Risk

Risk Is Central to Software Engineering

- Every bug may cost more to fix later.
- But every change (even bug fixes) may introduce more bugs.
- There are lots of different kinds of risks in software projects!

Today

- Learning goals:
  - Understand how key risks threaten software project success
  - Three key principles that affect software risk: *second system effect, the mythical man month*, and *Conway*'s *Law*.
    - (sorry — "man" is in the title of a book)

Technical Risks

- You chose to rely on a framework that was "almost done" — but it runs late.
- You rely on a platform, service, or framework that does not quite meet your needs
  - Or adds complexity without delivering enough value
- You underestimate the complexity of your own components

Financial Risks

- Running out of money (e.g., at a startup)
- Getting sued
- Need to give raises (for retention) but now can't hire needed staff

Requirements Risks

- Releasing software that does not meet user needs
  - (even if it is of high quality)
- Releasing software that frustrates users (poor UI)
- Releasing software too late

People-Related Risks

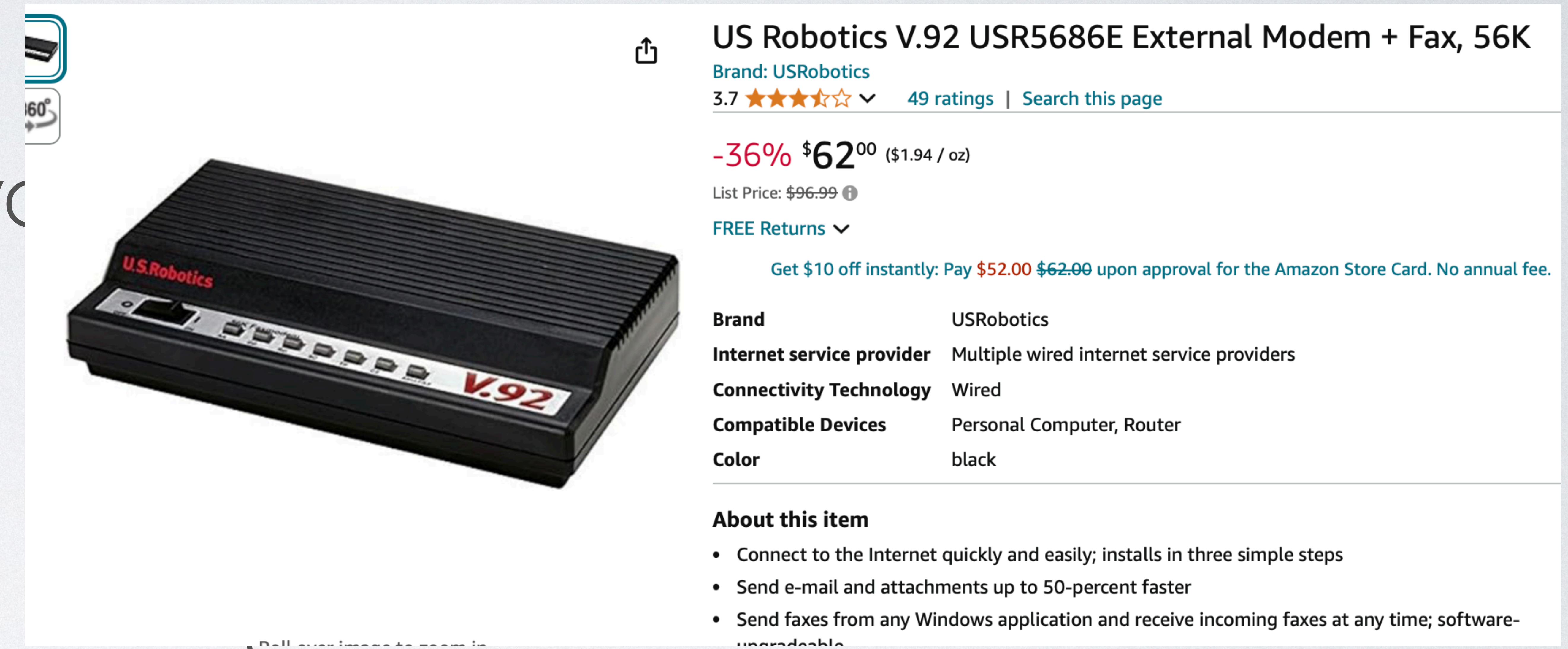
- People leaving
  - By choice (better job offer)
  - By circumstance or disaster (health problems)
  - By being fired (malfeasance)
  - By being stolen by Management to work on a higher-priority project

Management-Related Risks

- Management changes priorities
  - De-prioritizes a feature you invested in
  - Prioritizes a feature you *didn*'*t* invest in
- Management turnover
  - Suddenly spending a lot of time "managing up"

Market Risks

- My summer internship, 2004: wo
  - DVD authoring software
- Does anyone author DVDs anymore?
- Imagine working on a new, improved, VERY FAST, analog modem… right before broadband took over.



