システムの理解と
科学と社会のコミュニケーション

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ペルシャの伝説

- ある賢い廷臣が美しいチェス盤を王に献上した。何か褒美をと言う王に、「米を下さい。チェス盤の最初のマス目に1粒、2番目のマス目に2粒、3番目のマス目に4粒という具合に」。

- 王は快諾すると、倉庫から米を持ってくるように命じた。

- チェス盤の4つ目のマス目には？
  - 8粒の米が置かれた。

- 10番目のマス目には？
  - 512粒

- 15番目のマス目には？
  - 1万6384粒

- 21番目のマス目には？
  - 100万粒以上

- 41番目のマス目には？
  - 1兆粒！

- 最後の64番目のマス目？
  - 世界中の米粒をかき集めても足りなかっただろう！

システムとその挙動の理解

私たちは変化を直線的にとらえる傾向がある

- 1枚の紙を半分、また半分と、50回折ると、どのくらいの厚さになる？

- 地球から太陽までの距離！

- もう1回折ると、地球と太陽の往復!!

rrong scientific consensus on the
es and risks of climate change
ls in stark contrast to widespread
nd complacency among the public
does this gulf exist, and why does it
cies to manage complex natural and
stems should be based on the best
ientific knowledge, and the Inter-
al Panel on Climate Change (IPCC)
gorously vetted information to
ers. In democracies, however, the
e public, not only those of experts,
nment policy.

e risk communication is grounded
erstanding of the mental models of
ers and citizens (*3*). What, then,
cipal mental models shaping peo-
s about climate change? Studies
parent contradiction: Majorities in
States and other nations have heard
hange and say they support action
it, yet climate change ranks far
 economy, war, and terrorism
ple's greatest concerns, and large
oppose policies that would cut
 gas (GHG) emissions by raising
rices (*1*, *2*).
ling, a 2007 survey found a major-
respondents (54%) advocated

