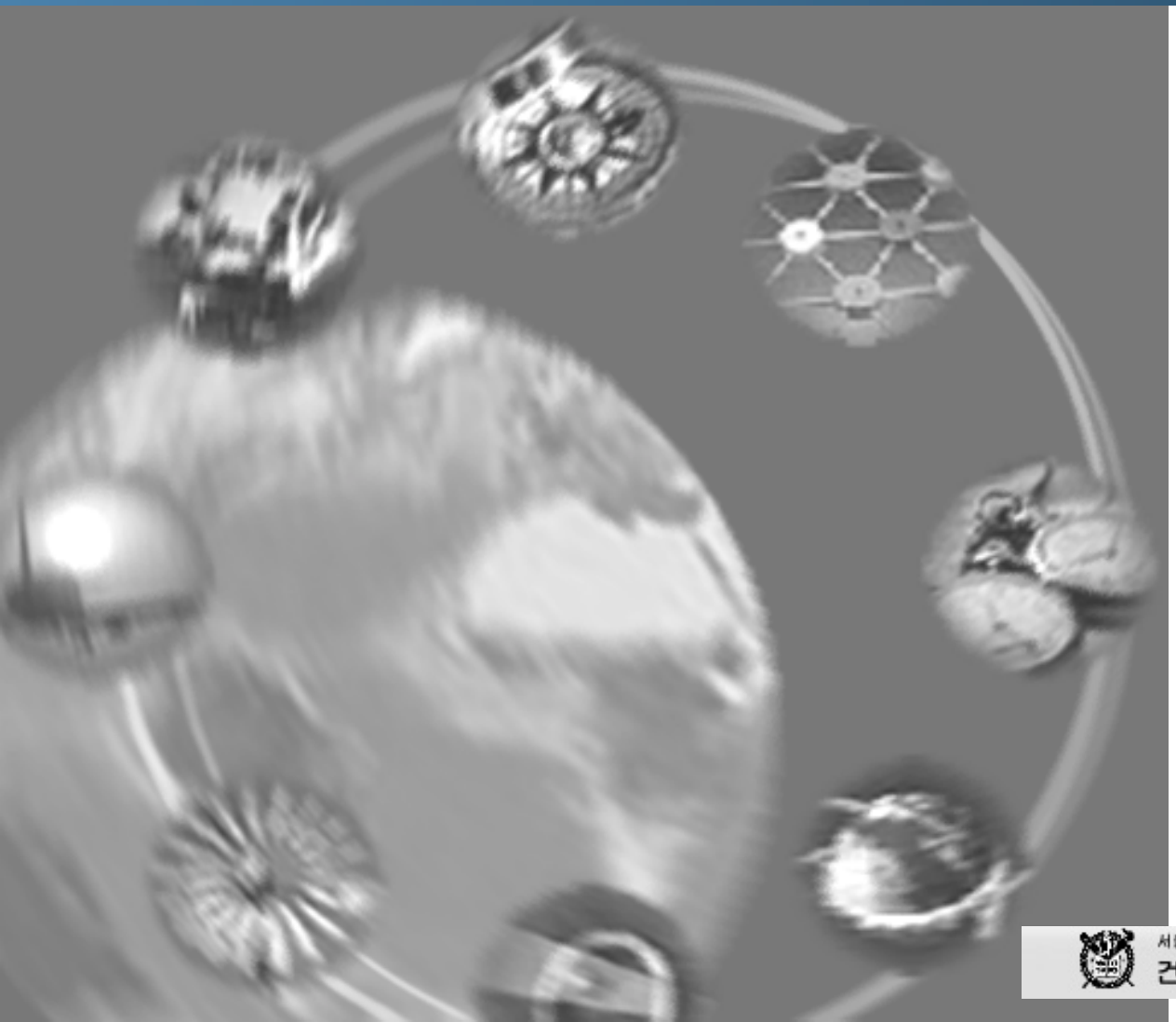
# Dynamics of Growth

## Path Dependency/Corporate Growth/Epidemic♪

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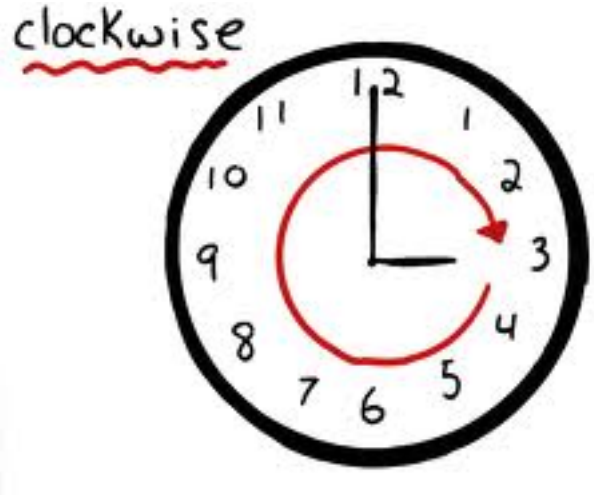
# Why?





- Do clocks go clockwise?
- Do people in most nations drive on the right?
- Did MS Windows and Intel's CPU come to dominate the market?
- Are there so many winner-takes-all markets?
- Does the rich get richer and the poor get poorer?

▪Business Dynamics, Sterman, 2000

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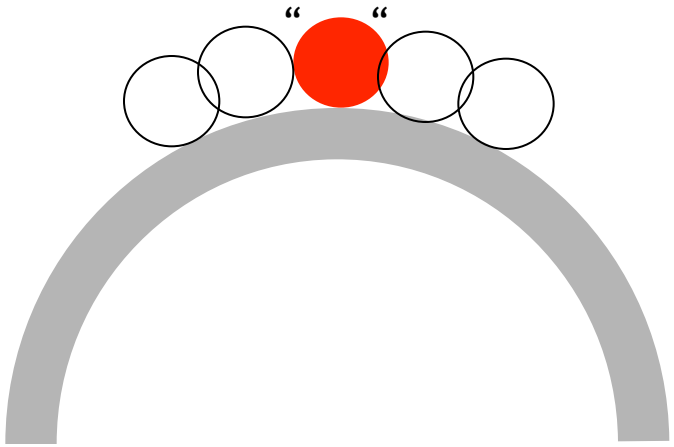
# Path Dependency

- A pattern of behavior in which small, random (unpredictable) events early in the history determines the ultimate end state.

- Path dependency arises in systems with locally unstable equilibrium.



- Business Dynamics, Sterman, 2000

- Even initially equally attractive, the symmetry is broken by microscopic noise.

- Positive feedback processes then amplify these small initial differences until they reach macroscopic significance.

- Once a dominant design or standard has emerged, the costs of switching become prohibitive, so the equilibrium is self-enforcing: the system has LOCK-IN.

▪Business Dynamics, Sterman, 2000

# An example: VHS vs. Betamax

- VCR introduced in 1975 by SONY with Betamax format.
- VHS format launched 18 months later by a consortium of Matsushita, JVC and RCA.
- Compatibility is the most important.
- SONY had comparative advantages: compatibility feedbacks, learning curves, scale economics, favoring the early leader.

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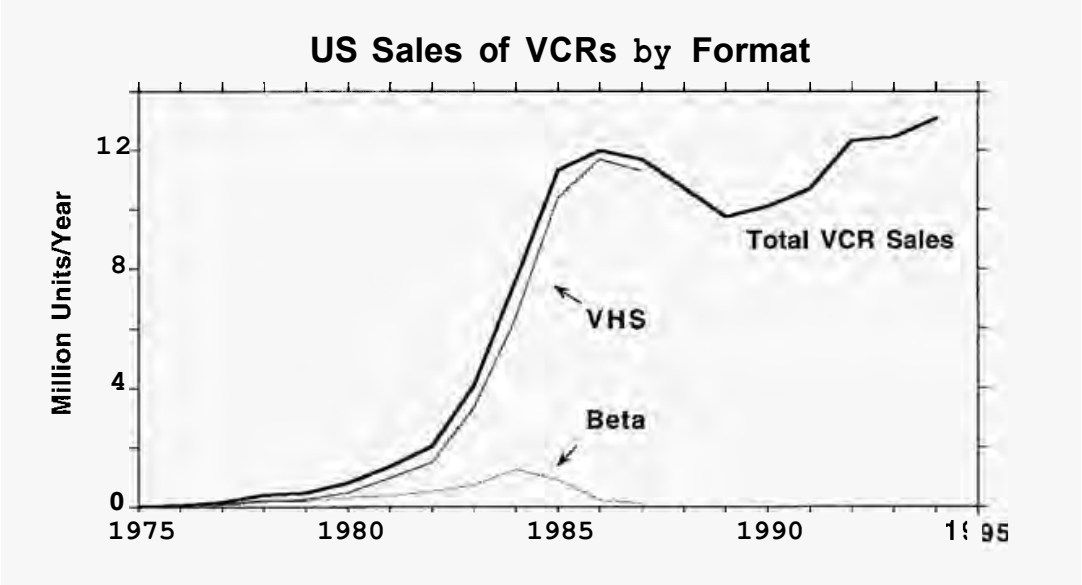
# Why did SONY lose its market leader position?




- Longer playtime
- Cheaper (vs. SONY's superior picture quality)
- Greater scale economics
- Learning curves

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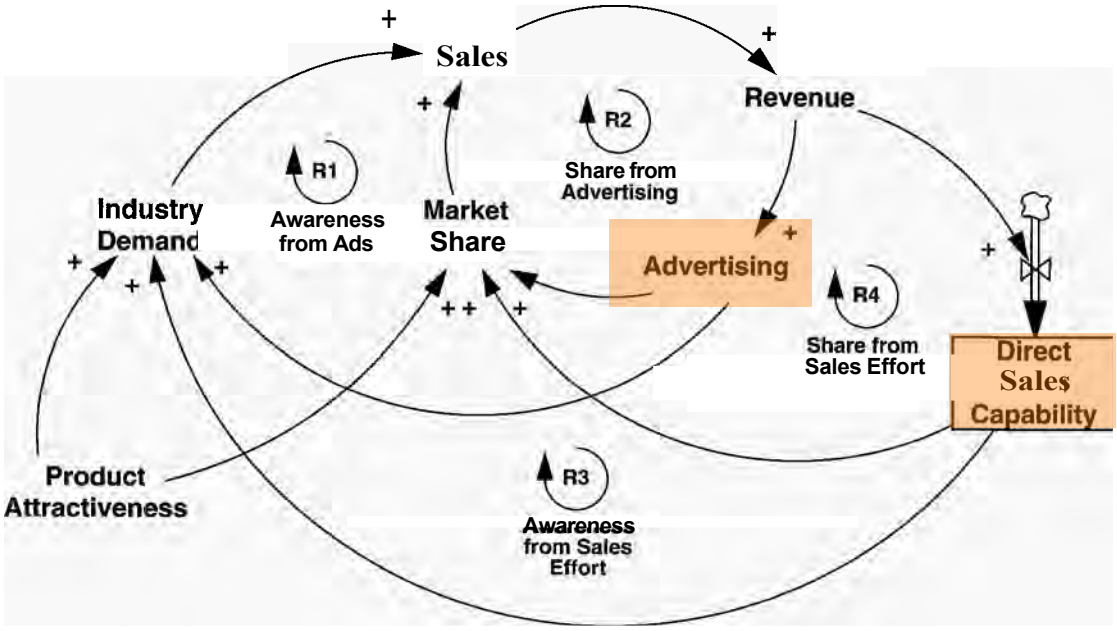
# Engine of Corporate Growth

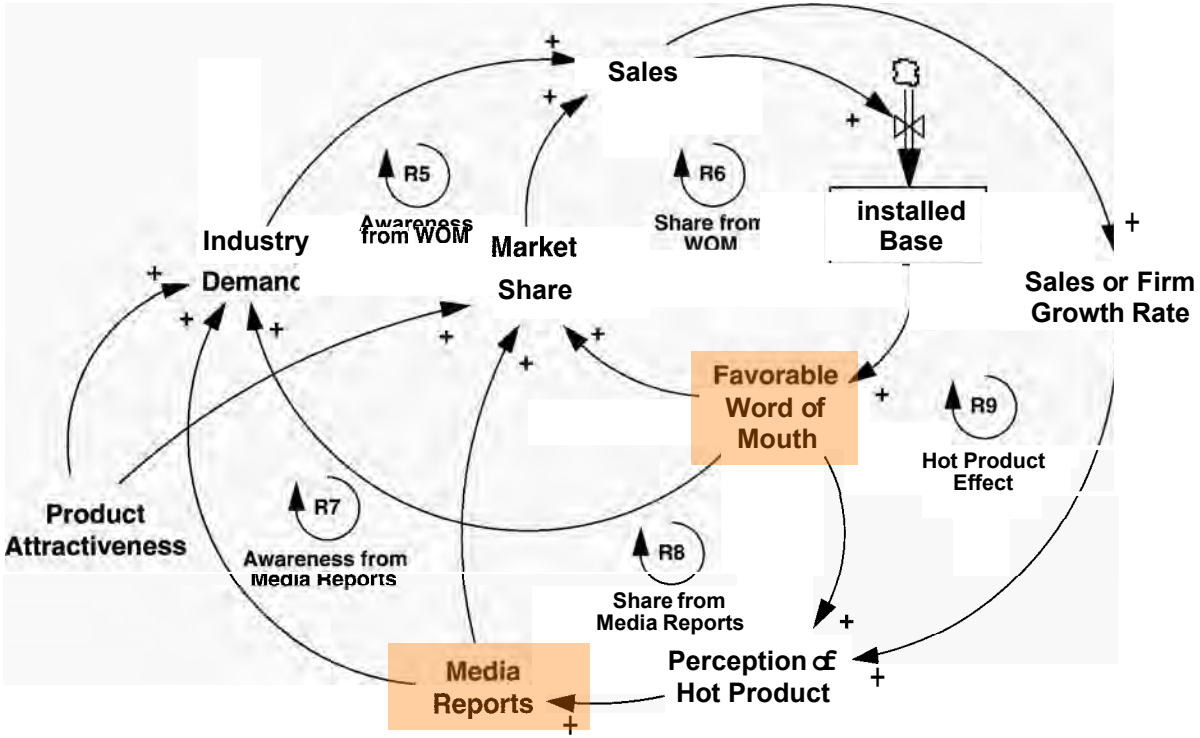
# Product Awareness

- How do potential customers become aware of a firm's products?

