experiment sandbox

resource: experimental design 4 the life sciences 4e

@cjlortie

subject-level experiments

life is an experiment of one

within-subject designs

[cross-over/repeated-measures]

typically use sequential treatments
to explore outcomes on same individual

A to B

change is the key response

sequential treatments are an efficacious design,
manipulative, & emulate natural dynamics

SHOULD THE U.S. GOVERNMENT BUILD A DEATH STAR?

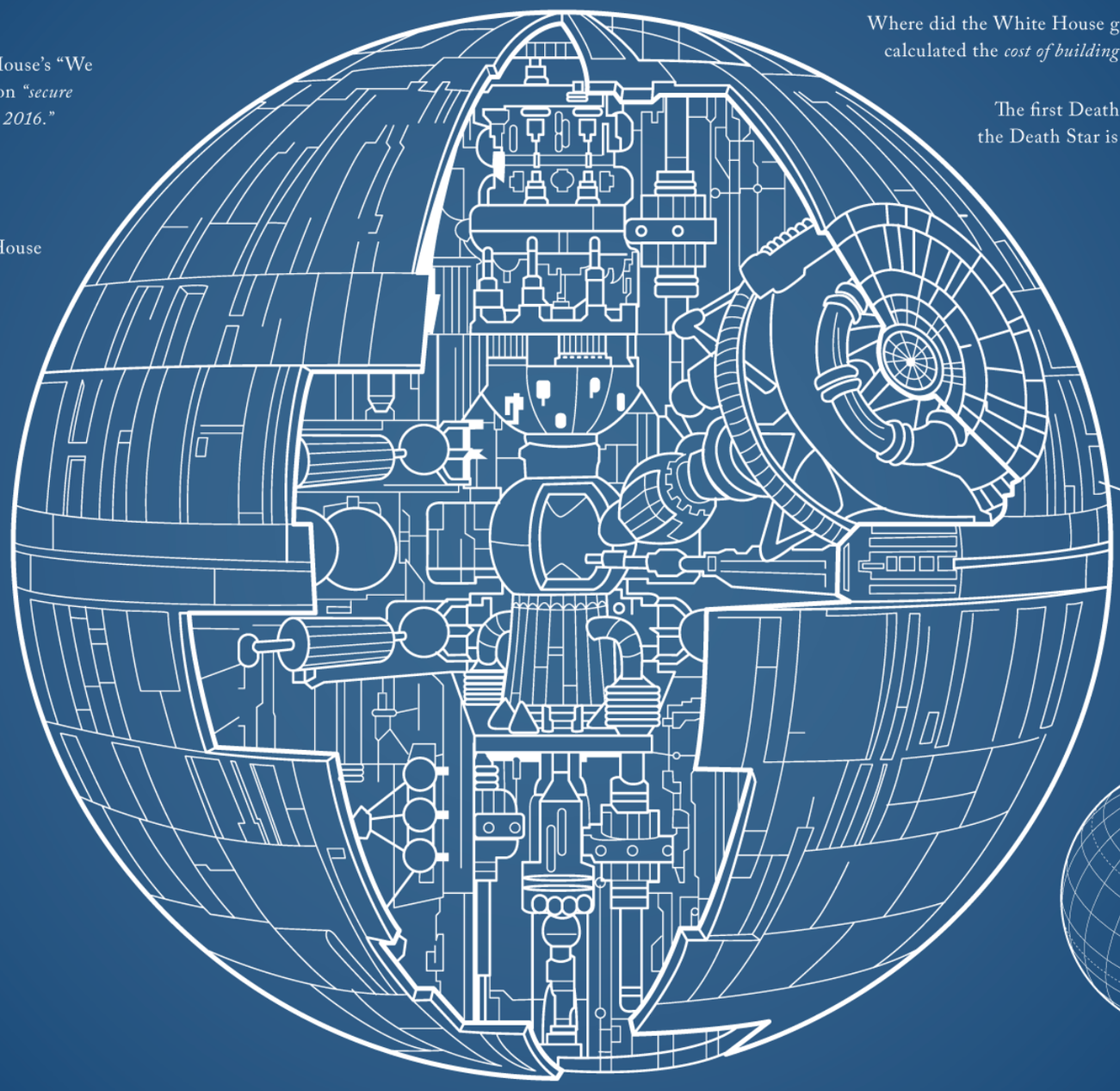
THE WHITE HOUSE REJECTS A PETITION TO FOLLOW IN DARTH VADER'S FOOTSTEPS.

In November 2012, a petition was submitted to the White House's "We The People" project requesting that the Obama administration *"secure resources and funding, and begin construction of a Death Star by 2016."*

The petition quickly garnered more than
25,000 SIGNATURES
(which was the threshold set by the White House for an official response)

In a January 2013 reply titled *"This Isn't the Petition Response You're Looking For,"* Paul Shawcross, the chief of the science and space branch at the White House Office of Management and Budget, declined the request:

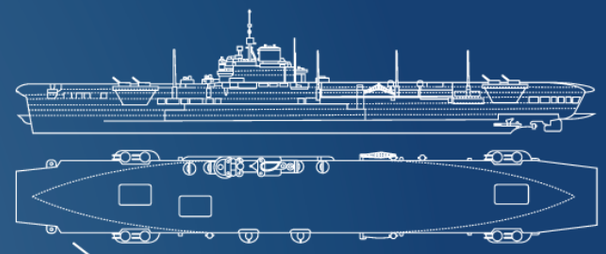
"The Administration shares your desire for job creation and a strong national defense, but a Death Star isn't on the horizon. Here are a few reasons: The construction of the Death Star has been estimated to cost more than $850,000,000,000,000,000. We're working hard to reduce the deficit, not expand it. The Administration does not support blowing up planets. Why would we spend countless taxpayer dollars on a Death Star with a fundamental flaw that can be exploited by a one-man starship?"