Consider a scenario in which the concentration of CO_2 in the atmosphere gradually rises to 400 ppm, about 8% higher than the level in 2000, then stabilizes by the year 2100, as shown here:
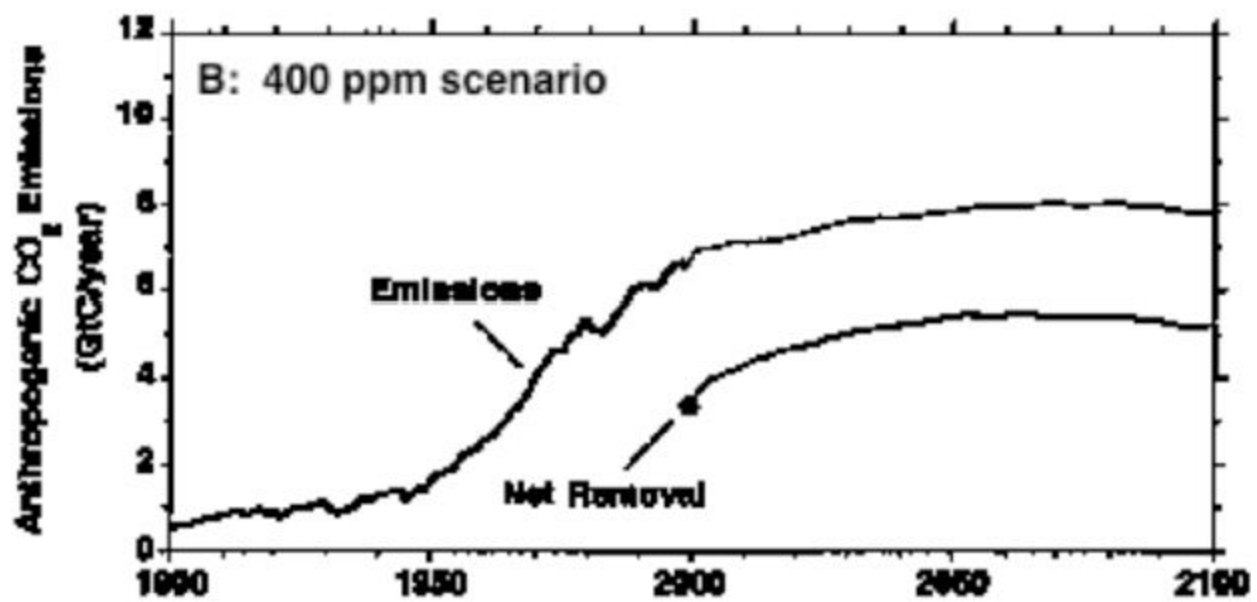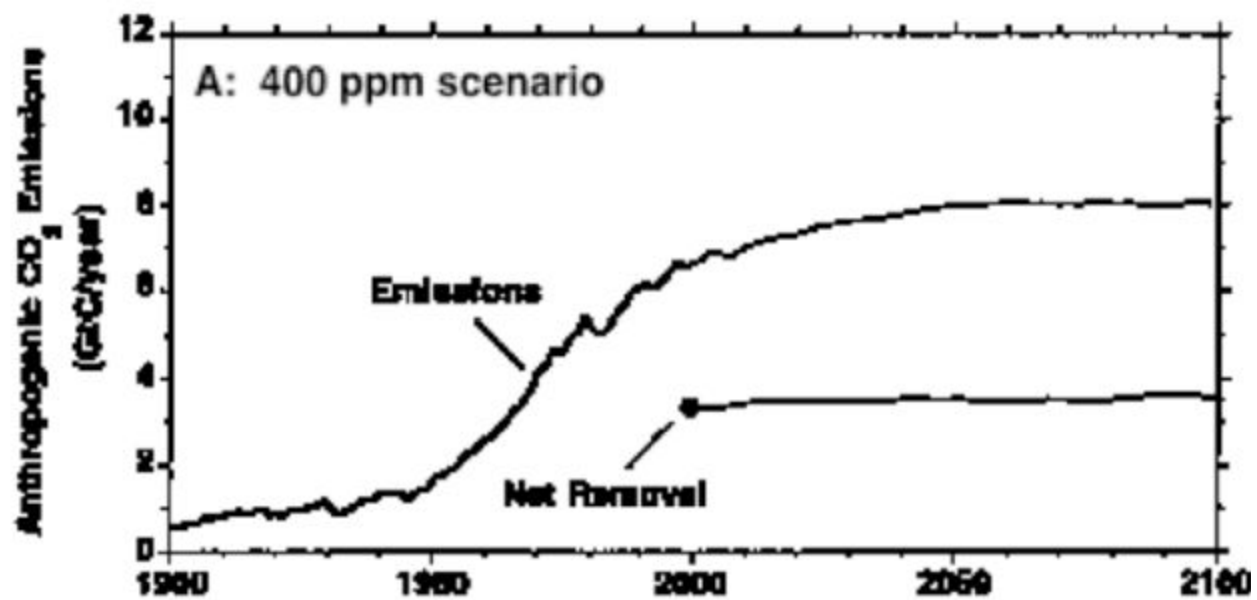

