Biscuits & Joinery

It’s not just for alignment

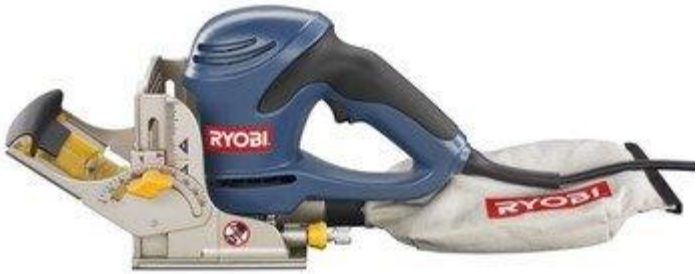
Cincinnati Woodworking Club
March 14, 2015

Joinery

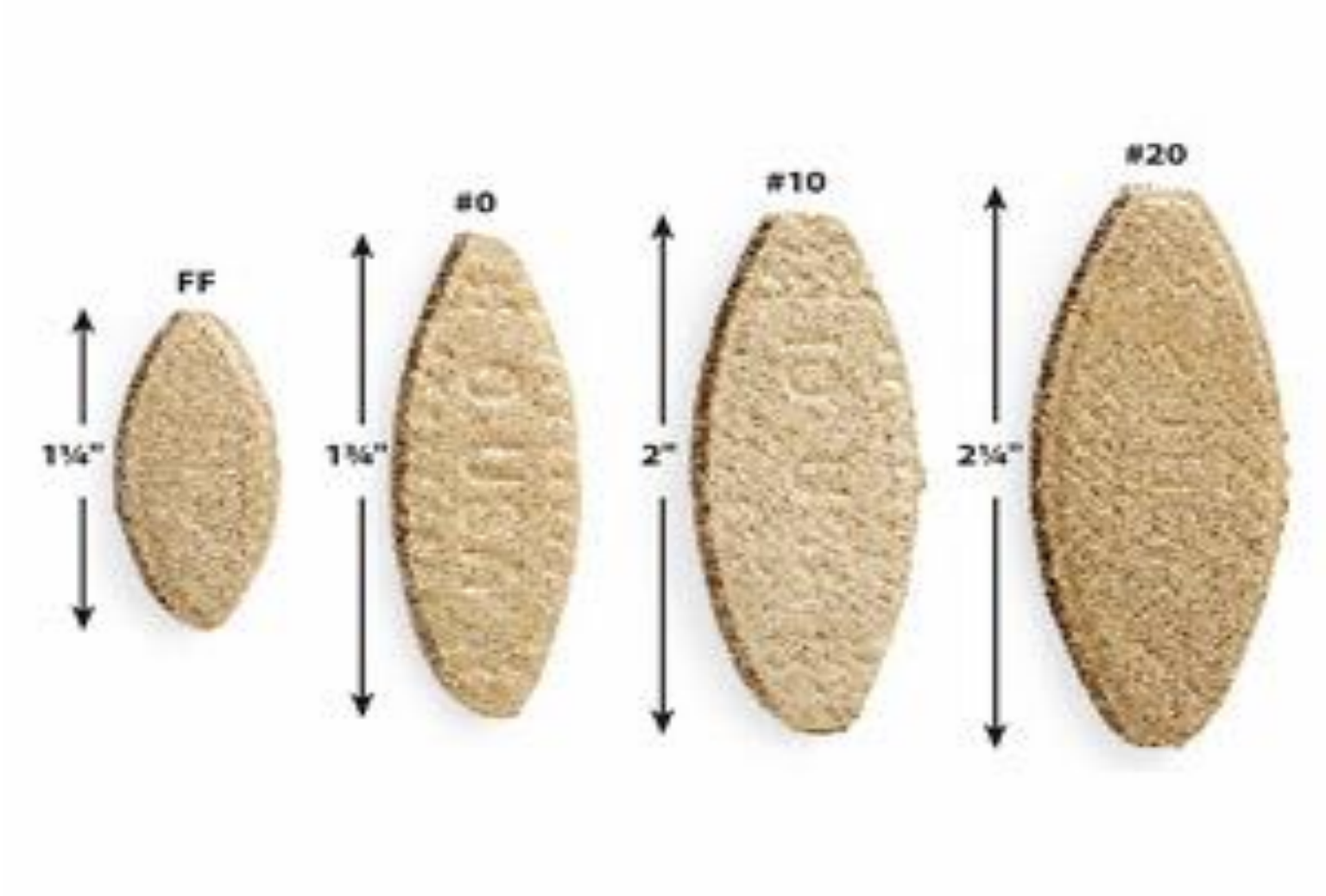
- What keeps us from having just a pile of pretty boards

