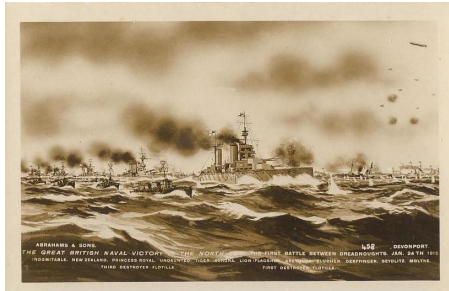


# Weighing the Fog of War

A Bayesian study of the Battle of the Dogger Bank, 24th January 1915




Niall MacKay, Christopher Price & Jamie Wood

THE UNIVERSITY *of* York



HADSS, May 2017

Based on MacKay, Price and Wood, *Historical Methods* **49** (2016) 80-91

The banner features a dark blue background on the left with a stylized, pixelated image of a fighter jet's tail fin. On the right, a vibrant rainbow gradient transitions from blue to yellow and orange.

## York Historical Warfare Analysis Group

Niall MacKay, Christopher Price and A. Jamie Wood,  
Weighing the Fog of War: Illustrating the power of Bayesian methods for  
historical analysis through the battle of the Dogger Bank,  
*Historical Methods* **49** (2016) 80-91

Niall MacKay, Christopher Price and A. Jamie Wood,  
Weight of Shell Must Tell: A Lanchestrian reappraisal of the battle of Jutland,  
*History* **101** (2016) 536-563

# Fifty years of technological development

1860



Warrior



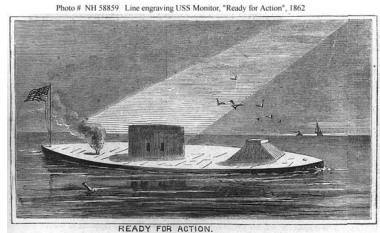
Gloire

# Fifty years of technological development

1862



Merrimack

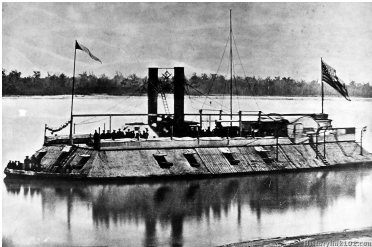


Monitor

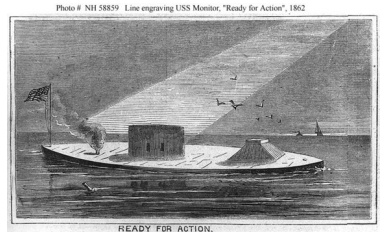


# Fifty years of technological development

1862



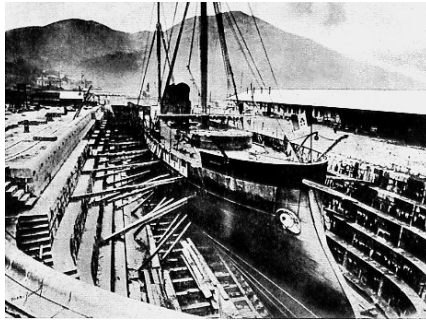
Virginia



Monitor

# Fifty years of technological development

**1866**



Affondatore

# Fifty years of technological development

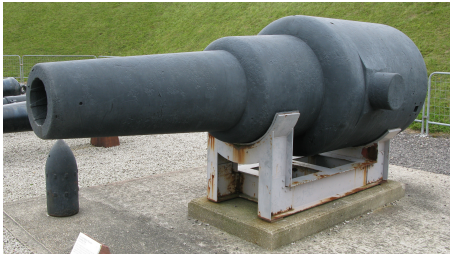
**1866**



Battle of Lissa

# Fifty years of technological development

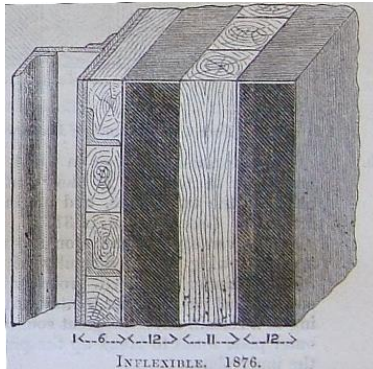
**1875**



British 11" muzzle-loading rifle

# Fifty years of technological development

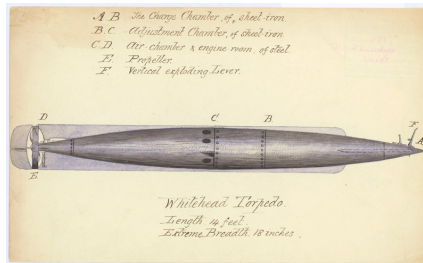
1876



Compound armour, HMS *Inflexible*

# Fifty years of technological development

1868 (approx.)



