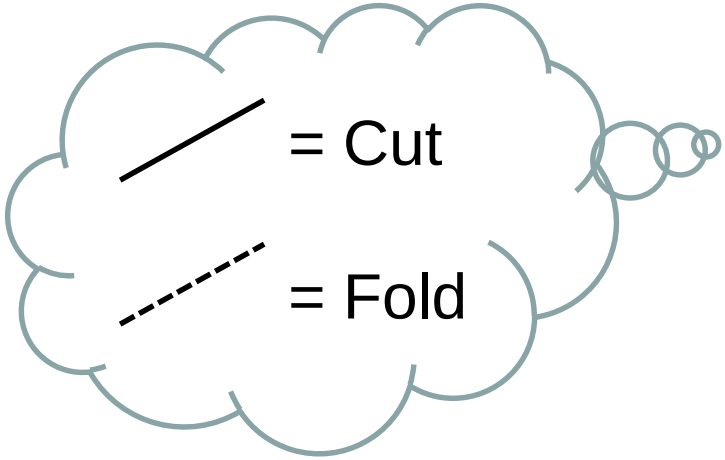
Paper Engineering

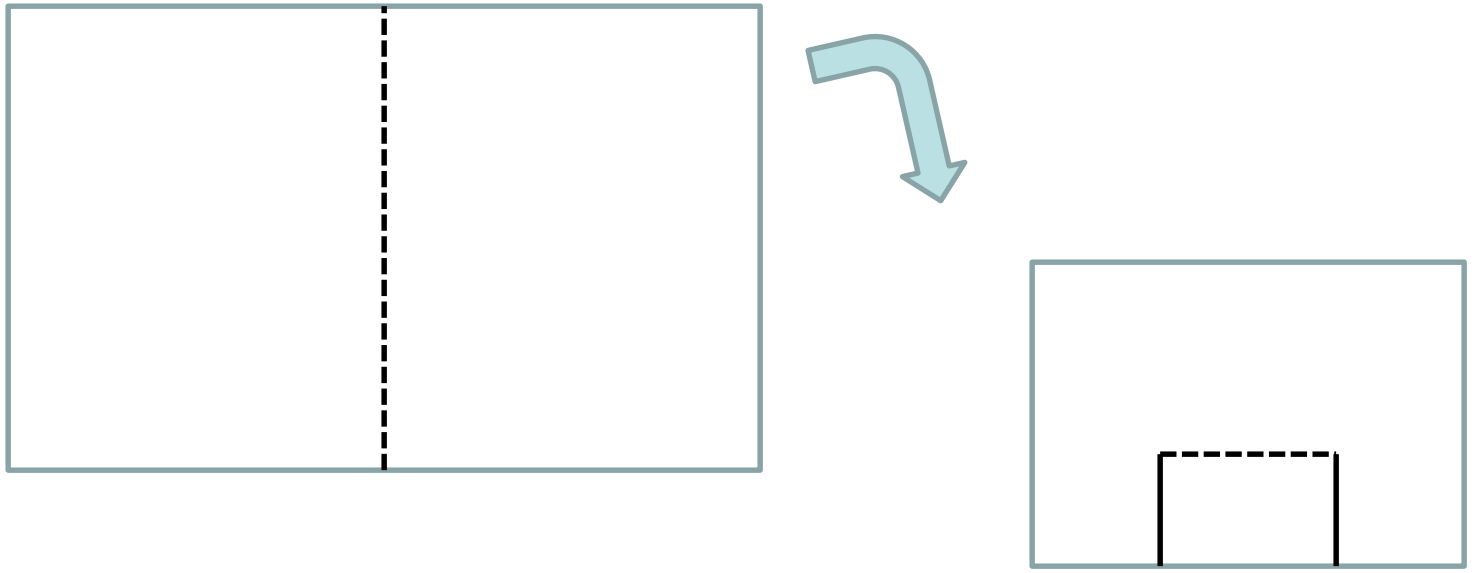
(Geometric Art for the Rest of Us)

