

TSC 220

an introduction to *systems*



how do we understand sustainability?

the world is too complicated for us to
understand sustainability

we need an abstraction so we can
grasp the issues

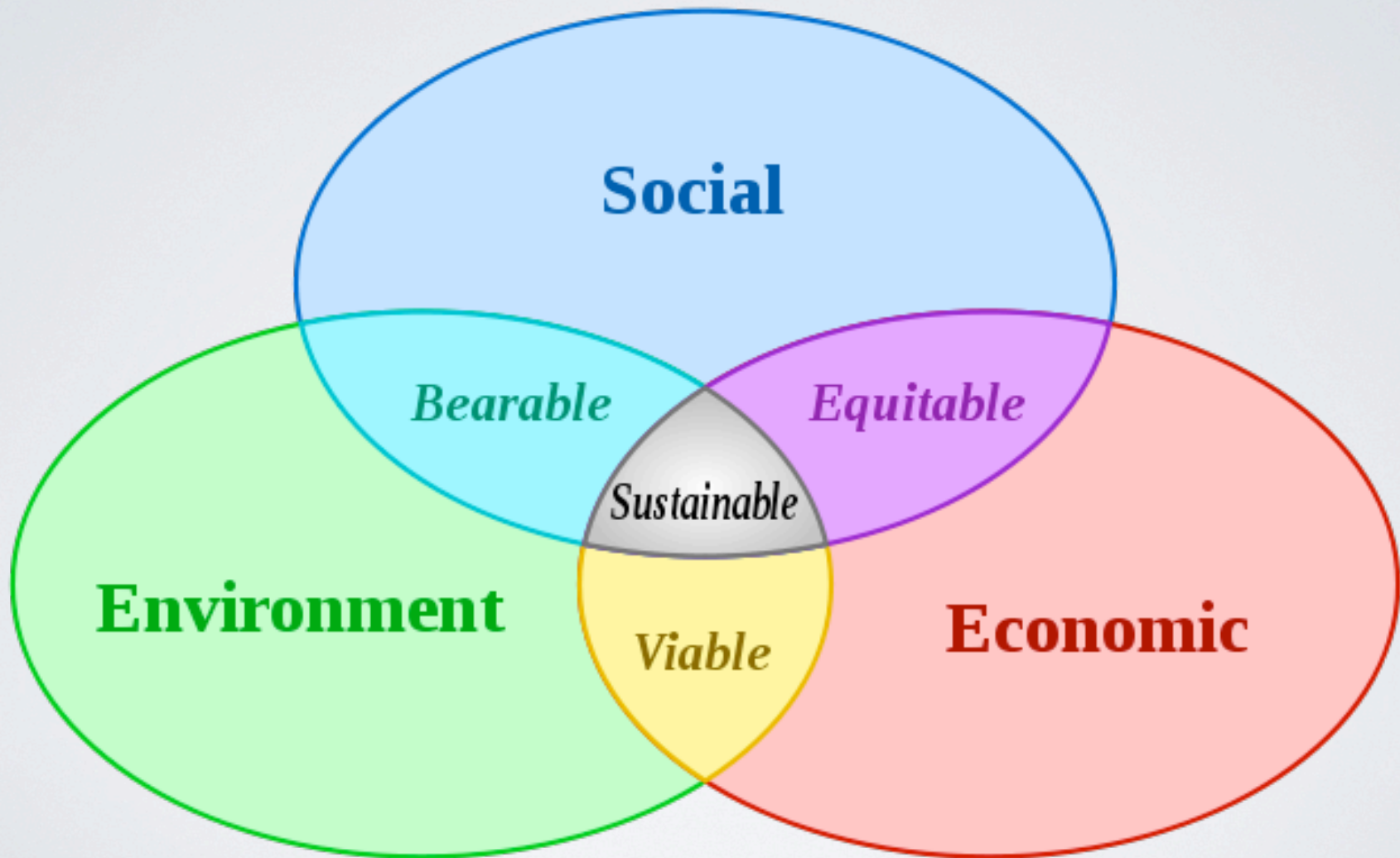
and we need a context for our decisions

we've organized the class by breaking the problem into interconnected components

energy, materials, economics, social issues,
villages, towns, cities, ...

