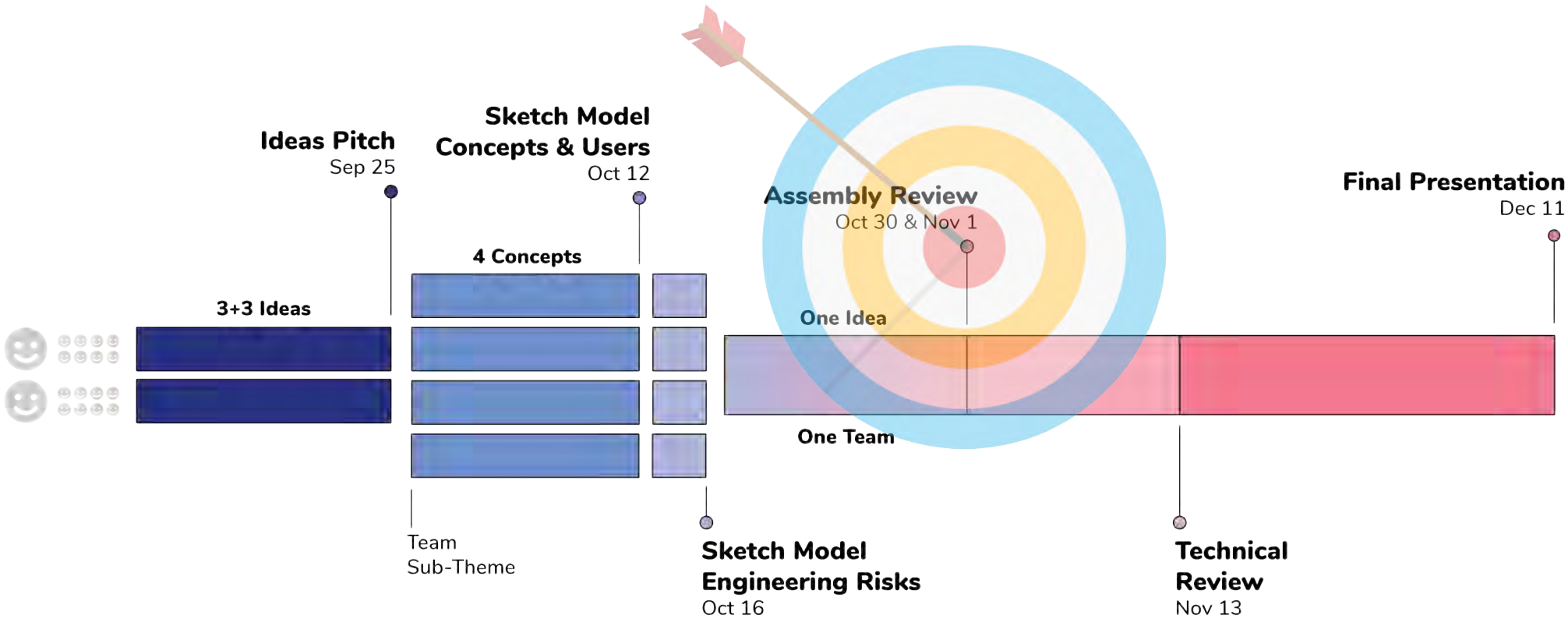
any **intelligent fool** can make things
more complex

