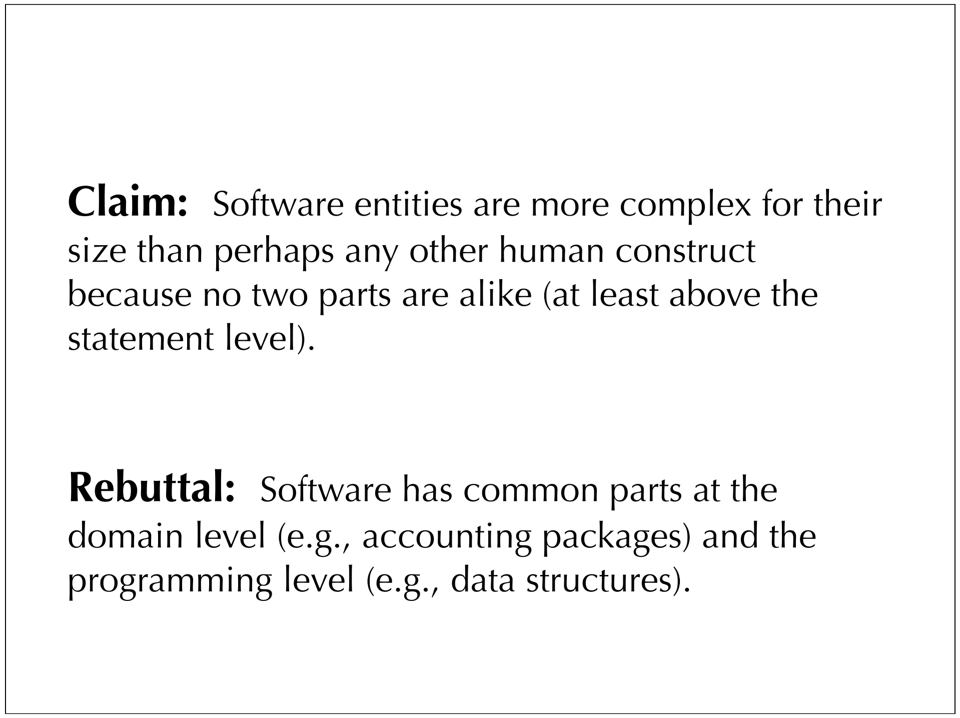
Let's play...

Devil's Advocate

I will give you one of Brooks's claims and a rebuttal.

How would Brooks argue against the rebuttal?
Is he right?

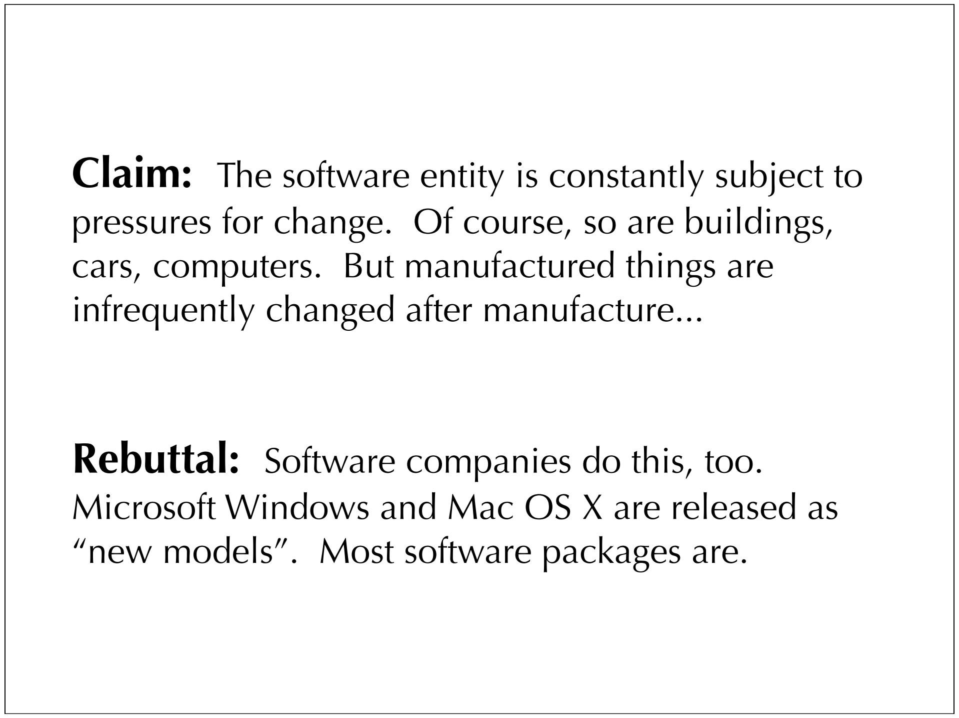
Brooks makes a lot of big claims, sometimes with no evidence. But is he right?