An early Whitehead torpedo

# Fifty years of technological development

1887



HMS *Victoria*

# Fifty years of technological development

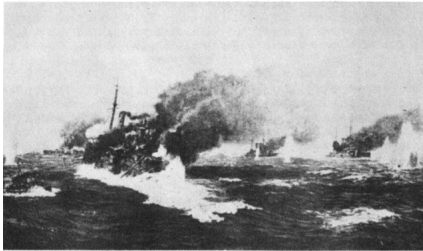
Karl Lautenschläger,  
Technology and the Evolution of Naval Warfare,  
*International Security* 8 (1983) 3-51



# Fifty years of technological development

1905

“吉めた！”  
“東郷大將は氣が立つた！”



日本海大海戦

明治35年5月27日午後、海軍が戦況に勝つて、敵軍は退却した。其の後方は敵軍司令部に突如として、大砲の火が降り、中央部は戦艦に燃え、右より三隻（赤松、豊島、高千穂、春日）が沈没した。

Battle of Tsushima

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### WHY TOGO WON.

By COMMANDER BRADLEY A. FISKE, U. S. Navy.

---

The accounts that we read of the final naval battle between the Japanese and Russians are so meager that one may easily become confused if he tries to make out exactly what things happened, and the succession in which they happened. Most accounts seem to show, however, that the two following conditions existed:

1. The two forces were so nearly equal in material, that whatever difference there was may be neglected in this inquiry.
2. The two forces were so nearly equal in bravery, that whatever difference there was may be neglected in this inquiry.

The cause of Togo's victory, therefore, was not the superiority of his forces in material or bravery. What was it?

Two causes stand out plainly:

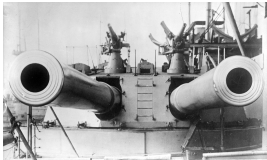
1. The Japanese fleet handling was better than the Russian.
2. The Japanese gunnery was better than the Russian.

Of these two causes, it is clearly impossible to decide which was the more important. Good gunnery is of little use, unless the fleet handling be so skillful as to keep many guns bearing on the enemy; and good fleet handling is of little use, unless the guns which it keeps bearing on the enemy are accurately fired. Fortunately, it is not necessary to decide which of the two was the more important, because excellence in either is not gotten at the expense of excellence in the other.

The fact that the Japanese excelled the Russians in both fleet handling and in gunnery, combined with the fact that the contestants were practically equal in material and in bravery, seems to explain Togo's victory so completely that the stating of it as a

# Fifty years of technological development

1905



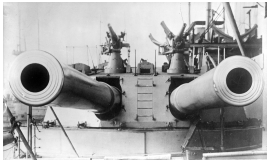
Gun



Armour

# Fifty years of technological development

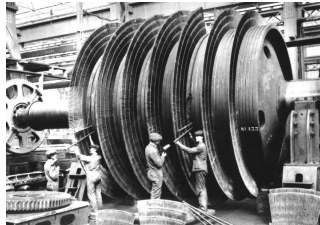
1905



Gun



Armour

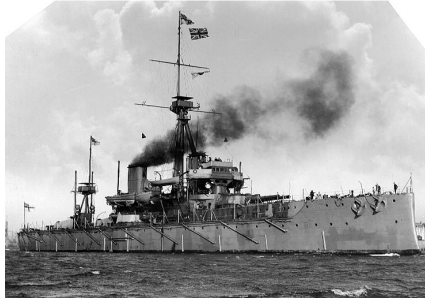


Parsons steam turbine

# The culmination

## Battleship

Photo # NH 63367 HMS Dreadnought (British battleship, 1906)