Albert Einstein 1879-1955



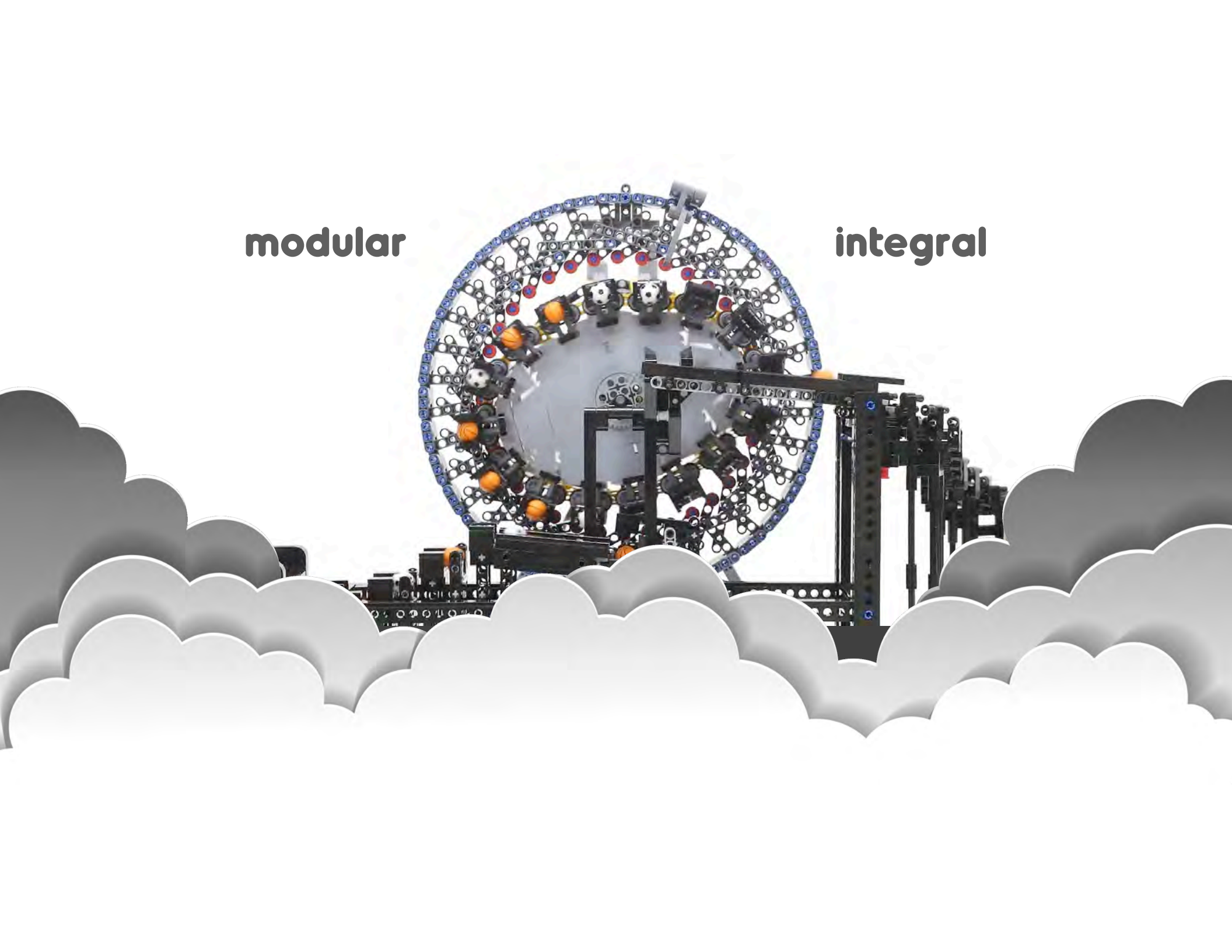
Process

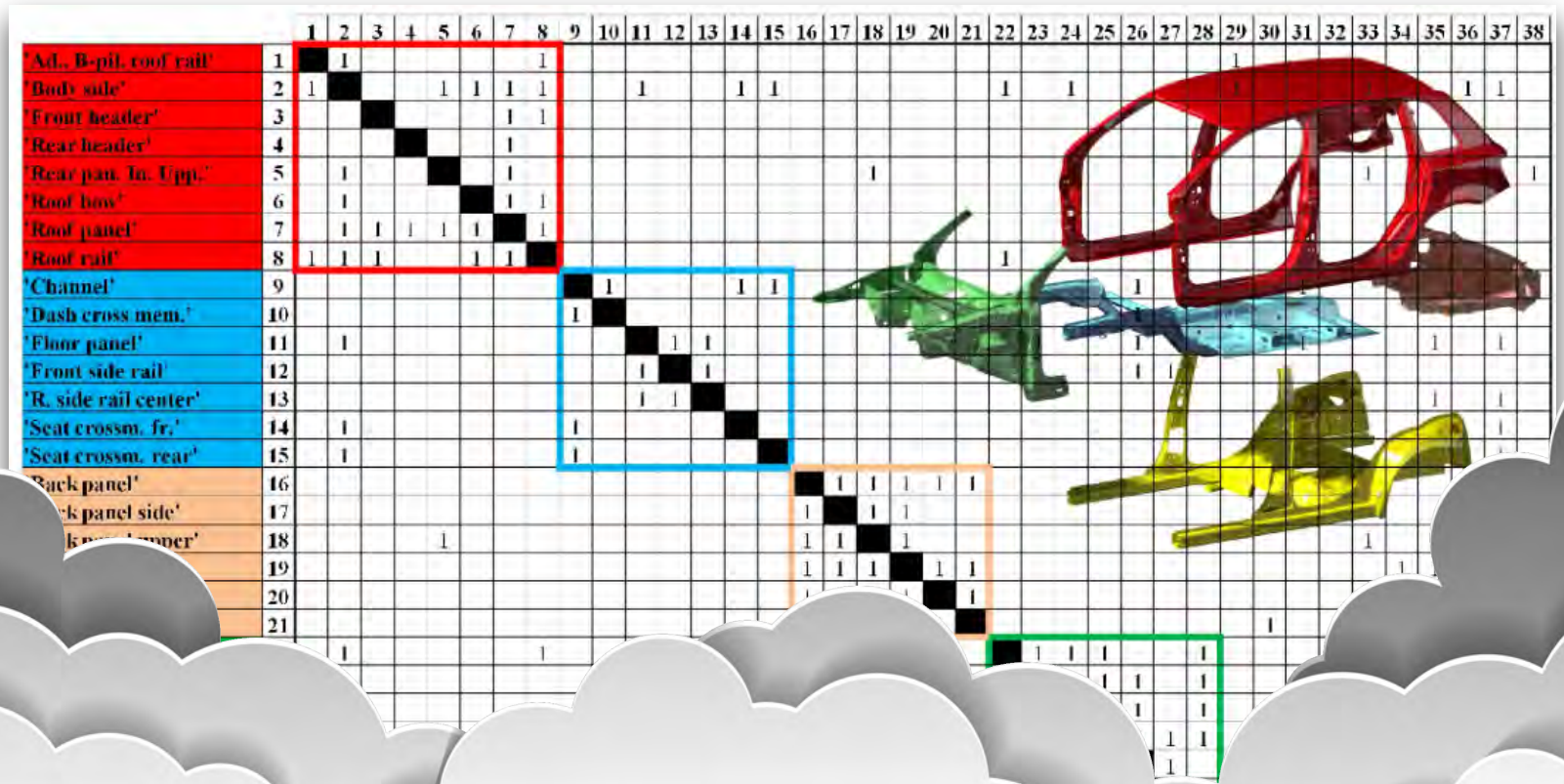
detail design

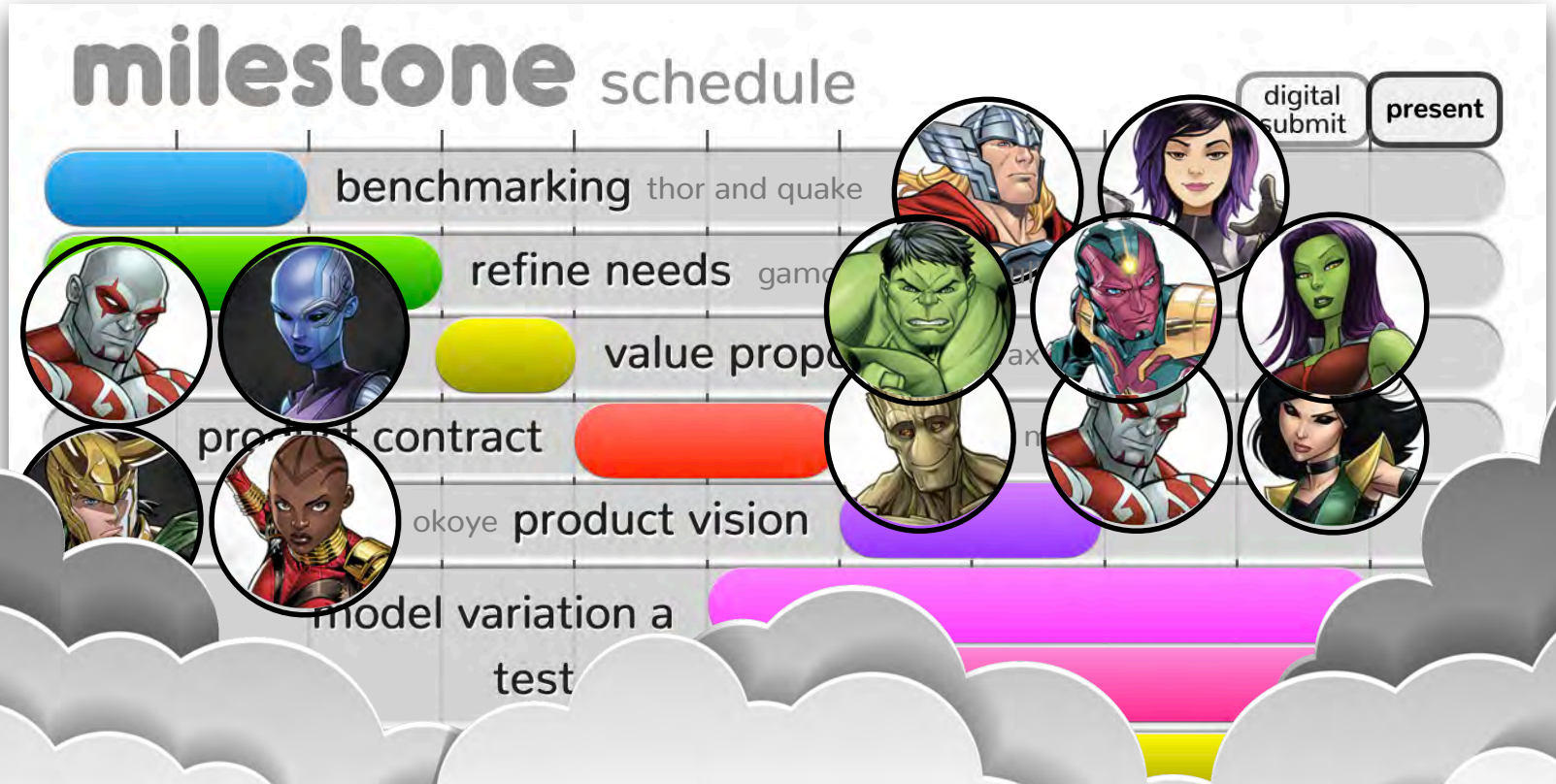

design time!

modular

integral




'Ad., B-pil. roof rail' 1
'Body side' 2
'Front header' 3
'Rear header' 4
'Rear pan. In. Upp.' 5
'Roof bow' 6
'Roof panel' 7
'Roof rail' 8
'Channel' 9
'Dash cross mem.' 10
'Floor panel' 11
'Front side rail' 12
'R. side rail center' 13
'Seat crossm. fr.' 14
'Seat crossm. rear' 15
'Back panel' 16
'k panel side' 17
19
20
21
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38


milestone schedule
digital submit
present
benchmarking thor and quake
refine needs
value prop
contract
okoye product vision
model variation a
test