to simplify the discussion, we can group those
issues in common themes

a convenient way to look at how all those issues fit together

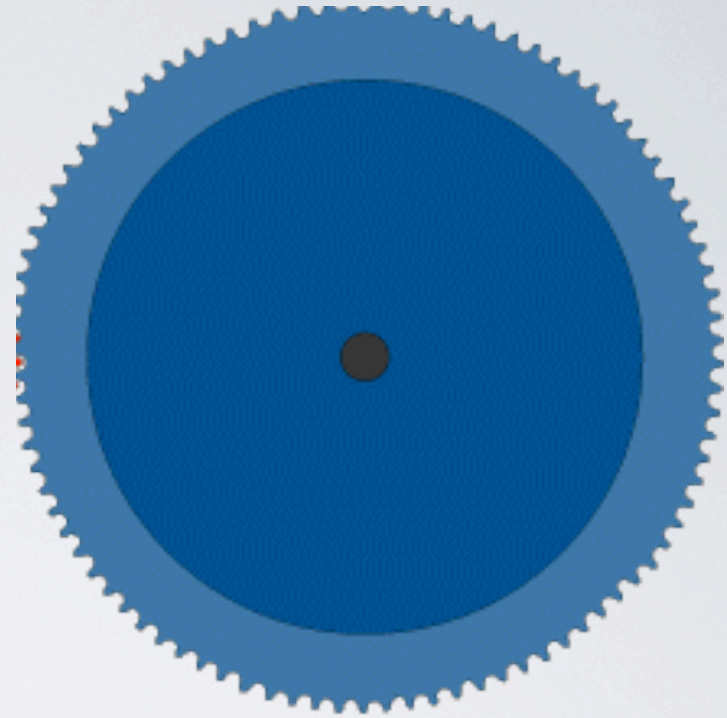


each of the ellipses is complicated in its own right