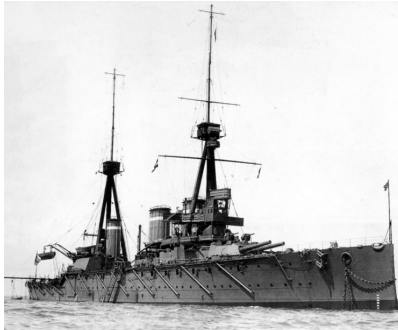


HMS *Dreadnought*

Guns + Propulsion + Armour

# The culmination

## Battlecruiser



HMS *Invincible*

Guns + Propulsion + Armour

# The Battle of the Dogger Bank

## The first clash of battle cruisers, 24th January 1915



*Blücher*



*Derfflinger*



*Moltke*



*Seydlitz*



*Indomitable*



*New Zealand*



*Princess Royal*



*Tiger*



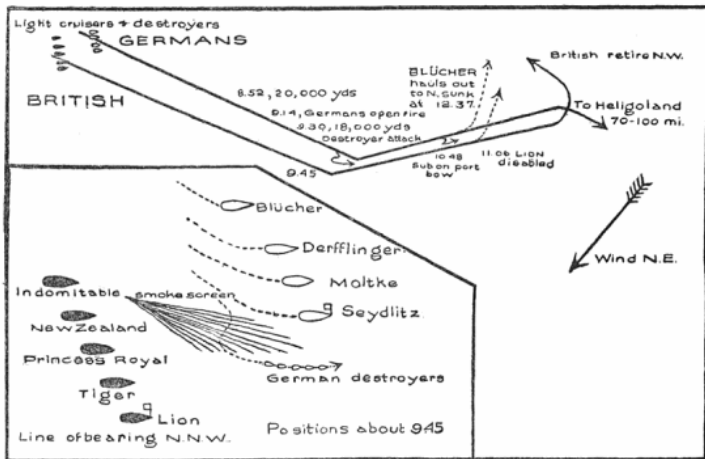
*Lion*

# The Battle of the Dogger Bank





# The Battle of the Dogger Bank



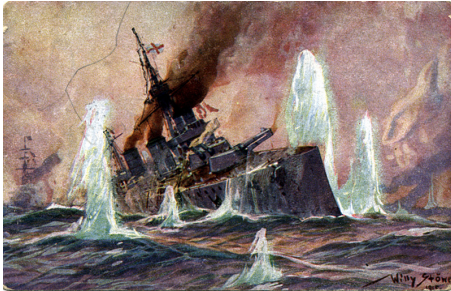
First sighting 0705, battlecruisers engage 0852

# The Battle of the Dogger Bank



0943 *Seydlitz* damaged

# The Battle of the Dogger Bank



1018 *Lion* hit

# The Battle of the Dogger Bank

**1100-1105**

Course North-East

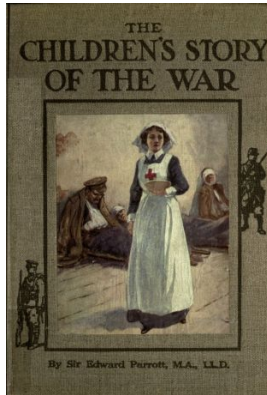
Engage the enemy's rear

# The Battle of the Dogger Bank



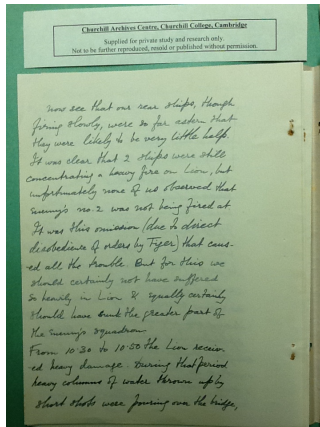
1313 *Blücher* sinks

# The Battle of the Dogger Bank



‘Only by sheer good luck did any of the German ships escape.’

# The Battle of the Dogger Bank



'But for *Tiger*'s misdirection of fire we ... certainly should have sunk the greater part of the enemy's squadron'

– diary entry, Cdr (later Vice Adm) Reginald Plunkett-...-Drax

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### A PLEA FOR THE BATTLE-CRUISER

By ASSISTANT NAVAL CONSTRUCTOR B. S. BULLARD, U. S. Navy

Prior to the introduction of steam for the propulsive element and of iron or steel for the construction of the hulls of fighting ships, the frigates, fast, comparatively lightly armed sailing vessels, performed all of the multitudinous duties which tactical and strategical considerations of the present day allot to the cruiser. This class of vessel carried on the scouting or despatch service; acted as protectors or destroyers of commerce; took their place in line of battle in concerted fleet action; performed all the duties connected with detached service; and their value as part of any naval establishment which, in time of war, aimed at the control of the sea, was fully recognized and universally understood. However, the true worth of the cruiser was forgotten in the tumultuous wave of enthusiasm which swept over England and France, the leading maritime nations of the period, when wrought iron was introduced in warships for the protection of the ships and of the gun-crews against shell fire. The introduction of armor led to a controversy among the world's leading naval architects upon the relative merits of the casemate ship, where all the guns were grouped in an armored casemate amidships, and the turret ship, where all the guns were isolated in separate armored turrets, but where nearly all of the units comprising a ship's main battery could be brought to bear upon any point of the horizon. These and many other momentous questions connected with the heavily armored first-line or ironclad ships occupied the attention of the naval architects of England and France during this period and the frigate or cruiser's natural course of development, parallel to that of the heavier ships, was cast into the shadow. In spite of this halt in the development of the cruiser, all of the considera-



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## THE ARRIVAL OF THE BATTLE-CRUISER

By COMMANDER YATES STIRLING, U. S. Navy

## THE BATTLESHIP

"The criterion of warship type will be found in a study of their ultimate service."

The acceptance of this maxim and its application to capital ships has committed the United States to the battleship and to the total exclusion of the battle-cruiser. No fault can be found in the maxim, but, in its application, unfortunately economic considerations have forced the United States Navy to adhere to the pure type in which guns, armor and speed are maintained in proportionate quantities.

"The ultimate test of war is battle. In a fleet action gun power and armor protection are the crowning attributes."

Again the maxim is sound, but have we correctly applied it?

History has shown that in all wars one side will take the initiative and act on the offensive, while the other will surrender the initiative and act upon the defensive. The nation acting upon the offensive does so because it feels itself the stronger. Its fleet, by virtue of its superior strength in type, in material and in morale, will attempt to bring the other fleet to action. The other fleet, the defensive one, will await the attack of its enemy within its own waters and probably behind its own fortifications. This is the condition now existing in the great war in Europe. England, with the stronger fleet, has taken the offensive against the weaker German fleet, which lies within the safety of its strongly fortified harbors of Cuxhaven and Kiel.