- Four principal channels: advertising, direct sales effort, word of mouth, and media attention




▪Business Dynamics, Sterman, 2000




- Word of mouth and media reports create a hot product

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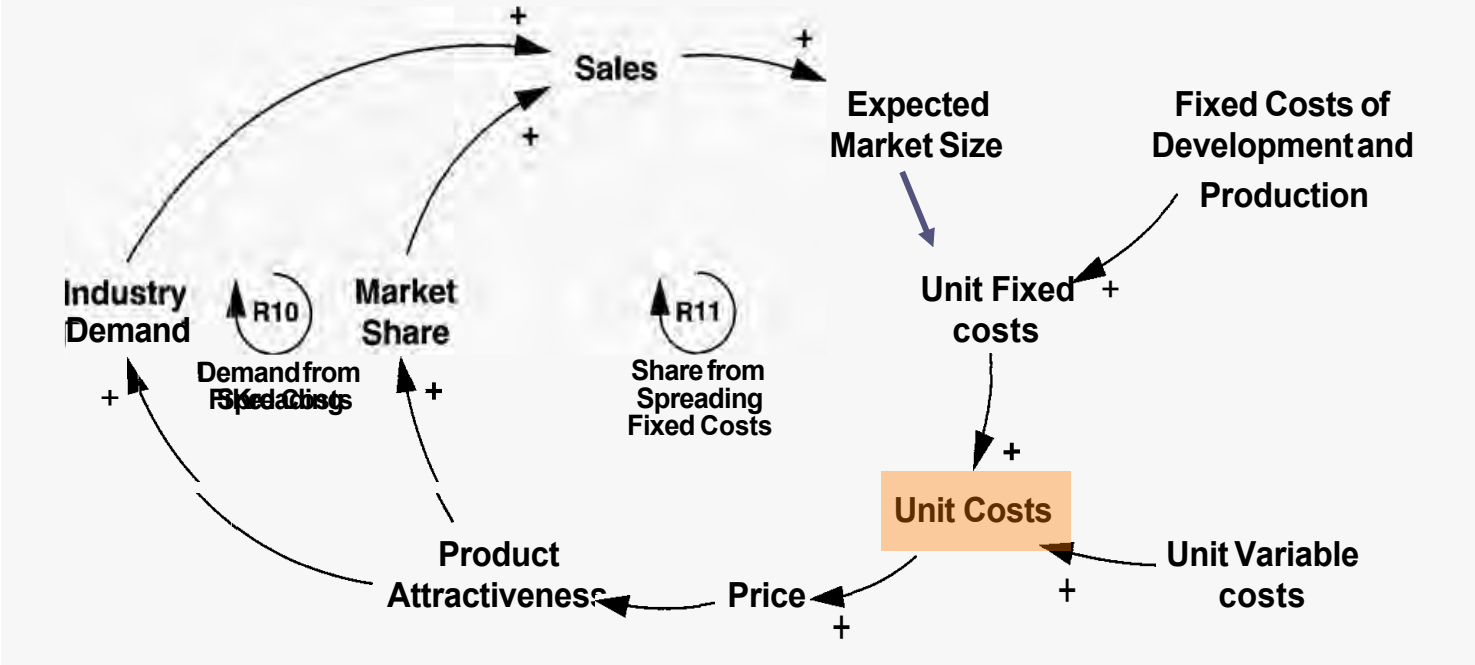
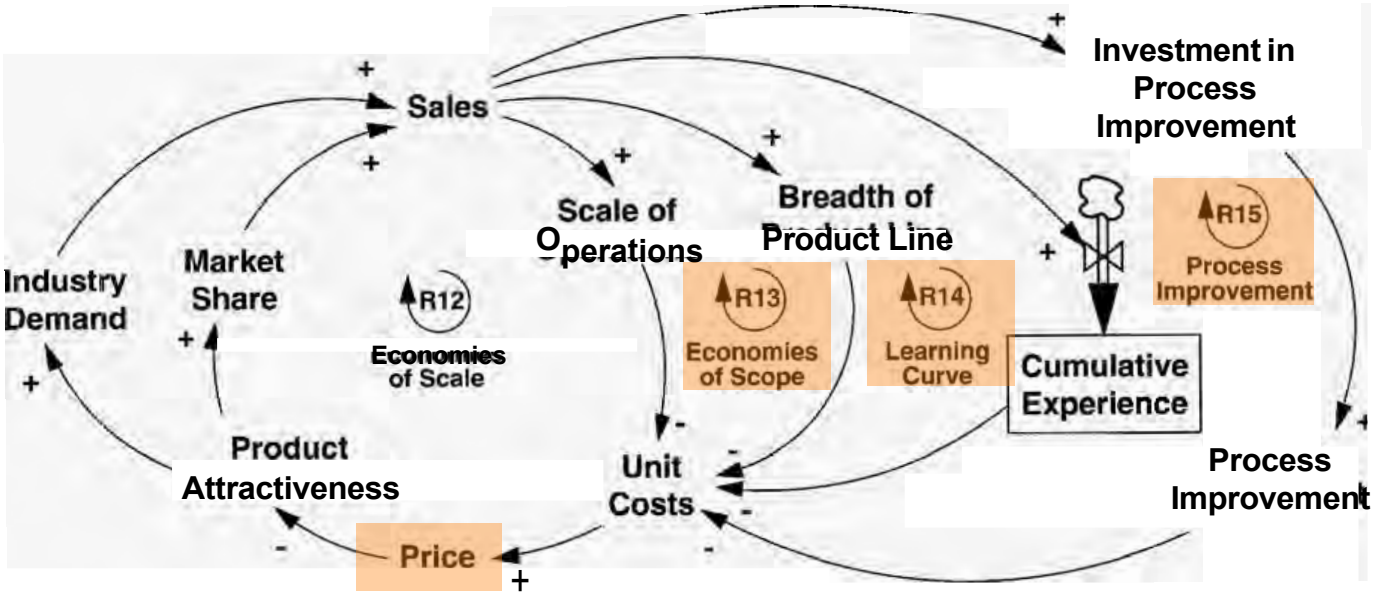
# Unit Development Costs




- Spreading fixed costs over a larger volume lowers price and leads to larger volumes

Business Dynamics, Sterman, 2000

# Price & Production Costs




- Scale and scope economies, learning curves, and process improvement

- Each effect creates two positive loops: One increases sales through market share gains, and one increases sales through expansion of the total size of the market.

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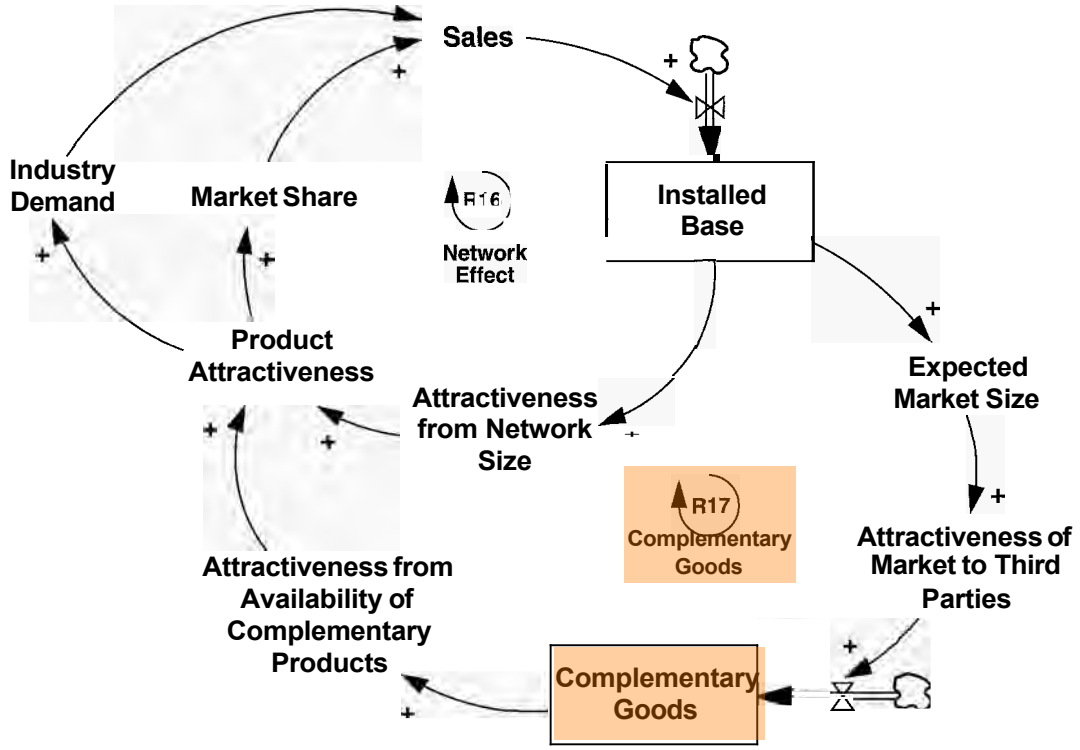
# Network Effects & Complementary Goods




- Each effect creates two positive loops: one increases sales through market share gains, and one increases sales through expansion of the total size of the market.