greenworks pro
60 VOLT
16"
BRUSHLESS
greenworks


product
not product

product

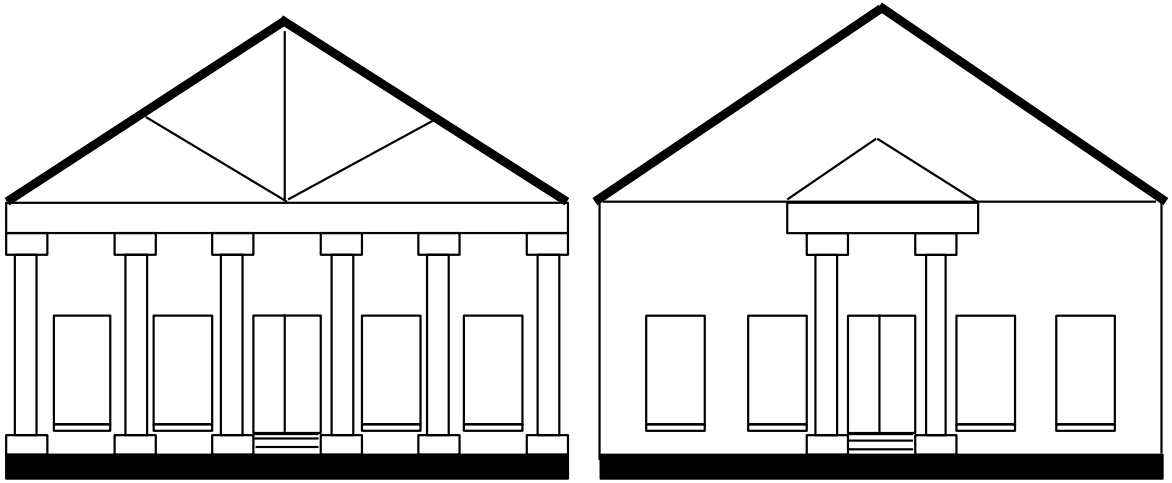
mini quiz

mini quiz

two not product to product **design strategies** are: ____, ____?

our guiding embodiment design principle

is ____ _____ _____.