In the application of these two maxims of "ultimate service," there lies the germ of misunderstanding. The idea that the enemy fleet would immediately operate to bring our fleet to action is in itself sound, but have the methods of accomplishment been correctly determined? Once the idea of a decisive battle is considered, attention at once focuses upon being strong at the point

# The Battle of the Dogger Bank

“The fighting capacity of the battle-cruiser is such that its employment in future fleet engagements is a certainty”

“The battle-cruiser is the mistress of the sea”

# The Battle of Jutland

On 31st May 1916, **three** British battle-cruisers were sunk by German gunfire.



**Indefatigable**



**Queen Mary**

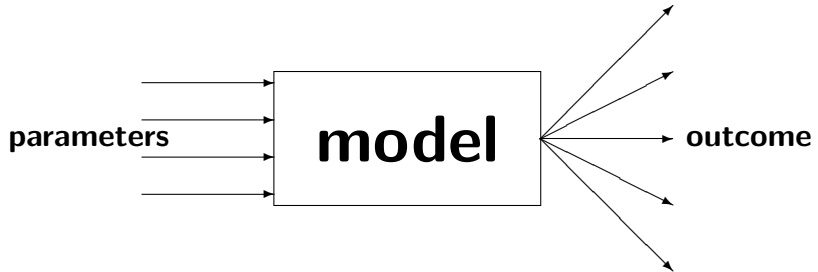


**Invincible**

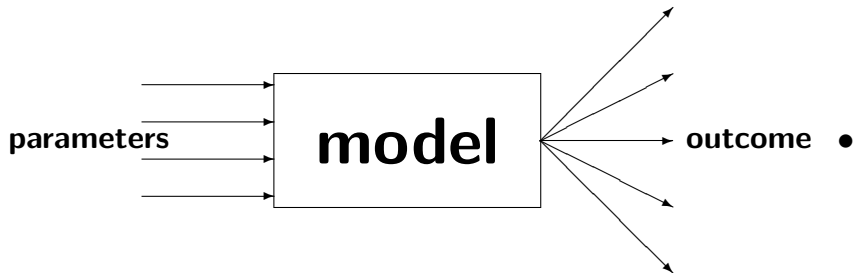
## Approximate Bayesian Computation (ABC)

Marjoram, Molitor, Plagnol & Tavaré, Markov chain Monte Carlo without likelihoods, *Proc. Nat. Acad. Sci.* 2003

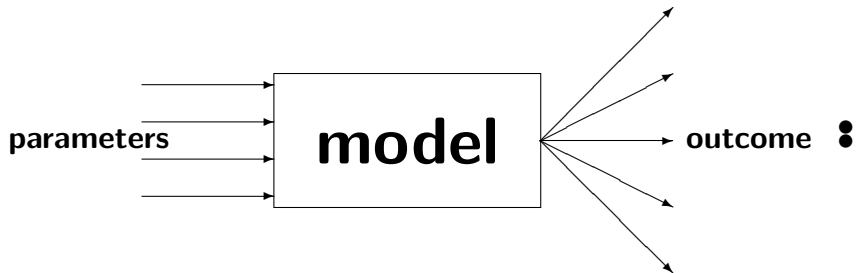
# Modeling The Battle of the Dogger Bank



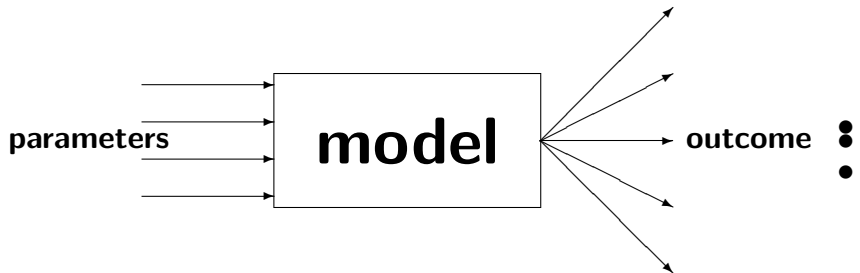
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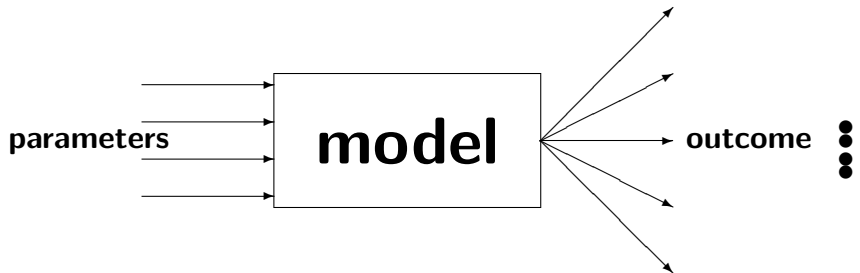