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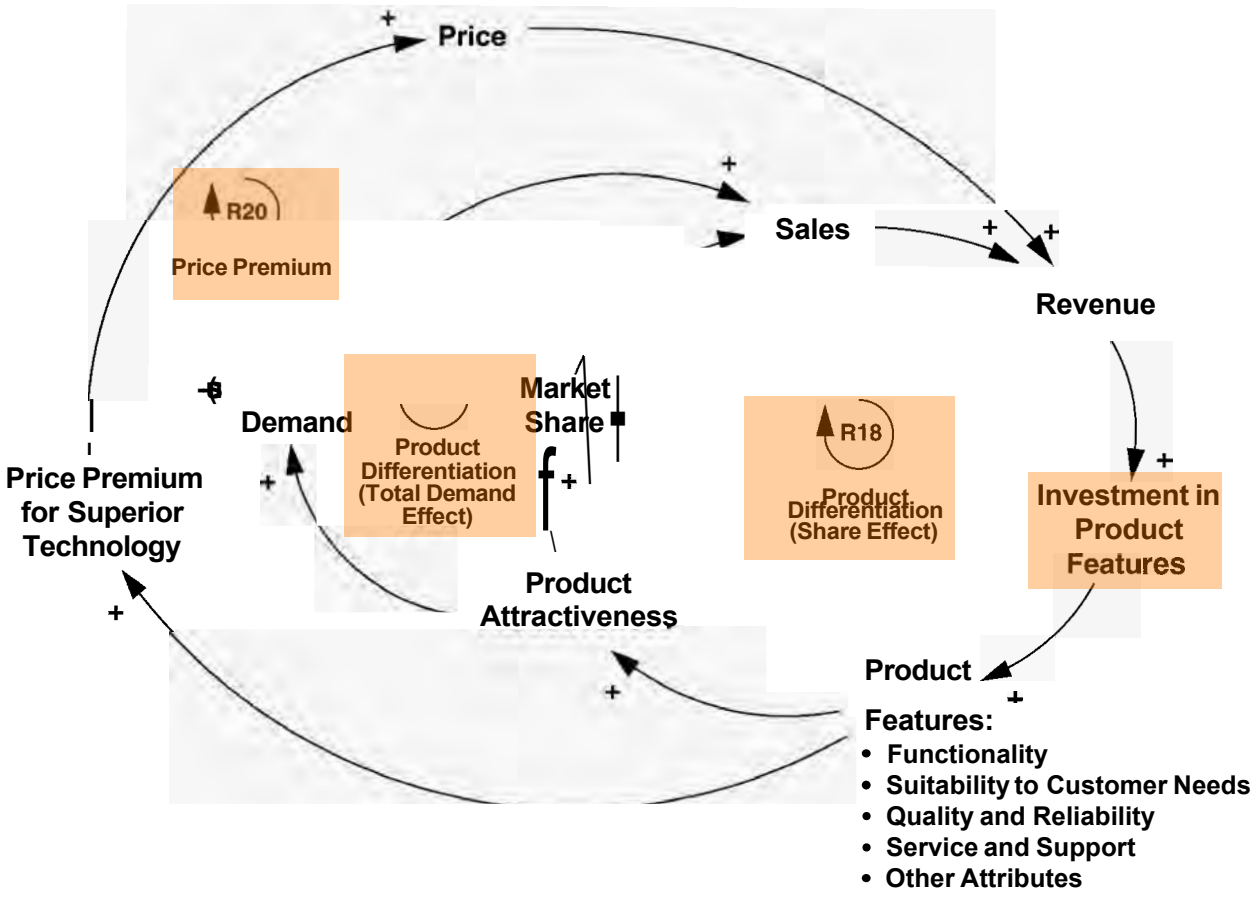
# Product Differentiation

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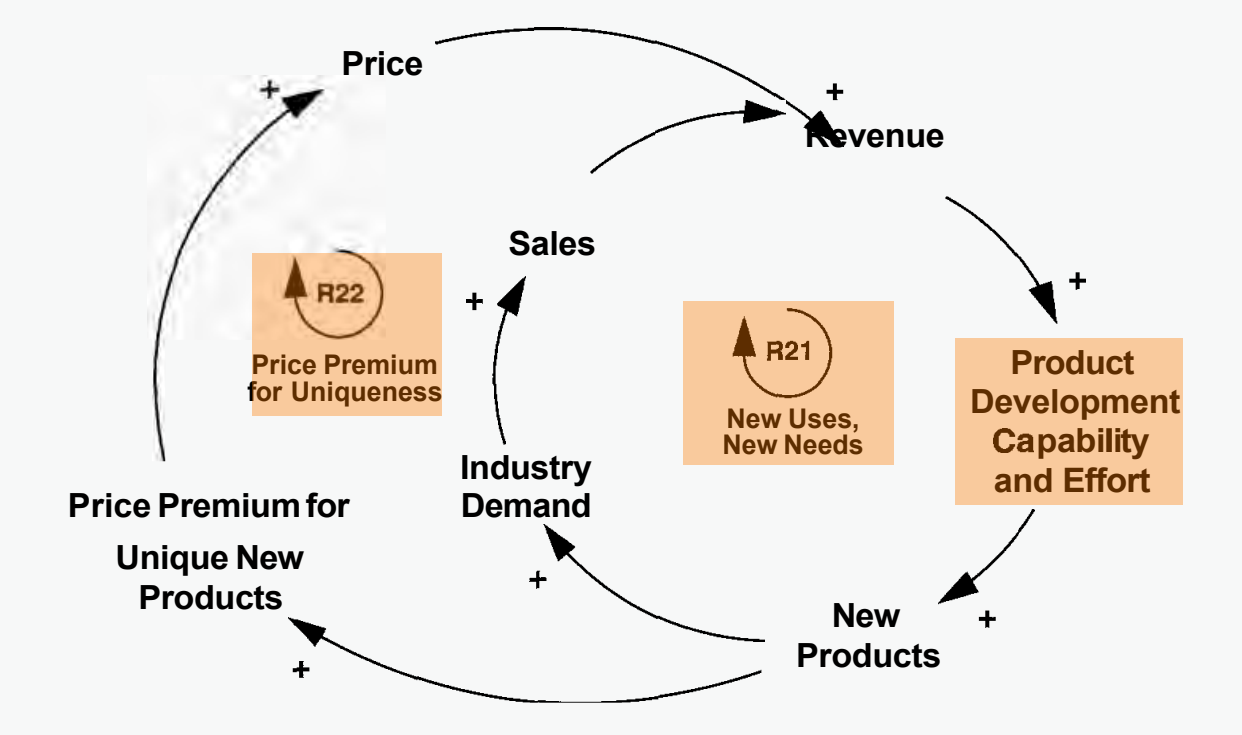
# New Product Development




- New product development creates new demand, boosting development resources.

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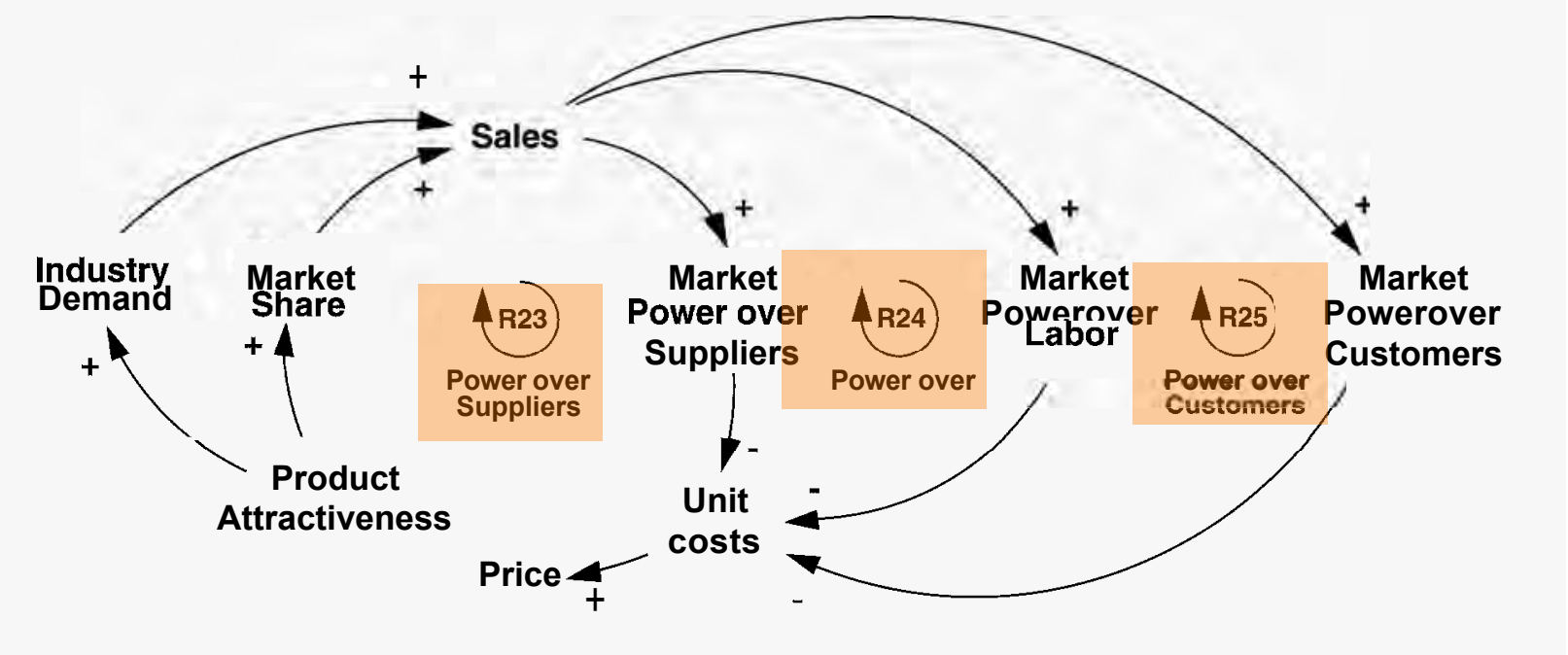
# Market Power




- Monopoly power over customers, suppliers, and workers is self-reinforcing.
- Each effect creates two loops: one increases market share and one increases total demand

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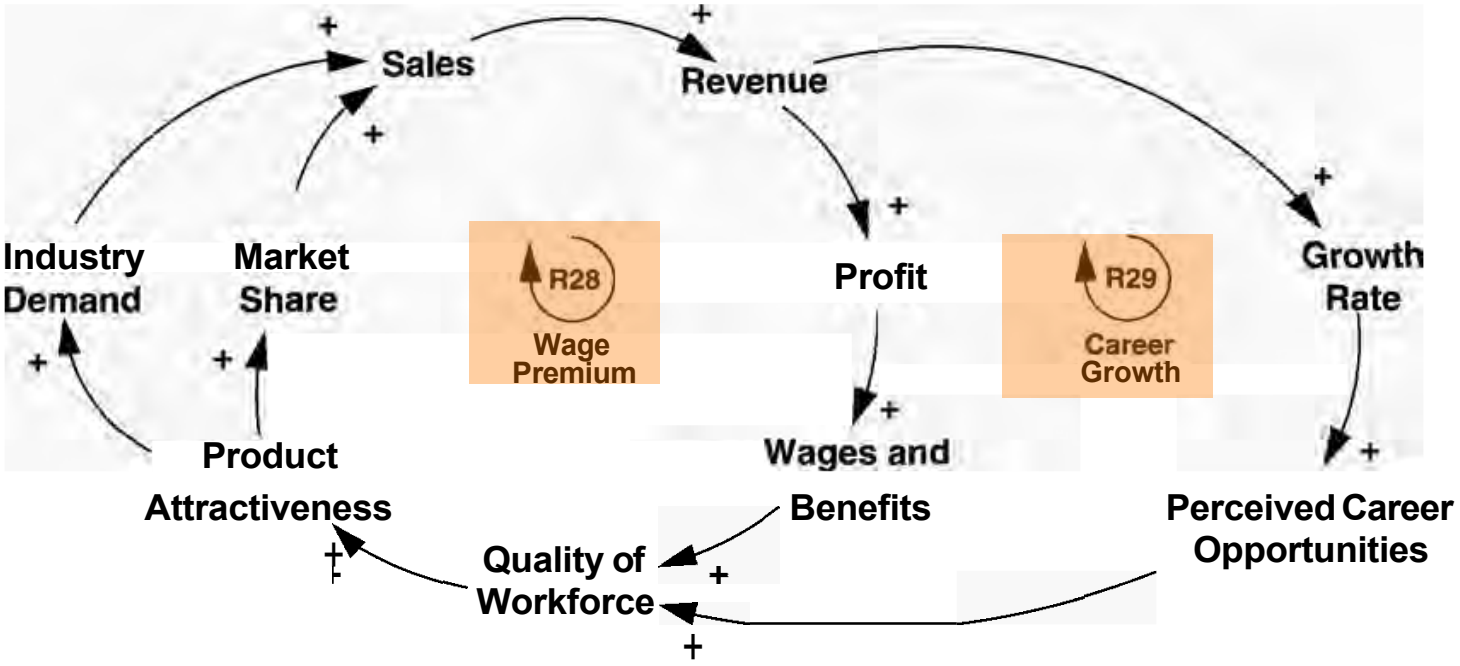
# Work Quality & Loyalty




- Profitable growth leads to recruitment and retention of the best people.
- Each effect creates two loops: one increases market share and one increases total demand.

