

# experiment sandbox



resource: experimental design 4 the life sciences 4e  
**@cjlortie**

balancing choice between categories of design



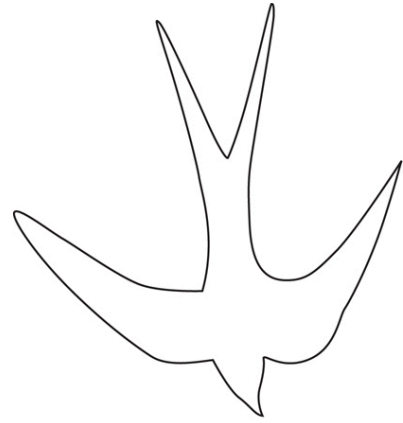
# **manipulative**

researcher changes an element of  
study system directly

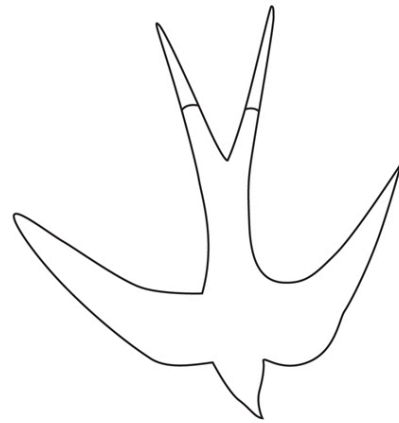


**observational or correlational** studies  
use existing variation to test  
predictions



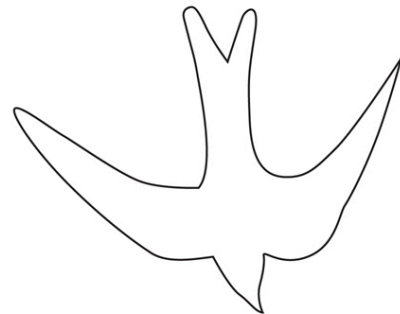


***Unmanipulated*** bird



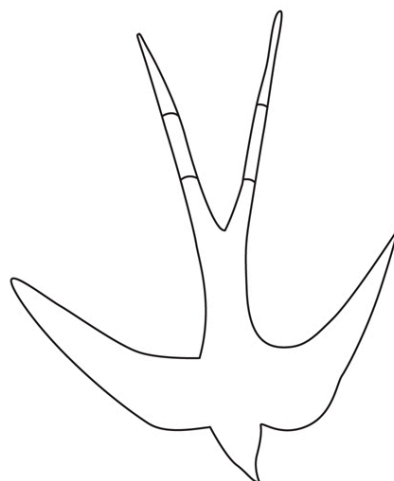
**Group 1**

Experiences the experimental manipulation but ends up with an ***unchanged*** streamer length



**Group 2**

Experiences the experimental manipulation ending up with a ***shortened*** streamer length



**Group 3**

Experiences the experimental manipulation ending up with an ***elongated*** streamer length

