

Working with Henry Wynn: From PhD Student to Co-Author, and Beyond

Personal Reflections

Roberto Fontana

15 June 2026

Politecnico di Torino

During my PhD (supervisors Professor Giovanni Pistone and Professor Henry Wynn)

- since the very beginning, Henry was always very kind;

During my PhD (supervisors Professor Giovanni Pistone and Professor Henry Wynn)

- since the very beginning, Henry was always very kind;
- he was listening to me and then I was under the impression that I was working on very important topics;

During my PhD (supervisors Professor Giovanni Pistone and Professor Henry Wynn)

- since the very beginning, Henry was always very kind;
- he was listening to me and then I was under the impression that I was working on very important topics;
- thanks to both Giovanni and Henry, I learned a lot about how to do scientific research

Full Factorial Design: $3 \times 4 \times 2$

```
/**** 3*4*2 full factorial design, "0,1,...,s-1" coding *****/  
free ff;  
  
do i1 = 0 to 2;  
  do i2 = 0 to 3;  
    do i3 = 0 to 1;  
      ff = ff // (i1 || i2 || i3);  
    end;  
  end;  
end;
```

```
/**** 3*4*2 full factorial design, "0,1,...,s-1" coding *****/  
0 0 0  
0 0 1  
0 1 0  
0 1 1  
0 2 0  
0 2 1  
0 3 0  
0 3 1  
1 0 0  
1 0 1  
1 1 0  
1 1 1  
1 2 0  
1 2 1  
1 3 0  
1 3 1  
2 0 0  
2 0 1  
2 1 0  
2 1 1  
2 2 0  
2 2 1  
2 3 0  
2 3 1
```

Full Factorial Design: $3 \times 4 \times 2 \times 5$

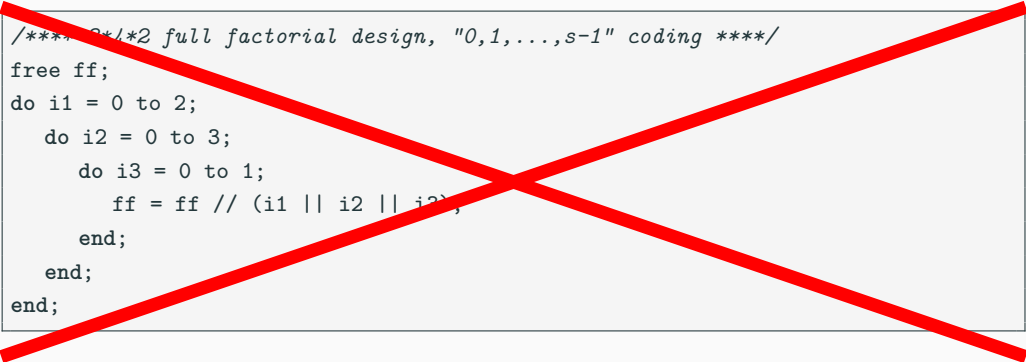
```
**** 3*4*2*5 full factorial design, "0,1,...,s-1" coding ****/  
free ff;  
do i1 = 0 to 2;  
  do i2 = 0 to 3;  
    do i3 = 0 to 1;  
      do i4 = 0 to 4;  
        ff = ff // (i1 || i2 || i3 || i4);  
      end;  
    end;  
  end;  
end;  
end;
```

Full Factorial Design

```
**** 3*4*2 full factorial design, "0,1,...,s-1" coding ****/  
free ff;  
do i1 = 0 to 2;  
  do i2 = 0 to 3;  
    do i3 = 0 to 1;  
      ff = ff // (i1 || i2 || i3);  
    end;  
  end;  
end;
```