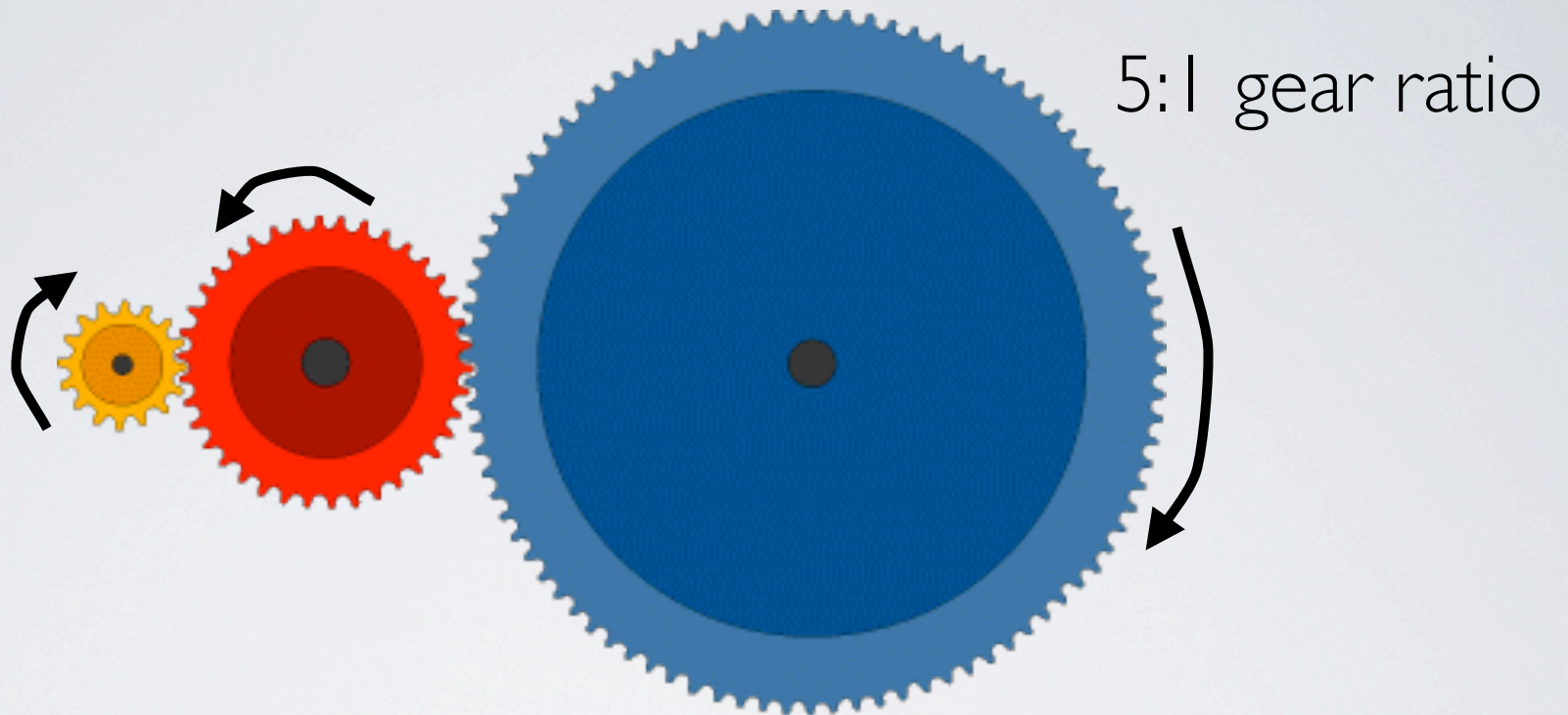
we need a further abstraction

we start by considering them as *systems*

a **system** is ...



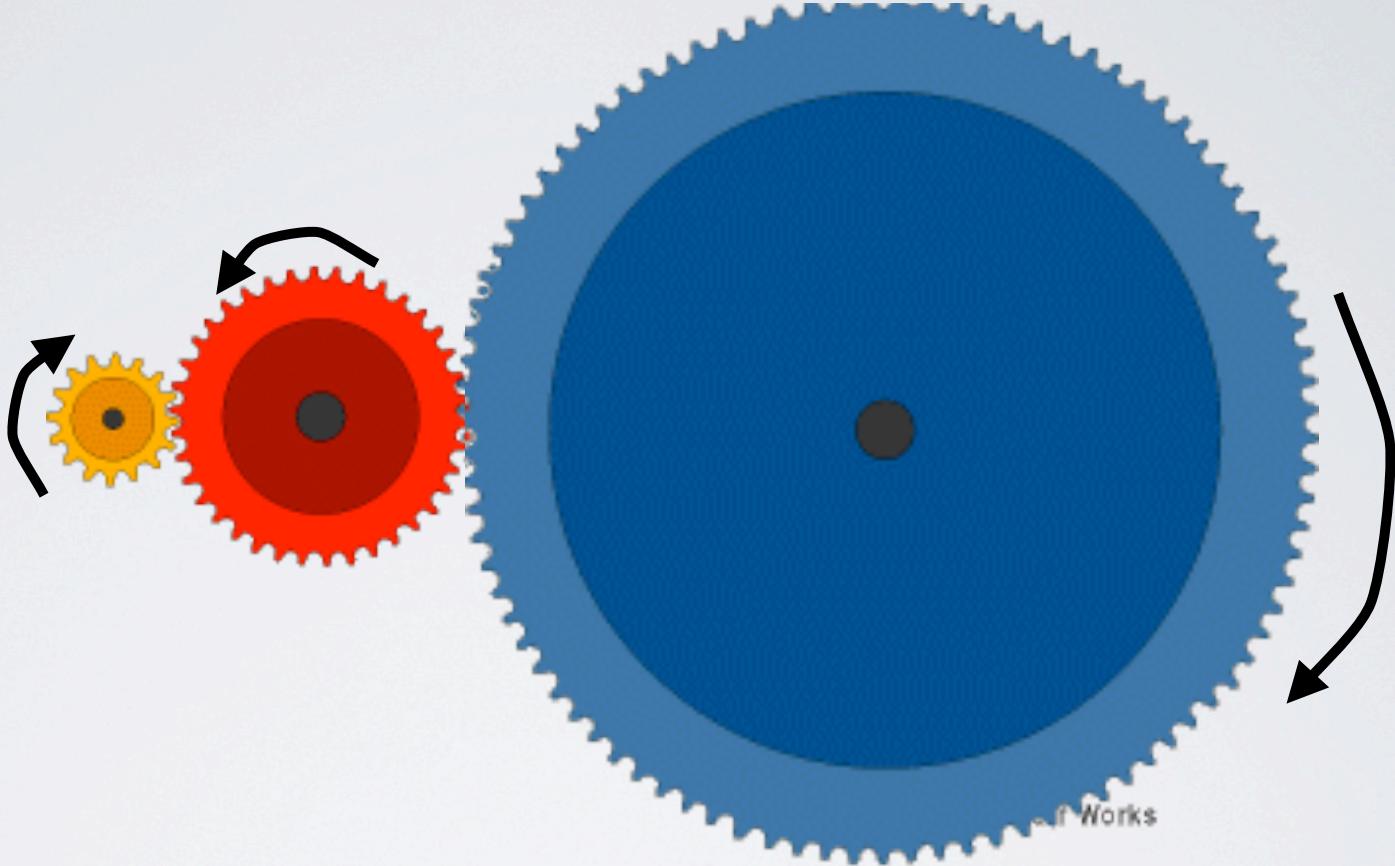
... a set of interconnected parts ...