Claim: Software entities are more complex for their size than perhaps any other human construct because no two parts are alike (at least above the statement level).

Rebuttal: Software has common parts at the domain level (e.g., accounting packages) and the programming level (e.g., data structures).

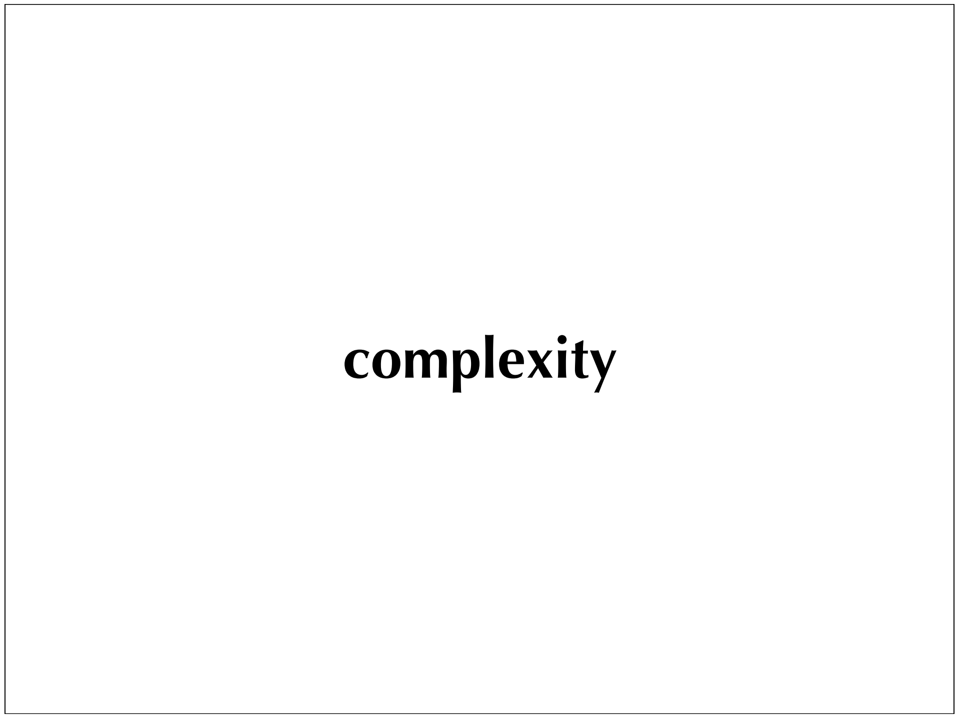
Brooks on data structures: Yes, but that is slowing down — and it's at the code level, really.
Brooks on application structures: Software operates in complex environments, created by humans, and these environments change. So do users' expectations.



Claim: The software entity is constantly subject to pressures for change. Of course, so are buildings, cars, computers. But manufactured things are infrequently changed after manufacture...