Joy Krygsheld, CEA Convention, October 2015

Most projects are based on one of four basic techniques…

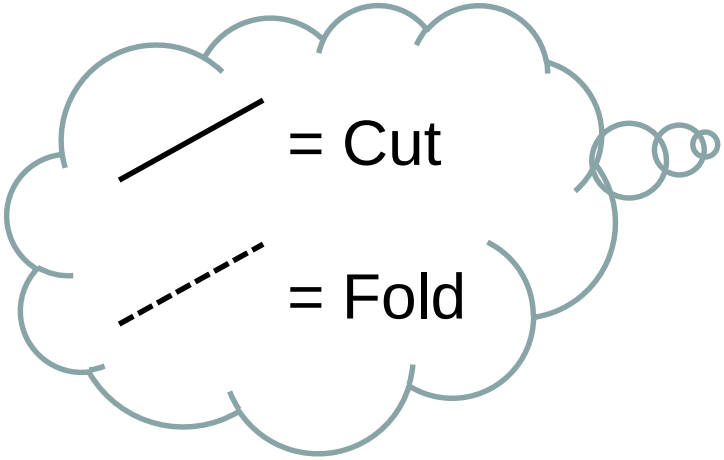
Technique #1
“Doggy Door”

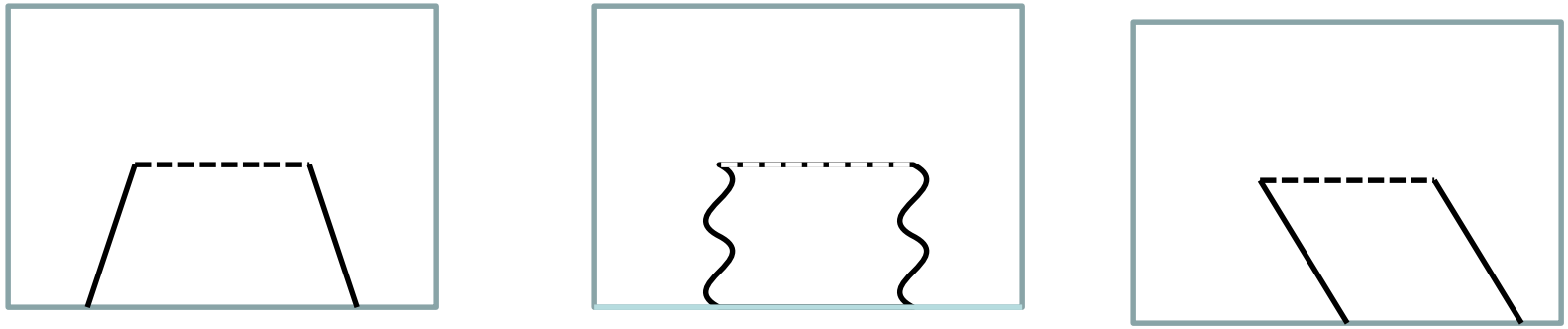




“Invert” the fold at the bottom and open to 90° to see your 3-D “box.”

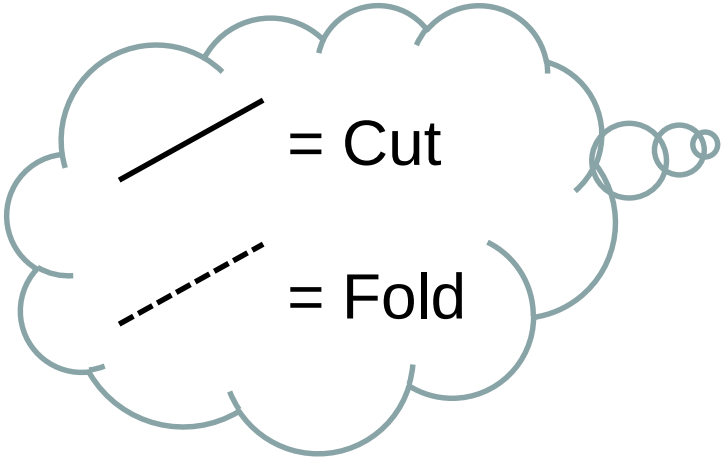
Technique #1
“Doggy Door”

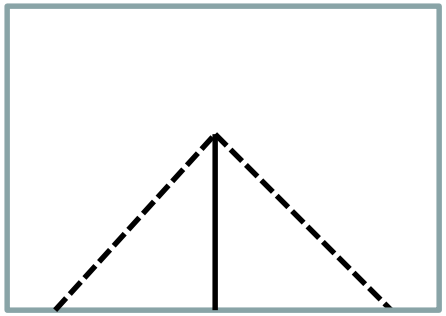




Try variations on your cuts
for a different effect!