control plus  
**plug and play  
experimental  
design**

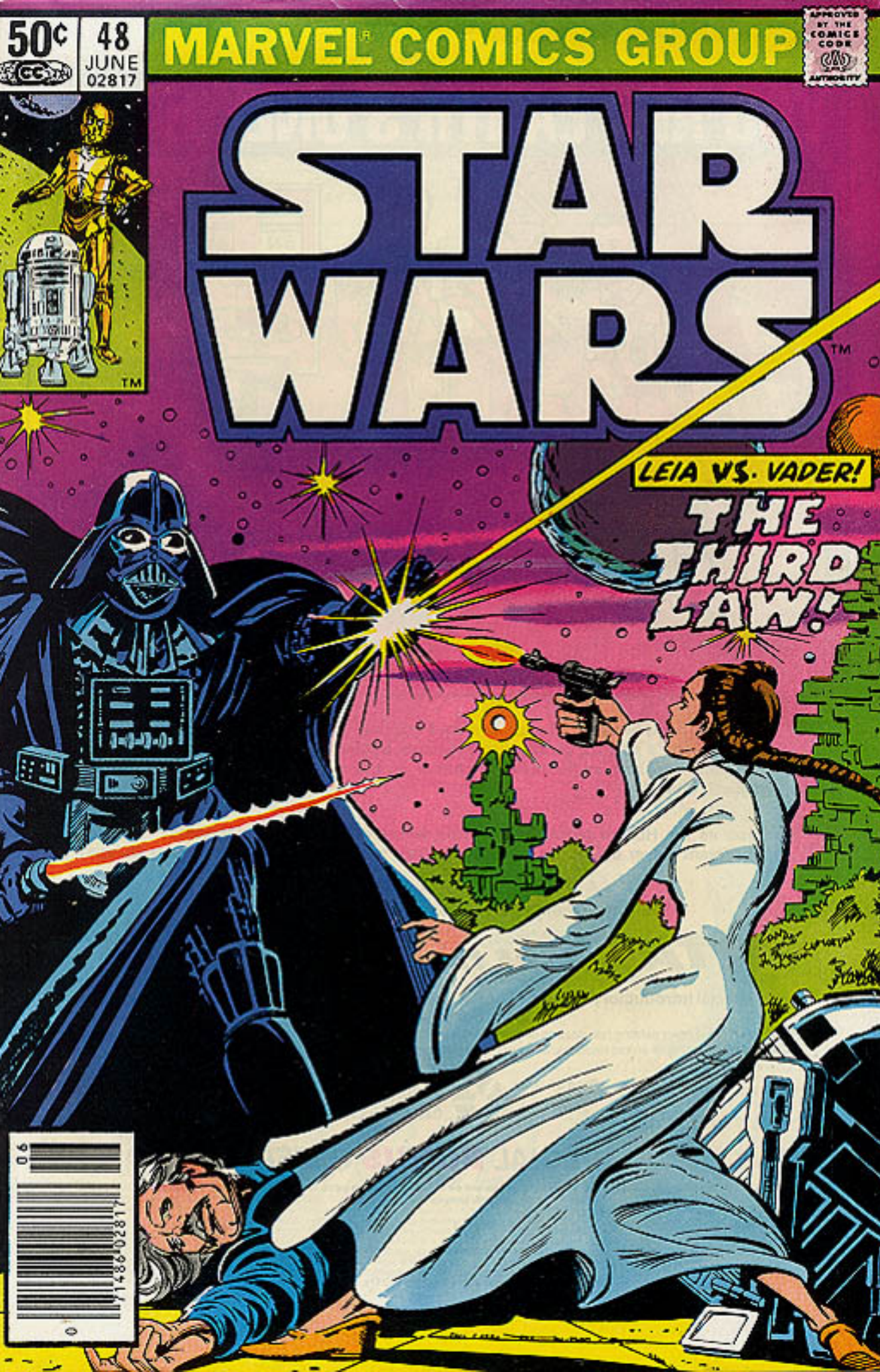


add or remove key variables



balancing choice on whether to observe  
or apply intervention(s) depends on  
natural variation of the system and complexity





## **third variable**

or confounding factor  
influences two other variables  
in a study  
(typically the inferred  
effect and response)