any **intelligent fool** can make things
more complex

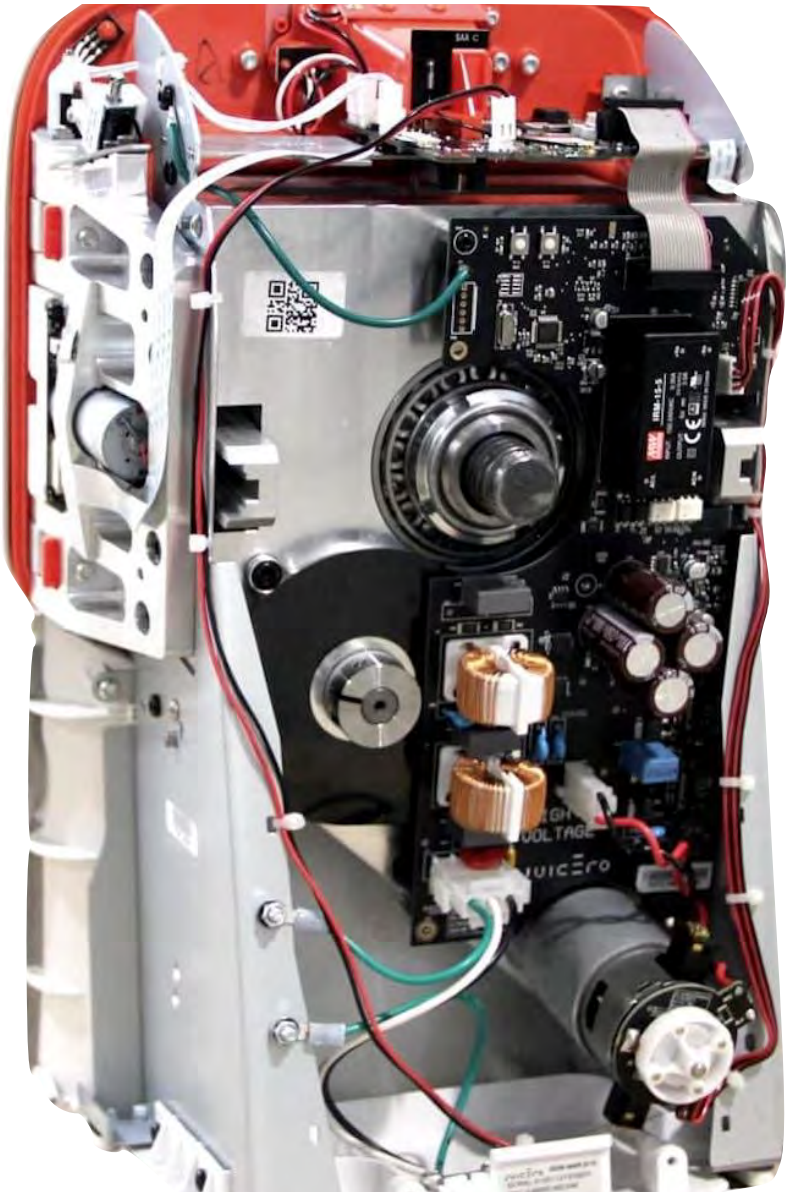
Albert F

any **intelligent fool** can make things
more complex

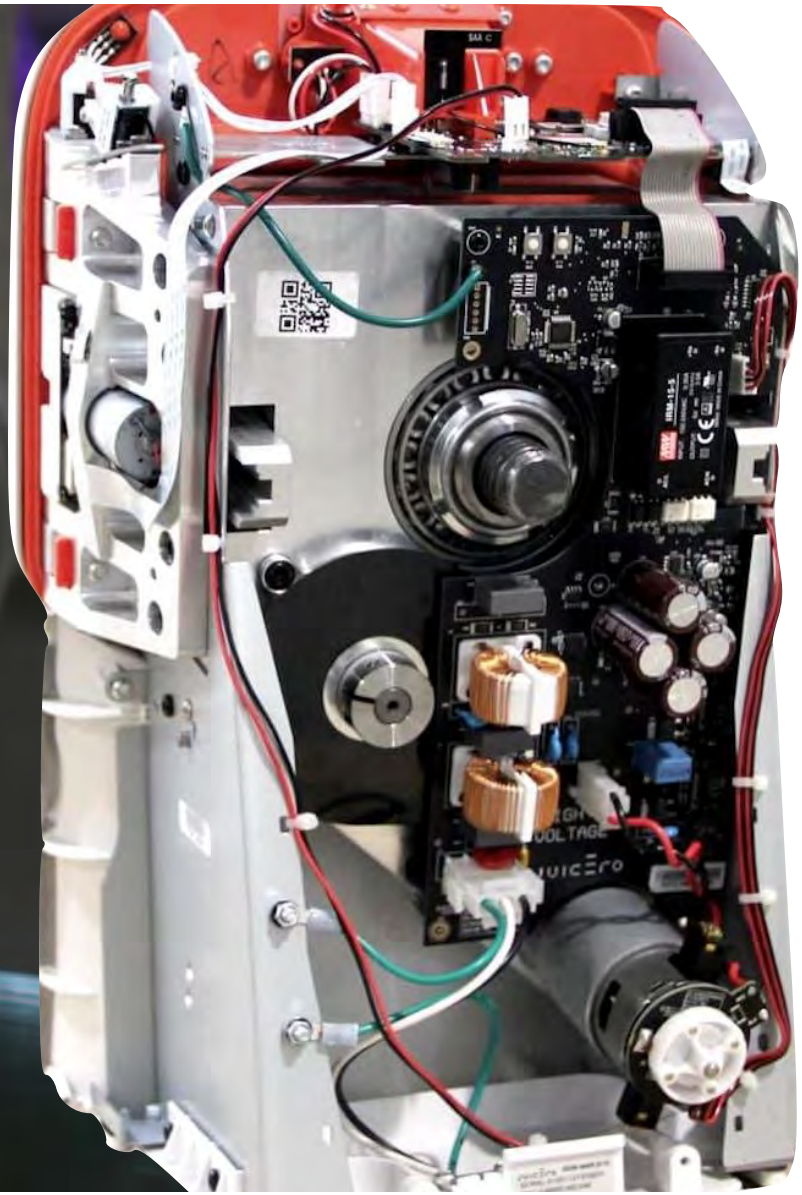
Albert Einstein 1879-1955


JUICERO
JUICERO
Sweet Greens
apple
baby spinach
pineapple
kale
lemon
NET WEIGHT 10 OZ (283 g)


JUICERO
Sweet Greens
apple
baby spinach
pineapple
kale
lemon
NET WEIGHT 10 OZ (283 g)




JUICERO




JuicEro
JuicEro
Sweet Greens
apple
baby spinach
pineapple
kale
lemon
NET WEIGHT 10 OZ (283 g)

design time!

design for assembly

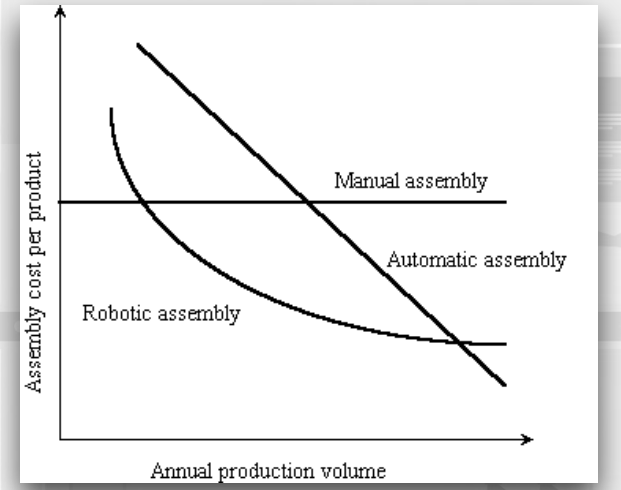
why now?

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.



design for assembly

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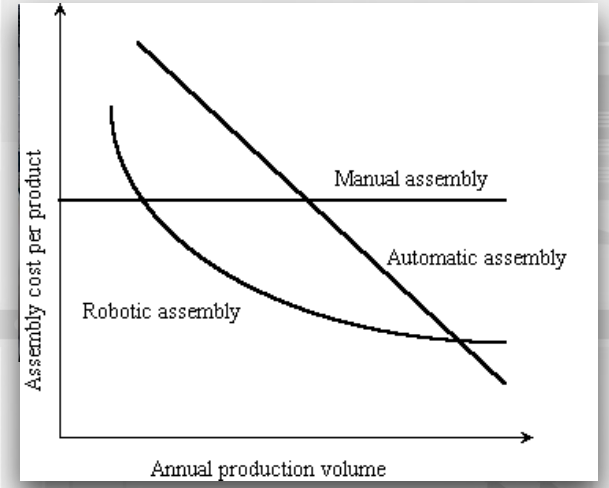

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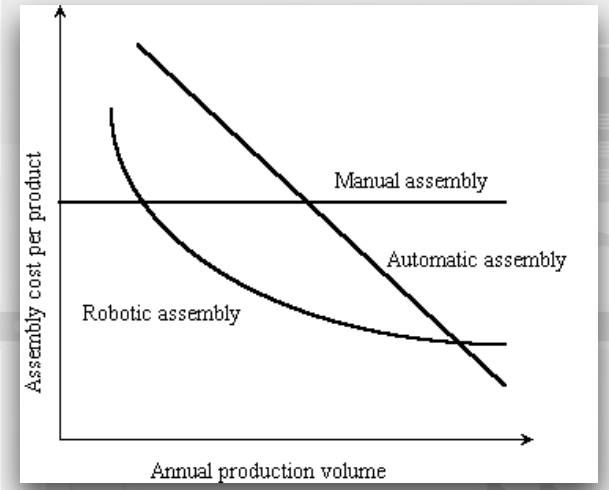