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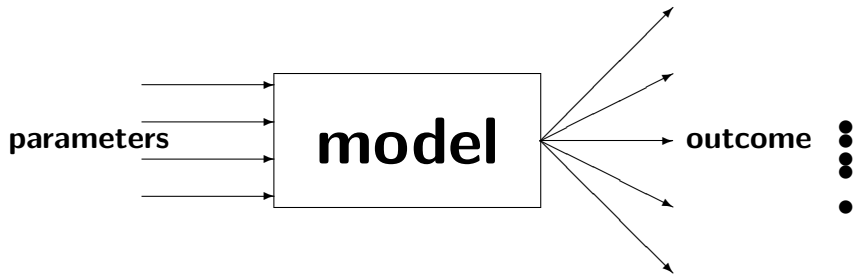




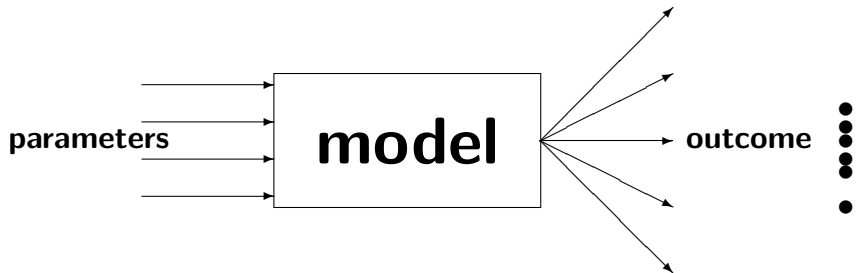
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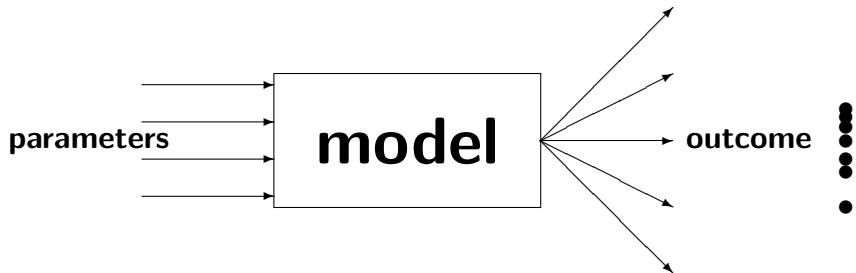
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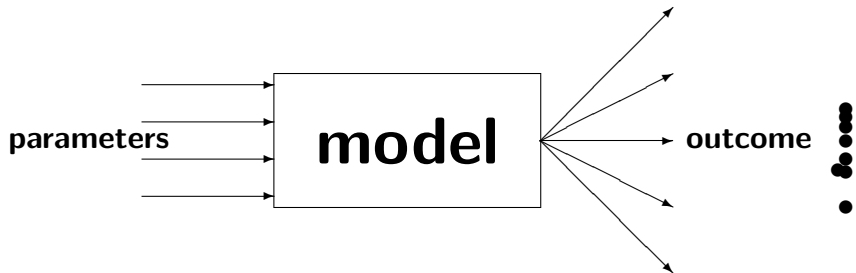
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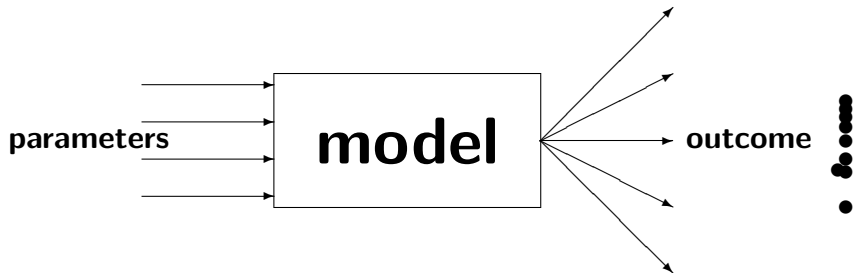
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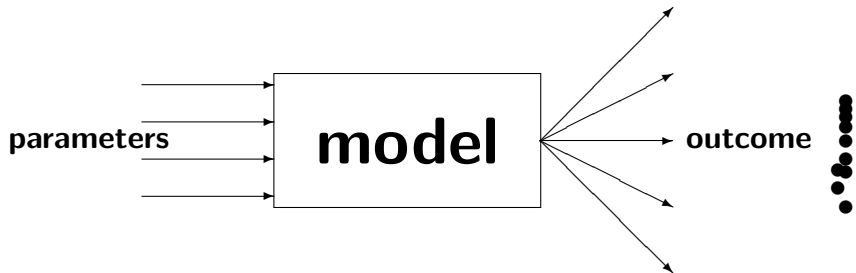
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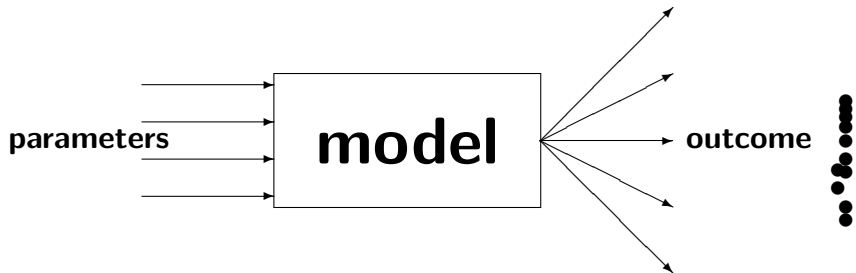
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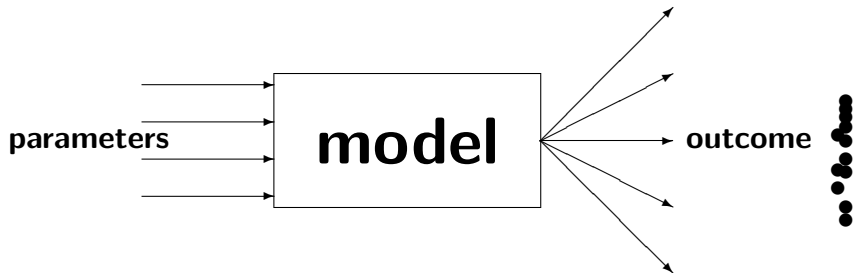


