I always wanted to be somebody…
I should have been more specific

Lily Tomlin
2.009 Product engineering processes

Today

Specifications what you follow for success
But first...

mini quiz: form follows function means...

intended meaning

sometimes

maybe

nope!

number of students

instructs

how to use/interact

instructs how it works/purpose

design inspired by function

function comes first/important

more
form is function
and...
a few reminders

team review results will be posted by Saturday
instructor review opens this weekend through 5 PM Wed.
full shop 6-9 PM Tuesday and Wednesday
consulting sessions Monday during class
### Specifications

**mockup review: preliminary product contract**

**Product Description:** Portable electric device for lifting automobiles.

**Intended Customers:** Backyard mechanics.

**Market:** Automotive accessories.

<table>
<thead>
<tr>
<th>Customer Need</th>
<th>Product Attribute(s)</th>
<th>Engineering Specification(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be easily transported in and out of a house.</td>
<td>Weight</td>
<td>Total weight less than 30 lbs.</td>
</tr>
<tr>
<td>Is easily stored in the home and office.</td>
<td>Size</td>
<td>Less than 14&quot; x 14&quot; x 14&quot; in smallest configuration.</td>
</tr>
<tr>
<td>Can handle most repair situations.</td>
<td>Lifting capability</td>
<td>More than 15 cycles at 1&quot; per second per charge for a 3000 lb. automobile.</td>
</tr>
<tr>
<td>Can be used on many uneven surfaces.</td>
<td>Stability</td>
<td>3000 lb vehicle raised 16 inches will not tip under 400 lb side loading. Base self-levels up to 1 inch discontinuities and 2% slopes in pavement.</td>
</tr>
</tbody>
</table>
Customer needs

Monday’s class

extracting customer data

observation

one-on-one interviews

converting customer data to customer needs

what, not how
positive, not negative
same specificity
do not prioritize
Identifying attributes
map attributes to needs

<table>
<thead>
<tr>
<th>Need</th>
<th>Attribute</th>
<th>assemblability</th>
<th>usability</th>
<th>fault detection</th>
<th>wow factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>easy to setup</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>safe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>special</td>
<td></td>
<td></td>
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house of quality
Once you have attributes

set specifications

translate the product attributes (mapped to customer needs) into quantitative design performance targets

quantify the core benefit of your product

define internal basis for measuring success

provide a basis for resolving trade-offs

keep the development effort focused
Setting specifications

**definition**

a precise description of *what* the product must do

customer need: easy to install
interpretation: average time to assemble is less than 60 seconds (Floyd)

design attribute: assemblability

**metric:** time to assemble
**unit:** seconds
**value:** less than 60
**owner:** Floyd
Setting specifications
they are NOT...

descriptions of how to implement the product (embodiment)

customer need: easy to find
design attribute: visibility
metric: color
unit: rgb
value: 255, 255, 0 (yellow!)
owner: Floyd

metric: time to spot
unit: seconds
value: less than 5
Identifying appropriate metrics measure the product attributes

metrics should be observable or analyzable properties/behaviors of the product

metrics should be quantifiable

include metrics used in the marketplace for benchmarking
Attributes and specifications

example: types of metric values

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<th>unit</th>
<th>value</th>
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<tbody>
<tr>
<td>damage detection</td>
<td>defects visible</td>
<td>binary</td>
<td>yes/no</td>
</tr>
<tr>
<td>solidifies in heat</td>
<td>thermo-sets</td>
<td>binary</td>
<td>yes/no</td>
</tr>
<tr>
<td>household usability</td>
<td>curing temperature</td>
<td>Celsius</td>
<td>between 50 and 100</td>
</tr>
<tr>
<td>producability</td>
<td>manufacturing time</td>
<td>days</td>
<td>between 1 and 2</td>
</tr>
<tr>
<td>food safe</td>
<td>FDA approved mat’ls.</td>
<td>binary</td>
<td>yes/no</td>
</tr>
<tr>
<td>Atkins-diet friendly</td>
<td>carbohydrate content</td>
<td>grams/product</td>
<td>less than 1</td>
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</table>

mini quiz! what product might meet these specifications?
## Attributes and specifications

**example: types of values**

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Exercise
writing specifications

each section has a ‘product’ kit
develop specifications consistent with the product
assess specifications developed by another team
interpret specifications and identify products that meet them (and why)
present and critique specifications
Exercise
step 1: 10 minutes

develop specifications consistent with your fruit “product”
use attribute and specification forms provided (one extra copy of each)
write legibly, use black sharpie provided

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Exercise
step 2: 7 minutes

review another section’s specification
i) use red sharpie to highlight questionable specifications
ii) identify products that fit the specification, using form provided

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<th>product is:</th>
<th>metric</th>
<th>unit</th>
<th>value</th>
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<tbody>
<tr>
<td>visible defects</td>
<td>binary</td>
<td>yes/no</td>
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**product description?** seems long
Exercise

step 3: 7 minutes

present and critique:
what products fit and why, discuss specification

critiqued a good specification?
critiqued a less good specification?