- Options
  - Mortise & tenon, bridle, cope & stick
  - Biscuit, Dowel, Domino, BeadLock, Loose tenon
  - Miter, splines, keys
  - Dovetail, box joint
  - Rabbet, dado, groove, half-lap,. Tongue & groove
  - Nails, Screws, Bolts, K-D fasteners
  - Glue

Tools



Biscuit Plates



Biscuits

- Dried, or dried and compressed
- Beech, birch or plywood
- Absorb moisture from PVA glues and swell
- May have swollen in storage
  - Microwave
  - Oven
  - Light box
  - Vice

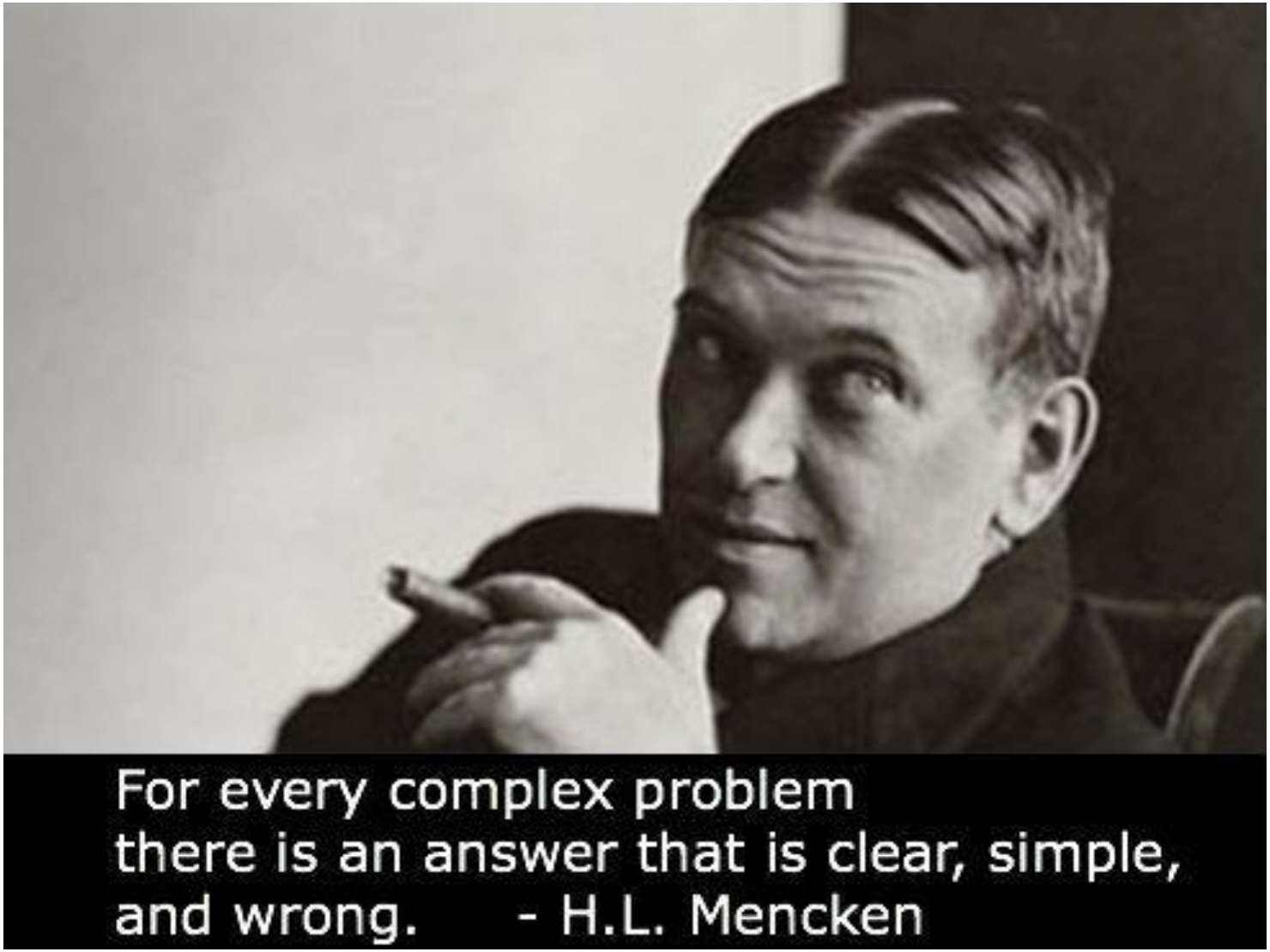
Myth vs. Facts

- Just for alignment
- Aren't strong
- vs
- My experiences
- My analysis (math)