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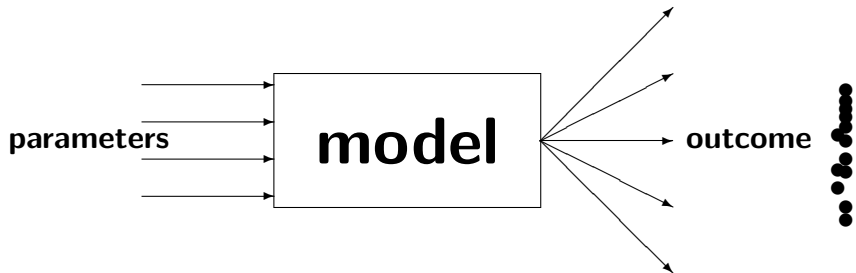




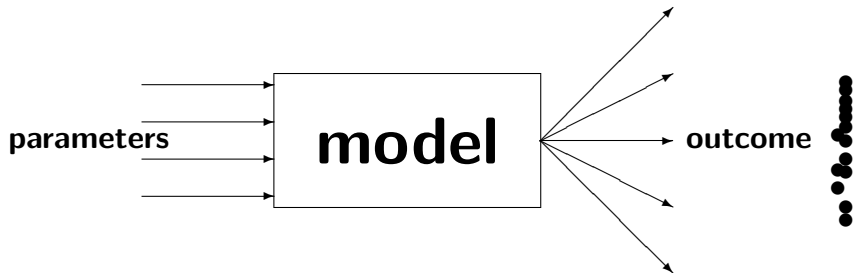
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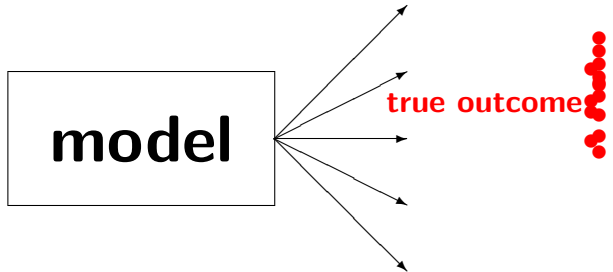
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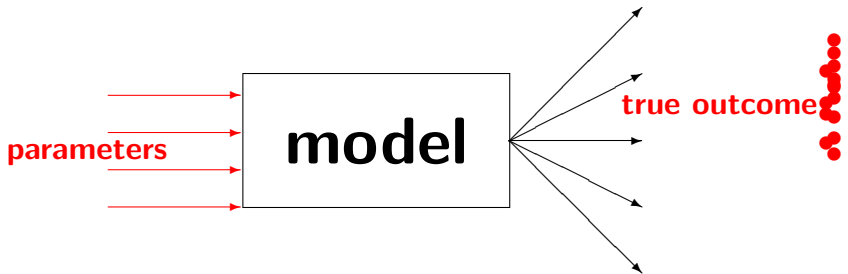
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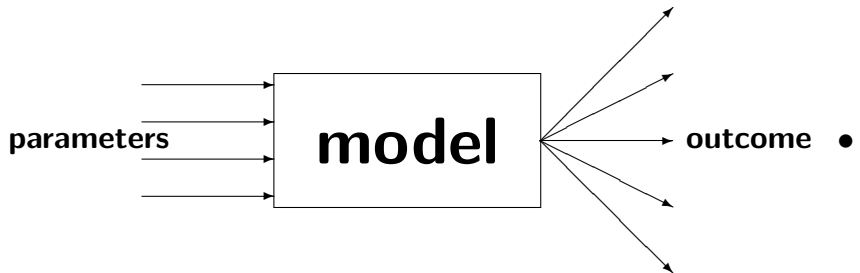
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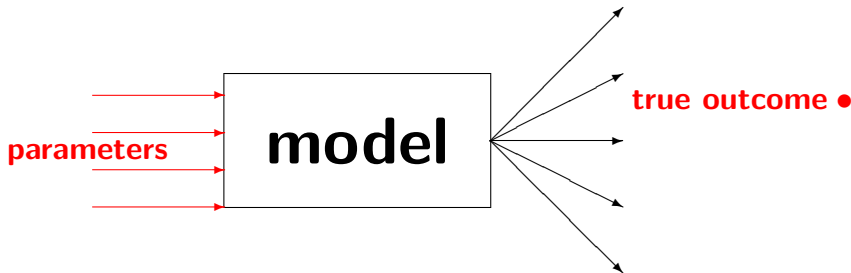
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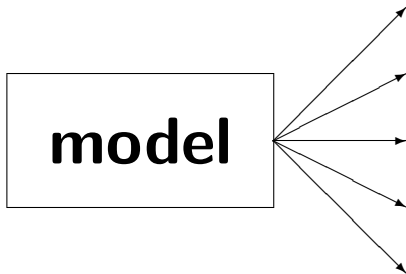