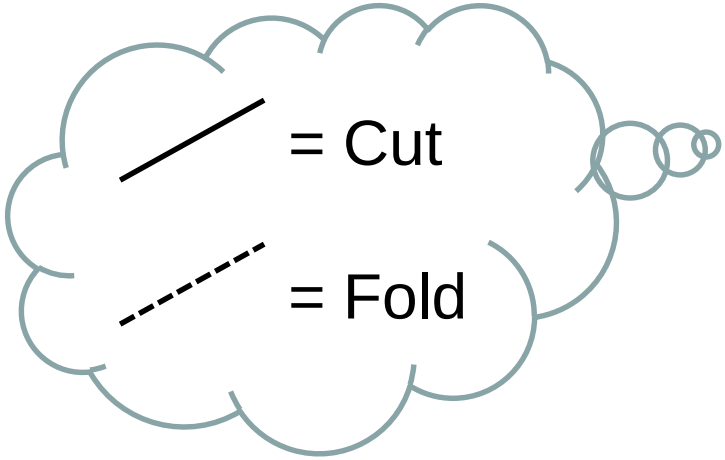
Technique #2
“Hi-Ho”

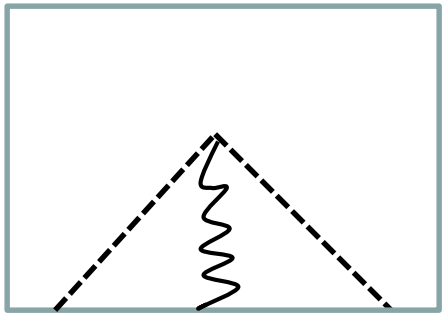




Invert your folds for something to talk (about?).

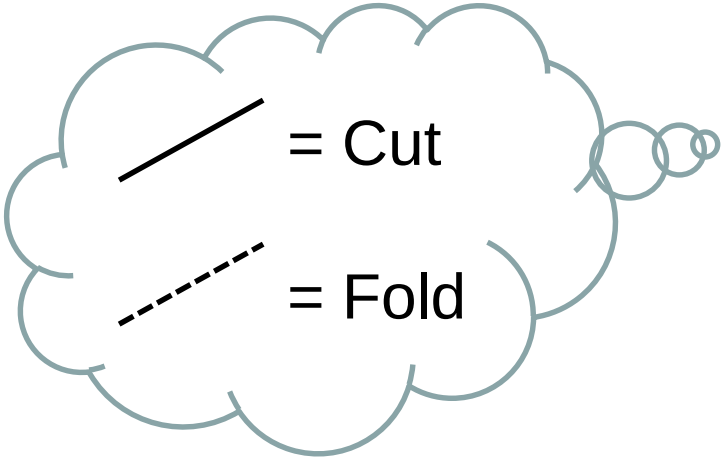
Technique #2
“Hi-Ho”

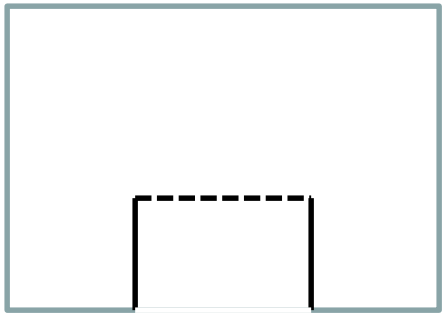




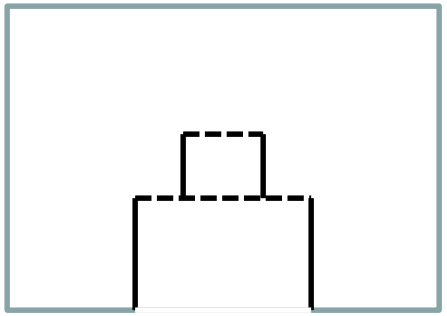
Try variations on your cuts
for a different effect or
add “eye slits” or ?????