## **reverse causation**

incorrectly assumes the effect-response  
interaction in a system

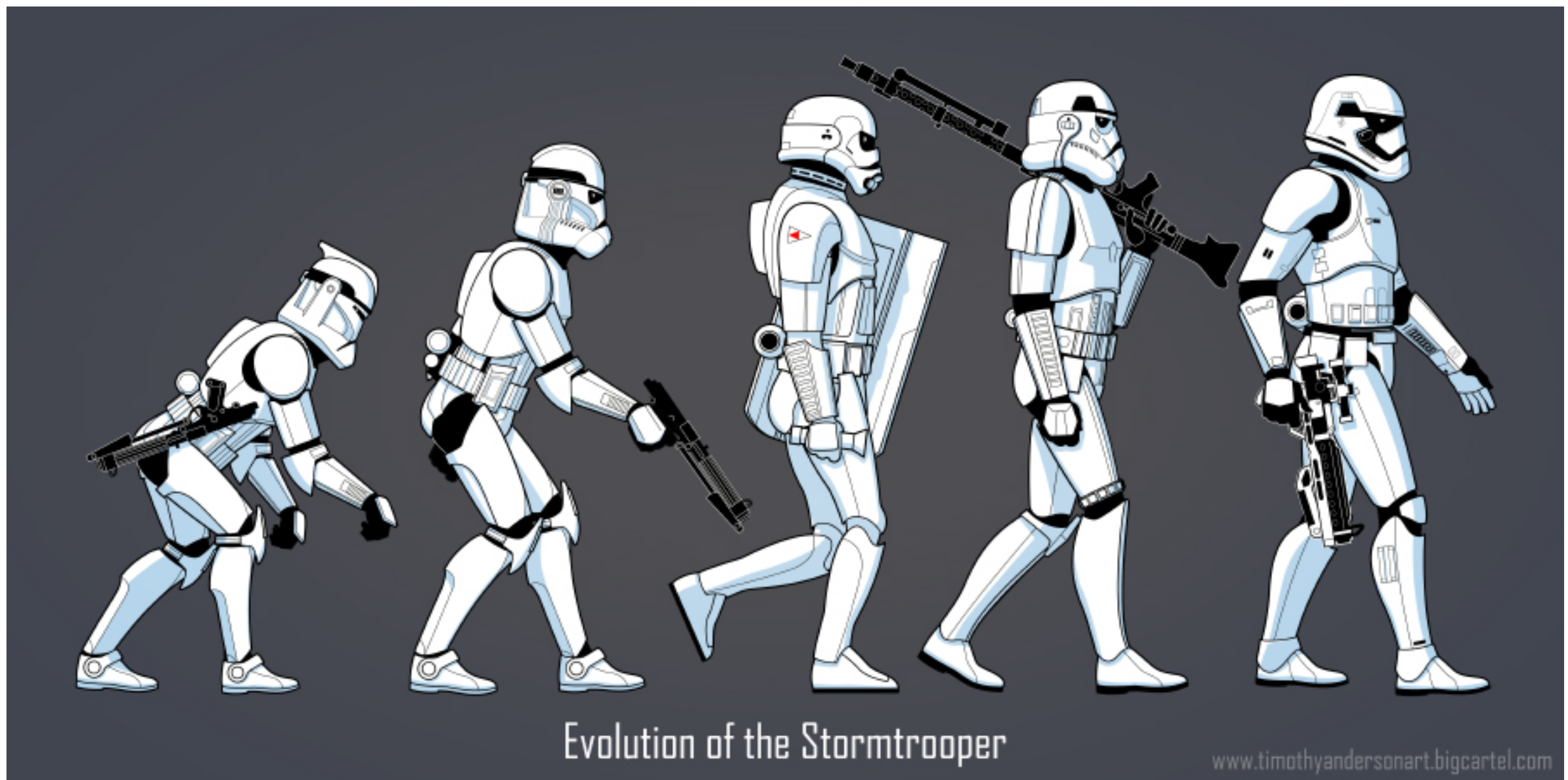


# STAR BUT INSTEAD OF NORMAL, IT'S WITH PHILOSOPHERS WARS





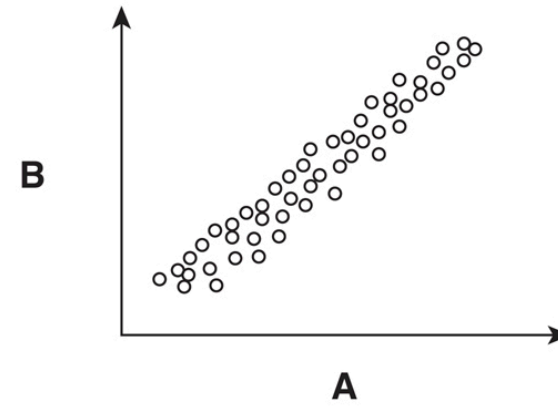
**timing of a measure**  
and  
common sense derived from  
observation can help  
resolve causation inference issues



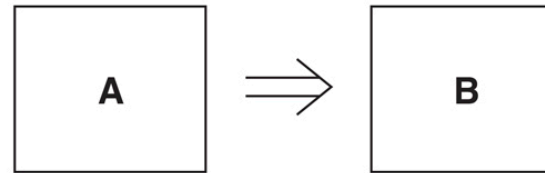
correlation almost always implies causation



***We see a relationship between A and B***

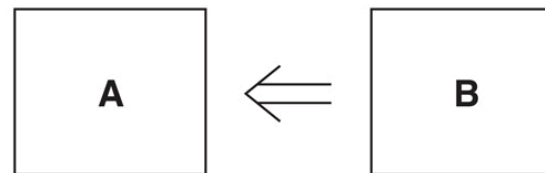


***It might be***



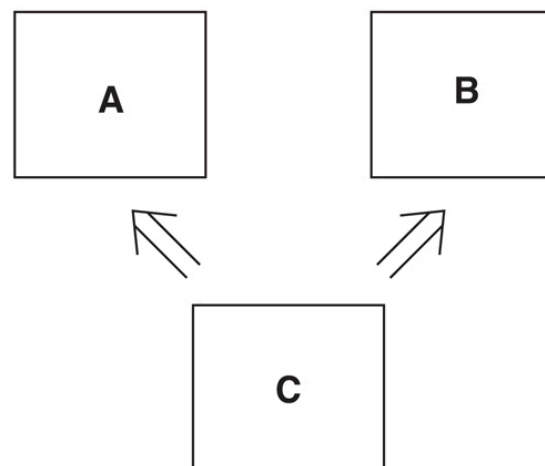
That A has an effect on B

***But it could be***



That cause and effect are the other way around and B has an effect on A. (This is reverse causation.)