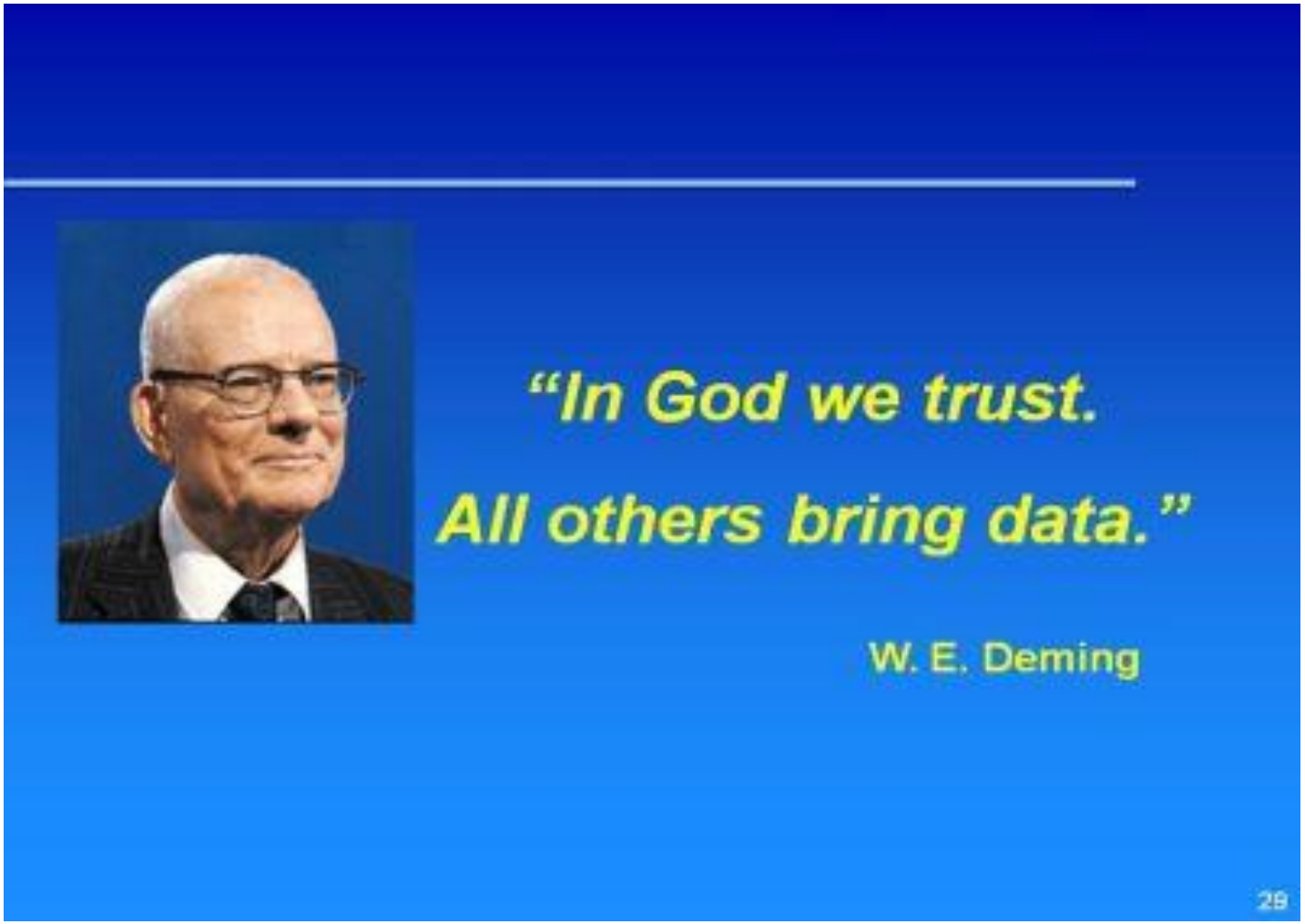
Strength, a Complex Problem

- Variations in wood species, moisture, etc. etc.
- Lumber vs. engineered wood
- Variations in wood axes - Anisotropic – Orthotropic
- Fit / gaps
- Surrounding wood failure
- Simple answer?

