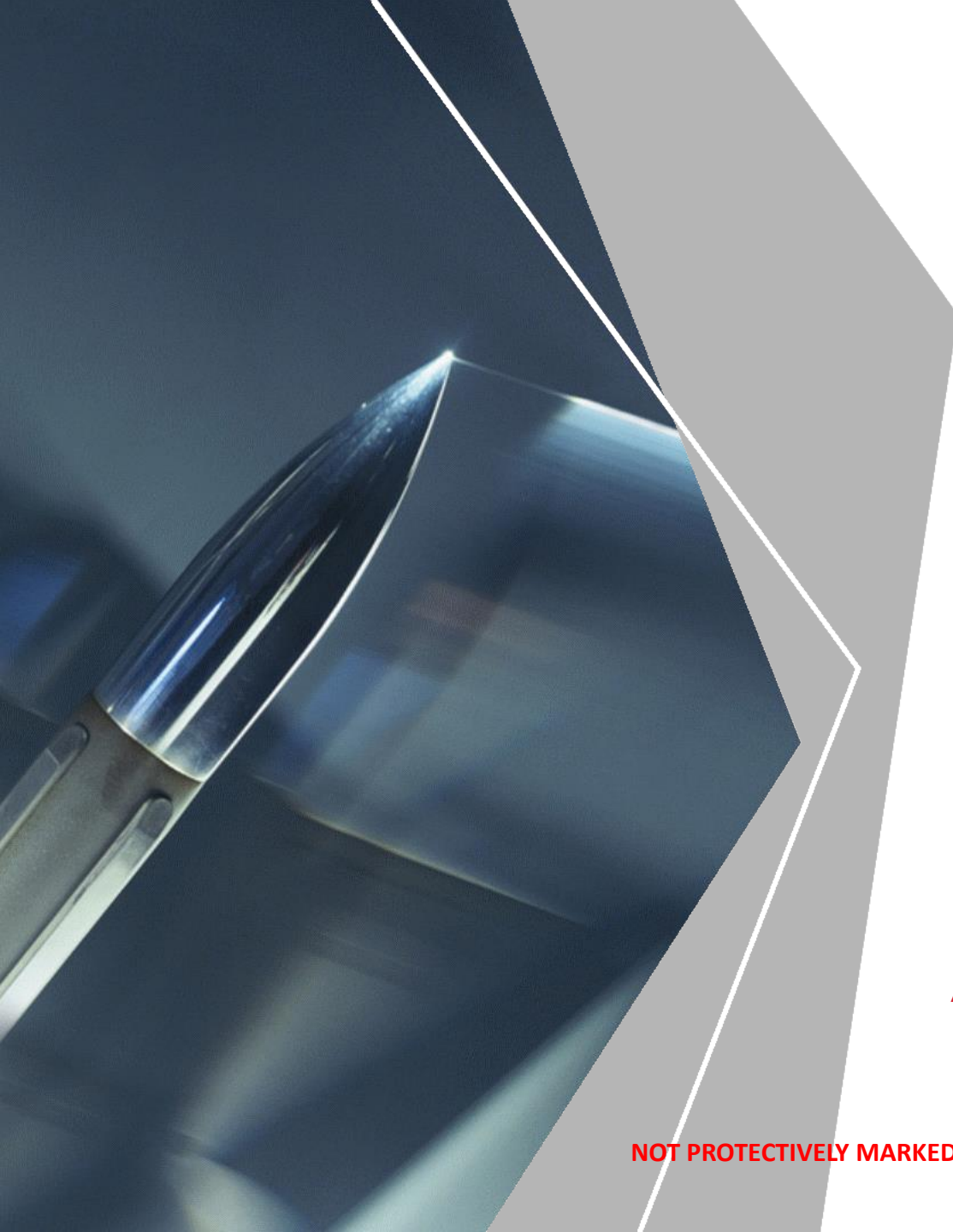




Keeping it real: Optimism Bias vs Historical Analysis

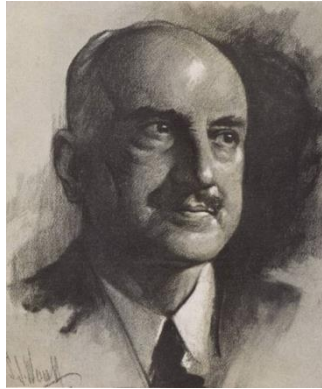
ISMOR 2017

A. Morley

MBDA
MISSILE SYSTEMS

NOT PROTECTIVELY MARKED

*“Those who cannot remember the past,
are condemned to repeat it”*



George Santayana

“Things will be different this time”