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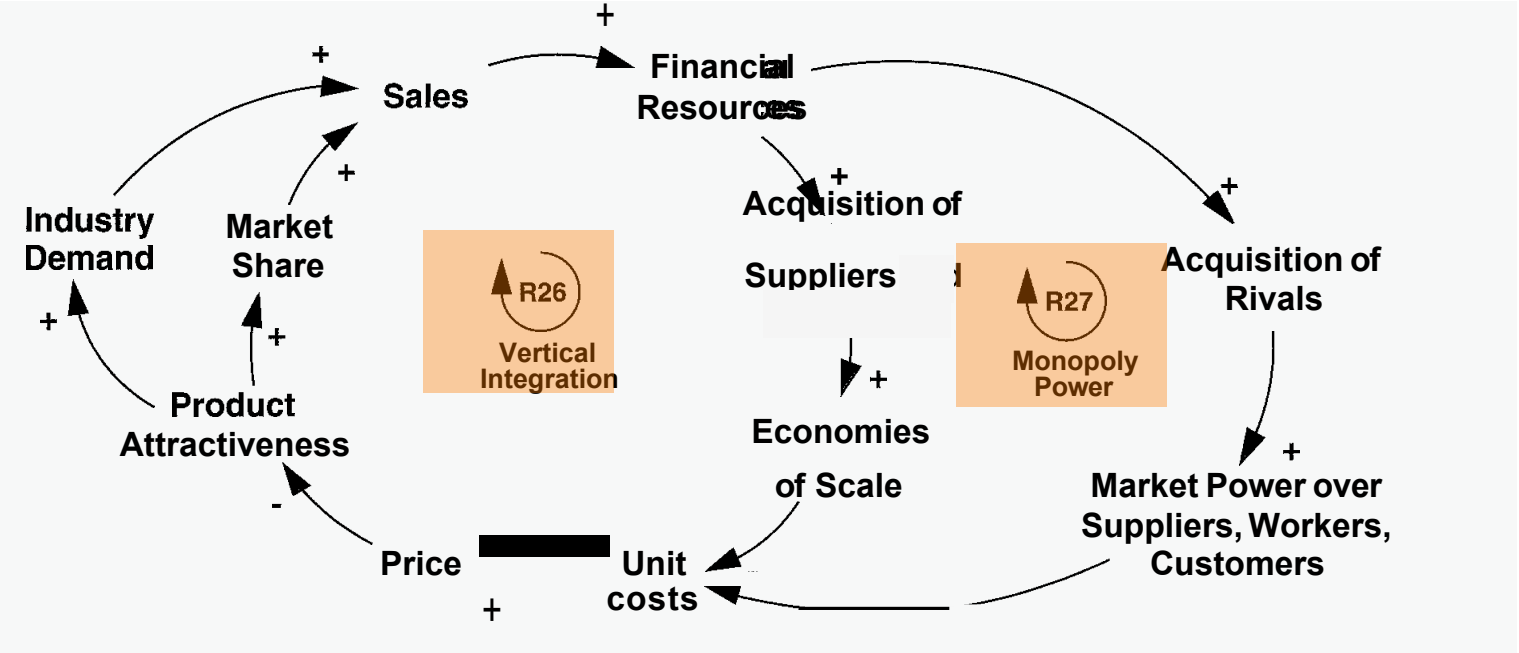
# Mergers & Acquisitions




- Self-reinforcing growth through acquisition
- Each effect creates two loops: one increases market share and one increases total demand.

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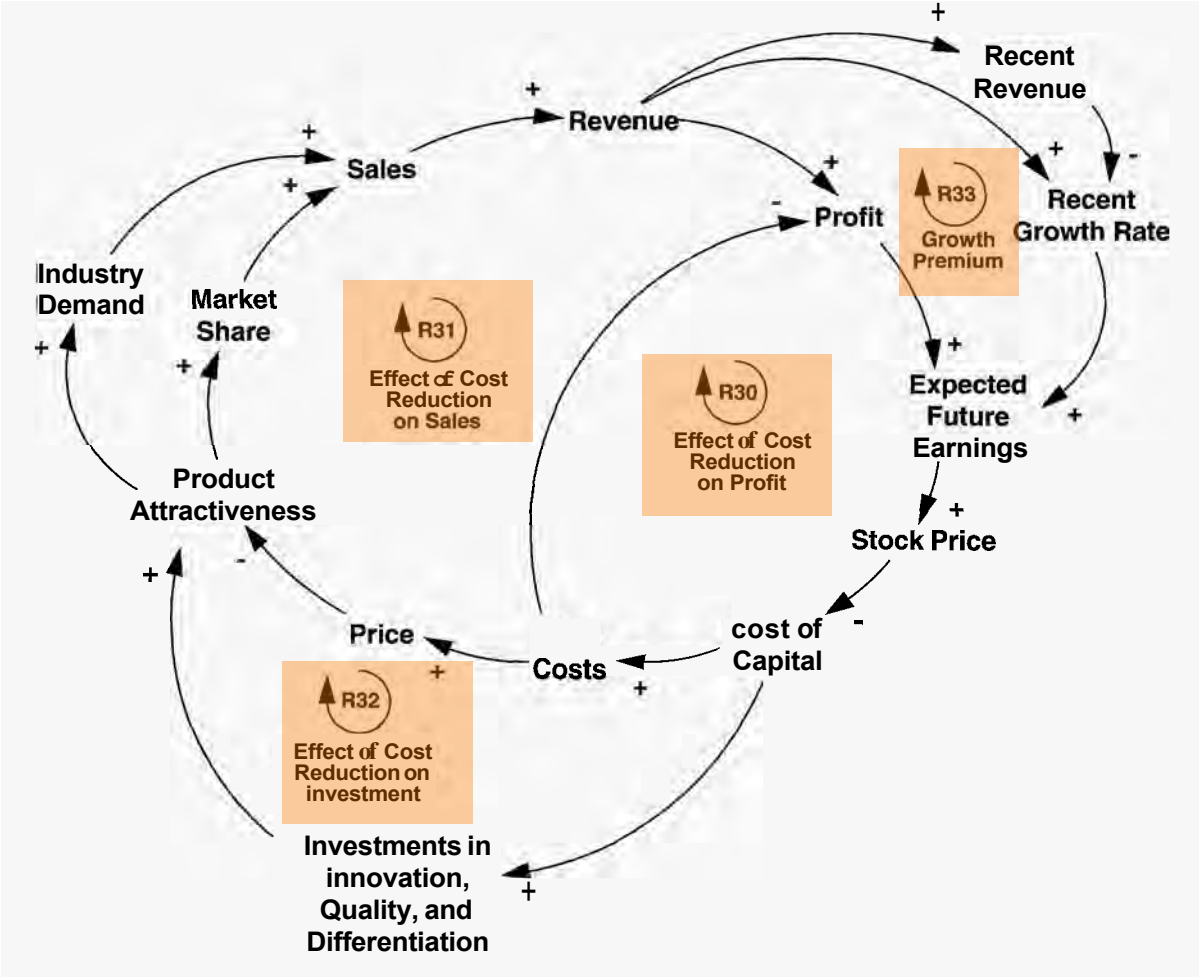
# Cost of Capital




- Profitable growth lowers the cost of capital, stimulating further growth.
- Each effect creates two loops: one increases market share and one increases total demand. Comparable loops for debt financing are not shown.

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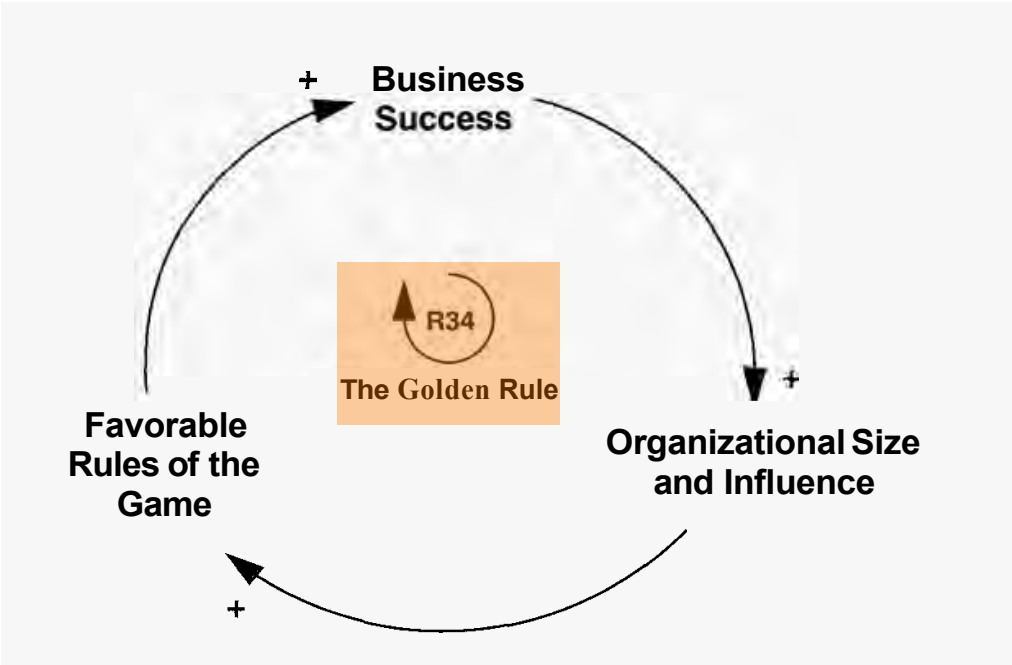
# Rule of the Game




- Whoever has the gold makes the rules

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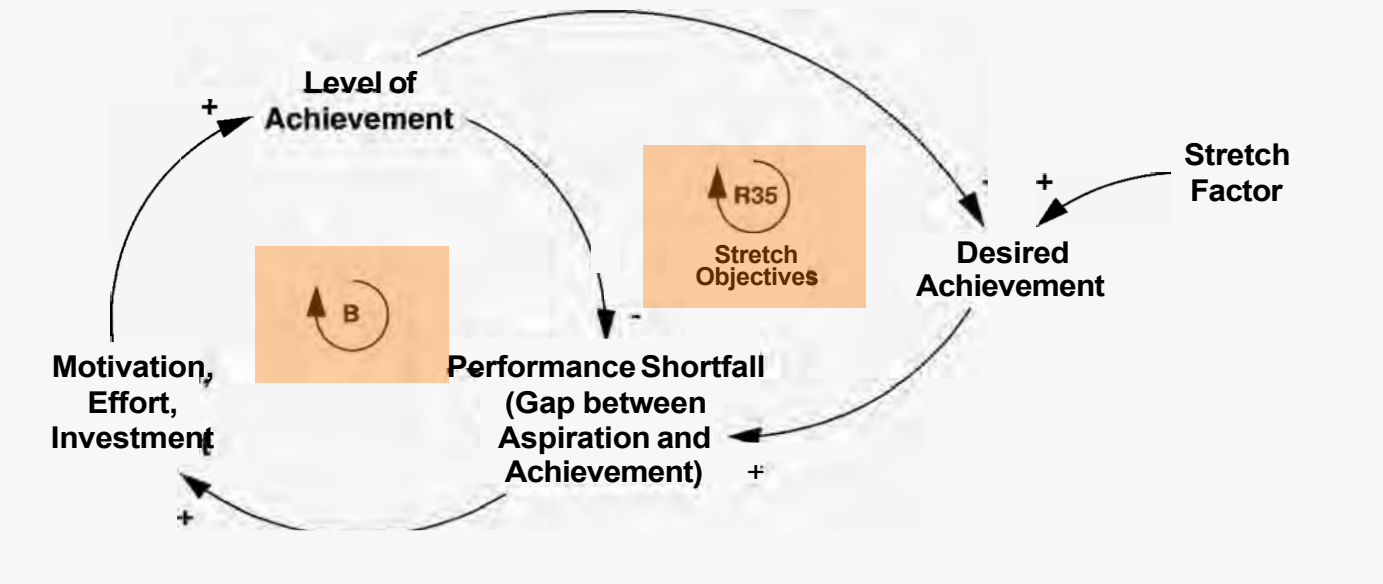
# Ambitions & Aspirations: a hunger for more




- That hunger can be a powerful motivator.
- But it can also lead to burnout, frustration, and feelings of in- adequacy. And it can lead to monomaniacal behavior, in which people sacrifice their friends, family, and ethics in endless pursuit of the next level.

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- The ability of leaders to articulate their vision and spur the best efforts of their employees depends not only on their personal charisma, but also on the size of the organization and the integrity of its culture, traditions, and folklore.

- The larger the organization and the less cohesive its culture, the harder it is for leaders to project their goals and motivate employees, creating negative feedbacks that can limit the ability of stretch objectives to generate growth.