Some Thoughts On Strength



How do we measure “strong?”



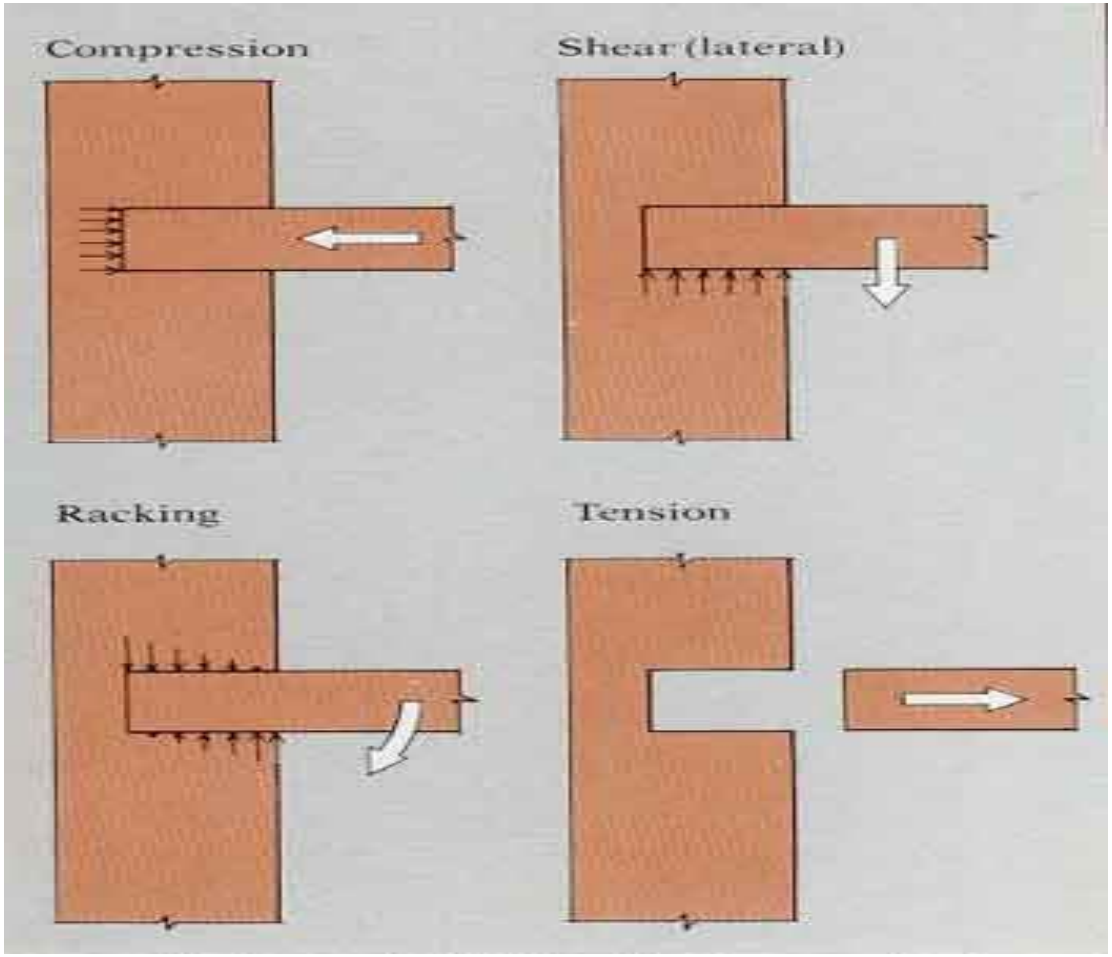
Types of stress & failure

- Sudden vs. gradual (dynamic / static load)
- Elastic / plastic / failure
- Flexible vs. rigid MACFAT
- Repairable vs. non-repairable – shear pins
- Moisture fluctuations over time – dowels & chair joints (Alexander & Hoadley)
- Distributed vs. concentrated load
- Built-in vs. cantilevered beam