The graph below shows anthropogenic CO_2 emissions from 1900–2000, and current net removal of CO_2 from the atmosphere by natural processes. Sketch:
  a. Your estimate of likely future net CO_2 removal, given the scenario above.
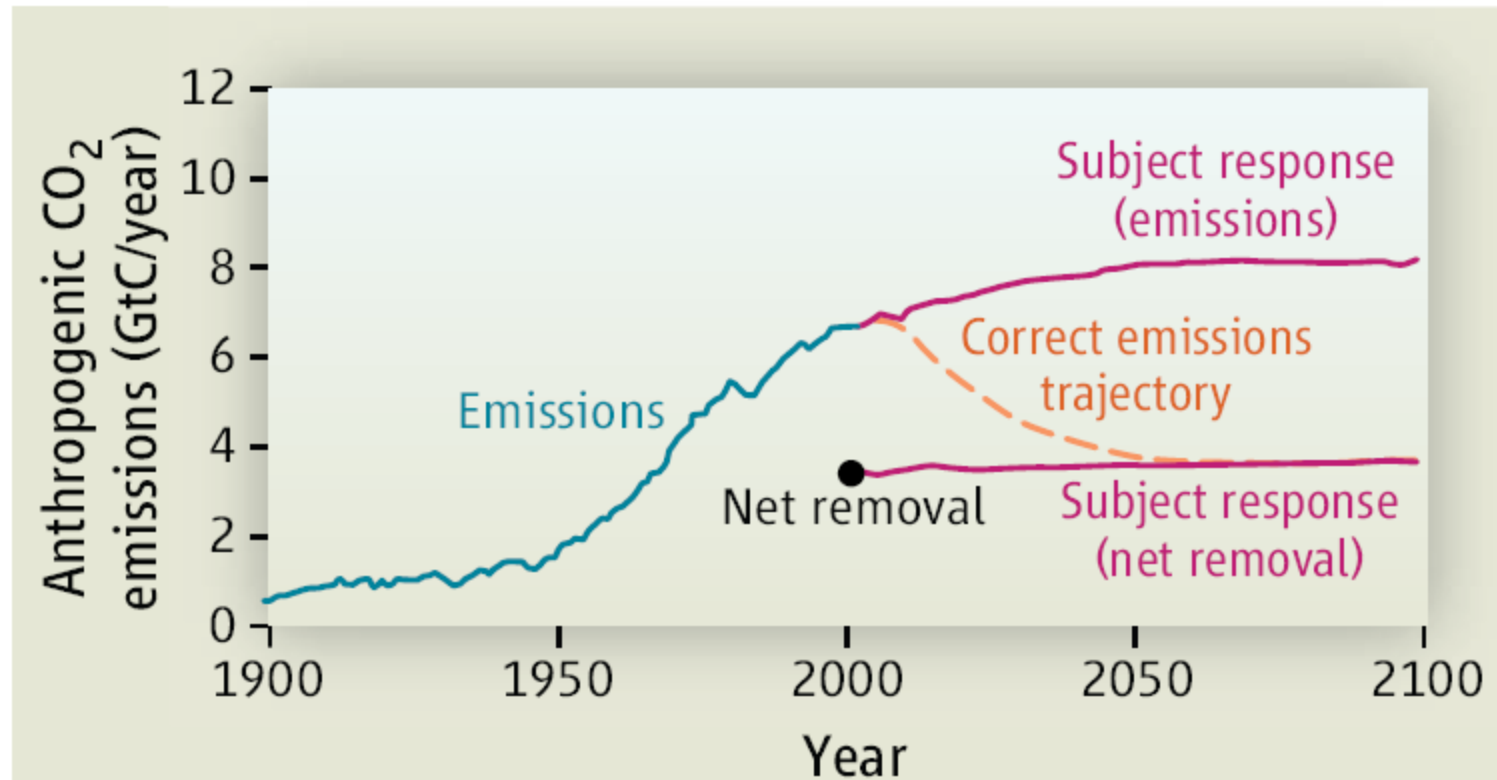 b. Your estimate of likely future anthropogenic CO_2 emissions, given the scenario above.
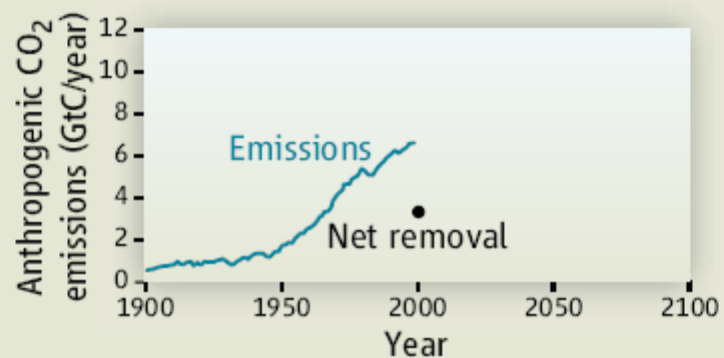
standing of stocks and flows
accumulation. Accumulatio
everyday experience: Our ba
late the inflow of water thr
less the outflow through the
accounts accumulate depo
drawals, and we all struggl
weight by managing the infl
of calories through diet an
despite their ubiquity, resea
people have difficulty relatir
and out of a stock to the level
in simple, familiar context
accounts and bathtubs. Inste
assess system dynamics u
matching heuristic, assuming
of a system should "look like
correlated with—its inputs (*1*

   Although sometimes usef
reasoning fails in systems
accumulations. Since 1950,
budget deficit and national
dramatically and are highly
0.84, $P < 0.0001$). Correlat
predicts that cutting the defic
the debt. However, because t
is a stock that accumulates the
rising even if the deficit falls;
the government runs a surpli

A: 400 ppm scenario

Emissions

Net Removal

B: 400 ppm scenario

Emissions

Net Removal

develop their intuitive systems thinking capabil-
ities. Bathtub analogies and interactive "man-