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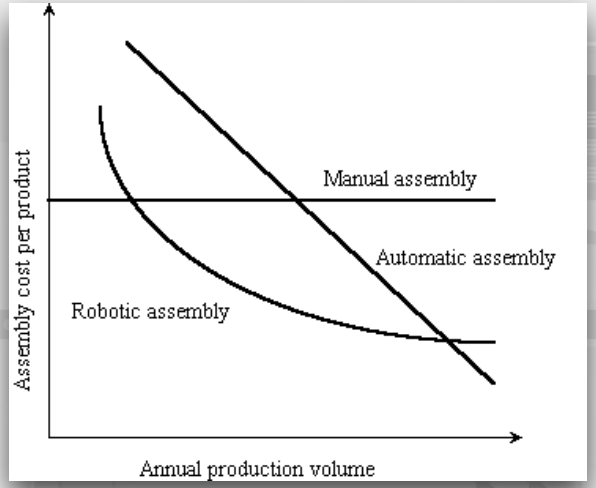

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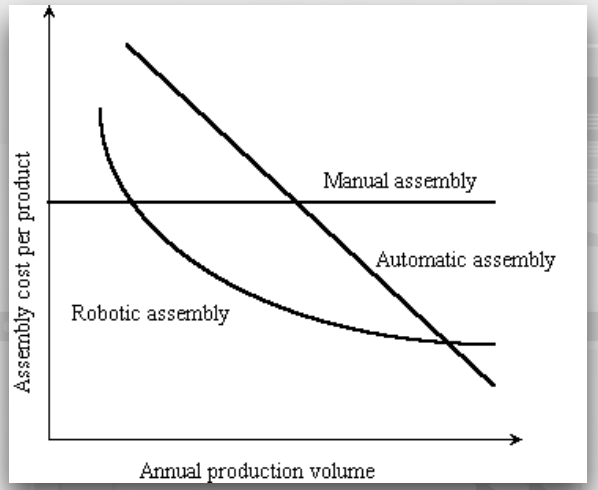
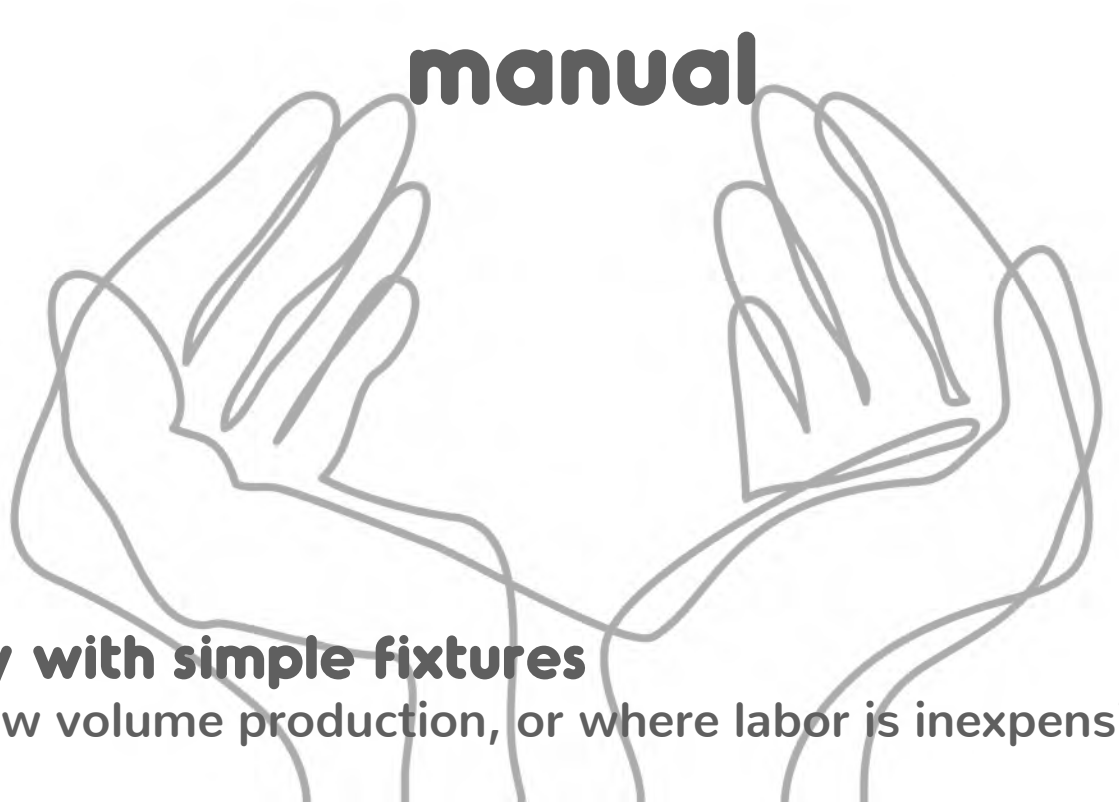


design for assembly

manual



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

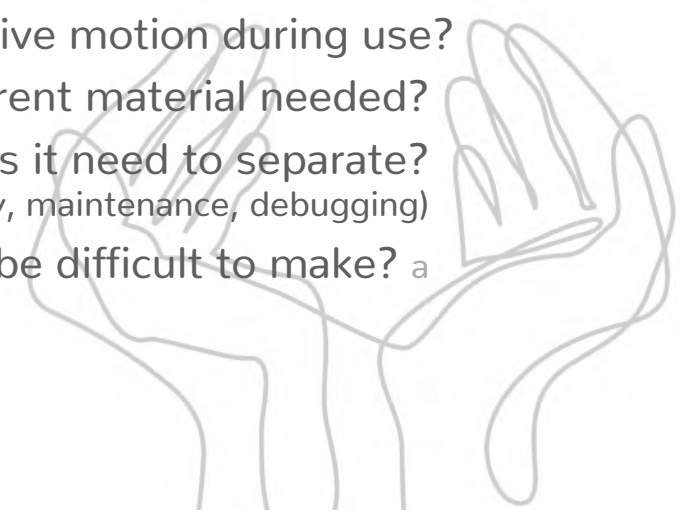
how to decide?

