ryder Cup Team
- Won 6 Majors
- Knighted in 2009
- Left School at 15

Colin ‘Monty’ Montgomerie
Captain 2010
European Ryder Cup Team
- Eight Order of Merit Titles
- 31 Tour Titles
- Never won a major
- Famous for his playing performances at the Ryder Cup

Malcolm Glazer
Owner
Manchester United FC
- Inherited his father's wholesale jewellery business
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The scheduling of Ryder Cup singles matches can be used to demonstrate the potential of Monte Carlo simulation...

Days 1 and 2: 4 foursomes and 4 fourball matches between pairs of European and pairs of American golfers (16 points)

Final day: All 12 players take part in singles matches (12 points)

The team with the highest overall points out of 28 matches wins. (If the competition finishes 14-14 the previous winners retain the cup)

Going into the final day’s single matches the US were leading 9 points to 7. To retain the Cup, Europe needed 7 points from 12 matches
On the eve of the final day, the team captains are required to submit their team slate for the final 12 singles matches

- Each match consists of the same 18 holes in the same order and so the matches are staggered
- The earlier matches typically finish first

Should the strongest players be sent out first?

Should the strongest players be saved for last?

Should the best players be scheduled for the critical matches?

If the Americans are going to front-load their slate then what is the best European strategy?
Faldo’s strategy was heavily criticised in the sporting press

No regrets for Faldo after Ryder Cup gamble backfires

Montgomerie joins attack on Faldo's folly

By James Corrigan at The Belfry
Thursday, 25 September 2008

Ryder Cup 2008 will be remembered for the Americans burning passion and Faldo's desperate blundering

Montgomerie yesterday blamed Nick Faldo for Europe’s Ryder Cup defeat - and refused to express any sympathy for the beaten captain.

Graeme McDowell also admitted Faldo got “the wrong line-up” in the singles at Valhalla as his side suffered their biggest defeat since 1981.

Ryder Cup: Americans seal win as Nick Faldo's singles gamble backfires

Captain Nick Faldo failed in his quest to lead Europe to Ryder Cup glory
Game Theory - the best a captain can do is pick names out of a hat

- To illustrate, suppose there were just two matches on the final day and Europe are required to win both matches to win the cup. Both Europe and the USA have a very good player, $\alpha$ and a good player, $\beta$ and depending on the selection order matches can either be between equally ranked players or be mismatches:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Good, $\alpha$</td>
<td>Good, $\beta$</td>
</tr>
<tr>
<td>Europe</td>
<td>$\frac{1}{2}$</td>
<td>$p$</td>
</tr>
<tr>
<td></td>
<td>$1-p$</td>
<td>$\frac{1}{2}$</td>
</tr>
</tbody>
</table>

- Selection order leads to the following pay-off matrix:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$(\alpha, \beta)$</td>
<td>$(\beta, \alpha)$</td>
</tr>
<tr>
<td>Europe</td>
<td>$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$</td>
<td>$p(1-p)$</td>
</tr>
<tr>
<td></td>
<td>$(\beta, \alpha)$</td>
<td>$(1-p)p$</td>
</tr>
<tr>
<td></td>
<td>$\frac{1}{4}$</td>
<td>$\frac{1}{4}$</td>
</tr>
</tbody>
</table>

- $p(1-p)$ is always less than $\frac{1}{4}$ for $p > \frac{1}{2}$. European team stands a better chance of winning both matches if they have the same strategy.

Optimal mixed strategy is to select $(\alpha, \beta)$ with a probability $\frac{1}{2}$ and $(\beta, \alpha)$ with a probability $\frac{1}{2}$. This is equivalent to picking names out of a hat.
The game theory result is based on two key assumptions?

<table>
<thead>
<tr>
<th>Assumption 1</th>
<th>Assumption 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>The captain has no reliable information about what the other side will do.</td>
<td>The captain has no reliable information about how his players will react under pressure. By this we mean that a golfer's performance is unaffected by whether his match is the first of the day or one of the later matches that determines the Ryder Cup.</td>
</tr>
</tbody>
</table>

An improvement on the optimal game theory results only exists if one of the above assumptions is invalid.
It was widely reported that the US were going to front-load their line up so Faldo could use this information to influence his team selection.