Anon

- **Informal Argument**
- **Optimism bias vs Historical Analysis**
 - Quick Exercise: Are we over-optimistic?
- **Optimism bias in defence**
- **Historical Analysis in defence**
 - Quick Exercise: Spot the trend...
- **Formal reasoning about the past**
 - Objections
 - Response to objections
- **Signs you are fooling yourself**
- **Conclusions**



- In Defence Analysis....
- We tend to ignore historical analogues when forming our expectations of the future, *especially when the analogues are unfavourable*
- This is a form of optimism (and over-confidence) biases which we should correct.

- **What is optimism bias?**
 - *A cognitive bias to overestimate the probability of favourable events and underestimate the probability of bad ones.*
- **One of a number of universal human cognitive biases**
 - Kahneman & Tversky, 1973.



“Something will turn up”



- **What is Historical analysis?**
 - Quantitative analysis of the past to inform our expectations of future states.
 - Proper surveys, proper statistics
 - NOT “essayism” and anecdote.
 - Data driven – closest to Economic History and Econometrics



0.736	0.126	0.198	0.686	0.324	0.645	0.856	0.617	0.074	0.103	0.117	0.790	0.194	0.044
0.076	0.742	0.628	0.925	0.571	0.866	0.651	0.848	0.130	0.656	0.466	0.713	0.613	0.625
0.431	0.576	0.989	0.317	0.776	0.155	0.373	0.268	0.276	0.656	0.373	0.719	0.204	0.238
0.166	0.370	0.322	0.479	0.852	0.535	0.233	0.783	0.506	0.900	0.621	0.810	0.869	0.236
0.821	0.783	0.181	0.780	0.159	0.691	0.867	0.248	0.295	0.120	0.225	0.887	0.772	0.624
0.040	0.423	0.506	0.364	0.165	0.586	0.553	0.082	0.835	0.801	0.284	0.320	0.688	0.962
0.819	0.320	0.449	0.638	0.213	0.410	0.407	0.651	0.650	0.153	0.010	0.507	0.995	0.108
0.339	0.626	0.502	0.796	0.570	0.029	0.677	0.846	0.046	0.120	0.200	0.001	0.170	0.135
0.467	0.485	0.523	0.446	0.231	0.597	0.786	0.052	0.185	0.629	0.100	0.002	0.395	0.580
0.987	0.154	0.954	0.173	0.355	0.469	0.734	0.403	0.237	0.536	0.000	0.807	0.537	0.910
0.606	0.713	0.601	0.255	0.704	0.502	0.663	0.453	0.222	0.531	0.000	0.329	0.644	0.691
0.878	0.584	0.564	0.314	0.355	0.647	0.761	0.311	0.296	0.000	0.989	0.788	0.745	0.192
0.512	0.197	0.874	0.796	0.575	0.577	0.717	0.269	0.825	0.000	0.770	0.278	0.831	0.136
0.210	0.984	0.575	0.290	0.199	0.196	0.935	0.128	0.641	0.000	0.436	0.738	0.559	0.631
0.049	0.713	0.464	0.106	0.733	0.548	0.802	0.697	0.600	0.000	0.620	0.881	0.978	0.736
0.881	0.773	0.460	0.693	0.625	0.289	0.849	0.991	0.000	0.000	0.211	0.204	0.932	0.777
0.799	0.598	0.299	0.986	0.340	0.844	0.645	0.890	0.000	0.000	0.208	0.593	0.468	0.993
0.849	0.368	0.144	0.450	0.359	0.838	0.848	0.636	0.000	0.000	0.311	0.544	0.716	0.384
0.763	0.593	0.084	0.416	0.092	0.233	0.689	0.000	0.000	0.000	0.458	0.551	0.644	0.515
0.418	0.250	0.668	0.504	0.582	0.247	0.435	0.000	0.000	0.000	0.045	0.817	0.718	0.587
0.304	0.000	0.008	0.512	0.263	0.637	0.160	0.000	0.000	0.000	0.291	0.912	0.825	0.470
0.280	0.000	0.000	0.083	0.194	0.490	0.000	0.000	0.000	0.000	0.45	0.990	0.710	0.656
0.033	0.322	0.000	0.000	0.000	0.936	0.000	0.000	0.000	0.000	0.022	0.861	0.446	0.490
0.157	0.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.755	0.652	0.512
0.130	0.590	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.572	0.627	0.822	0.591
0.715	0.850	0.603	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.191	0.565	0.780	0.947
0.624	0.551	0.915	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.457	0.579	0.555	0.072
0.033	0.474	0.064	0.881	0.000	0.000	0.000	0.000	0.000	0.000	0.32	0.609	0.803	0.158
0.414	0.173	0.326	0.378	0.000	0.000	0.000	0.000	0.000	0.000	0.757	0.125	0.631	0.281
0.029	0.301	0.071	0.646	0.700	0.000	0.000	0.000	0.000	0.000	0.253	0.670	0.712	0.572
0.123	0.299	0.206	0.612	0.599	0.000	0.000	0.000	0.000	0.000	0.661	0.276	0.768	0.147
0.393	0.504	0.715	0.086	0.399	0.000	0.000	0.000	0.000	0.000	0.151	0.584	0.731	0.305