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? a



design for assembly

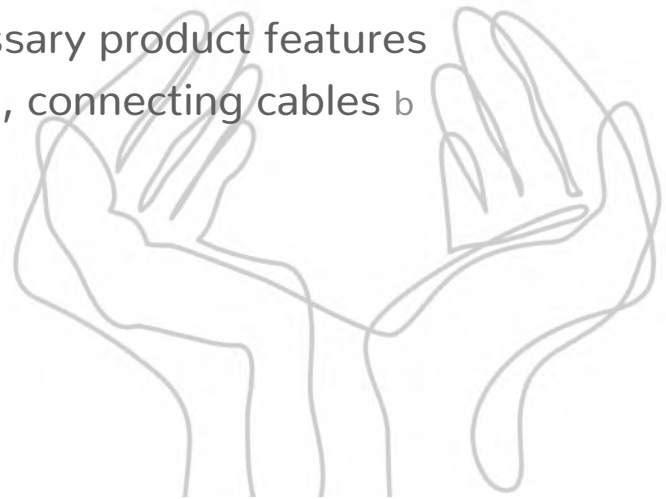
reduce part types

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

other considerations

eliminate unnecessary product features

avoid wiring harnesses, connecting cables b



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

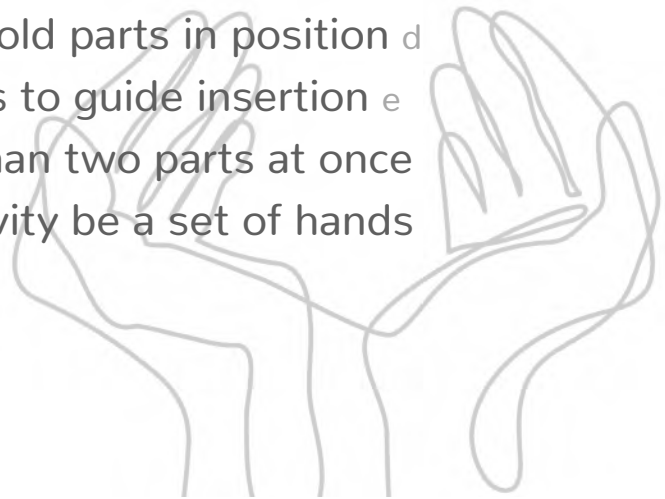
use locating pins or features (e.g. bolted joints) c

design for assembly

use self-locating features
minimize dexterity requirements

design tips

use features to hold parts in position d
use features to guide insertion e
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 maintenance, debugging
adopt a single assembly direction f

design for assembly

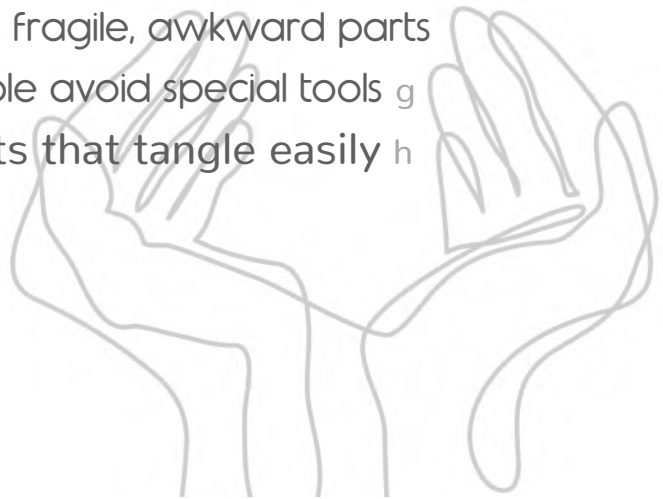
make parts easy and safe to handle
take care of the workers!

design tips

avoid heavy, sharp, fragile, awkward parts

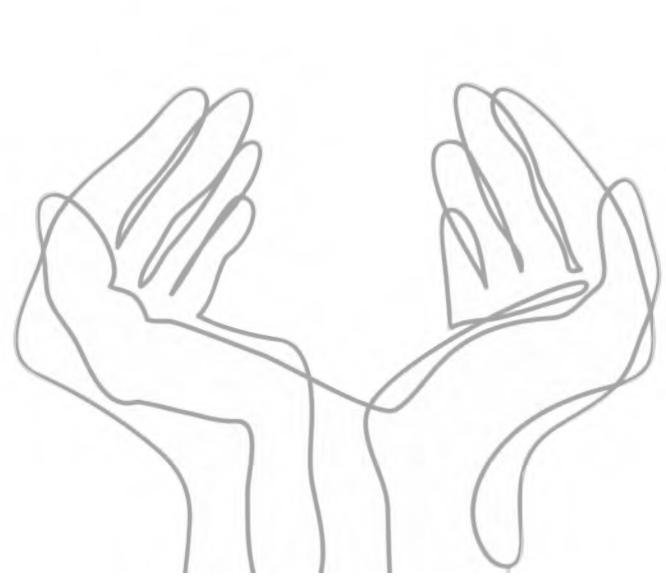
if possible avoid special tools g

avoid parts that tangle easily h



design for assembly

make only correct assembly possible
otherwise mistakes will happen!

