any intelligent fool can make things more complex

Albert Einstein 1879-1955
G'DAY
mini quiz: meaning is?

G’DAY
an Australian greeting

Rebecca Slater
mini quiz: meaning is?

G'DAY
Miller Geschke

go
do all you - can

G'DAY
G'DAY

give. decide. accept. yo-wup!
Eero Aarnio ball chair, designed in 1963.
I will remain intellectually curious.

A chair is to sit on.

Eero Aarnio
ball chair, designed in 1963
I will remain intellectually curious
SquidCuber

The world's fastest Lego Rubik's Cube solver
nothing's for free!
mini quiz

what are **advantages** and **disadvantages** of a modular product architecture?
any intelligent fool can make things design time!
any intelligent fool can make things more complex

Albert Einstein 1879-1955
design time!
design time!
design for assembly
why now?
why now?
design for assembly

what assembly method?
consider things like part count, capital investment, and payback period when deciding how to assemble. Production volume is key factor.
human assembly with simple fixtures
almost always for low volume production, or where labor is inexpensive
design for assembly

+ low initial capital outlay
  high flexibility and adaptability

- assembly cost does not lower with volume
  can be error prone
  it can be a really tough job

human assembly with simple fixtures
almost always for low volume production, or where labor is inexpensive
design for assembly

overall procedure
for each part, decide if it is really necessary

if a part is necessary
design it so that it is easy to assemble
design for assembly

reduce part count
for each part, decide if it is really necessary

how to decide?

is there relative motion during use?
is a different material needed?
does it need to separate?
(assembly, maintenance, debugging)
will it be difficult to make?
design for assembly

reduce part types
standardize components (e.g., robertson, phillips, torx, allen)

other considerations
eliminate unnecessary product features
avoid wiring harnesses, connecting cables
design for assembly

eliminate adjustments (design to fit)
manufacture fit, avoid adjusting fit at assembly

to increase reliability
avoid joining parts if they can be made as one
use locating pins or features (e.g. bolted joints)
design for assembly

use self-locating features
minimize dexterity requirements

design tips

use features to hold parts in position
use features to guide insertion
avoid aligning more than two parts at once
let gravity be a set of hands
design for assembly

keep it comfortable
design for access

design tips
provide space for hands and tools
a direct line of sight for mating surface
consider assembly, maintenance, debugging
adopt a single assembly direction
design for assembly

make parts easy and safe to handle
take care of the workers!

design tips

- avoid heavy, sharp, fragile, awkward parts
- if possible avoid special tools
- avoid parts that tangle easily
design for assembly

make only correct assembly possible
otherwise mistakes will happen!

design tips

make parts fully symmetric
make parts clearly asymmetric
avoid almost fits. Make miss-assembly obvious
use features to block incorrect assembly
provide registration/alignment marks
avoid flexible parts
product contract: value proposition, up-to-date user, and key needs, attributes and specifications

assembly review
design variations: vision, web-viewable assembly, exploded assembly, use storyboard…

assembly review
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assembly review
who-did-what: all team-members contribute to the deliverable. You may work in pairs

assembly review