US Robotics V.92 USR5686E External Modem + Fax, 56K

Brand: USRobotics

3.7 ★★★★☆ 49 ratings | Search this page

-36% $62.00 ($1.94 / oz)

List Price: ~~$96.99~~

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Get $10 off instantly: Pay $52.00 ~~$62.00~~ upon approval for the Amazon Store Card. No annual fee.

Brand	USRobotics
Internet service provider	Multiple wired internet service providers
Connectivity Technology	Wired
Compatible Devices	Personal Computer, Router
Color	black

About this item

- Connect to the Internet quickly and easily; installs in three simple steps
- Send e-mail and attachments up to 50-percent faster
- Send faxes from any Windows application and receive incoming faxes at any time; software-

Osborne 1

- First sold in 1981
- 4 MHz CPU, 64 KB RAM
- 5" monochrome CRT
- Portable (24.5 lbs)

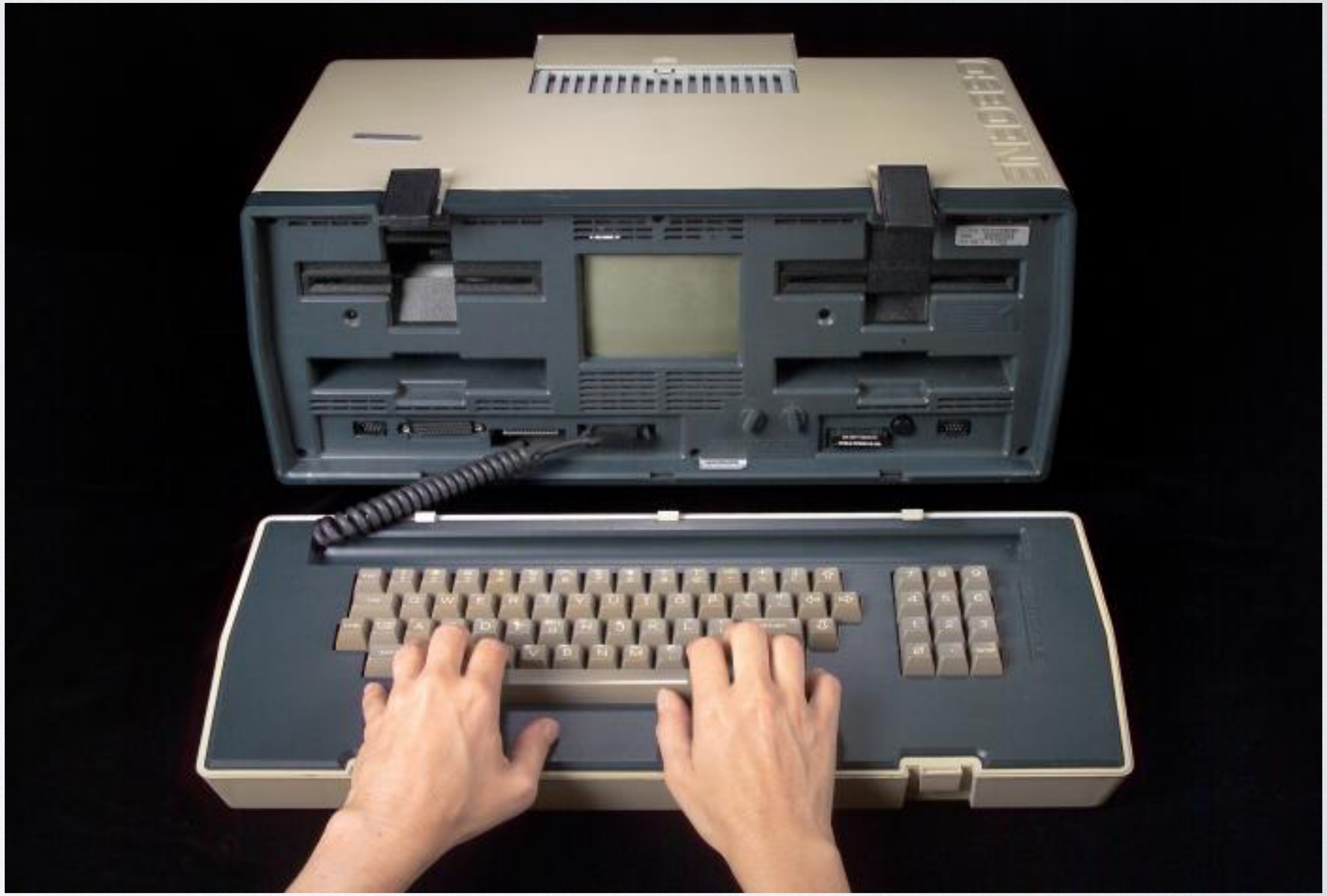

Image credit: Wikipedia

The Osborne Effect

- April 1983: Osborne Computer Corporation pre-announced several next-generation models
- Dealers canceled orders for Osborne 1
- Osborne dramatically reduced prices for Osborne 1
- September 1983: Osborne Computer Corporation bankrupt
- Note: Kaypro machine sales were starting to cut into Osborne sales, so this may have been a factor too!

https://en.wikipedia.org/wiki/Osborne_effect

Scenario #1: Old and Trusted, or New and Slick?

- You are starting a new web app development project.
- Worldwide math tutoring service. Connects tutors with students (who can afford to pay for the service). Vision: 24/7 tutoring. You can get help anytime, day or night, via worldwide staff.
- The year is 2030. React is old and stale (think of Ruby today). "Webby" is up and coming.
- Webby offers better performance, internationalization, and accessibility built-in.
- How will you decide? Changing later would be very expensive.

Scenario #2: Cut or Press Forward?

- One month until you promised your investors the app would launch.
- Two key features have five weeks of estimated work left:
  - AI-based tutor screening (otherwise will have to interview prospective tutors; very expensive)
  - Algorithm-based tutor matching (e.g., need a calculus expert to do calculus tutoring)

- Ideas:
  - Move engineers from A to B (or vice versa); defer the other feature
  - Ask engineers to work evenings and weekends
  - Hire engineers from elsewhere
  - Something else?

The Mythical Man-Month

- (sorry; this is the title of a book from 1975 by Fred Brooks)
- Brooks's Law: adding more people to a late software project makes it *later*
    - New people consume resources getting up to speed ("hey, can you explain…?")