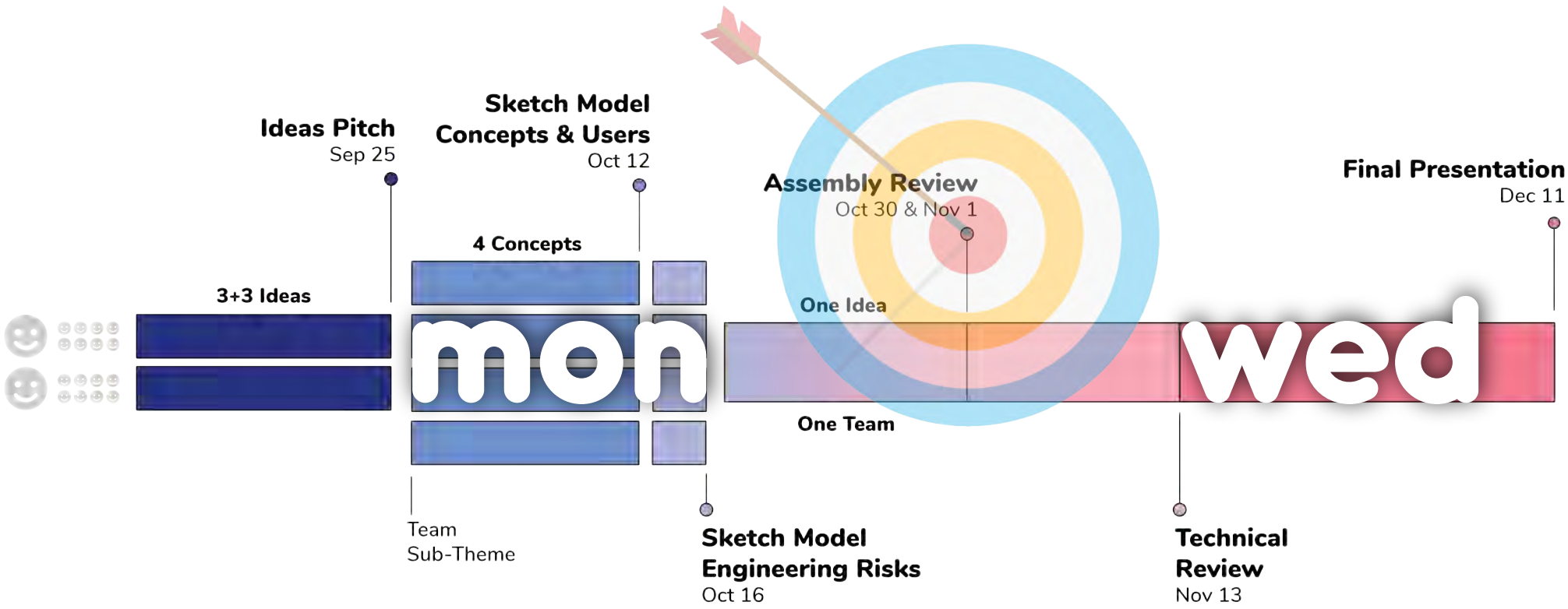


design for assembly

make only correct assembly possible
otherwise mistakes will happen!

design tips

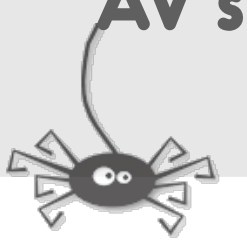
make parts fully symmetric
make parts clearly asymmetric
avoid almost fits. Make miss-assembly obvious
use features to block incorrect assembly i
provide registration/alignment marks
avoid flexible parts j


Ideas Pitch
Sep 25
Sketch Model
Concepts & Users
Oct 12
Assembly Review
Oct 30 & Nov 1
Final Presentation
Dec 11
4 Concepts
3+3 Ideas
One Idea
mon
wed
One Team
Team
Sub-Theme
Sketch Model
Engineering Risks
Oct 16
Technical
Review
Nov 13

mon 30

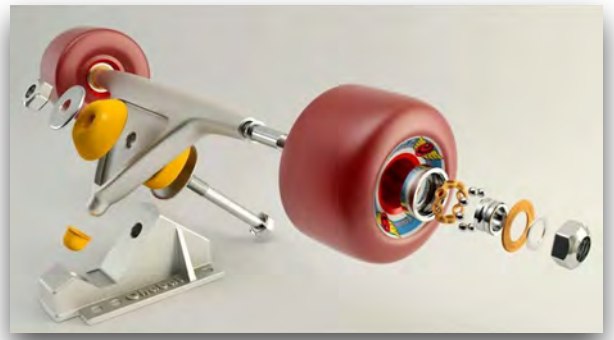
wed 1

AV setup: bring two computers, one for your main slides, one for specifications



AV setup: bring two computers, one for your main slides, one for specifications

user need	product attribute(s)	engineering specification(s)
can be easily transported	weight	total weight less than 40 lbs
is easily stored in the home garage	size	less than 24" x 24" x 24" in smallest configuration
can handle most repair situations	lifting capability	more than lift 15 cycles for a 3000 lb automobile with external power
can be used on many uneven surfaces	stability	3000 lb vehicle raised 16 inches will not tip under 400 lb side loading



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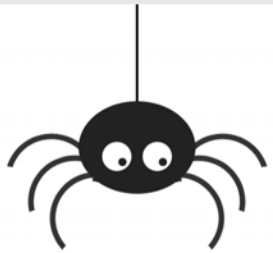
practice times: 8:30 AM to 9:15 AM before each class

online submission: images, link to online assembly view by midnight before

discussion: 12 minutes, discuss your most current work



design for assembly

product costing Fri at 4 PM. 3-333