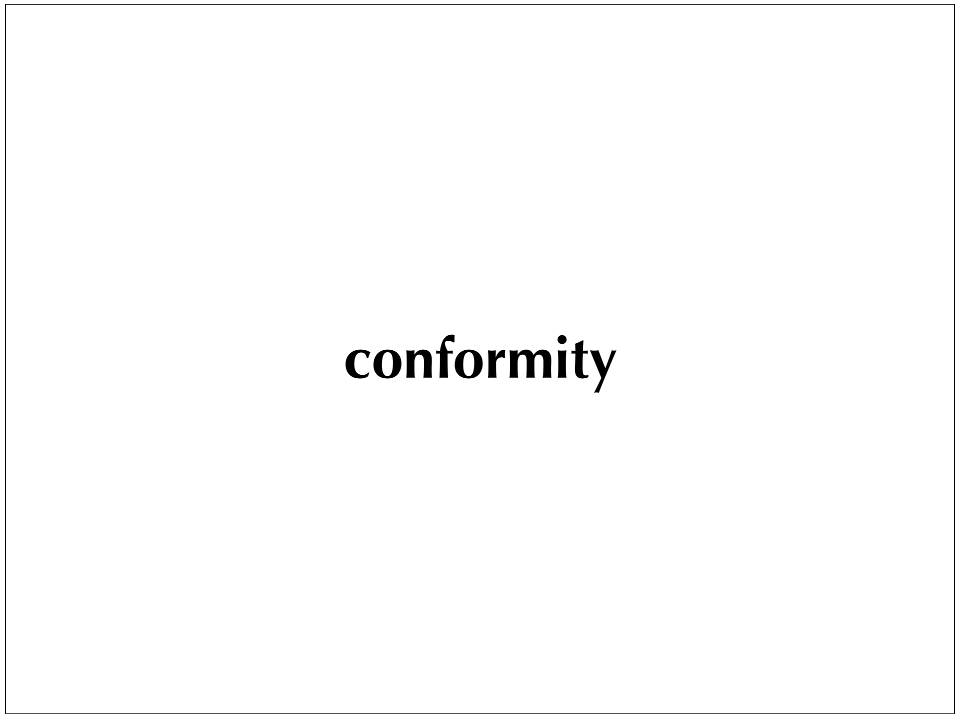
Rebuttal: Software companies do this, too. Microsoft Windows and Mac OS X are released as "new models". Most software packages are.

Brooks: Shrink-wrap software is but a small portion of software in the world. Most software is built in-house or on-spec for custom applications. People's needs change and grow over time, and **the cost of change is much less**.



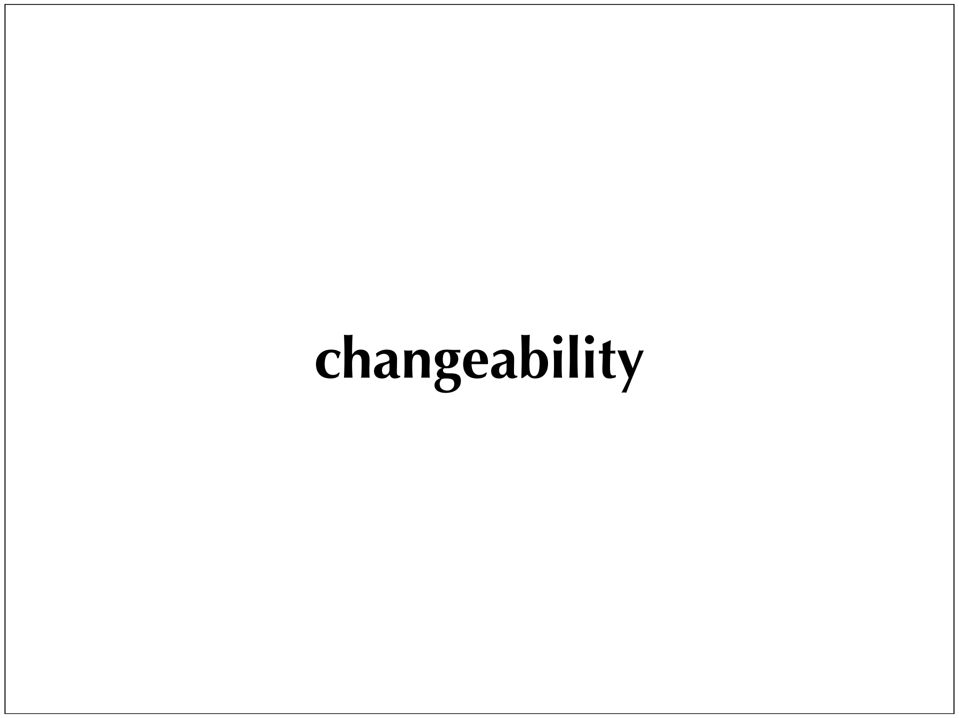
complexity

Essence 1 of software.
software system >> digital computer >> most things people build — # of distinct states