***Or***



That A and B have absolutely no effect on each other, but both are affected by a third variable C

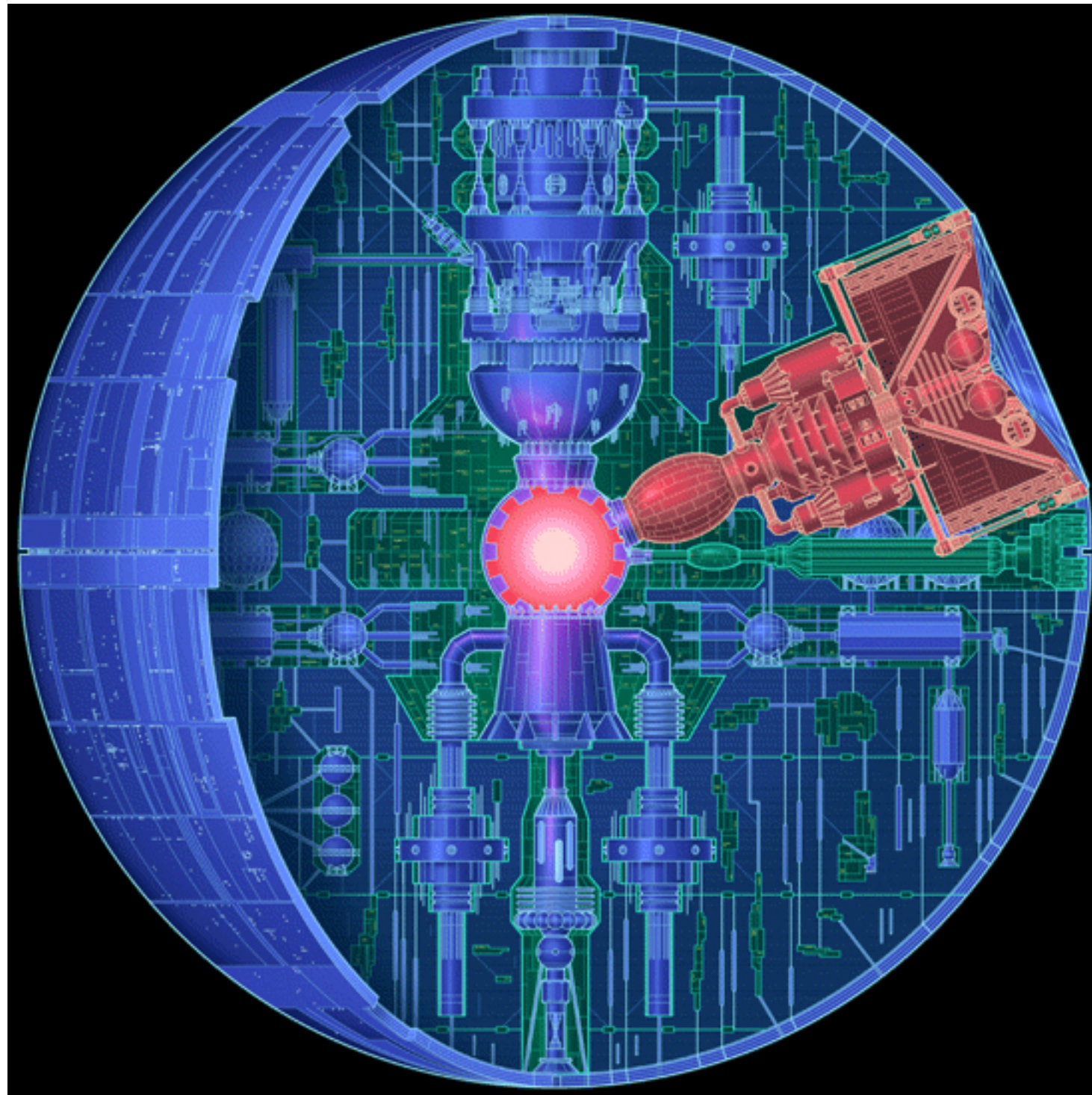
solution:  
consider an observational/correlational  
study prior to manipulative work





once designed, consider blind procedures to reduce bias  
and design changes

lab versus field  
is decided by extent that variation needs to be controlled and  
inherent complexity of a system





scope of inference from any study is a  
key consideration for design thinkers

there is no perfect experiment  
(but there are better choices)

demonstrate **mechanism** as a design fall back or  
plan B







science designs 1.0, 2.0 & 3.0  
balanced with complexity and  
extent of change  
influence our  
capacity to use each design choice  
to inform inference