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14. J. D. Ste
    (2007).
15. G. Prins,
16. Searchir
    change"
17. C.-J. Yan
18. J. Willia
    Years, 1!
19. A. Tversk
20. J. D. Ste
    New Yor
21. Manage
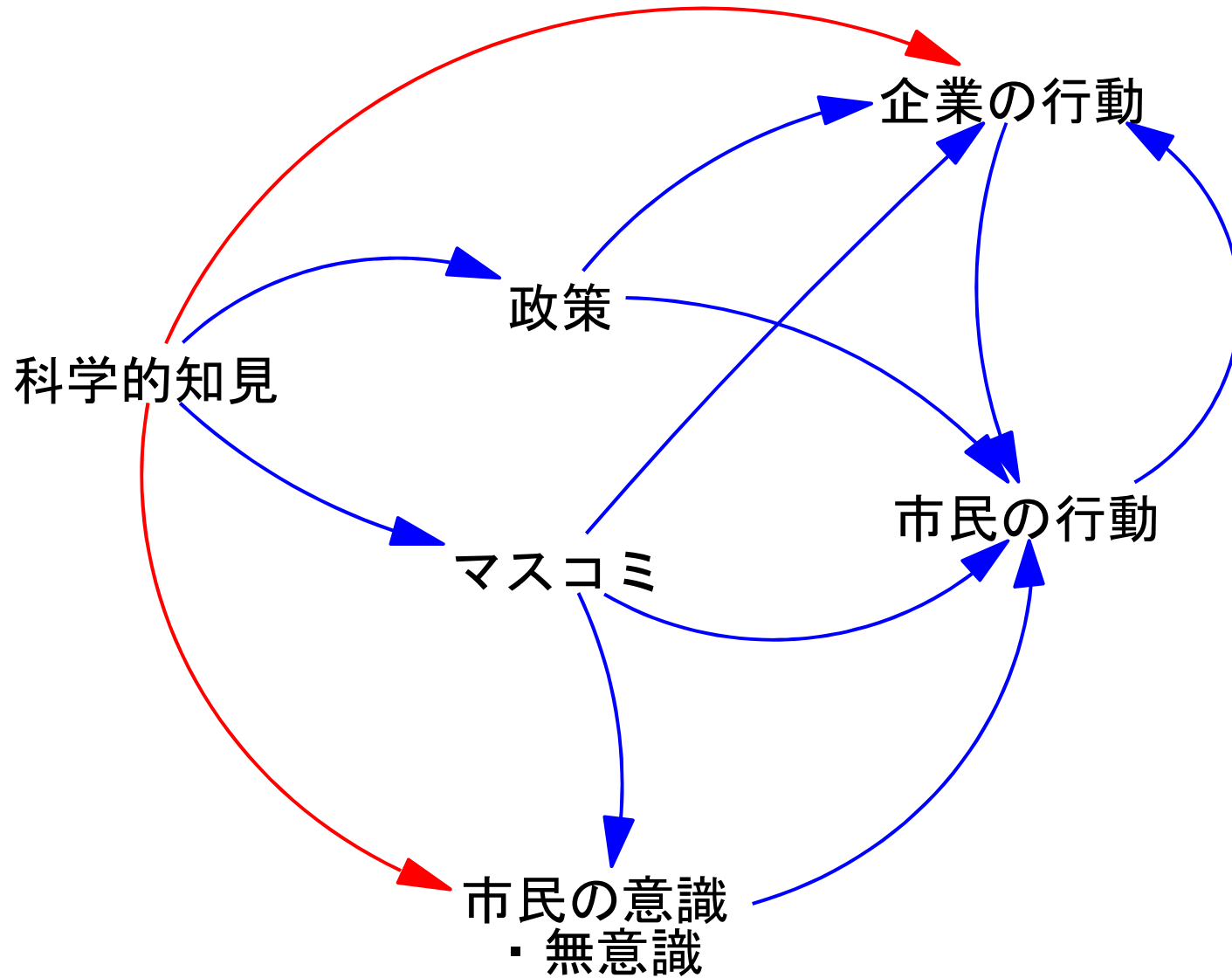   ~jsterma
22. Financia
    Markets

A typical response to the climate stabilization task. Future emissions are erroneously correlated with atmospheric CO_2. Gold dashed line indicates the correct emissions path to stabilize CO_2 given the subject's estimate of net removal.

Supporting C
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科学と市民

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- 市民の科学リテラシーを高める
- 3つの思考停止に陥らない
- 不確実性とのつきあい方
- 手段と目的を区別する　例：25％削減目標
- バランスと柔軟性（"仕掛品"意識）