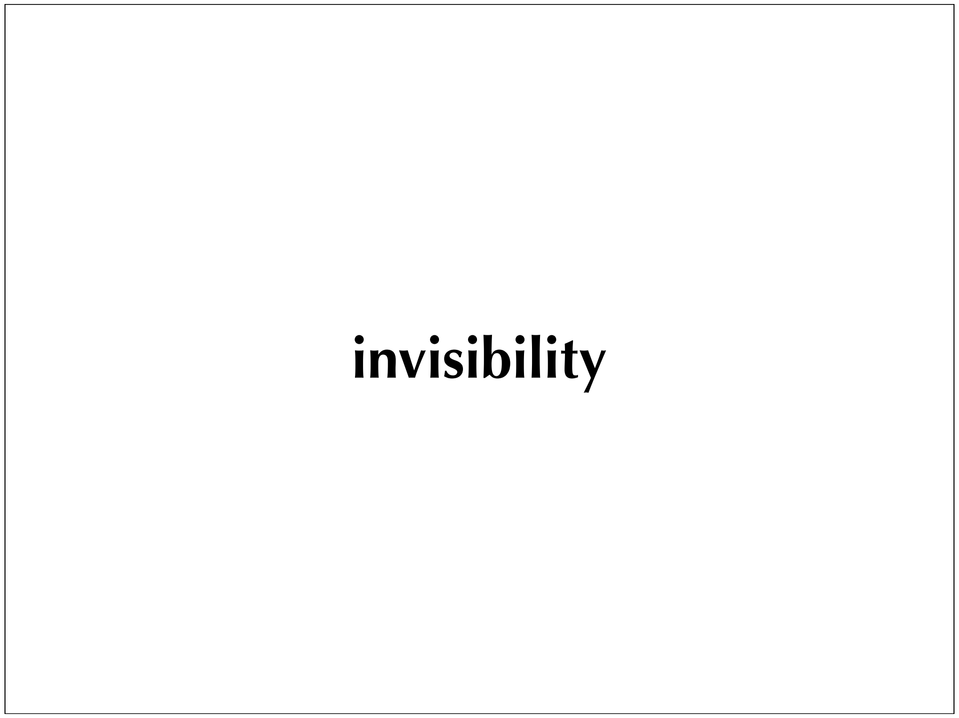
conformity

Essence 2 of software.
Software must conform to human-designed interfaces. Much worse than physics!?
Human complexity is **arbitrary** and **particular**.



changeability

Essence 3 of software.
The cost of change is much less than in traditional, material design.



invisibility

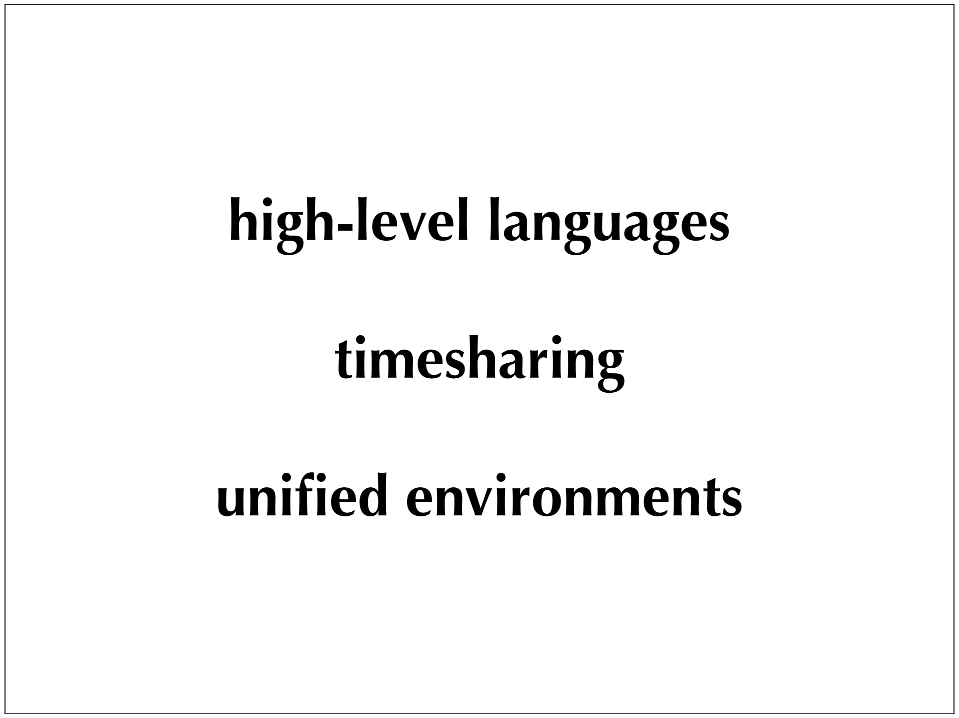
Essence 4 of software.
People don’t see it, so think it is easy to change.
    ... but: “The computer won’t let us.”
Software is not constrained in space.   We can model it in an arbitrary number of ways.
Still: We have **components** with **data flows** between them.