Technique #3
“Layered Boxes”

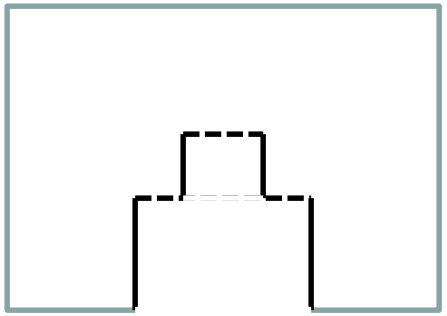




Start with a standard “Doggie Door.”

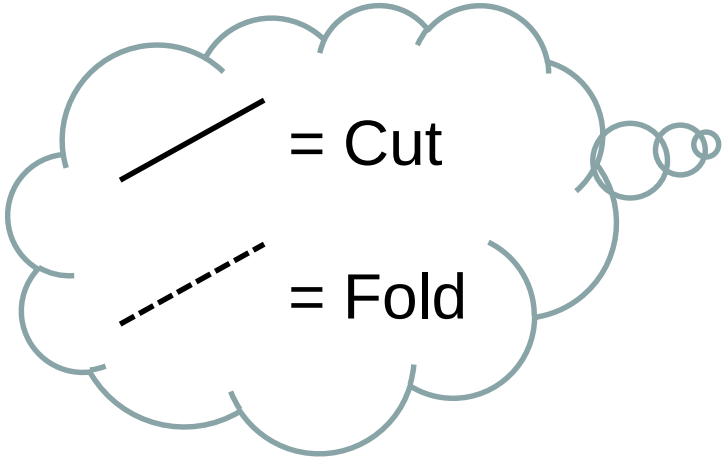


Create another “Doggie Door” on the next level up.

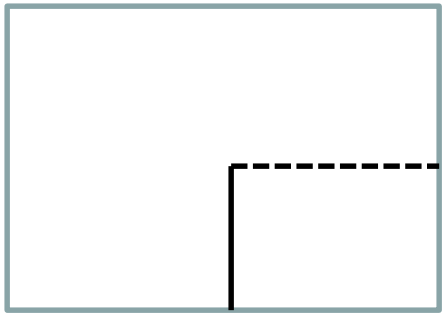


Repeat. How far can you cut and still have it work?

Technique #4
“Sierpinski’s Triangle”
(a recursive creation)

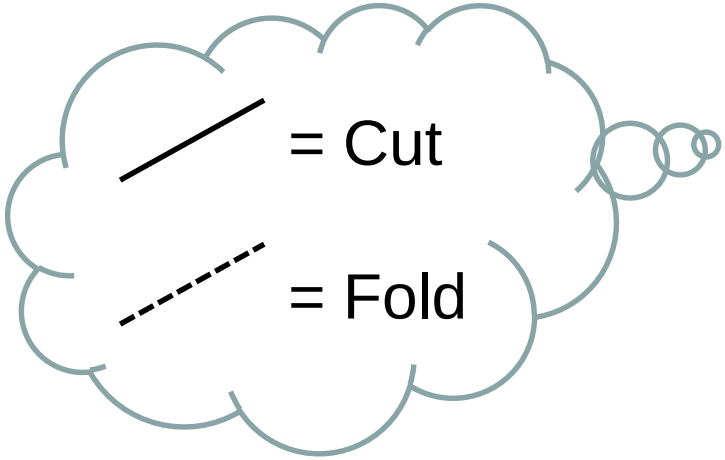


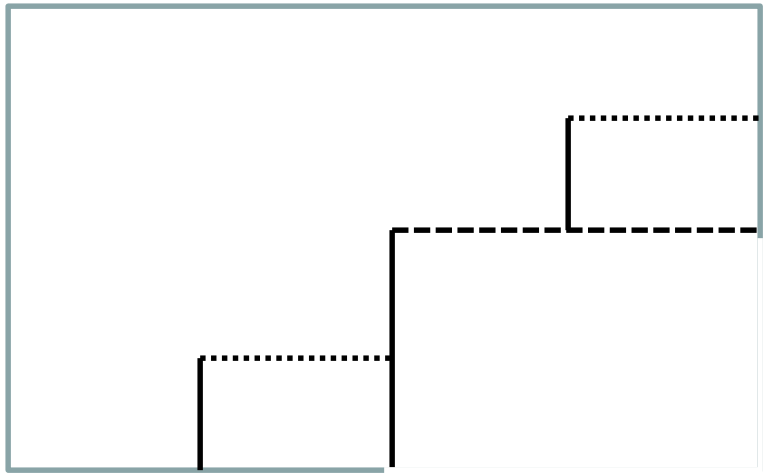
Begin as usual, folding and rotating the paper.