Full Factorial Design

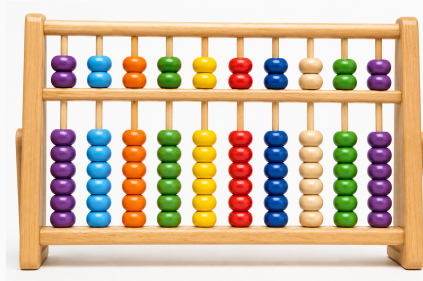
```
**** 2*1*2 full factorial design, "0,1,...,s-1" coding ****/  
free ff;  
do i1 = 0 to 2;  
  do i2 = 0 to 3;  
    do i3 = 0 to 1;  
      ff = ff // (i1 || i2 || i3);  
    end;  
  end;  
end;
```



not the right way

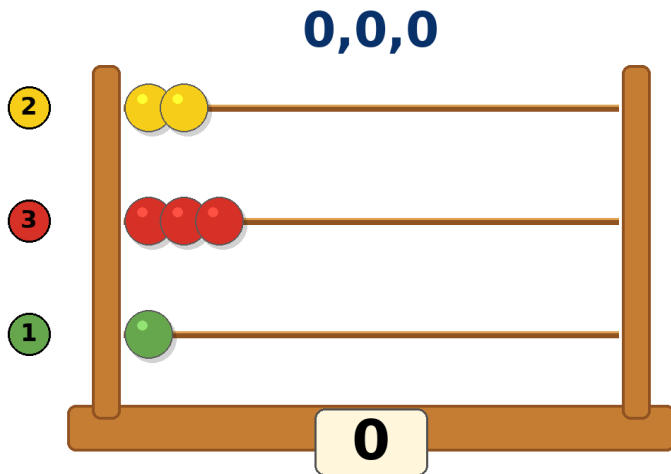
More than thirty years ago ... my PhD

"The full factorial design is like an abacus."

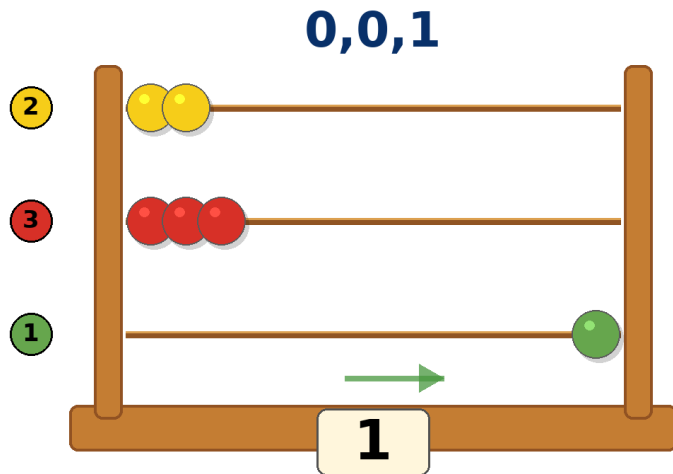


A colored abacus

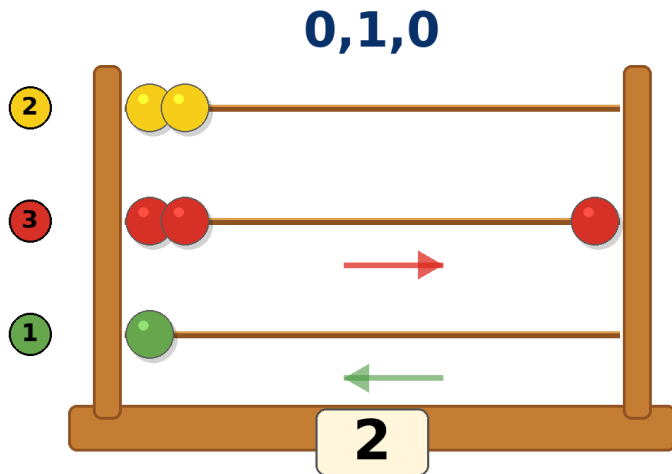
$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding



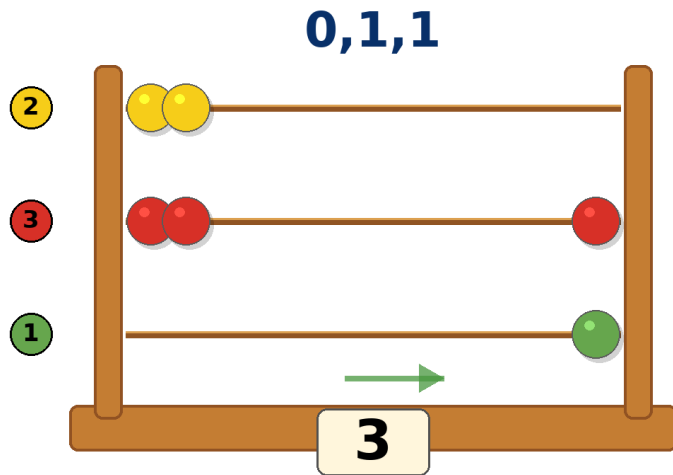
$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding



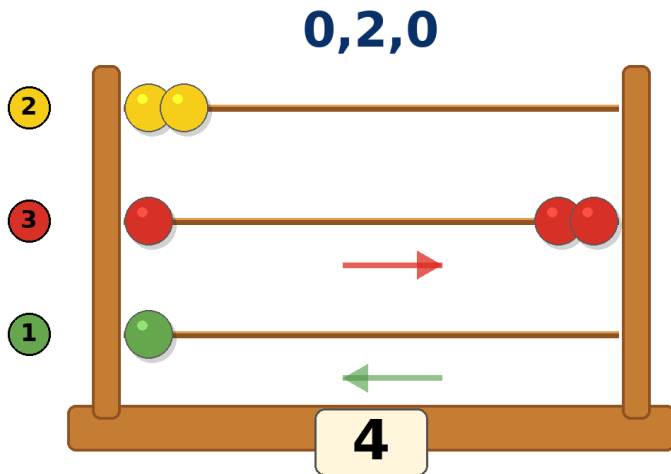
$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding



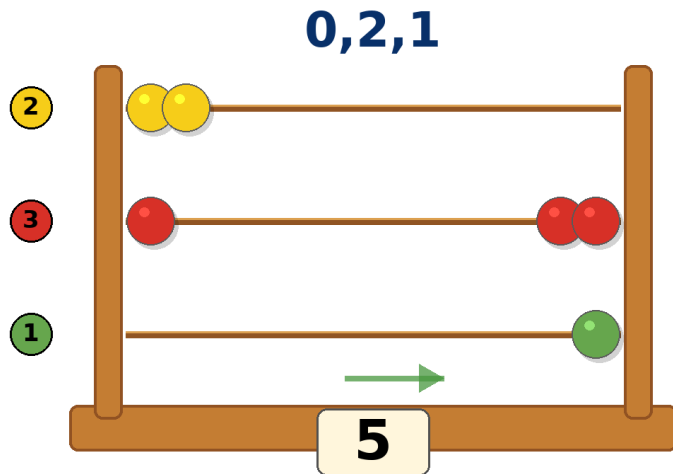
$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding



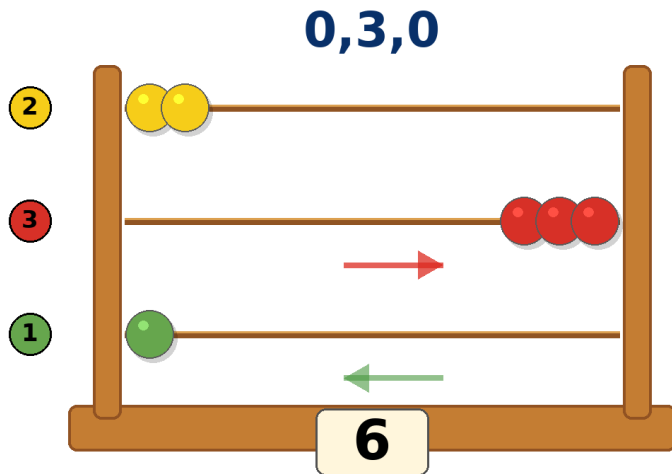
$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding



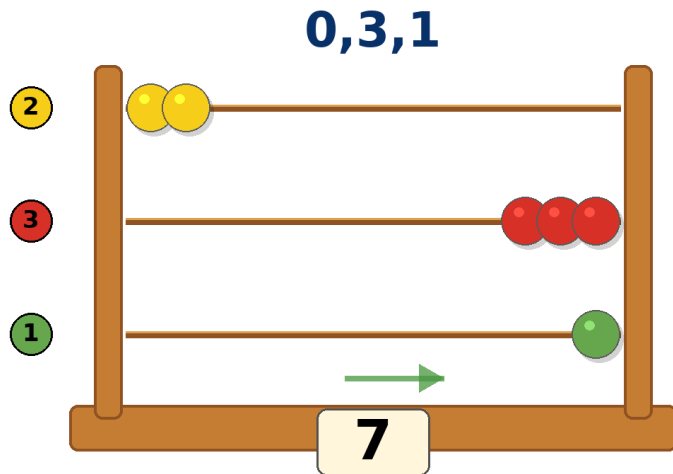
$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding



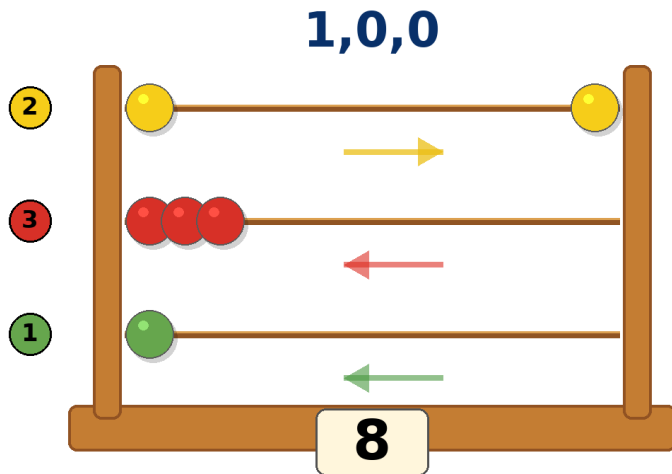
$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding



$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding



$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s-1$ -coding



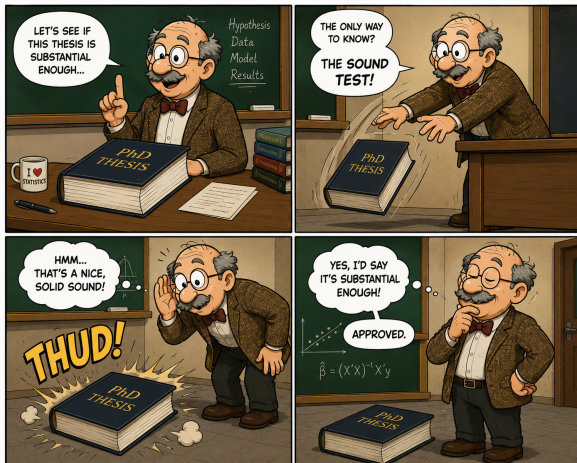
$3 \times 4 \times 2$ full factorial design, $0, 1, \dots, s - 1$ -coding

and so on ...

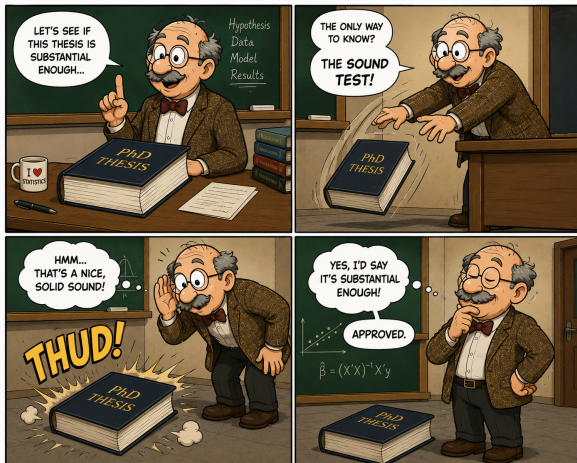
ffmix - *my most-used script*

```
start ffmix(lev);
  nfac=ncol(lev); /*number of factors*/
  npt=1;
  do i=1 to nfac;
    npt=npt*lev[i]; /* cardinality of the design*/
  end;
  ff=j(npt,nfac,0);
  do i=0 to npt-1;
    tmp=i;
    do j=1 to nfac;
      ff[i+1,nfac-j+1]= mod(tmp,lev[nfac-j+1]); /*conversion base algorithm*/
      tmp=int(tmp/lev[nfac-j+1]);
    end;
  end;
return(ff);
finish;
```