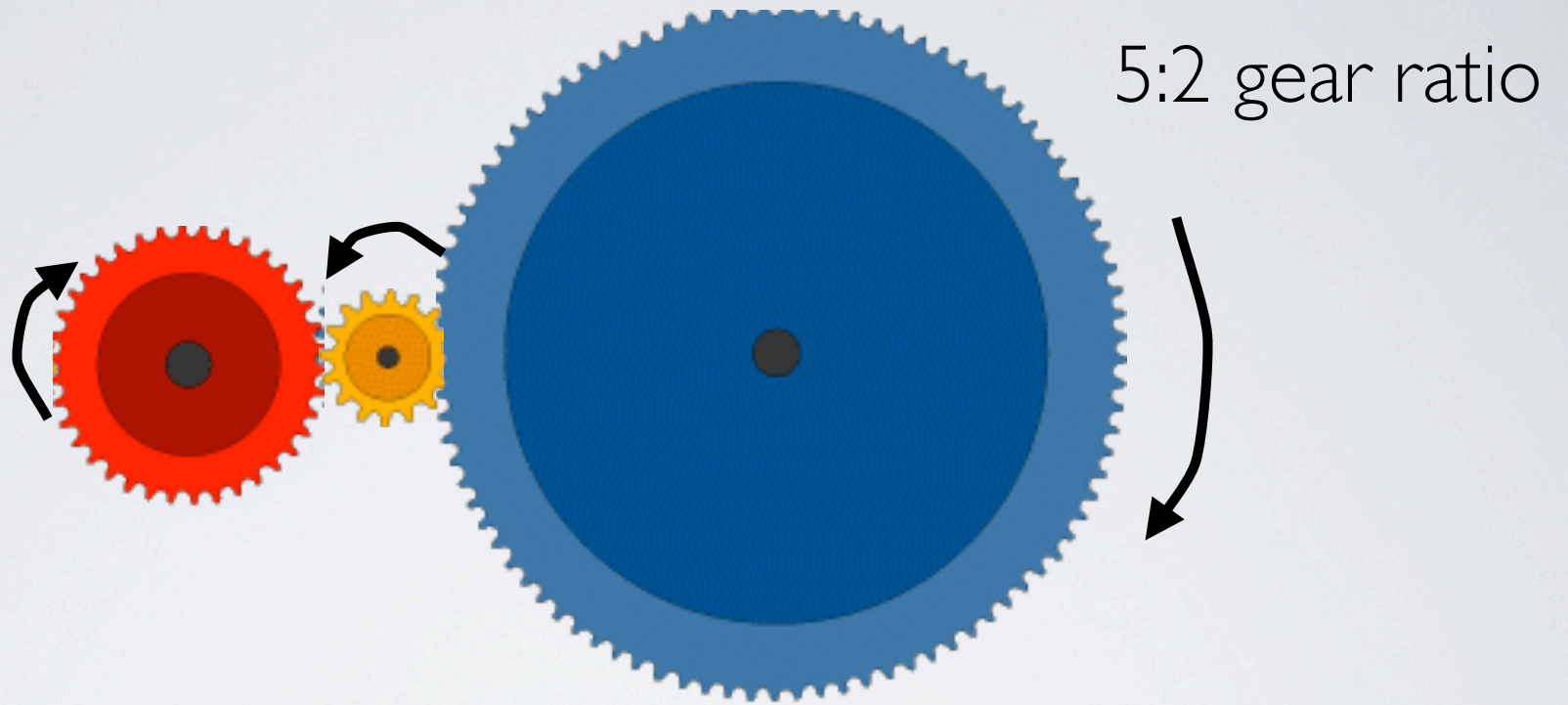
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... making an integrated whole