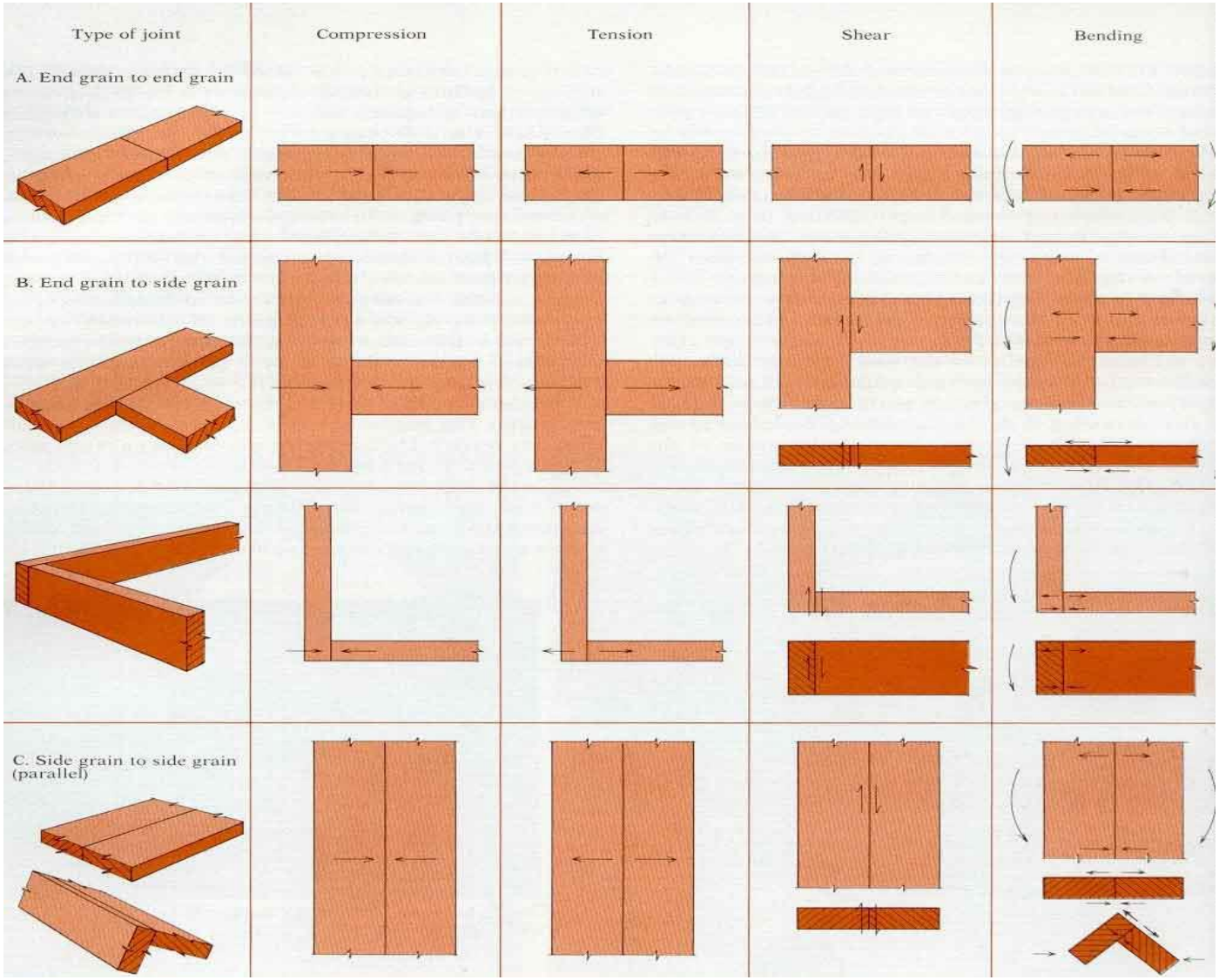
Direction of Stress

- Shear – ASTM D905 test
- Racking / turning /bending – most joint tests
- Tension – dovetails
- Compression
- Cleavage (no not that kind) wedging
- Peel – veneer, stress at point of separation