Thirty years ago ... my PhD



Thirty years ago ... my PhD



"You can now submit your thesis ... it is heavy enough!"

Then ... $(CE)^2$

Project record:

CORDIS BRPR960282

Contract cited in publications:

BE96-3046

Then ... $(CE)^2$

Project record:

CORDIS BRPR960282

Contract cited in publications:

BE96-3046



Concurrent Engineering needed faster multi-objective design tools

The project targeted the gap between increasingly capable numerical simulation and the practical difficulty of using slow simulators inside global, multi-objective optimisation loops.

Industrial motivation

- Reduce time to market.
- Consider product aspects together: performance, safety, environmental impact, reliability.
- Support complex product/process development rather than single-domain optimisation.

Technical bottleneck

- High-fidelity simulation codes can take too long for repeated optimisation runs.
- Multi-objective algorithms require many evaluations.
- Tools were missing for simultaneous, cross-domain optimisation.

Sources: CORDIS objective text; ECCOMAS 2000 project paper.

Simulation codes → Computer experiments → Fast emulators →
Multi-objective optimisation

The idea "*fast emulator instead of slow simulator*" is based on

Sacks, J., Welch, W. J., Mitchell, T. J., & Wynn, H. P. (1989). *Design and Analysis of Computer Experiments*. Statistical Science, 4(4), 409–423.

The final project publication was presented at ECCOMAS 2000

3 July 1998

CNRS, Sophia Antipolis

3 July 1998

CNRS, Sophia Antipolis

**But there was something else happening
that day...**

France–Italy, 1998 FIFA World Cup
quarter-final, played at the Stade de France.

3 July 1998

CNRS, Sophia Antipolis

**But there was something else happening
that day...**

France–Italy, 1998 FIFA World Cup
quarter-final, played at the Stade de France.



3 July 1998

CNRS, Sophia Antipolis

But there was something else happening that day...

France–Italy, 1998 FIFA World Cup quarter-final, played at the Stade de France.

After a goalless draw, France won the penalty shoot-out 4–3. France progressed to the semi-finals and eventually won the World Cup.



The conclusion ...



European projects involve many meetings ...

and, inevitably,

many lunches and dinners.

Another $(CE)^2$ project meeting

European projects involve many meetings ...

and, inevitably,

many lunches and dinners.

In Greece ...



Henry had a remarkable ability to engage with engineers, understand their problems, and convince them of the value of elegant theoretical ideas.

Fontana, R., Rapallo, F., & Wynn, H. P.
(2022). *Circuits for Robust Designs*.
Statistical Papers, 63(5), 1537–1560.

StatPapers 2022



- The theory gives a very special and detailed representation of the kernel of the design model matrix, named *circuit basis*.

- The theory gives a very special and detailed representation of the kernel of the design model matrix, named *circuit basis*.
- This representation turns out to be an appropriate way to study robustness criteria, namely the sensitivity of a design to the removal of design points.

- The theory gives a very special and detailed representation of the kernel of the design model matrix, named *circuit basis*.
- This representation turns out to be an appropriate way to study robustness criteria, namely the sensitivity of a design to the removal of design points.
- Exploiting the combinatorial properties of the circuit basis, we show that high levels of robustness are obtained by avoiding small circuits.