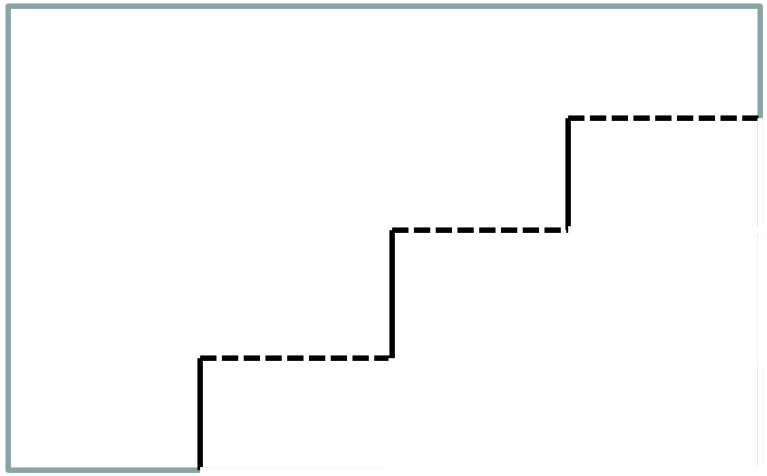


Make **one** cut, half-way along the folded edge and half-way up toward the open end of the paper. Fold and invert. This is the first “iteration,” or “generation.”

Technique #4
“Sierpinski’s Triangle”
(a recursive creation)