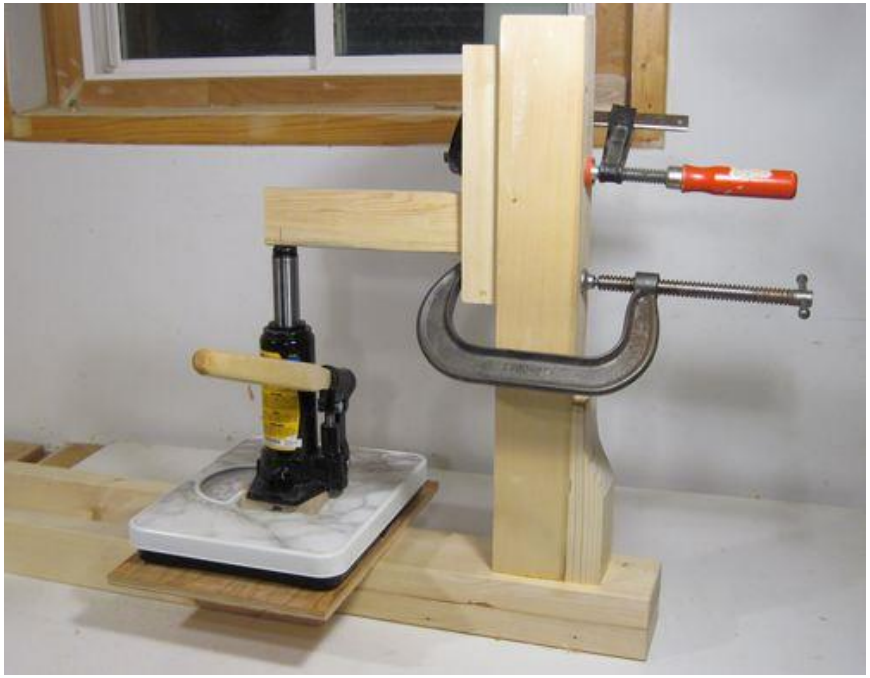
Stress



Joints vs. Stress

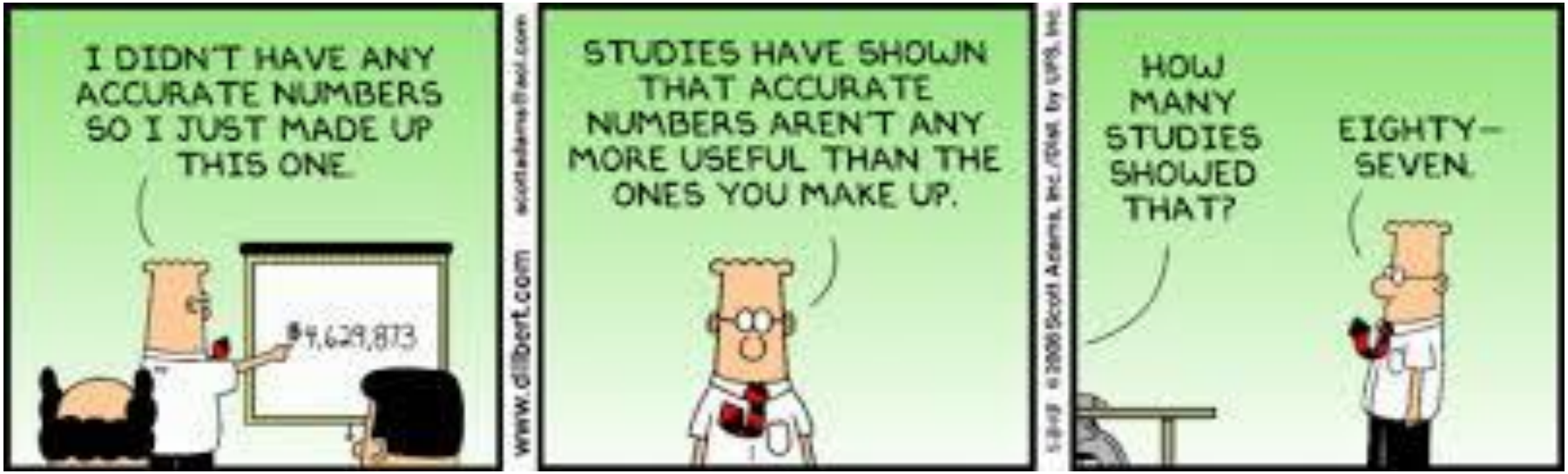


Why Does Everyone Do the Same Type of Test?