6:1 gear ratio



change the parts



change the interconnection

characteristics

structure (parts)
interconnections

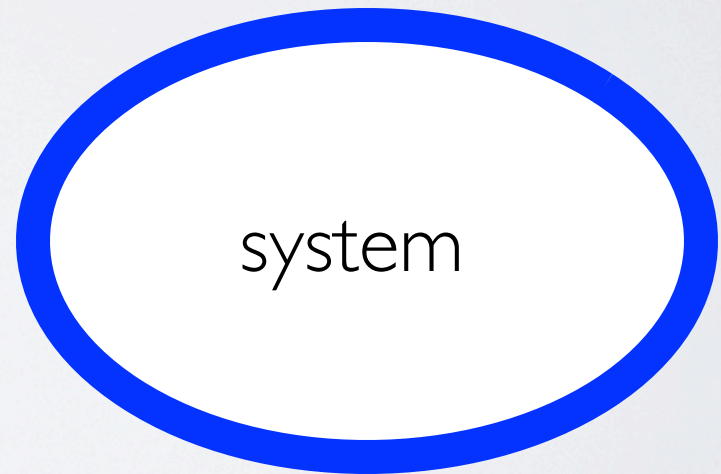


behavior (inputs \Leftrightarrow outputs)

all systems have boundaries

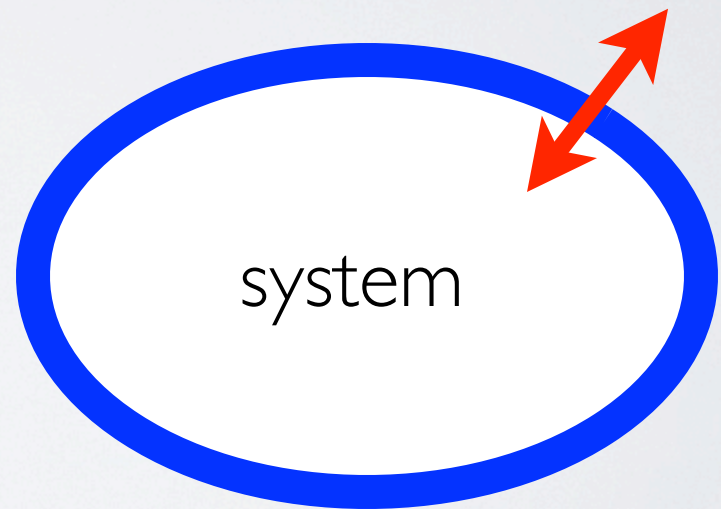
closed system

isolated from outside
environment



open system

interacts in some way with
outside environment



open or closed?

a car

a town

the earth

we need to **define** the boundaries of a
system

systems

a convenient way to think about
complicated problems

the “black box”

a conceptual **system** is ...