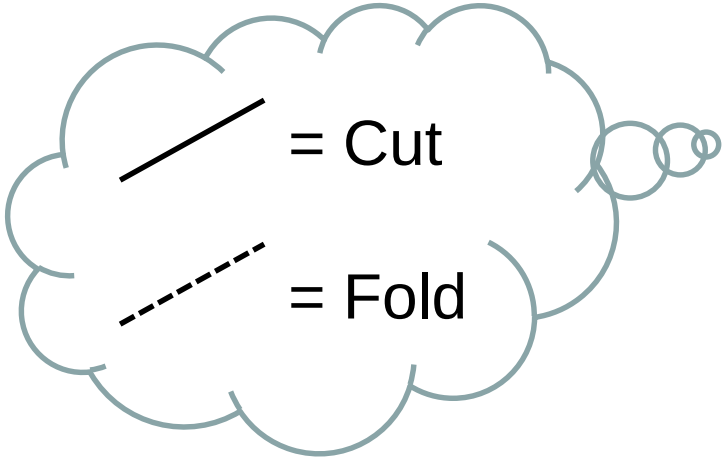


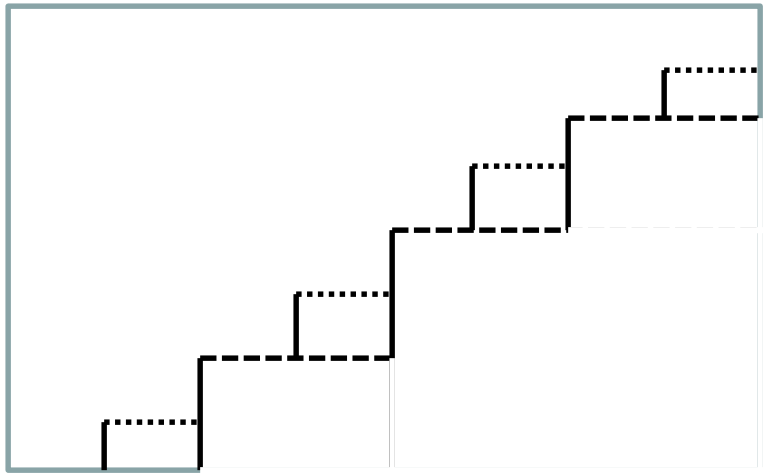




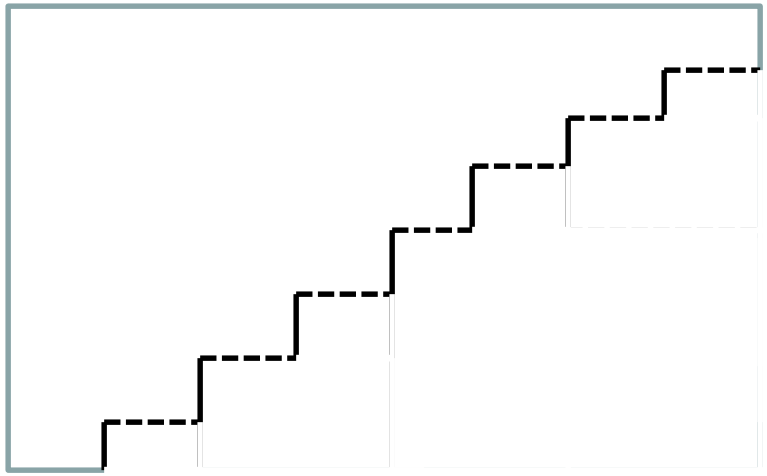
Now make one cut on each of the halves, “half-way” up. Fold/invert for the second “generation/iteration.”

Technique #4
“Sierpinski’s Triangle”
(a recursive creation)





Repeat the cut/fold/invert process for the third “generation/iteration.”



The final samples shown went to the fourth generation/iteration. How many iterations can you do?

A few helpful tips to keep in mind:

(You may wish to share these with your students or just let them discover them for themselves.)

- Cuts should stop “half-way” or before.
- A backing sheet with a contrasting color yields a more impressive result.
- More than one technique can be used on the same creation.
- The best way to do Paper Engineering is by experimentation – have fun!

Educational Concepts Addressed:

- Geometry vocabulary – as you “coach” students on creating the figures, use proper vocabulary (“right isosceles triangle,” “midpoint,” “adjacent,” “recursive,” etc.).
- Spatial awareness
- Fine motor skill development
- Geometric “hypothesis testing” (problem-solving with geometric models)
- Construction of 3-dimensional geometric figures
- Springboard for discussion on other topics including fractals, Pascal’s Triangle, Sierpinski’s Triangle, etc.

Name:_____ Class Period _____ Due Date_____

Paper Engineering Project Scoring Rubric (Extra Credit)

Basic Shapes

1 shape	2+ shapes
1 pt.	2 pts.

Neatness

Not so neat	Neat
1 pt.	2 pts.

Color

Color	Creative use of color
1 pt.	2 pts.

Design

Copied idea from class	Original idea	Extremely creative, original idea
1 pt.	3 pts.	4 pts.

Grade yourself. My score is _____ extra credit points.

Extra credit points earned: _____ (Comments on reverse)

Acknowledgements/References:

- Thanks to Sue Younker and Marisa Struyk, Metropolitan Mathematics Club of Chicago Conference presenters 1-'10 (they got me hooked and inspired this presentation).

- Experimentation is best, but if you'd like resources, here are some excellent books, available on Amazon or eBay:

Kirigami *(Laura Badalucco 2000)*

Kirigami Greeting Cards: The Art of Paper Cutting and Folding *(Karol Krcmár, 2005)*

Paper Engineering for Dummies *(Rob Ives, 2009)*

Paper Engineering for Pop-up Books and Cards *(Mark Hiner, 1986)*

Pop-Up Paper Structure: The Beginner's Guide to Creating 3-D Elements for Books, Cards & More *(Heidi Pridemore, '07)*

A Few Notes about this Presentation:

- I have intentionally left out the pictures of most of the "finished products" because part of the beauty of Paper Engineering is the aspect of discovery, serendipity. Samples act as 3-dimensional illustrations without being "how-to" guides.
- You are welcome to use the presentation yourself as-is or modify it to your preferences. You can download it from my website at jkrygsheldlcs.weebly.com/schedules-and-links.html
- The (extra credit) scoring sheet comes compliments of S. Younker and M. Struyk (print it as a 2-slide handout for a ½-sheet copy).
- If you have a document camera or a webcam for presentations, you might consider hyperlinking it within your presentation.
- Thanks for coming!

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