Fred Brooks

IBM System 360

OS/360

This guy knows what he is talking about.
Don’t bow to authority, but respect experience and understanding.



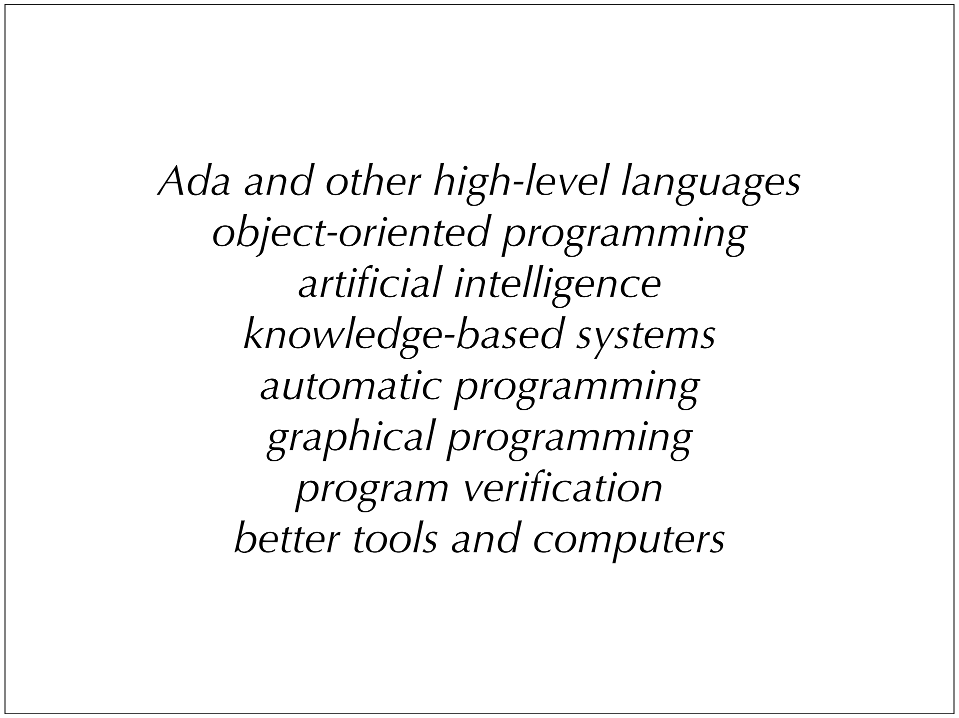
high-level languages

timesharing

unified environments

“Past breakthroughs solved accidental difficulties.”
... difficulties in expressing **solutions.** These are at the **programming** level.

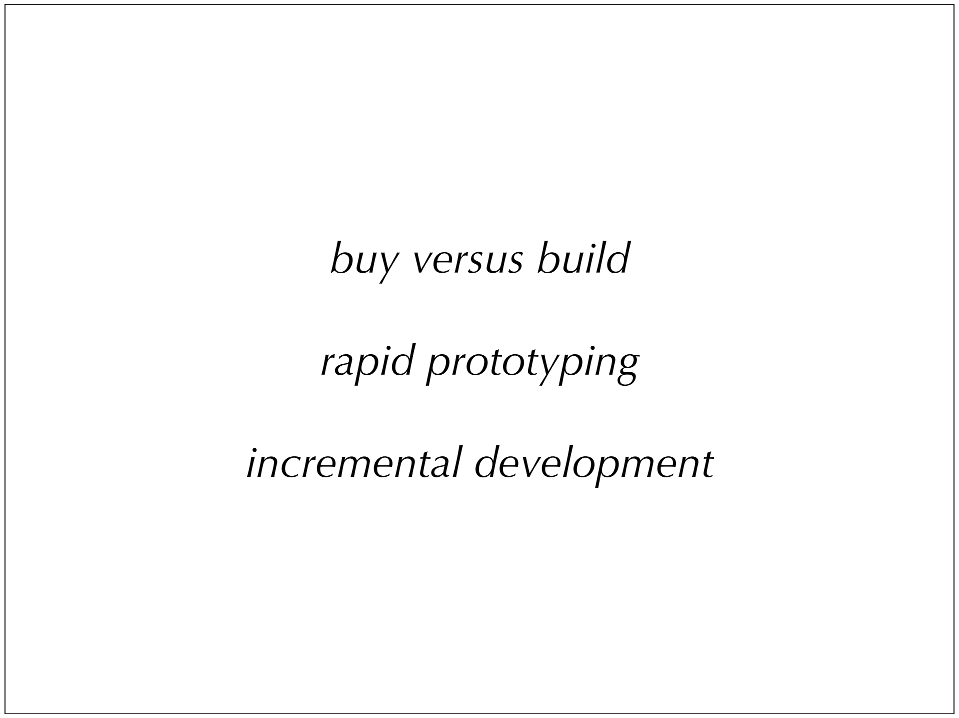
Timesharing? /remember the past.../
Unified environments? IDEs: Eclipse, NetBeans, ... Dr. Scheme, Dr. Java, JES, GNAT