(Lucas Films)

Where did the White House get that cost estimate? Some students from Lehigh University calculated the *cost of building a planet-destroying super-weapon* at their econ blog, *Centives*.

The first Death Star is reported to be 140 kilometers in diameter. Assuming the Death Star is made of steel, it can be modeled as having similar density in steel as a modern warship.



HMS ILLUSTRIOUS
Volume: 28,591.2m^3, Mass: 22,000 tonnes

Scaling this up to the size of the Death Star:

Volume:
1,440,000km^3

Mass:
1.08 X 10^{15} TONNES

The earth's core features enough iron to create
OVER 2 MILLION DEATH STARS

At today's rate of steel production, in order to produce enough steel it would take
833,315 YEARS

and it would cost
$852 QUADRILLION
(roughly 13,000 times the world's GDP)

WE COMMEND THE OBAMA ADMINISTRATION ON ITS FISCAL DISCIPLINE AND MILITARY RESTRAINT.

limitations

1. temporal-ordering effects
2. carry-over effects

solutions for each challenge

counterbalancing ensures that the order of treatments is varied to encompass all permutations

to redress carry-over effects
design washout periods or buffers
in sequencing

test for **reversibility**, i.e.
the capacity for subjects to return
to pre-intervention states

sequence effect depends on timing
first-order and higher-order carry-overs

rare that subjects return to baseline conditions

better design focus

n = 1
delta = 2

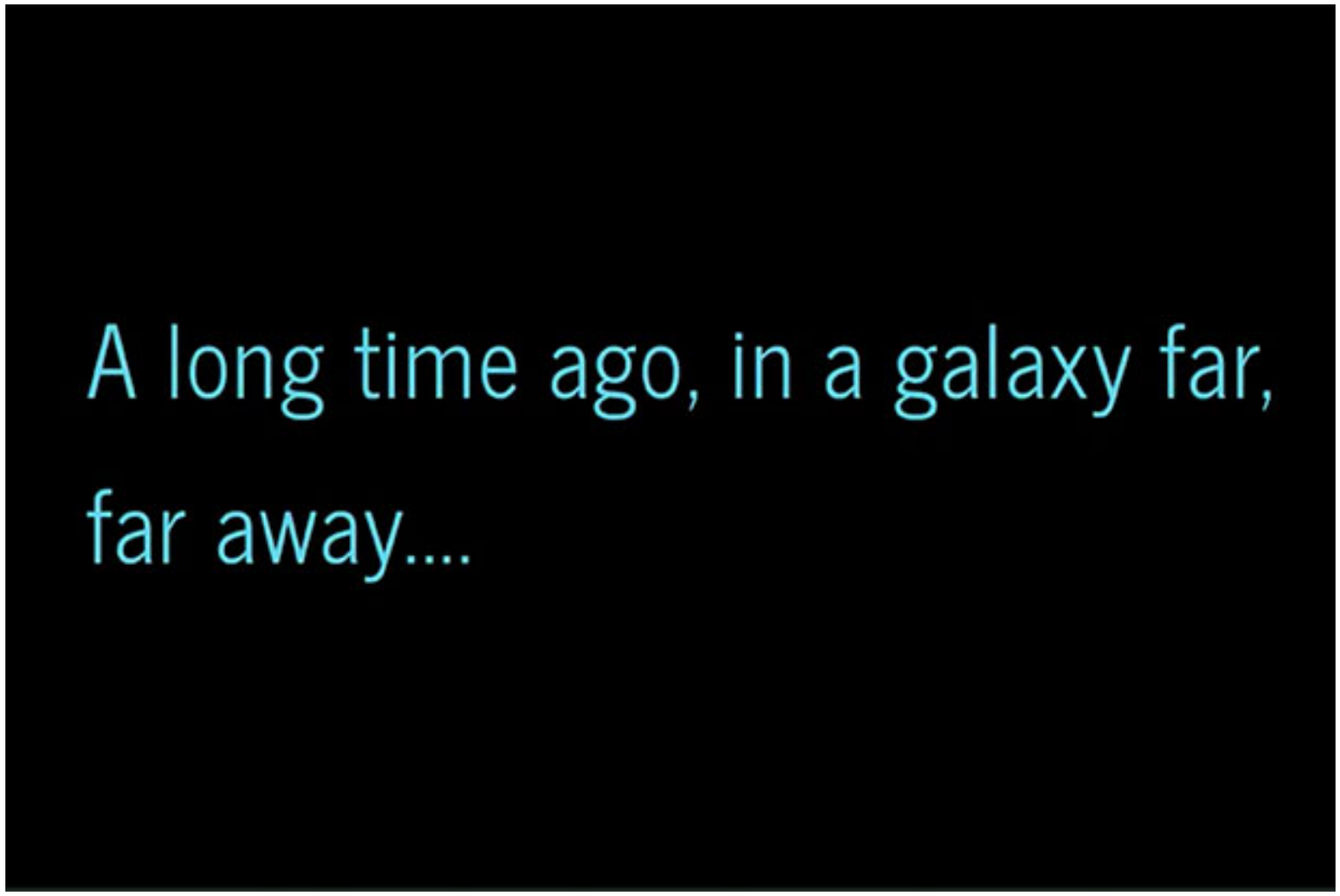
measure change and collapse measures
when possible to avoid pseudoreplication

delta > 4 treatments switch from each first order(ing) to random

ideal strategy is random permutations of all order

one block model typically
and focus on sequence (of attack/intervention)
to precipitate changes

typically employ sequencing and
not simultaneous treatments
and can lead to more protracted experimentation



consider coding time as a factors in models