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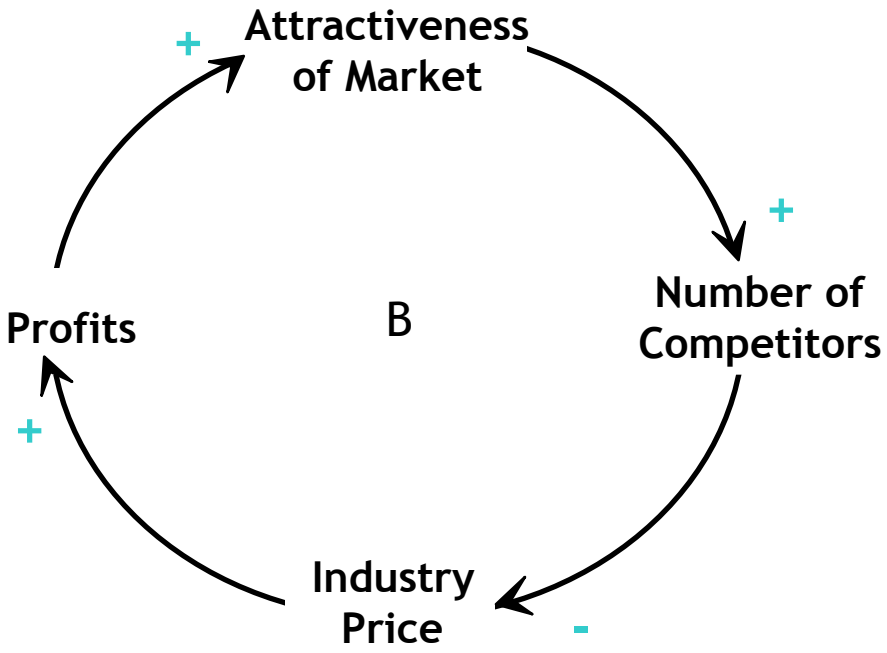
# The feedbacks can drive the growth of a business enterprise…BUT

- Traditional economic theory suggests that markets are dominated by negative feedbacks

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# Creating Synergy for Corporate Growth

- The growth tigers does not rely on any single positive loop to drive their growth but successfully used many of the positive feedbacks to create synergy.

- Not all the positive feedbacks that can drive corporate growth are compatible with one another.

- Many long-successful firms stumbled when the positive loops driving growth in their industry changed while their strategy did not.

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# Does Economy always Lock in to Superior Technologies?

- NOT Always.
- The stronger the network, compatibility, development cost, market power, and golden rule loops, the more likely it is the ultimate winner will be determined by factors unrelated to product quality, functionality, and features.
- Examples:
  - SONY Betamax vs. VHS
  - MS Windows vs. Apple OS
  - Metric system vs. English measurement system

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# Lock in to a equilibrium indefinitely?

- Many examples in which a dominant standard was overthrown.

- Such revolutions usually occur when the system in which the standard is dominant becomes obsolete or is itself overthrown.



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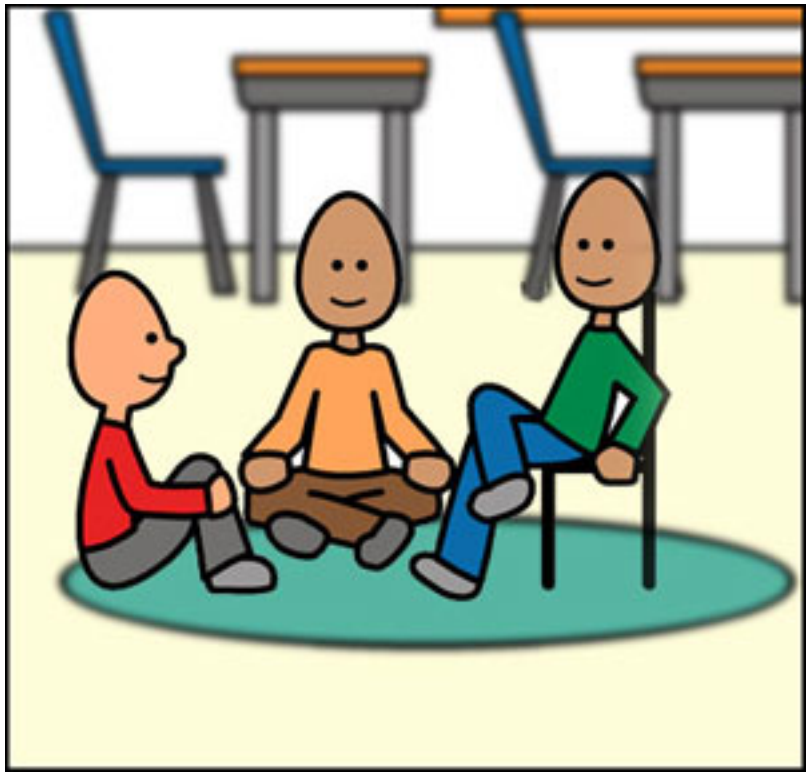
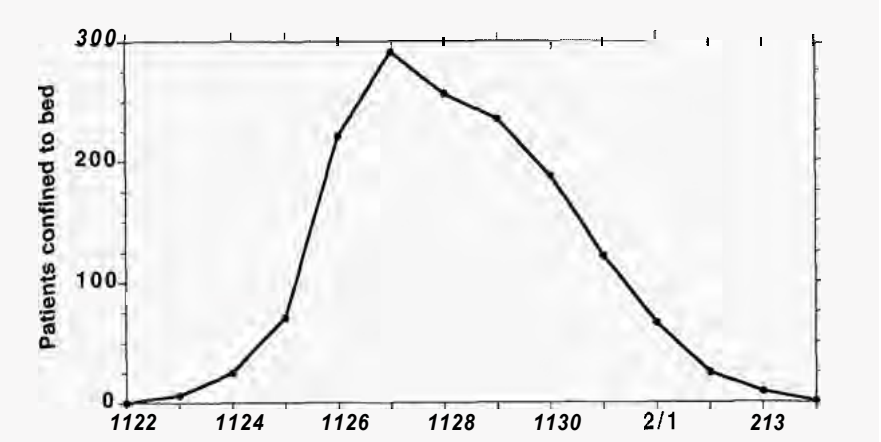
# Group Discussion: Policy Implications



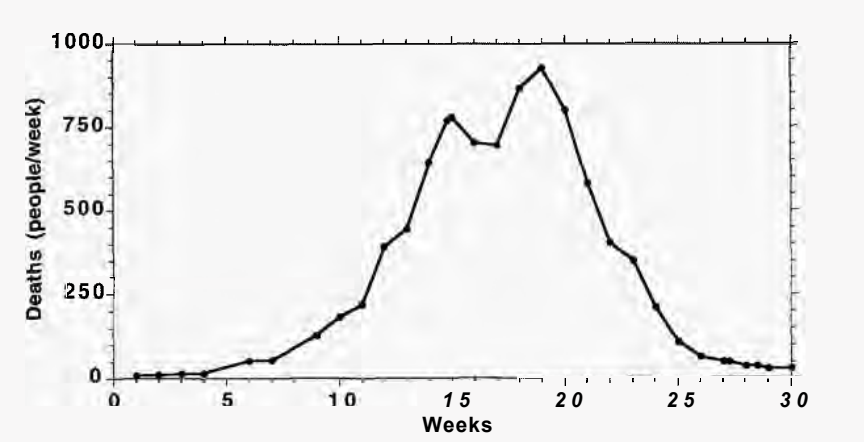
# Dynamics of Growth: Epidemic

# Dynamics of Disease

- The cumulative number of cases follows an S-shaped curve,
- While the rate at which new cases occur rises exponentially, peaks, then falls as the epidemic ends.




Influenza epidemic: at an English boarding school, January 22-February 3, 19'78




Epidemic of plague, Bombay, India 1905-6

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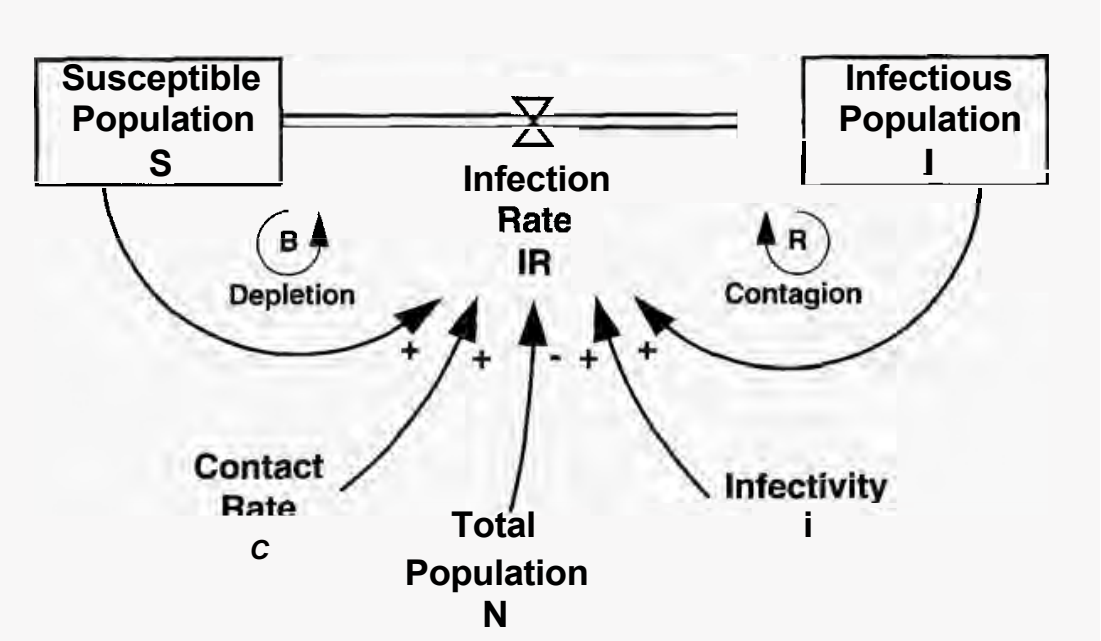
# SI Model




- Structure of a simple model of an epidemic
- Births, deaths, and migration are omitted so the total population is a constant, and people remain infectious indefinitely.

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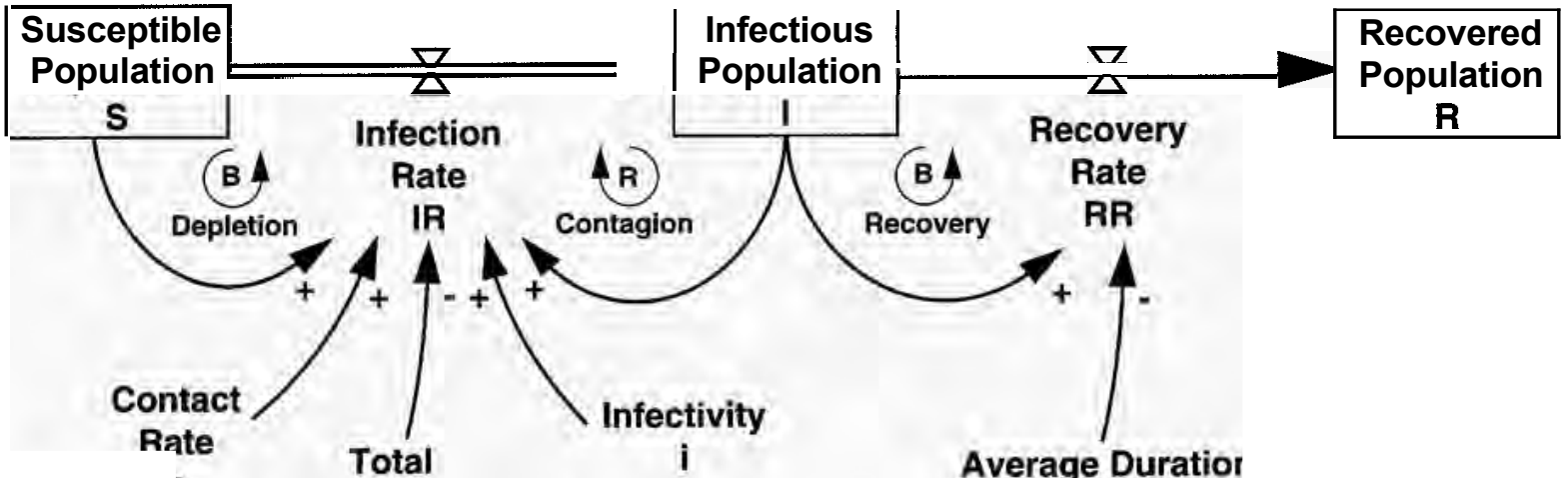
# SIR Model




- People remain infectious and sick for a limited time, then recovered and develop immunity.

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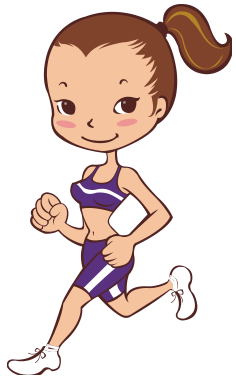
# Vaccine or medicine? That's the question….