... a set of interconnected *non-physical*
objects ...

... making an integrated whole

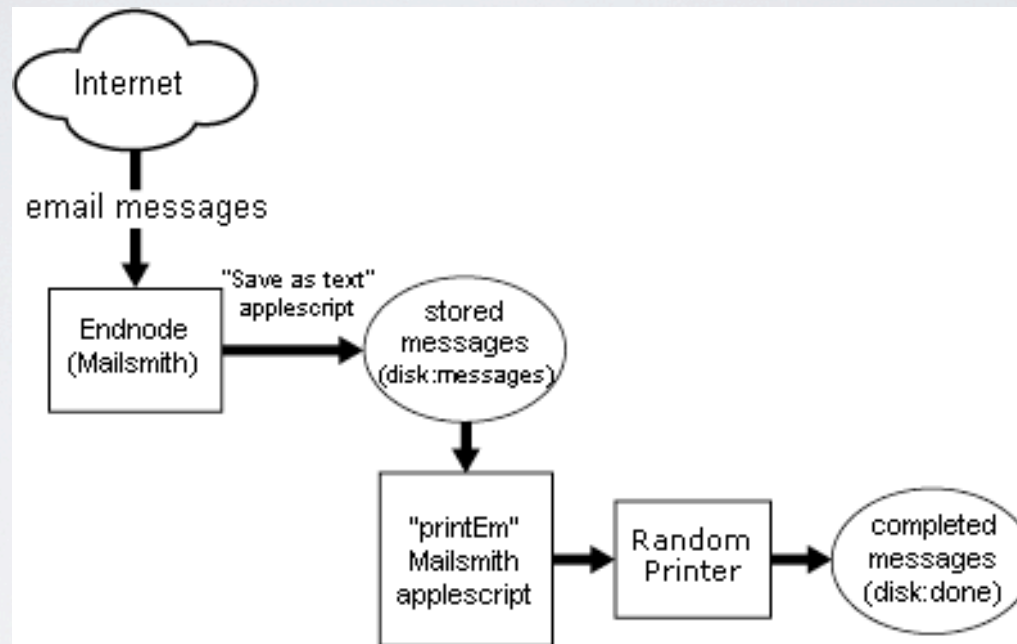
conceptual systems

ethics

logic

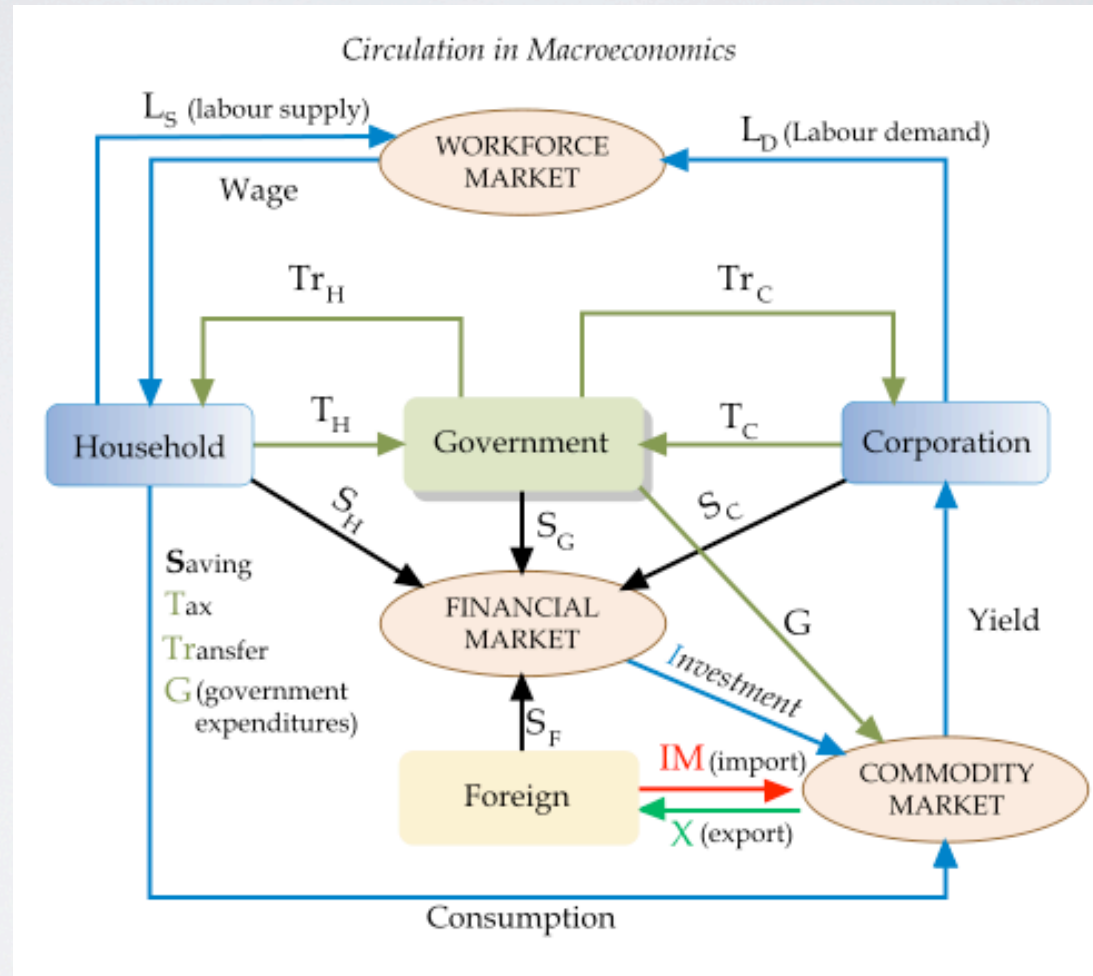
economic theory

system diagrams

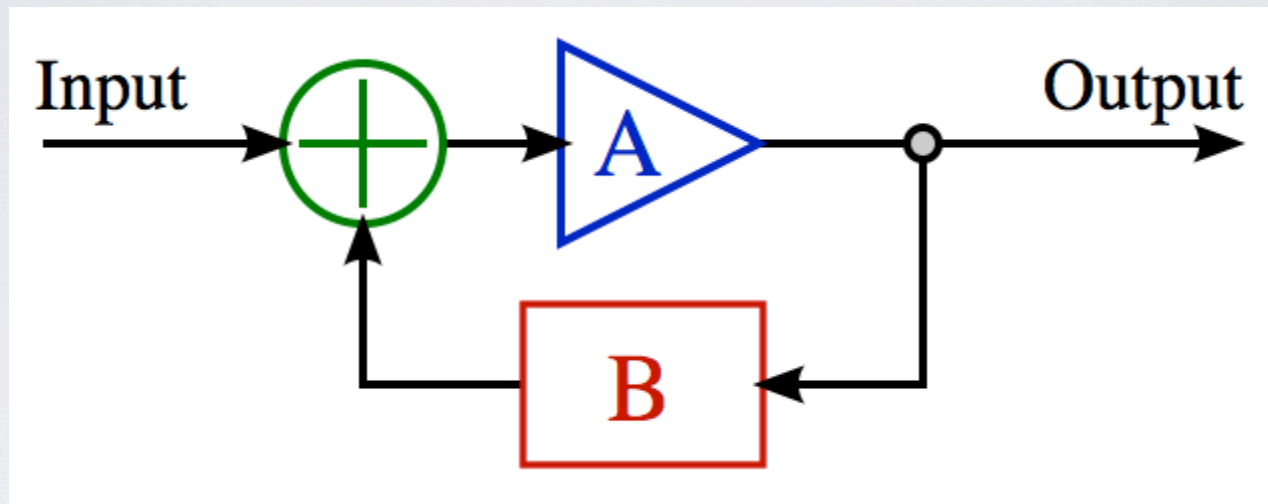