More Questions than Answers

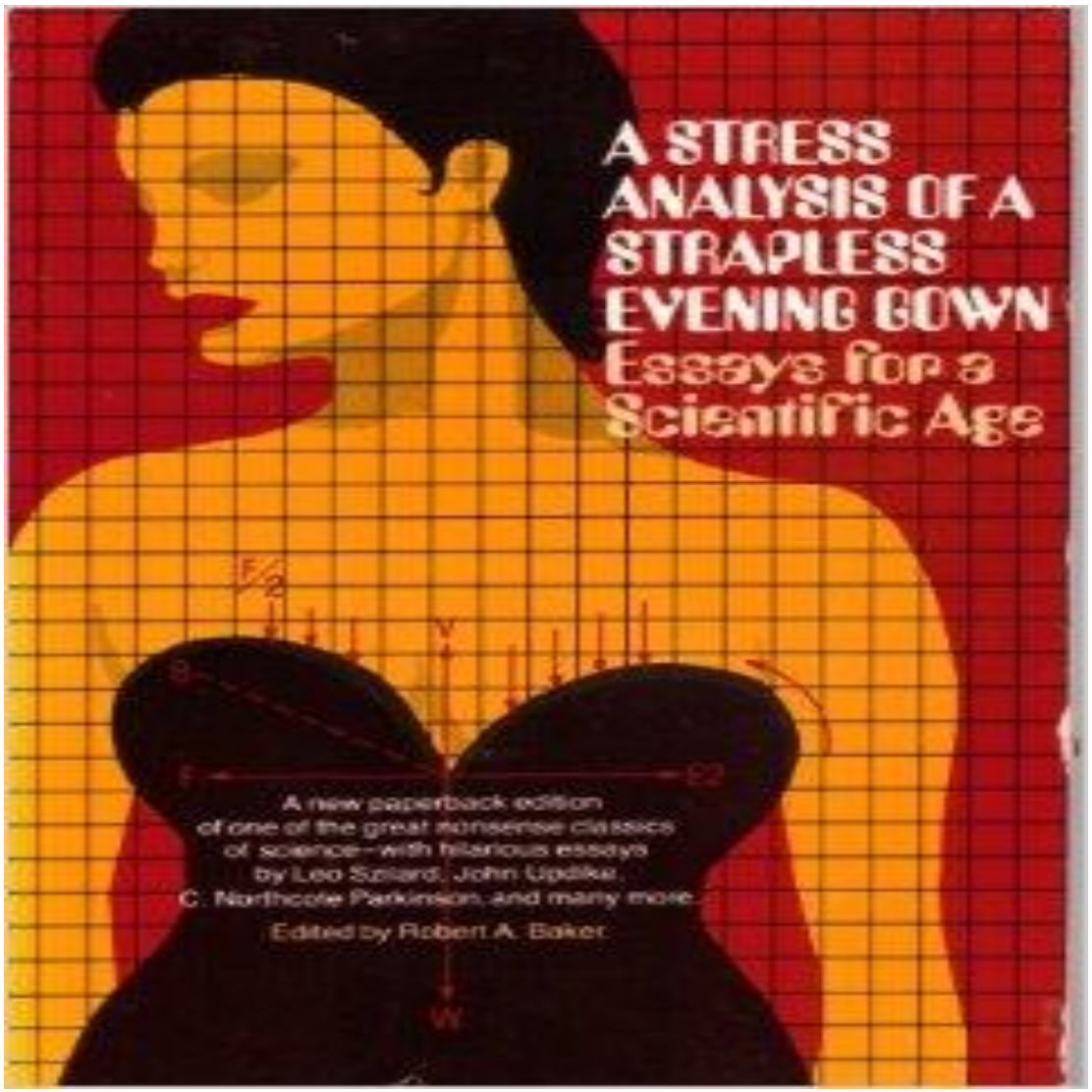
Run some tests?



Google it?


First, I looked in the back of the book, but it wasn't an odd-numbered problem.
Then I asked my little brother, but he wanted me to pay him $5.
2-10
Finally, I found it on the Internet with Google.
MY MATH TEACHER WANTS US TO SHOW HOW WE GET OUR ANSWERS.
AH.