    - New people introduce more bugs
        - New people re-introduce old bugs
    - More people increase communication overhead (meetings…)

Communication Overhead

- Group intercommunication formula: $n(n - 1)/2$.
- Example: 50 developers give $50 \times (50 - 1)/2 = 1{,}225$ channels of communication.
- Moral: keep teams small (not 50!)

source: https://en.wikipedia.org/wiki/The_Mythical_Man-Month

The Second System Effect

- The *first* time you design something, you *know* you don't know what you're doing.
- The *second* time, you think you know, and you fix all the things that were wrong the first time
- Therefore, the *second* system is the riskiest!
- I did this in my second system — even though I knew about the Second System Effect!

Incremental Slippage

- Q: How does a project get one year late?
- A: One day at a time.

Awareness–Understanding Matrix

	Aware	**Not aware**
Understand	**Known knowns**: Things we are aware of and understand	**Unknown knowns:** Things we are not aware of but do understand or know implicitly
Don't understand	**Known unknowns:** Things we are aware of but don't understand	**Unknown unknowns:** Things we are neither aware of nor understand

https://en.wikipedia.org/wiki/There_are_unknown_unknowns

Inherent Vs. Accidental Complexity

- Some problems bring *inherent complexity*
  - Tax software is inherently complex because it has to be at least as complex as the tax code (law)
  - Automated driving software has to handle the complexities of physics *and* driving laws *and* human behavior
- But some software systems make problems *even harder*
  - You've seen these systems too

Conway's Law

- "[O]rganizations which design systems…are constrained to produce designs which are copies of the communication structures of these organizations."
- Therefore, organizational structure poses architectural risks!

https://en.wikipedia.org/wiki/Conway's_law

Surfacing Risk

- Ask team members: what might go wrong?
    - A diverse team is more likely to identify more risks
- Then you can make mitigation plans.

Scenario #3:

- You are three months from releasing the tutoring web app.
- New laws in 37 US states require tutors to hold *tutoring licenses*
- Addison-Wesley (textbook manufacturer) launches a new web-based tutoring service
- Now what?
- Discuss with a partner. **Submit your plan on Gradescope.**

Conclusion

- Surfacing risks in many categories enables you to mitigate them
- Mitigating risks often requires tradeoffs
- Know:
  - *Second system effect*
  - *Mythical man month: Adding new people to a late software project makes it later*