Science Director



General Manager


Narrator

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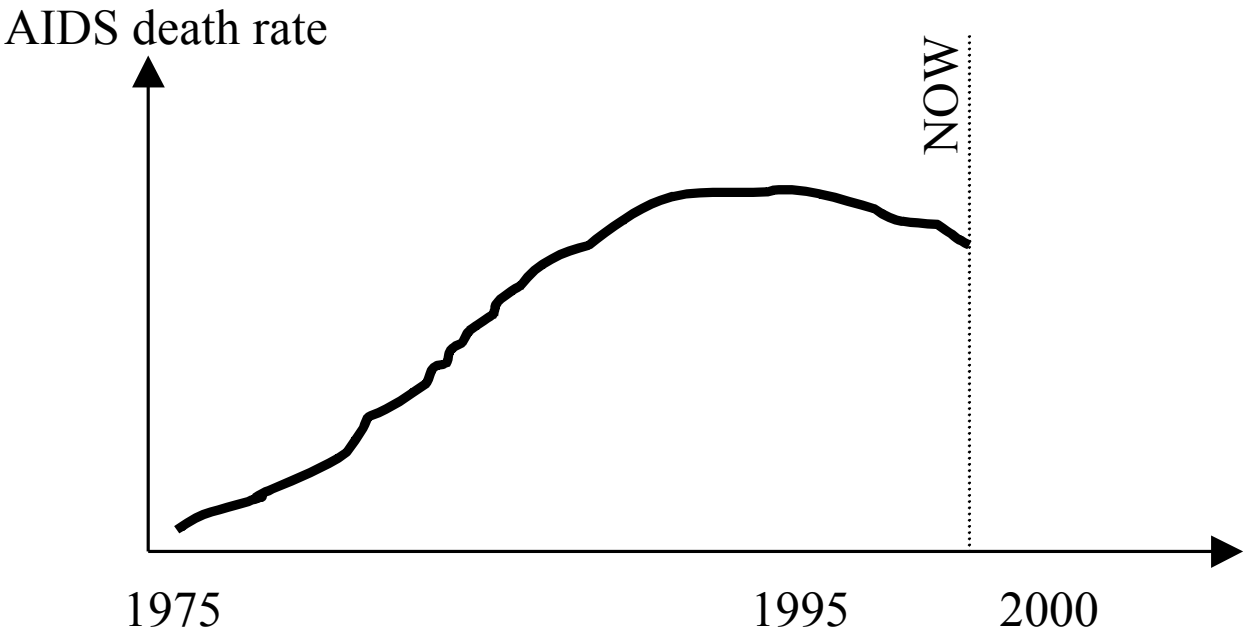
"deaths from AIDS peaked in the mid 90's.

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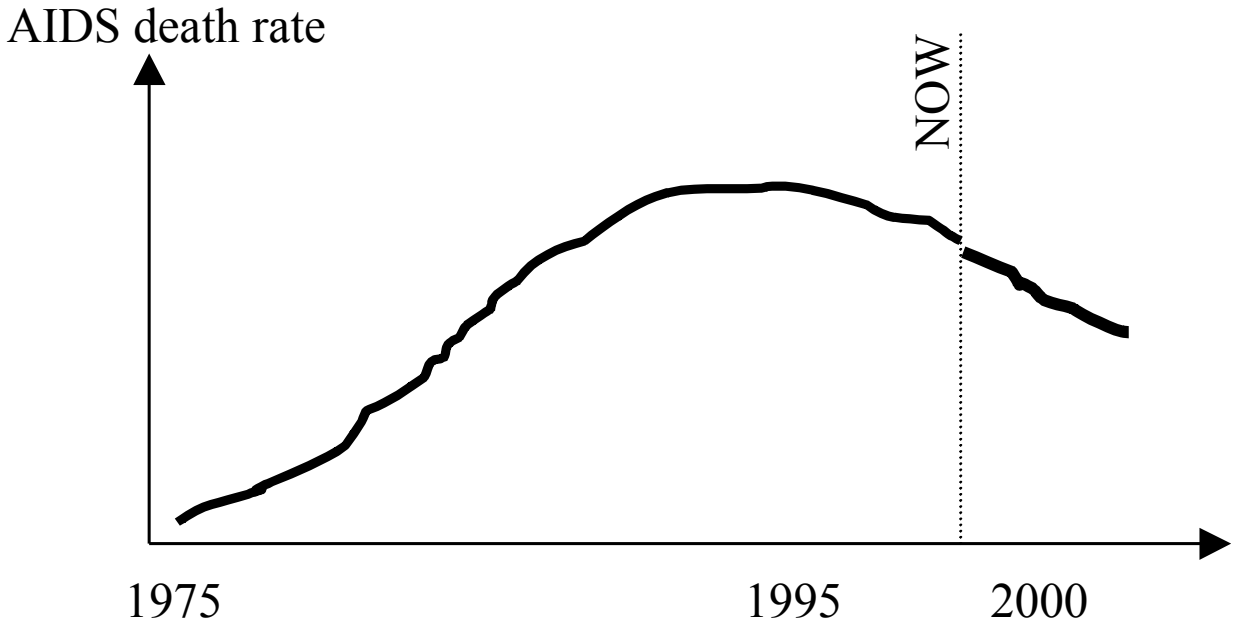
"That's about it, and I think the trend will continue.  That's right.  Like that."

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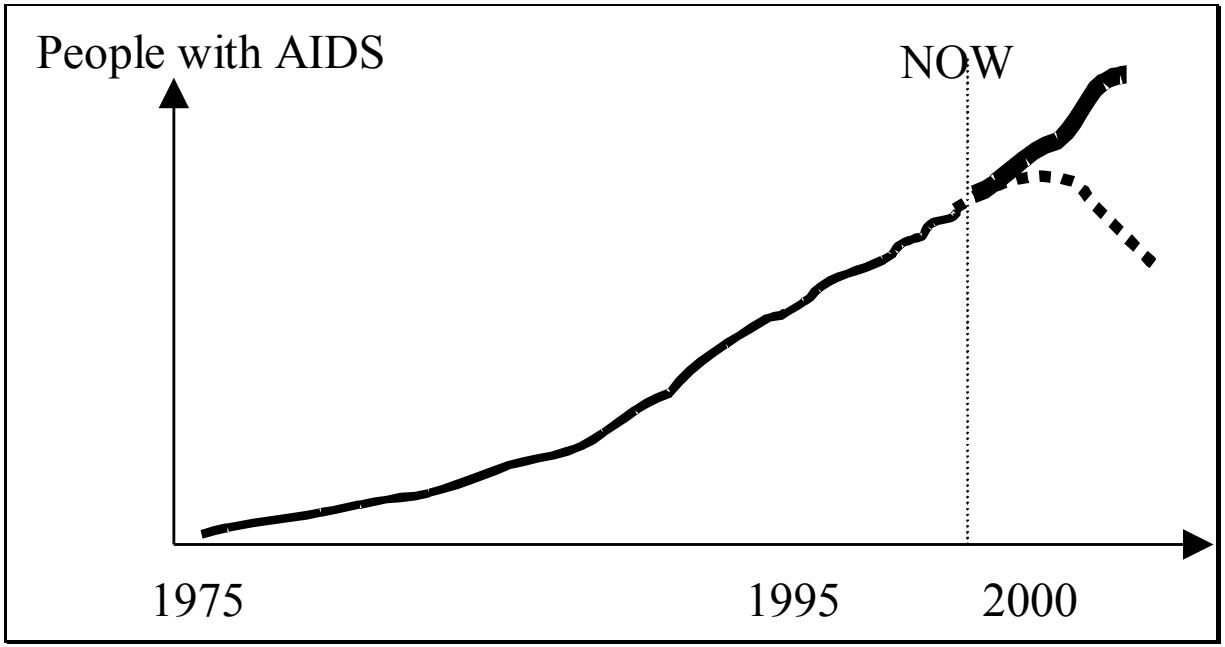
The Science Director offered, "We don't have figures on HIV positives, but the data I've seen shows people with AIDS continuing to rise. Something like this  He stepped to the white board.  "And I guess the question is whether it's going to look like this or like this?"

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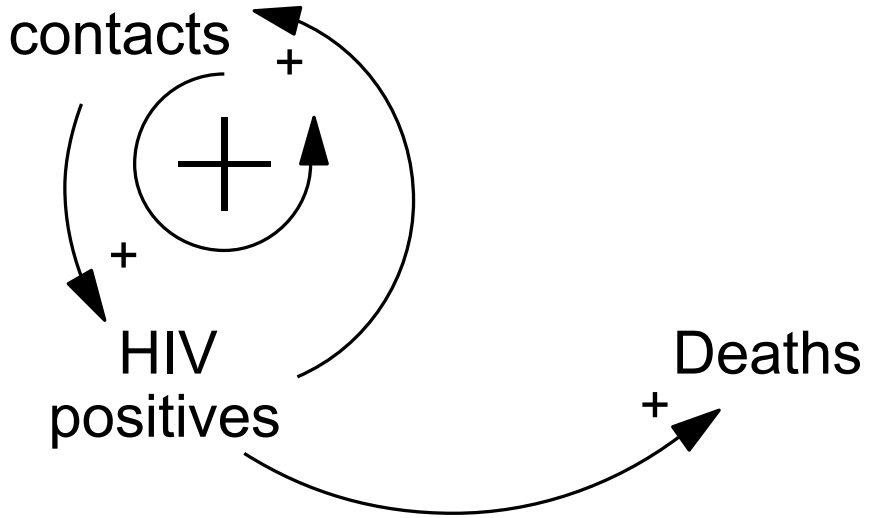
# Building CLDs

- Consider the followings:
- The average contact rate may fall as people become aware of the risk of HIV and the ways in which it can be transmitted.
- The infectivity of contacts depends on people's behavior.
- What causes deaths to decline and what might cause the infection to decline?
- Concern makes contacts go down and, drugs make deaths go down.
- From what does *concern* come?
- Drugs come out of concern?

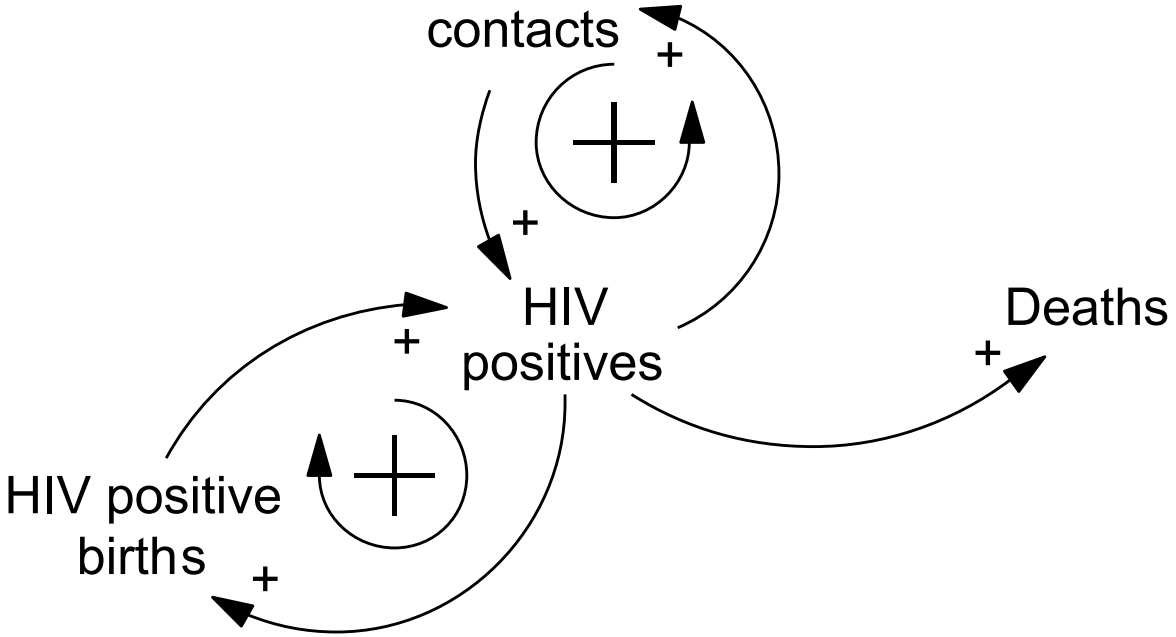
Jim Hines , 2000

"Yeah, well, people are being very cautious these days. Contacts must be way down."