- **Why matters?**

- We live in an age where “impossible” things are happening on the strategic level far too often; something is wrong with our filters.
 - BREXIT, TRUMP, UK General Election...
- Traditional model approaches limited in regard to current question set
- Policy / desk officers as much in the dark as analysts!

- **“It will be different next time...”**

- Tendency to “explain away” failure as resulting from single, isolated factors which will not be repeated.
 - Hence success more likely next time
- Aversion to blaming failure on long-term structural factors,
 - Hence failure (more) likely next time
- Assuming things will go to plan when they did NOT go to plan the last time



QUICK EXERCISE: Are we over-optimistic?

- Which of the following describes the strength of *your own belief* in each of the following policy statements: **True, Mostly True, Neither True nor False, Mostly False, False**:
 - “The *timescales and budget* to deliver future planned capabilities are reasonable”
 - “Future equipment will work as expected in a future operational context”
 - “We can accurately anticipate the *location and character* of future conflicts”



QUICK EXERCISE: Are we over-optimistic?

- **“The *timescales and budget* to deliver planned capabilities are reasonable”**
 - Type 45, BOWMAN, JSF, Eurofighter, FRES, Nimrod MPA etc.
 - [Still think that statement is reasonable?]
- **“Equipment will work as planned in a future operational context”**
 - SA-80, Rapier, Tornado radar, Chinook helicopters (air certification), Apache air filters, Type 45 powerplant, Challenger 1, Tigerfish torpedo, Pheonix UAV, Nimrod AEW etc.
 - [Still think that statement is reasonable?]
- **“We are well prepared for the *location and character* of future conflicts”**
 - Were we prepared/anticipating 9-11, Iraq War, COIN in Afghanistan, Interventions in Libya, resurgent Russia and ISIS in Syria/Iraq?
 - [Still think that statement is reasonable?]



- **Self-Serving**
 - Political and career factors make it easier to accord with “unrealistic” assumptions held by superiors
 - Analysts get prizes for efficiency, conformism, reliability, and maybe innovation. NOT accuracy
- **Social cohort**
 - Higher professional work selects for optimistic people. Military organisations stress “can do” and optimism.
- **Loci of Control**
 - I am not the Captain of my fate. I am just its noisiest passenger.
- **Egocentrism**
 - Damn it, we’re smarter than those guys!
- **Base rate of failure**
 - Failure is more common than we like to think
 - In conflict, *someone* loses *at least* half the time. Why is it never us?