<table>
<thead>
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<th>Assumption 1</th>
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</thead>
<tbody>
<tr>
<td>The captain has no reliable information about what the other side will do.</td>
</tr>
</tbody>
</table>

What would you have done?

- Anthony Kim (5)
- Hunter Mahan (7)
- Justin Leonard (3)
- Phil Mickelson (1)
- Kenny Perry (6)
- Boo Weekley (9)
- J.B. Holmes (11)
- Jim Furyk (2)
- Steward Cink (4)
- Steve Stricker (8)
- Ben Curtis (12)
- Chad Campbell (10)

<table>
<thead>
<tr>
<th>Ian Poulter (3)</th>
<th>Lee Westwood (5)</th>
<th>Oliver Wilson (9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sergio Garcia (2)</td>
<td>Soren Hansen (12)</td>
<td>Justin Rose (6)</td>
</tr>
<tr>
<td>Paul Cassey (11)</td>
<td>Graeme McDowell (10)</td>
<td>Padraig Harrington (1)</td>
</tr>
<tr>
<td>Robert Karlsson (7)</td>
<td>Henrik Stenson (4)</td>
<td>Miguel Angel Jimenez (8)</td>
</tr>
</tbody>
</table>
Also, when the pressure is on, some players are more likely to raise their games whilst others will crumble

Assumption 2

| The captain also has no reliable information about how his players will react under pressure. |

- Suppose two players perform better if they have the chance to be the hero and two players are able to hold their nerve and avoid becoming the villain.
  - Be a hero (if winning a hole will win the match and the Ryder cup)
  - Be a villain (if losing a hole will concede the Ryder cup)

- Where would you place these players?

You would want your ‘pressure players’ to play the critical holes – when the Ryder Cup will be either won or lost
A Monte Carlo simulation was used to determine the position of the critical matches.

- Towards the end of the day and on the back nine, a European player can:
  - Be a hero (if winning a hole will win the match and the Ryder cup)
  - Be a villain (if losing a hole will concede the Ryder cup)

- A match is critical if a player can be either a hero or villain on the same hole
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The success of the Ryder Cup analysis led to creation of a weekly Operational Research blog

Statistical Skewness wins the Election
Following the election being called on Tuesday, we were unable to resist the opportunity to delve into some electoral statistics.

Strike Strategies
Following news today, that planned strike action by rail workers on the four days after Easter weekend has been called off at the last minute after a court injunction, commuters throughout the UK will no doubt be breathing a sigh of relief. Although the rail companies will share in that relief, there will have been quite a bit of work done behind closed doors this week preparing for the planned action. In this week’s Figure It Out, we’ve considered the decisions that companies have to make when faced with strike action and some of the strategies they employ.
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In recent months a consortium of business men ‘The Red Knights’ have been discussing a bid for Manchester United Football Club.
The Red Knights proposed bid has generated lots of publicity... with each report quoting different statistics...

Red Knights: 'We can save United – if fans pay £2,500 each'

Consortium makes offer to supporters but admits its plan to buy out the Glazer family is far from simple

By Ian Herbert and Nick Harris

Wednesday, 3 March 2010

As many as 100,000 Manchester United fans will be asked to contribute £2,500 each to the Red Knight fund to buy out the club from the Glazer family, under initial costings drawn up by those leading the audacious plan.

United's £1bn Super Knights: Two wealthy fans bid to force out Glazers

By JOE BERNSTEIN Last updated at 12:54 AM on 21st March 2010

Two Manchester United 'Super Knights' are prepared to put in £500million each to force the Glazer family out of Old Trafford.

However, the Red Knights, who are trying to buy the club from the Glazers, are likely to reject the offer as they build a consortium of 40 people putting in £15m each.

So far, the Red Knights - led by lifelong United fan Jim O'Neill, the chief economist at global investment banking and securities firm Goldman Sachs - have 80 potential investors.

But the Red Knights want evidence of more commitment before they will pledge cash support to the tune of around £10m-£15m each from the 40-50 wealthy backers.