a way to visualize the parts and interconnections of a system

system diagrams are approximations of reality



feedback



mechanism that is looped back
to control a system

system optimization

choosing the “best” alternative from a
set of possible options

optimizing a system does not mean
optimizing each part

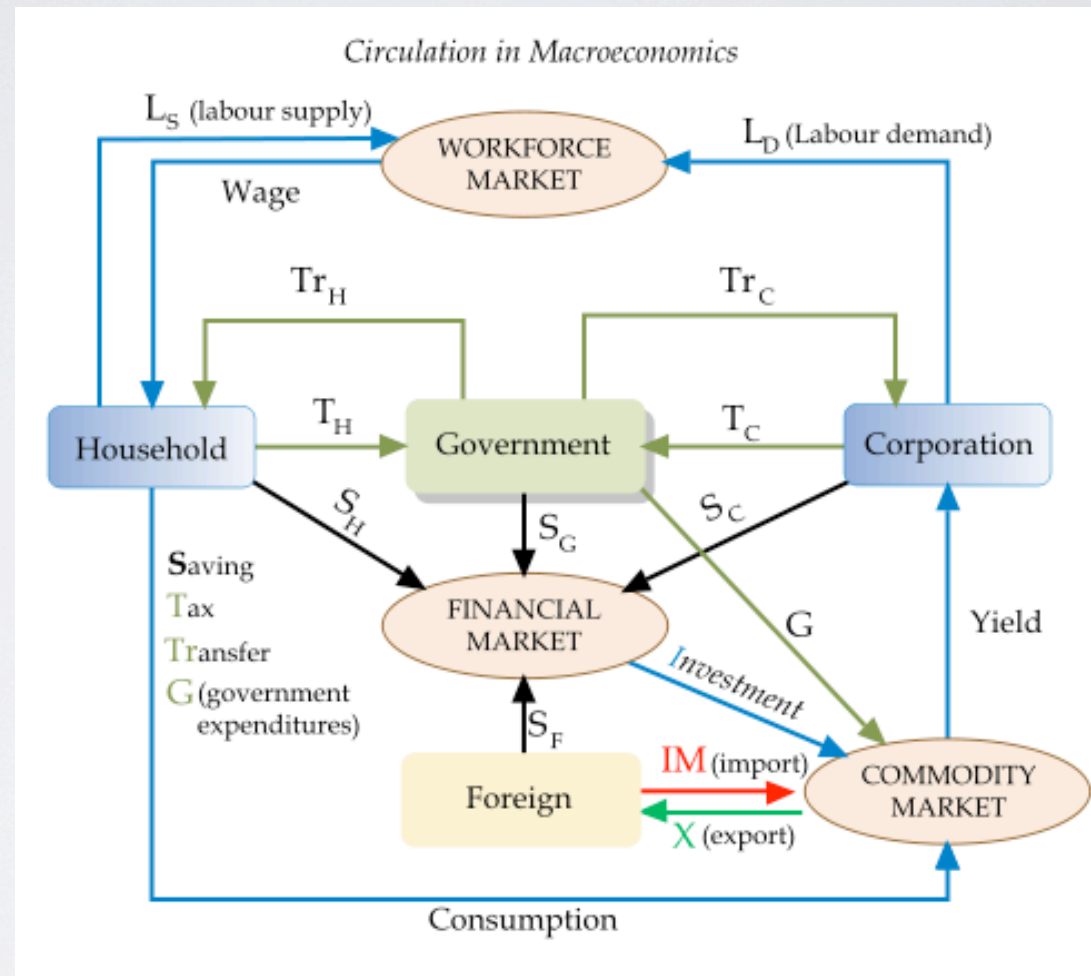
the best alternative usually involves a
compromise of properties

a ***system of systems*** is ...

... a set of interconnected *systems* ...

... making an integrated whole

a system of systems



system of systems

a car

a town

the earth

questions