- **Biases are common to all thought.**
 - Long term observations in psychology, economics etc.
 - Bias is different from error: bias is systemic error in one direction.
 - Evolution of Heuristics which are “good enough” rather than perfect.
- **Optimism bias (and over-confidence bias) are of particular concern to disciplines concerned with forecasting the future**
- **Bias CAN be corrected/reduced with appropriate training/awareness**
- **Previous examples (Historical Analysis) provide a powerful corrective to optimism and over-confidence bias in defence analysis**

- **Campaign outcomes**

- Campaign outcomes
- Campaign duration
- Casualty rates
- Combat effectiveness
- Surrender and breakpoints
- Terrorist attack frequencies

- **Programme management**

- Trial success and proving rates
- Cost and time overruns

- **Strategic planning**

- Strategic warning times
- ISD / OSD
- Reconstitution periods



QUICK EXERCISE: Spot the trend...?

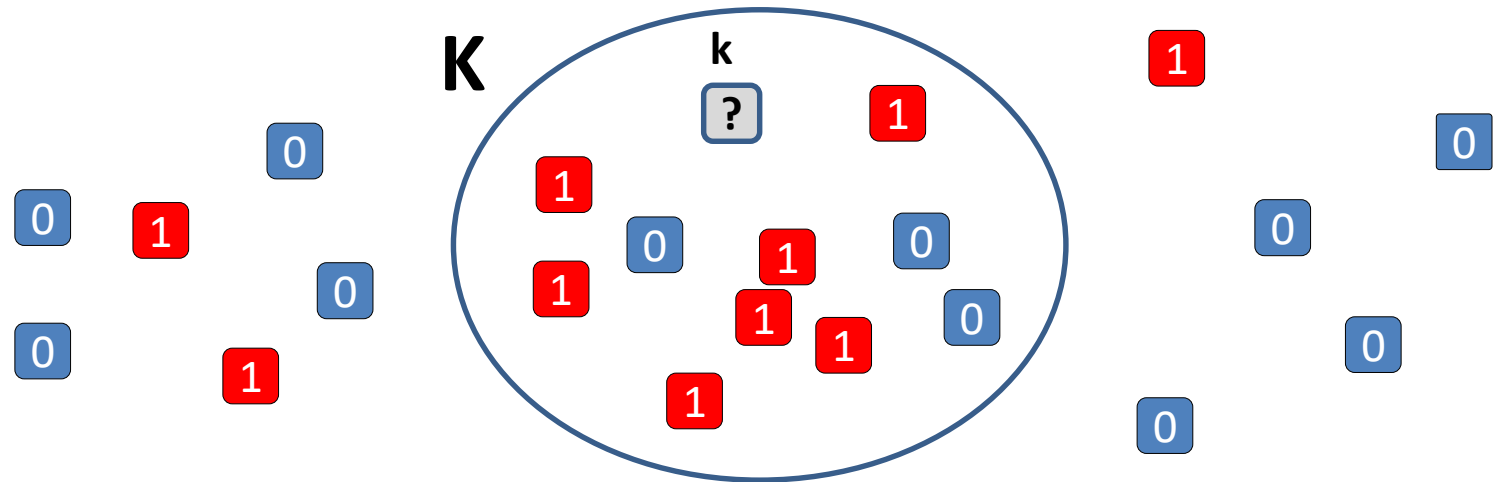
- **256, 47, 72, 0, 1, 456, 179, 0,...?**
 - UK military fatalities in significant operations, Falklands onwards
- **Partial, Fail, Fail, Fail, Success, Fail,x?**
 - Global Anti-Ship missile air defence engagements, Falklands onwards
- **Fail, Fail, Fail, Fail, Success, Success, Successx ?**
 - Trials firing outcome for a major weapon system which won't be named



- “Historical Analysis” is really just short-hand for Bayesian reasoning about the present on the basis of the past.
- How might we formalise the problem?
- Current event k , is just one of a set of *previous comparable events K* .
- Every member of Set K has an associated Outcome measure
 - Fail/Success, casualty level, time delay, cost multiple etc.
- We know (with some level of confidence) the outcome measures for previous events in the set but not that of k itself, which we wish to infer.



- What value should we expect for k ?



Set of comparable events:
e.g. "Wars we fought in Europe"



- Knowing nothing more about the case event than its membership of K , our expected outcome of k is simply drawn from the mean of the set.