Stress Analysis of…



.. A Strapless Evening Gown

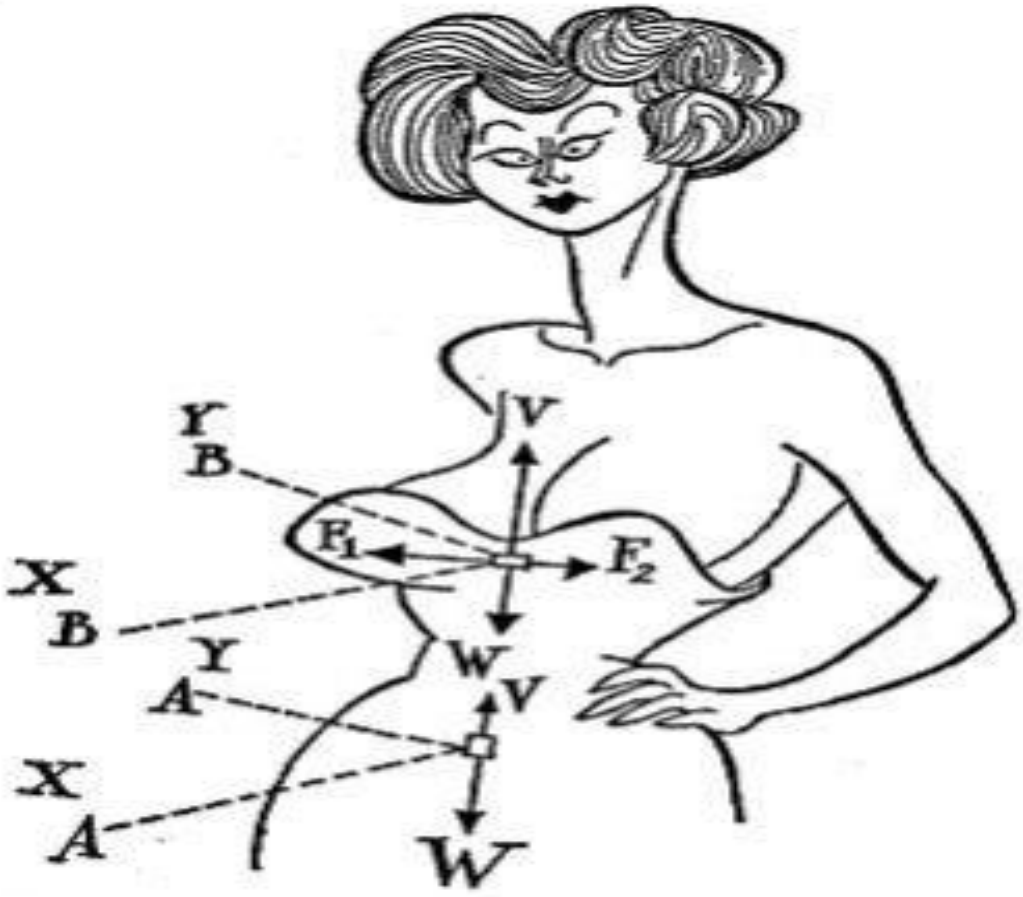


Figure 1.

Forces Acting On Cloth Element.

Hooke's Law
For Orthotropic materials

$$\begin{bmatrix} \epsilon_{xx} \\ \epsilon_{yy} \\ \epsilon_{zz} \\ 2\epsilon_{yz} \\ 2\epsilon_{zx} \\ 2\epsilon_{xy} \end{bmatrix} = \begin{bmatrix} \frac{1}{E_x} & -\frac{\nu_{yx}}{E_y} & -\frac{\nu_{zx}}{E_z} & 0 & 0 & 0 \\ -\frac{\nu_{xy}}{E_x} & \frac{1}{E_y} & -\frac{\nu_{zy}}{E_z} & 0 & 0 & 0 \\ -\frac{\nu_{xz}}{E_x} & -\frac{\nu_{yz}}{E_y} & \frac{1}{E_z} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{G_{yz}} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{G_{zx}} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{G_{xy}} \end{bmatrix} \begin{bmatrix} \sigma_{xx} \\ \sigma_{yy} \\ \sigma_{zz} \\ \sigma_{yz} \\ \sigma_{zx} \\ \sigma_{xy} \end{bmatrix}$$

Conclusion

- Seemingly simple questions (how strong) can have complex answers.
- Critical factors = depth of penetration &

type of stress

Factors to consider

- Speed
- Cost
- Strength
- Appearance

Biscuit Joint Trade-offs

- Weaker than good M & T, but faster
- Weaker than Domino, but cheaper
- Stronger, faster, less fussy than dowels, but more expensive
- Prettier than pocket screws, maybe stronger, but slower

- **Strong enough for many applications**

On with the show…

- Use largest # possible
- Mark and cut joints using **reference surface**
  - Bottom of joiner when possible
  - If you can ‘t be right, be consistent
  - Cabinetmaker’s triangle
- **Exact center** not important
  - Lateral adjustment
- Dry fit
- Glue and clamp
- Let dry before sanding or planing

Sample joints

- Twenty different types of joints demo