Ada and other high-level languages
object-oriented programming
artificial intelligence
knowledge-based systems
automatic programming
graphical programming
program verification
better tools and computers

“Hopes for the silver” — approaches that have failed or will fail.
... difficulties in expressing **solutions.** These are at the **programming** level.

My career: AI, KBS, OOP, HLL moving targets, seamless modeling, generate what we can
Most are incremental, not orders-of-magnitude. We run into scale and **ill-defined problems.**



buy versus build

rapid prototyping

incremental development

"Promising attacks on the ... essence" — approaches that offer hope of incremental advance.

Buying works (only) for stock problems. But everyone wants to tinker. See: Collab Suite.

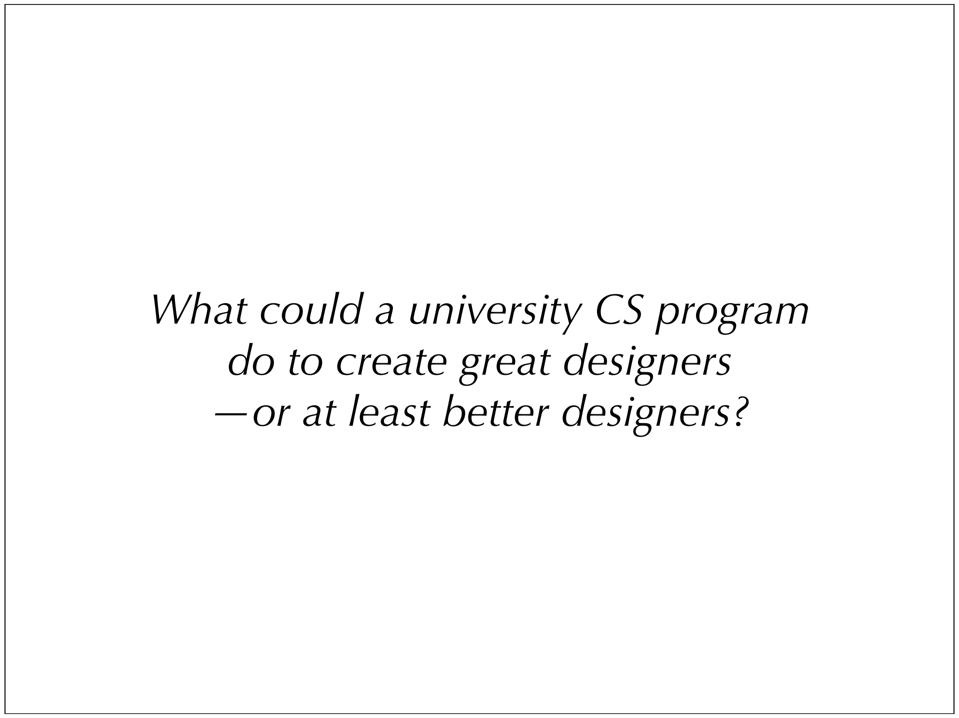
The other two: "Grow software, don't build it." Yes! The agile approaches. But not silver.

great designers

Final “promising attack”

Yes!

But you cannot mass-produce Mozart, or Steve Jobs, or Fred Brooks. (a composer/artist?)



What could a university CS program do to create great designers —or at least better designers?

My thoughts:
Build more systems. Build bigger systems. Get feedback from other designers. Work with users.
- open source projects
- “studio courses” a la architecture

Students: practice, practice, practice!