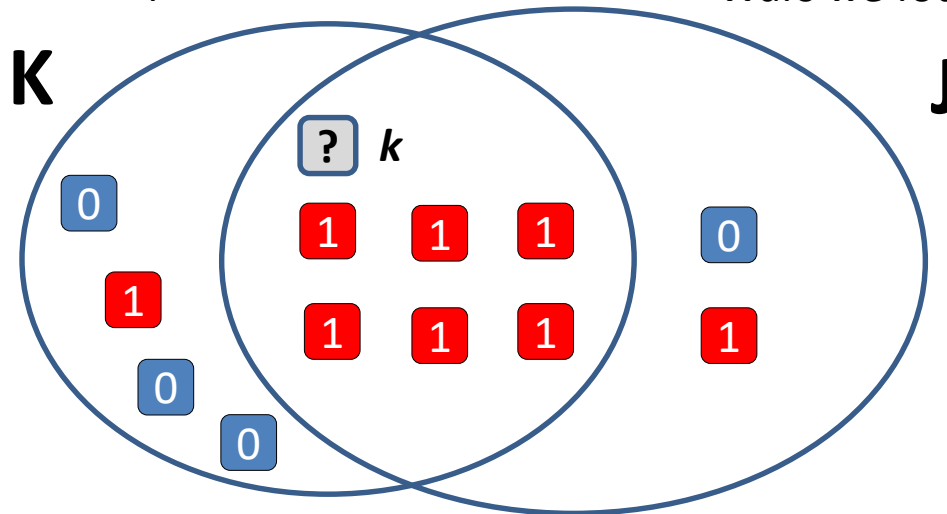
“Ah-ha!” says the critic. “*But this time it’s different.* You can’t possibly compare current circumstances to those old examples. Our technology has moved on. This time we have super-widget x in our arsenal. And we have computers now. They didn’t have computers back in 1990. I think. Or they were the wrong type of computer. In any event that war was a long time ago; they fought wars completely differently then using attrition, or something. Whilst we are just so much smarter than those people; we use manoeuvre, or we attack the enemy will to resist by using all the levers of power across the battlespace; I read a book about our new paradigm of hybrid warfare and in the future all wars will be conducted in cyberspace. Or maybe the Baltic. So if it didn’t happen in either of those totally specific places it can’t tell us anything. Or on a Tuesday. Everyone know the Russians always win wars that start on Tu....

- What the critic contends is not that our logic is wrong, but our choice of *previous comparable events* is wrong
 - Sometimes this is *well-founded* objection
 - Sometimes it’s just a cloak for wanting to deny the existence of previous analogues

- The critic wants us to consider an additional set criteria, **J**, such that our set of *previous comparable events* is the joint set of $K \cap J$.

“Wars we fought in Europe”

“Wars we fought with US support”



- Fine as far as it goes, right?



- **Unfortunately the critic's objection may not be *well-founded*:**
 - The additional criteria may not be relevant to the problem, or not very relevant.
 - Even if criteria is in some sense *justified*, it may be a bad criteria to use because it *destroys information* by excluding *close but not perfect analogues*.
 - A gain in specificity is traded against lower accuracy
 - No analogue is perfect
 - Worse, the critic may be acting in *bad faith*. Spurious criteria ("Only wars starting on Tuesday") may be added to arbitrarily refine the comparable set of events to 0.
 - The critic can then turn to his preferred alternative method of prediction...
 - This is actually anti-scientific when carried to an extreme. As all events are ultimately uniquely caused in a set of size 1, it denies that any set-based inductive reasoning is possible.



- **Rules for selecting the set of comparable events**
- **“Have a formal model of the most important factors. Refine set of comparable events only with reference to this.”**
 - In selecting analogues, we already have an informal model of the most relevant factors in our heads
 - The data can talk. We can *build* models from the data and interrogate them to find the most relevant factors that explain the variation.
 - Which factors explain most of the variation? Is your preferred excuse really amongst them? Occam's Razor.
 - If a refinement does NOT significantly change the outcome values, stick with the original set.