There are understood to have been 40 serious expressions of interest in investment from would-be Red Knights, though initial proposals discussed by O'Neill and the Manchester United Supporters' Trust (Must) are understood to envisage 50 high net-worth individuals, each contributing between £10m and £15m each, raising at least £500m; a further 100 throwing in between £1m and £5m each, raising a further £200m based on their investment being £2m each and - most challenging of all - the £2,500 contribution from fans.
We put all of these different sources and came up with a model.

### Figure it Out no 42: Green, Gold and Red Knights

<table>
<thead>
<tr>
<th>Capgemini Consulting</th>
<th>Stefan <a href="mailto:Sadnicki@capgemini.com">Sadnicki@capgemini.com</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid Acceptance Criteria</td>
<td>Probability of Bid Success</td>
</tr>
<tr>
<td>Absolute Minimum</td>
<td>£272m</td>
</tr>
<tr>
<td>Take their money and run...</td>
<td>£800m</td>
</tr>
<tr>
<td>Glazer Inflexibility (0-10)</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Members</th>
<th>Contribution</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Knights</td>
<td>30</td>
<td>Red Knights</td>
<td>£12.5m</td>
<td>£2.0m</td>
</tr>
<tr>
<td>Wealthy Individuals</td>
<td>75</td>
<td>Wealthy Individuals</td>
<td>£2.5m</td>
<td>£1.0m</td>
</tr>
<tr>
<td>Fans</td>
<td>75,000</td>
<td>Fans</td>
<td>£2,500</td>
<td>£2,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calculations</th>
<th>Expected</th>
<th>Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Knights</td>
<td>£375.0m</td>
<td>£375.0m</td>
</tr>
<tr>
<td>Wealthy Individuals</td>
<td>£187.5m</td>
<td>£187.5m</td>
</tr>
<tr>
<td>Fans</td>
<td>£187.5m</td>
<td>£187.5m</td>
</tr>
</tbody>
</table>

**Expected Bid Value**: £750m

**Simulation Bid Value**: £750m

**Probability Bid is Successful**: 67%

**Single Simulation Result**: 1 Accept

**Overall Probability of Success**: 56%
Further Information

- Our ‘Figure it Out’ Blog
  - updated every week
    http://www.uk.capgemini.com/orblog/
  - Faldo’s Folly or Monty’s Carlo – OR Insight
  - Green, Gold, and Red Knights
    http://www.uk.capgemini.com/orblog/2010/03/green_gold_and_red_knights.php

- The Operational Team also has
  - 200 success stories:
    http://www.uk.capgemini.com/services/consulting/or/success_stories/
  - and over 30 demo models:
    http://www.uk.capgemini.com/services/consulting/or/demos/

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Original Article

Faldo’s folly or Monty’s Carlo

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E-mail: Stefan.Sadnicki@capgemini.co.uk
*Corresponding author.

Abstract The Ryder Cup is arguably the most prestigious and most exciting golf tournament in the world. It is a team event contested once every two years between 12 golfers from Europe and 12 golfers from the United States of America. For the 12 singles matches on the final Sunday, each captain selects the order in which his players tee off. In 2008, after an eventual US victory, the sporting press was hugely critical of Nick Faldo’s (the European captain) slate selection. This article looks to explore the justification of such criticism. First, existing academic results are reviewed and, where necessary, updated for 2008. Second, using Monte Carlo simulation, we consider the scheduling of players who react differently under pressure. This simple sporting example illustrates how Monte Carlo simulation can be used to analyse a range of potential scenarios enabling better, more informed decisions. Within a business context, where a winning outcome is essential, non-OR practitioners must understand how OR techniques can be used to make better, more informed decisions. This article concludes by discussing how the Ryder Cup model, together with a related example analysing interdependent project risks, was successfully used within a consultancy environment to introduce non-OR practitioners to the theory behind and the potential of Monte Carlo simulation.

OR Insight (2009) 22, 185–206. doi:10.1057/or.2009.8

Keywords: Monte Carlo simulation; consulting; the Ryder Cup; golf; OR in sport

Introduction

Within large management consultancies, an OR group will be made up of individuals with capabilities quite distinct from their colleagues elsewhere in the organisation. From the authors’ experience, good OR consultants are equipped with a comprehensive toolkit of OR techniques together with softer consulting