# Modeling The Battle of the Dogger Bank



# Modeling The Battle of the Dogger Bank

true outcome •





# Modeling the Battle of the Dogger Bank

**Either**

# Modeling the Battle of the Dogger Bank

**Either**

the model is wrong

**or**

# Modeling the Battle of the Dogger Bank

**Either**

the model is wrong

**or**

the parameters are (very) wrong

**or**

# Modeling the Battle of the Dogger Bank

**Either**

the model is wrong

**or**

the parameters are (very) wrong

**or**

something very unlikely has happened.

# The Model

Baudry, Chase, Fiske, Lanchester, Osipov (1902-1916)

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**A force causes damage in proportion to its numbers**

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*Gunnery Practices in the Grand Fleet 1914-1918*, ADM 137/4822, ADM 186/339, Kew

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*Gunnery Practices in the Grand Fleet 1914-1918, ADM 137/4822, ADM 186/339, Kew*

— more than good enough.

# The Parameters

Deduced from Dogger Bank and Jutland, taken together  
—valid *unless* they changed greatly between Dogger Bank and Jutland

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Shells, ships/guns/armour, gunnery practice,

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Shells, ships/guns/armour, gunnery practice, *flash fire!*

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Deduced from Dogger Bank and Jutland, taken together  
—valid *unless* they changed greatly between Dogger Bank and Jutland

Shells, ships/guns/armour, gunnery practice, *flash fire!*

On the German side big changes happened, because of *Seydlitz*

# The Parameters

On the British side they probably didn't.

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Nicholas Lambert, "Our bloody ships" or "Our bloody system"? Jutland and the loss of the British battle-cruisers, 1916, *JMH* 62 (1998) 29-55



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An Admiralty memorandum of February 1915 urges better flash discipline

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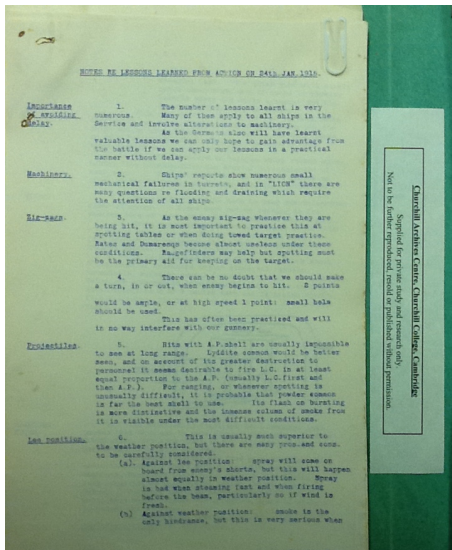
Nicholas Lambert, "Our bloody ships" or "Our bloody system"? Jutland and the loss of the British battle-cruisers, 1916, *JMH* 62 (1998) 29-55

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An Admiralty memorandum of February 1915 urges better flash discipline ... but may not have been widely acted upon (Lambert).

# The Parameters

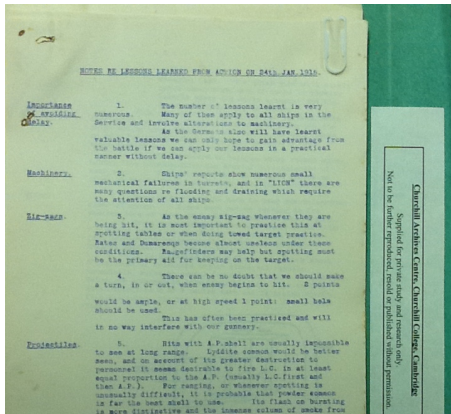
## Nothing in the 'lessons learned'



# The Parameters

Nothing in the 'lessons learned'

although 'German shell, for incendiary effect and damage to personnel, are far inferior to ours. Their only good quality lies in armour penetration and damage to material.'