- **“It’s different this time” / Denial of all priors**
 - All events have unique causes, but denying potential commonality across sets denies the possibility of science.
 - *Most* claims to novel / discontinuity are and have been false. Adjust your priors accordingly.
 - “Always something new out of Africa”
- **“Cherrypicking” / Denial of some priors**
 - Refinement of comparable event set without good reason from a formal model
 - *Especially* when set refinement appears arbitrarily chosen, or is flattering or self-serving
- **Sample interpretation**
 - Mistaking a trend for a constant
 - “4 failures and 4 successes....so the odds on the next one look even?”
 - Mistaking a constant for a trend
 - The Overton Window moves. Pundits fall out.



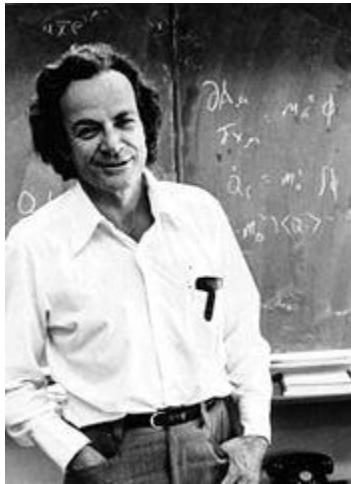
- **The present will become the past**
- **Your present events of interest will become a data point for some future analyst**
- **Will they regard it as “exceptional” “without precedent” “wholly novel” or “discontinuous”?**
- **Or will they just see your present events as part of a longer, larger pattern?**

It's very tempting to ignore
historical analogues to present experience

DON'T DO THIS

(at least not without *clear set-based reasoning* and a *formal model* which justifies the rejection)

“The first principle is that you must not fool yourself and you are the easiest person to fool”



Richard Feynman



End



Reserve slides



Historical Analysis in Defence: Constants, Trends, Discontinuities

- **Constants**

- A large set of priors with stationary or bounded/distributed values
- Examples: size of wars, gender ratios at birth, proven mineral reserves,

- **Trends**

- A large set of priors with values showing movement in a direction
- Example - Deaths from warfare, Moore's Law, Flynn Effect, global population, urbanisation, world records, height of tallest buildings, etc
 - Linear
 - Accelerating
 - Decelerating (asymptotic)

- **Discontinuities**

- Abrupt changes in an smooth trend or shift in a constant beyond previous bounds.
- “Black Swan” events
- Often associated with a new “paradigm”
- VERY RARE



- **How much confidence should we have in a trend?**
 - If you observe a trend, the chances are you are in the middle of it.
 - Therefore the *best bet* is that the trend will continue for as long as it currently has.
- **Unfortunately, trends often don't have any information about their duration**



*Big discontinuities in warfare
(it was different that time!)*

- **Neolithic weaponry: sling/bow/spear**
- **Bronze**
- **Iron**
- **Ancient military systems**
- **Horses/saddle/stirrup**
- **Early artillery**
- **Effective personal firearms (1550-present)**
- **The modern state system (1650-present)**
- **Rifled firearms (1850-present)**
- **Mechanised warfare (~1920-present)**
- **Nuclear Weapons (1945-present)**
- **Precision/Guided weapons (~1970-present)**
- **“Third offset” ????**



- **“Thinking, Fast and Slow”**
 - Daniel Kahneman
- **“The Black Swan” (better – “Fooled by randomness”)**
 - Nassim Nicholas Taleb
- **“Superforecasting”**
 - Philip E. Tetlock and Dan Gardner
- **“Correlates of War project”** <http://correlatesofwar.org/>
 - David J. Singer
- **Rogers commission report, appendix f**
 - Richard Feynman
- **[http:// Fivethirtyeight.com](http://Fivethirtyeight.com)**
 - Nate Silver (on a good day)
- **<http://Overcomingbias.com>**
 - Robin Hanson
- **http://econlog.econlib.org/archives/2016/05/why_i_win.html**
 - Brian Caplan

- Current (or prospective) event k_N is just the last of a set of N **previous comparable events** K .
- Each member of K has an outcome value, m , such that $K_{nm} = x$
- We know (with some level of confidence) the value for previous events $K_{n=1,m}$ to $K_{n=N-1,m}$ but not that of K_{Nm} itself, which we wish to infer.

“Wars we fought in Europe” K