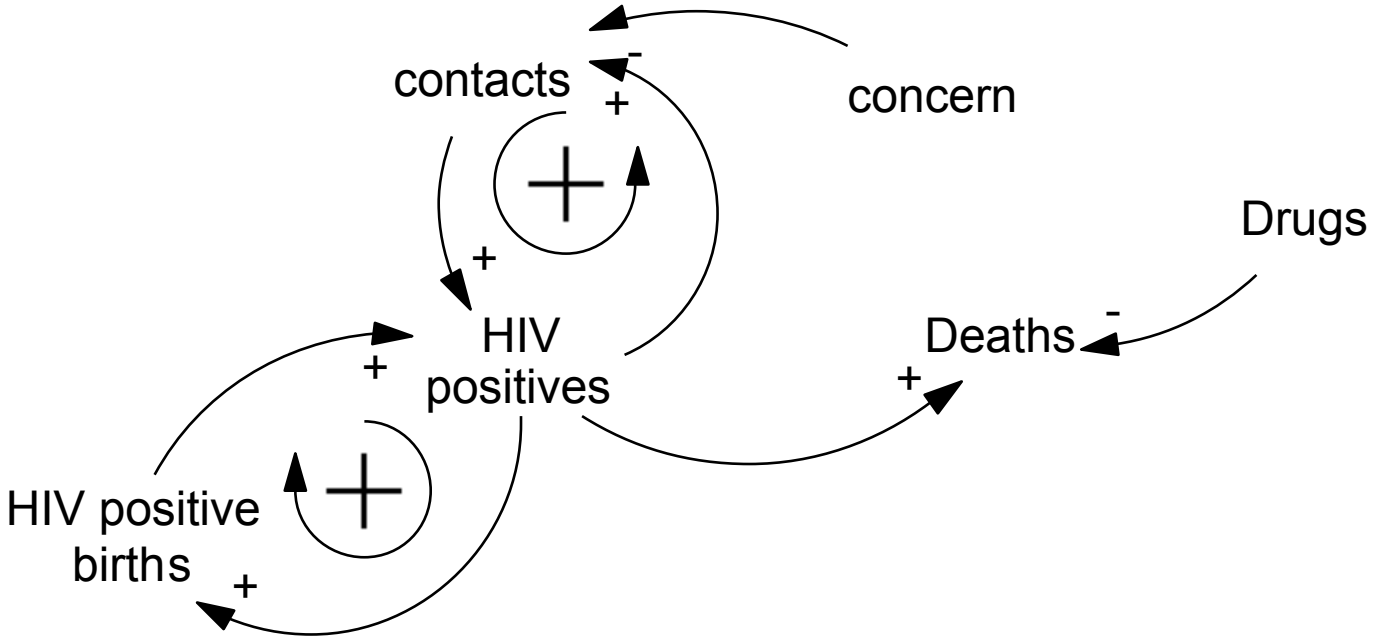

"Well in the beginning no one had it, so you couldn't catch it. But then as more people got it, it was easier to contract, so more people got it and more people died"

"all the children who are infected at birth."



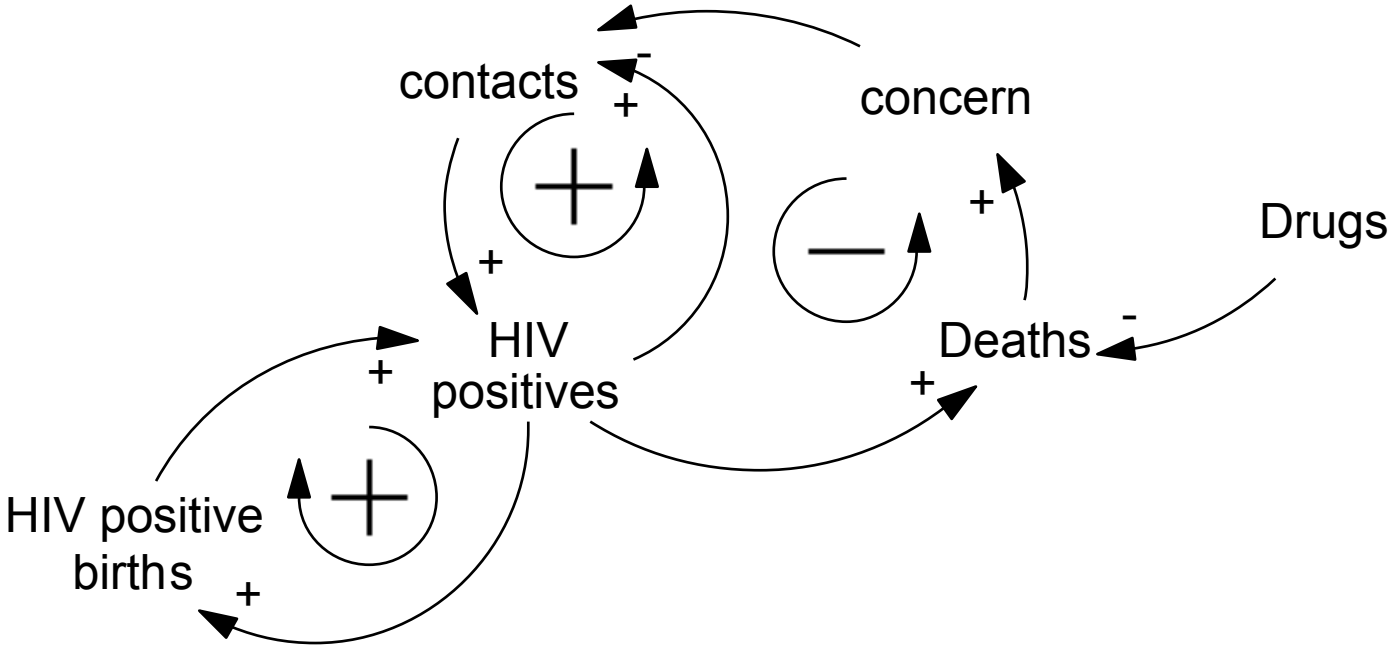

Jim Hines , 2000

"Got it,", "But, what caused deaths to decline and what might cause the infection to decline?"




"concern makes contacts go down and, drugs make deaths go down"

"But doesn't *concern* come from deaths?"

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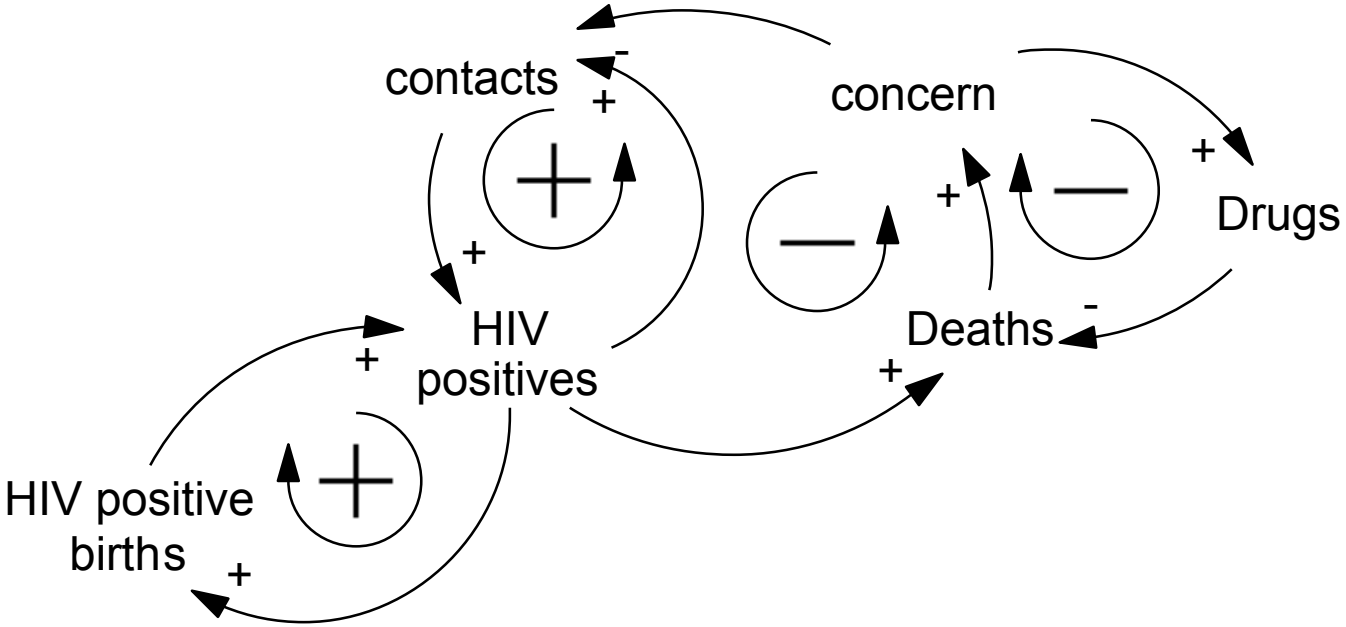


"drugs come out of concern, too, right?"

"People get concerned and there's no more contact, and the new drugs mean there are no more sick people, and so we're in a tough spot. I still say the vaccine is it."


"Yeah, but look," The scientist said standing, "As deaths drop concern drops, so we get more contacts again. We're back in business. I'm not saying that's a good thing. But, we are back in business, right?"

# Building S&F Diagrams

- Many epidemiological models of HIV/AIDS disaggregate the population into several categories that represent the different modes of transmission (primarily homosexual contact, heterosexual contact, and intravenous drug use), as well as gender, age, socioeconomic status, region, and perhaps other groups overlap and interact.
- However, for the purpose of this challenge, divide the population only into four pools, one of youths and three of adults.

- Allowance was made for natural (i.e. non-aids) deaths from each stock, and from AIDS adults there was an additional outflow representing people succumbing to the disease.
- Based on SI model♪

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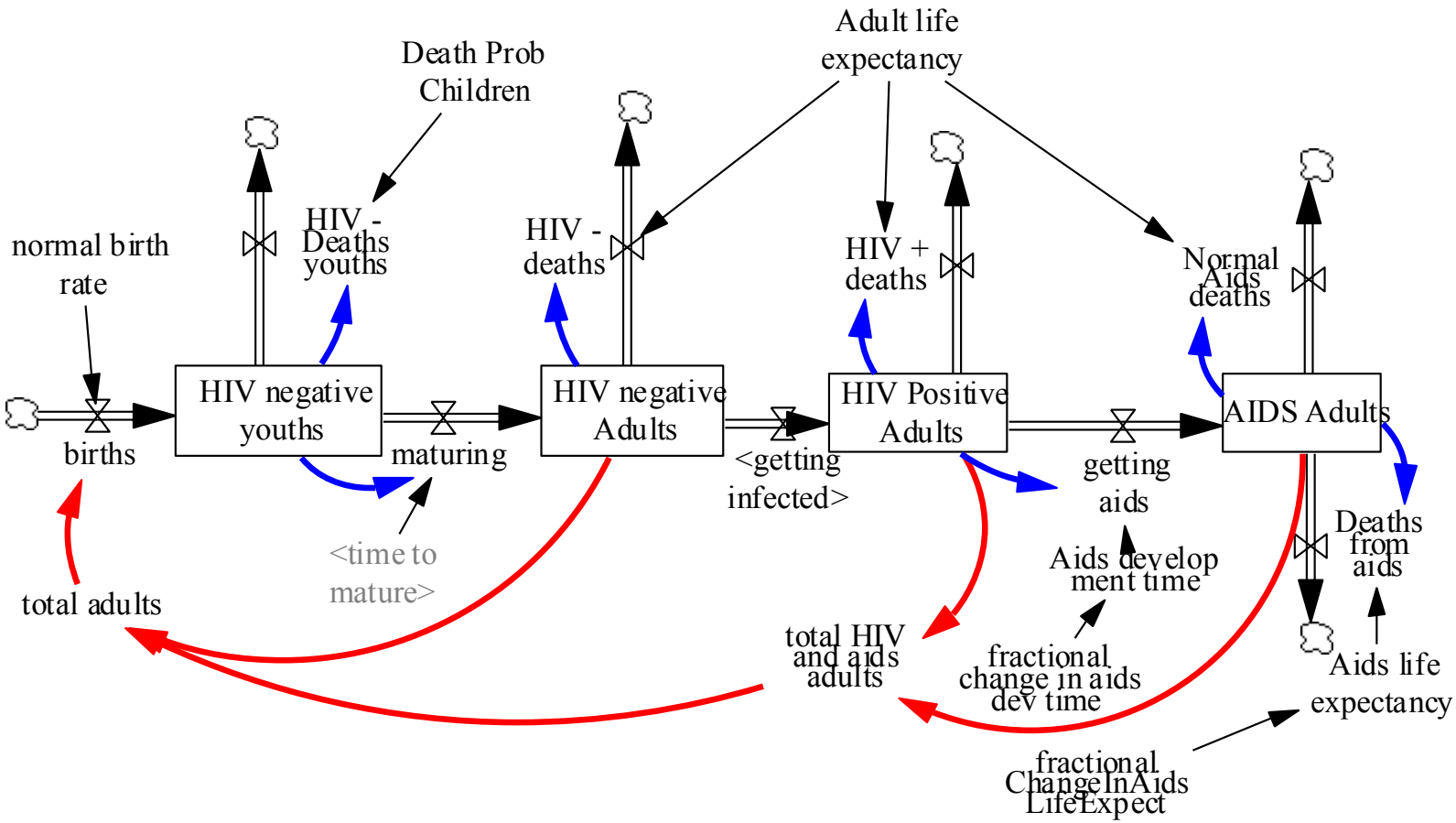
# Aging chain of the population representing the flow of the American population from birth to death ♪




Missing stocks?