- The theory gives a very special and detailed representation of the kernel of the design model matrix, named *circuit basis*.
- This representation turns out to be an appropriate way to study robustness criteria, namely the sensitivity of a design to the removal of design points.
- Exploiting the combinatorial properties of the circuit basis, we show that high levels of robustness are obtained by avoiding small circuits.
- **Keywords:** Algebraic Statistics and Combinatorics; Design of Experiments; Robustness.

Scientific Collaboration: The Panic Level

Before the talk

"I can feel my panic level rising rapidly. It's almost 10 now. I'm really nervous..."



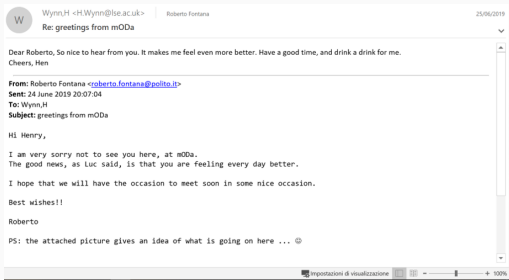
Scientific Collaboration: The Panic Level

A couple of minutes later

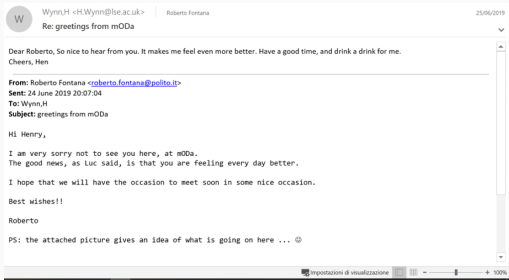
"Much better now — around 8."



mODa 12: Smolenice, Slovakia, 2019



mODa 12: Smolenice, Slovakia, 2019



Publication

Fontana, R., Luciano, E., & Semeraro, P. (2021).

Model Risk in Credit Risk.

Mathematical Finance, 31(1), 176–202.

A collaboration applying algebraic and statistical ideas to the assessment of model risk in credit risk.

Check for updates

Received: 19 July 2019 | Accepted: 24 July 2020
DOI: 10.1111/mafi.12285

ORIGINAL ARTICLE

MATHEMATICAL FINANCE
An International Journal of Probability
and Financial Economics
WILEY

Model risk in credit risk

Roberto Fontana¹ | Elisa Luciano² | Patrizia Semeraro¹ 

¹ Department of Mathematical Sciences G. Lagrange, Politecnico di Torino, Corso Duca degli Abruzzi, Torino, Italy

² ESOMAS Department and Collegio Carlo Alberto, Università di Torino, Torino, Italy

Correspondence
Patrizia Semeraro, Department of Mathematical Sciences G. Lagrange, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129 Torino, Italy.
Email: patrizia.semeraro@polito.it

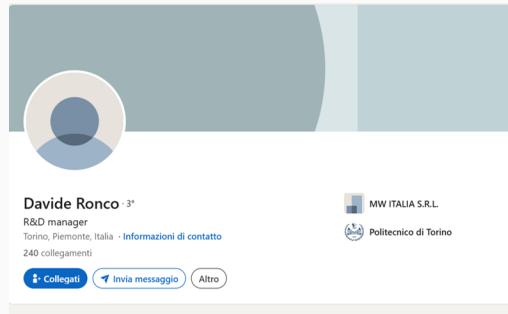
Funding information
Italian Ministry of Education, University and Research (MIUR), "Dipartimento di Matematica G. Lagrange"

Abstract
We provide sharp analytical upper and lower bounds for value-at-risk (VaR) and sharp bounds for expected shortfall (ES) of portfolios of any dimension subject to default risk. To do so, the main methodological contribution of the paper consists in analytically finding the convex hull generators for the class of exchangeable Bernoulli variables with given mean and for the class of exchangeable Bernoulli variables with given mean and correlation in any dimension. Using these analytical results, we first describe all possible dependence structures for default, in the class of finite sequences of exchangeable Bernoulli random variables. We then measure how model risk

The Future: Young PhD Students in Industrial Statistics



Giuseppe Galizia



Davide Ronco



Slow Monday in Algebraic Statistics, Sep 2017, UniGe (I)