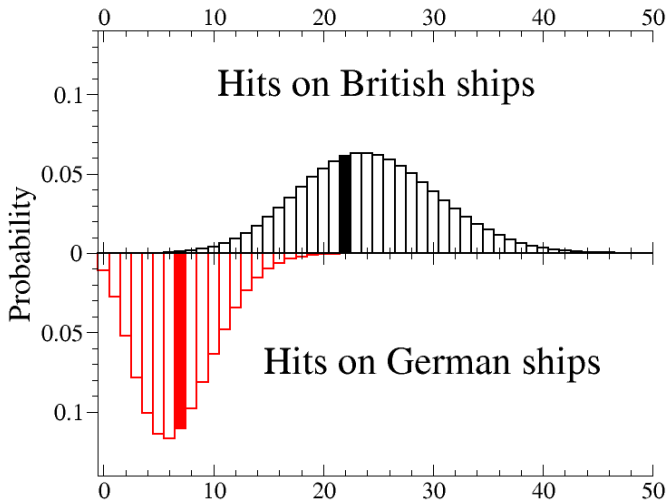


Using

## **Approximate Bayesian Computation (ABC)**

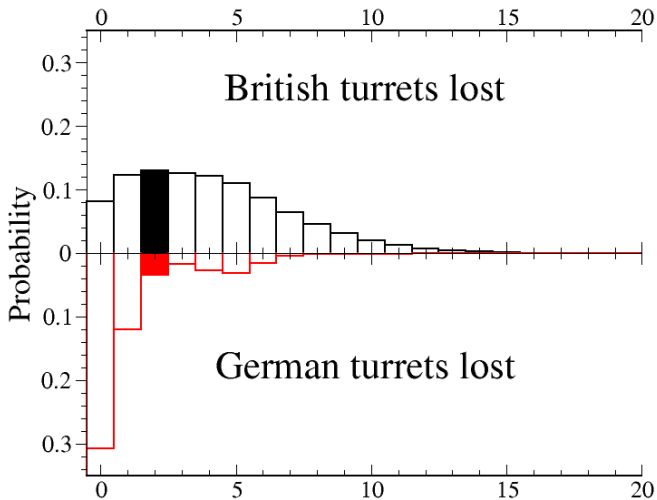
we have a standardized, optimal methodology with which to explore *all* of the parameter space for its capacity to reproduce real results.

# The Results

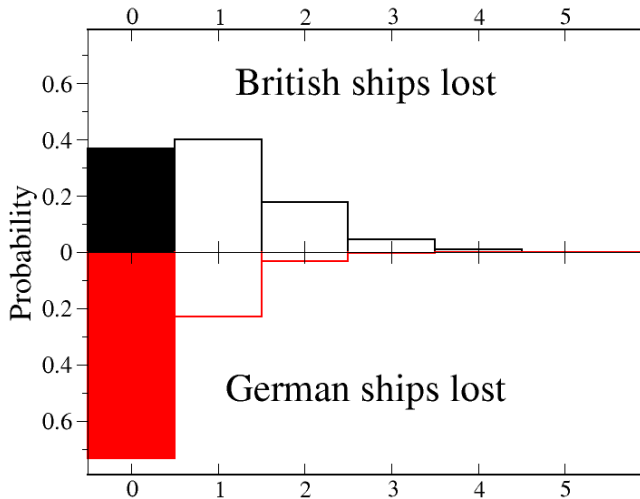




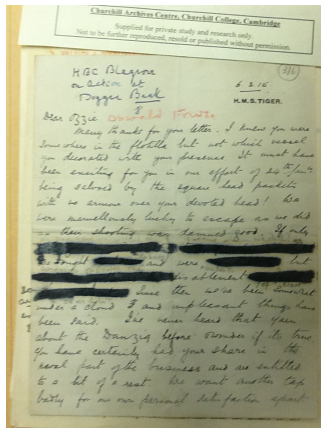
# The Results



# The Results



## The Results



'We were marvellously lucky to escape as we did as their shooting was damned good'

- Lt (later Rear Adm) Henry Blagrove

# The Results

Essentially, the British got lucky:

given that they lost 3 battle-cruisers at Jutland (1916) to magazine explosions, they were very lucky not to lose ships at Dogger Bank

# The Results

Essentially, the British got lucky:

given that they lost 3 battle-cruisers at Jutland (1916) to magazine explosions, they were very lucky not to lose ships at Dogger Bank — and would almost certainly have done so had the action not been truncated.

# Historical Methodology

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*Why* did events unfold as they did?



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*Why* did events unfold as they did?

– implies that things might have happened differently

# Historical Methodology

## Counterfactual History

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No event is inevitable, simply more or less probable

# Historical Methodology

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“Perhaps someone got lucky” need no longer be counsel of despair. When history is quantifiable, not wildly ramified, can be modelled, and the parameters accurately determined (*almost never, then*) the answer is **ABC**.

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Tetlock and Gardner, *Superforecasting*, 2015

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**Sometimes Bayesian methods can help**