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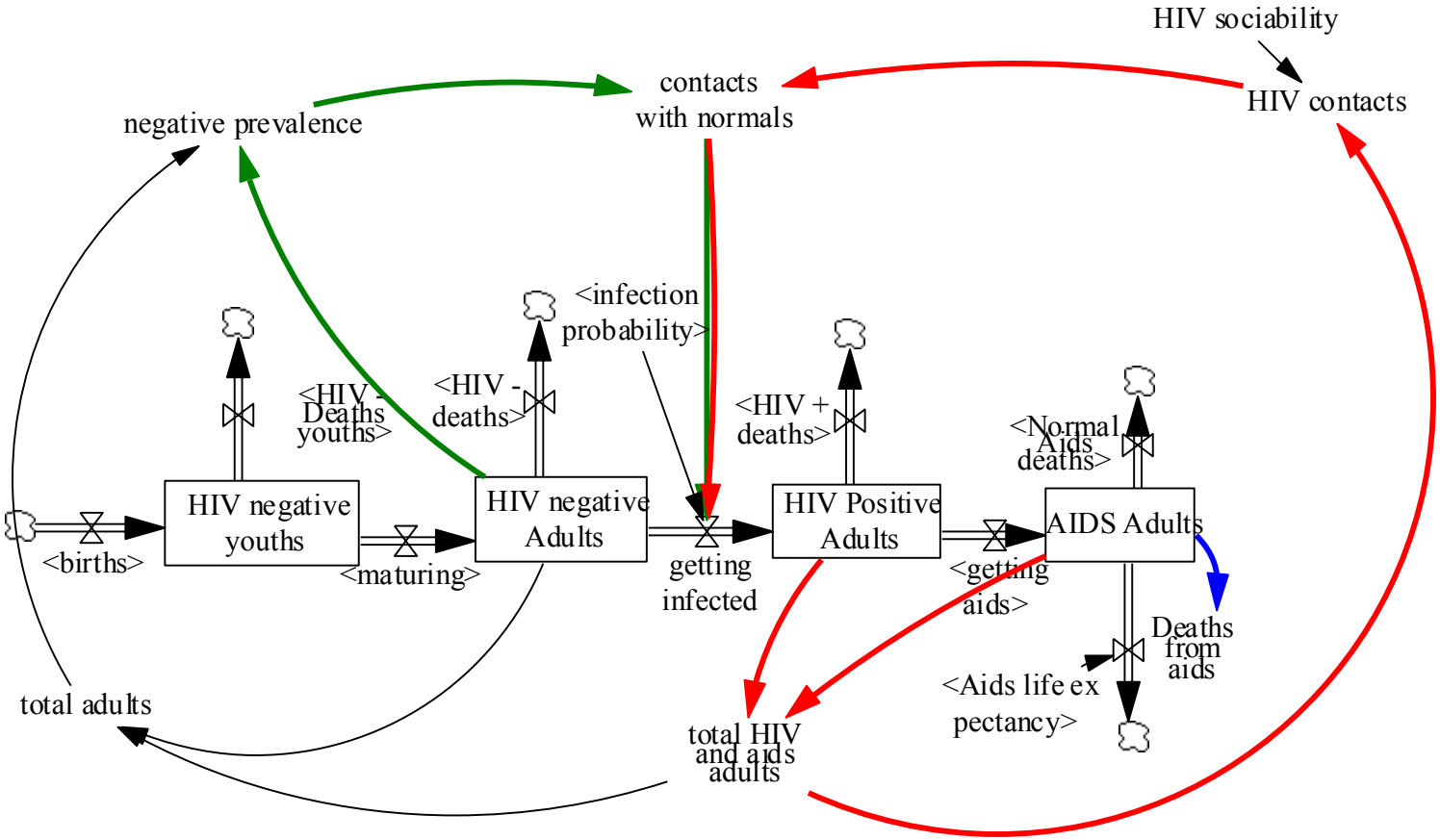
"As people without the HIV virus come into contact with infected people, there is a probability that the disease will be transmitted."

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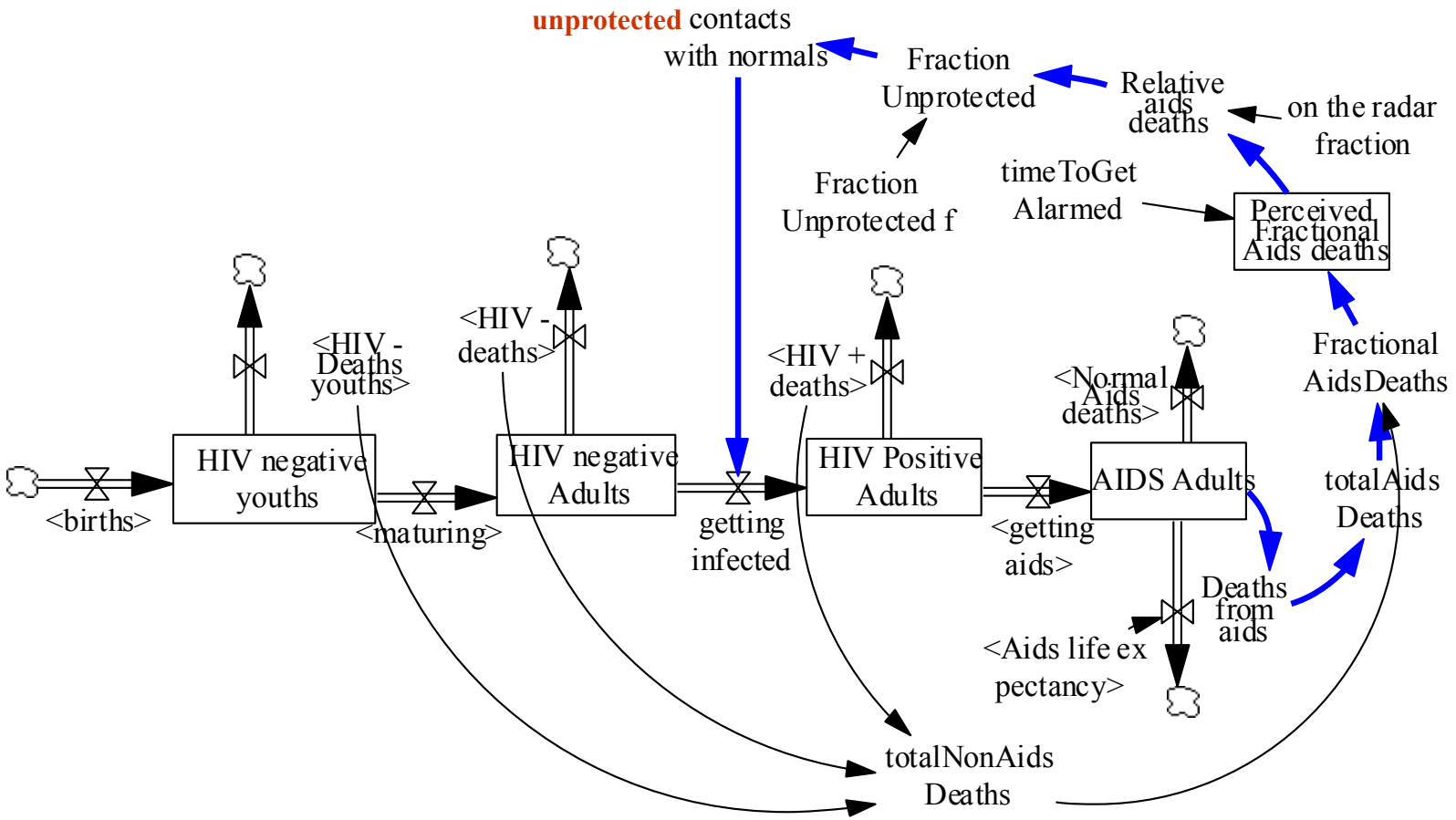
"How people become concerned and reduce the riskiness of their behavior?"

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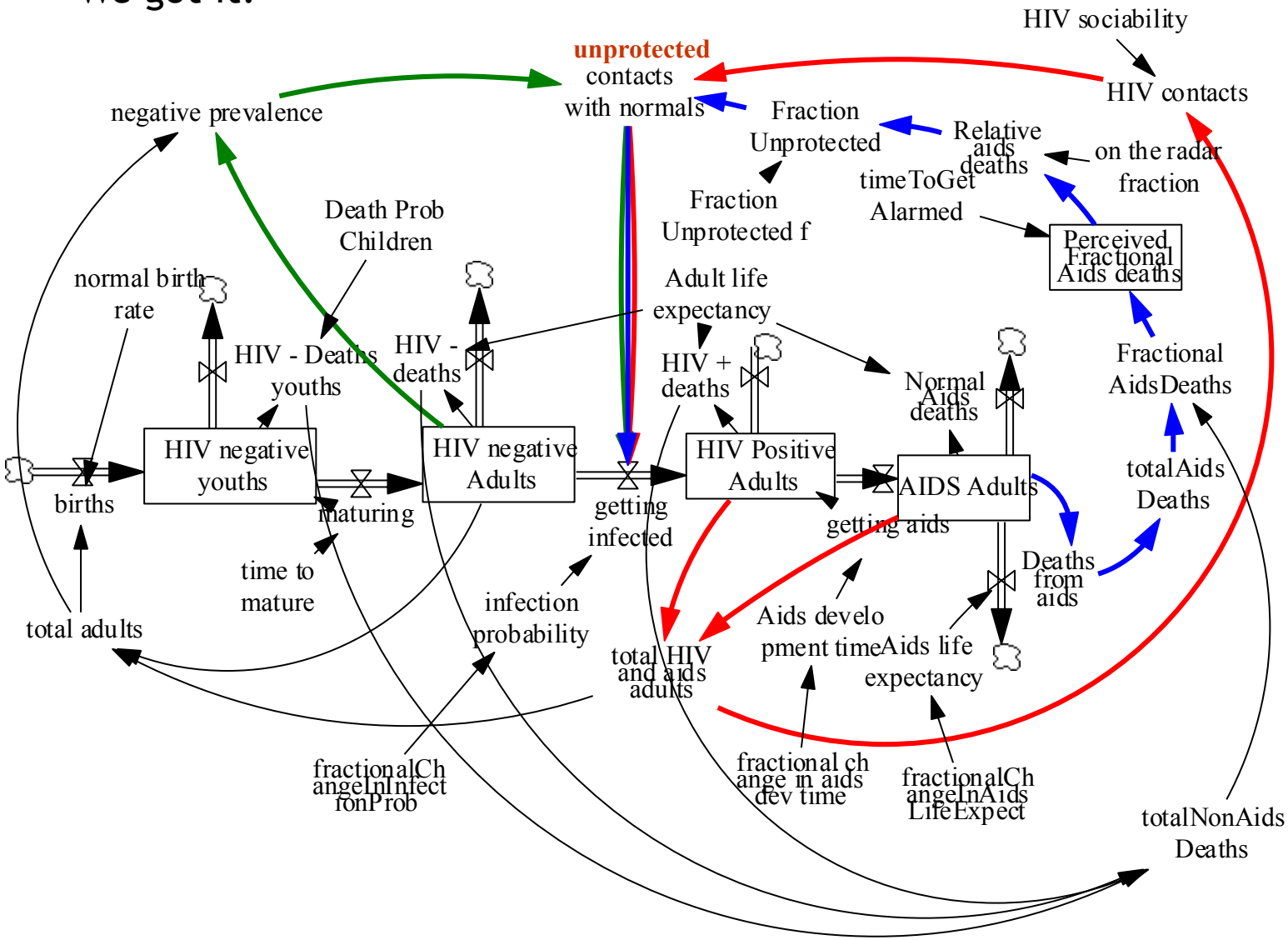
# “We got it!”

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# Model Behavior Analysis

1. Consider the medicine

1) Sketch how you think Aids Deaths and Fractional Aids deaths would change if the life expectancy of AIDS victims increased.
2) Make a "life extender" run using *fractionalChangeInAIDSLifeExpectancy*. And look at Aids Deaths and Fractional Aids Deaths.

2. Consider the vaccine

1) Sketch how you think Aids Deaths and Fractional Aids deaths would change if the a vaccine were partially effective in reducing infections.

2) Make a "vaccine" run using *fractionalChangeInInfectionProb*, *a*nd look at Aids Deaths and Fractional Aids Deaths.

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