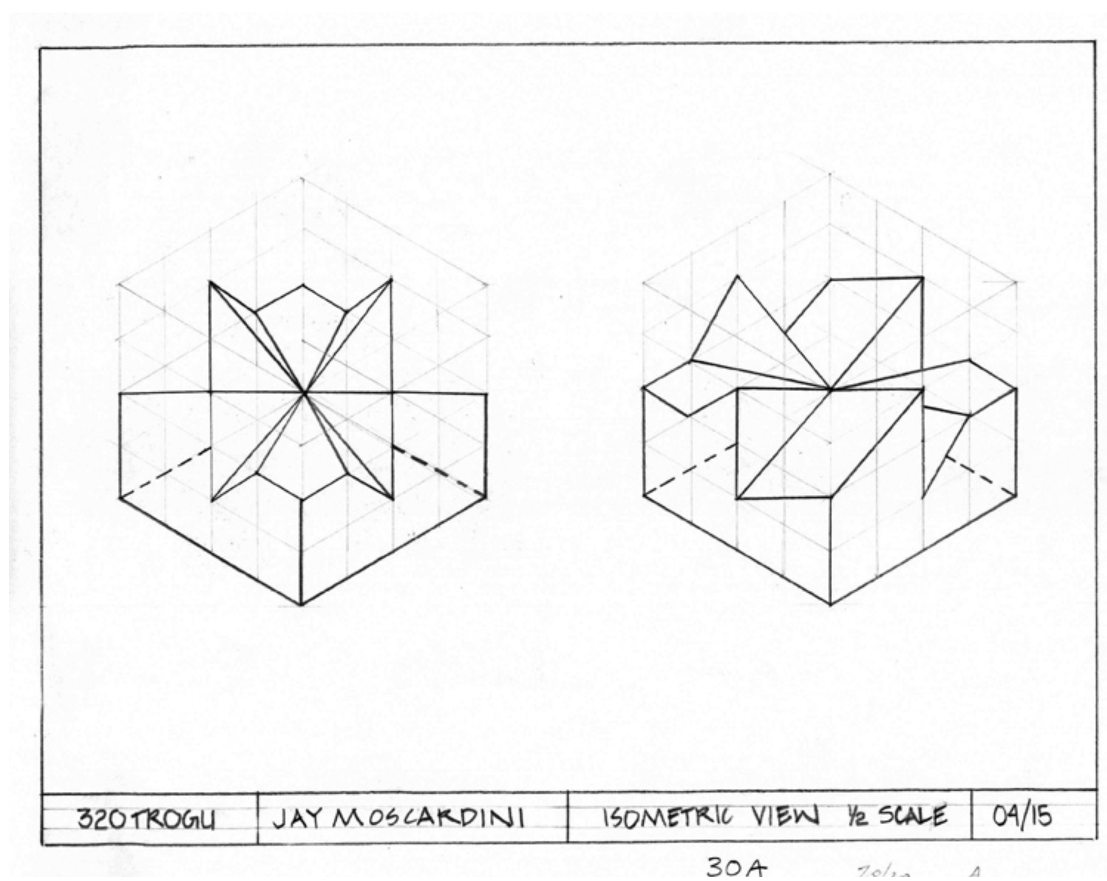
ROTATIONAL GEOMETRY AS A TEACHING TOOL : APPLYING THE WORK OF GIORGIO SCARPA

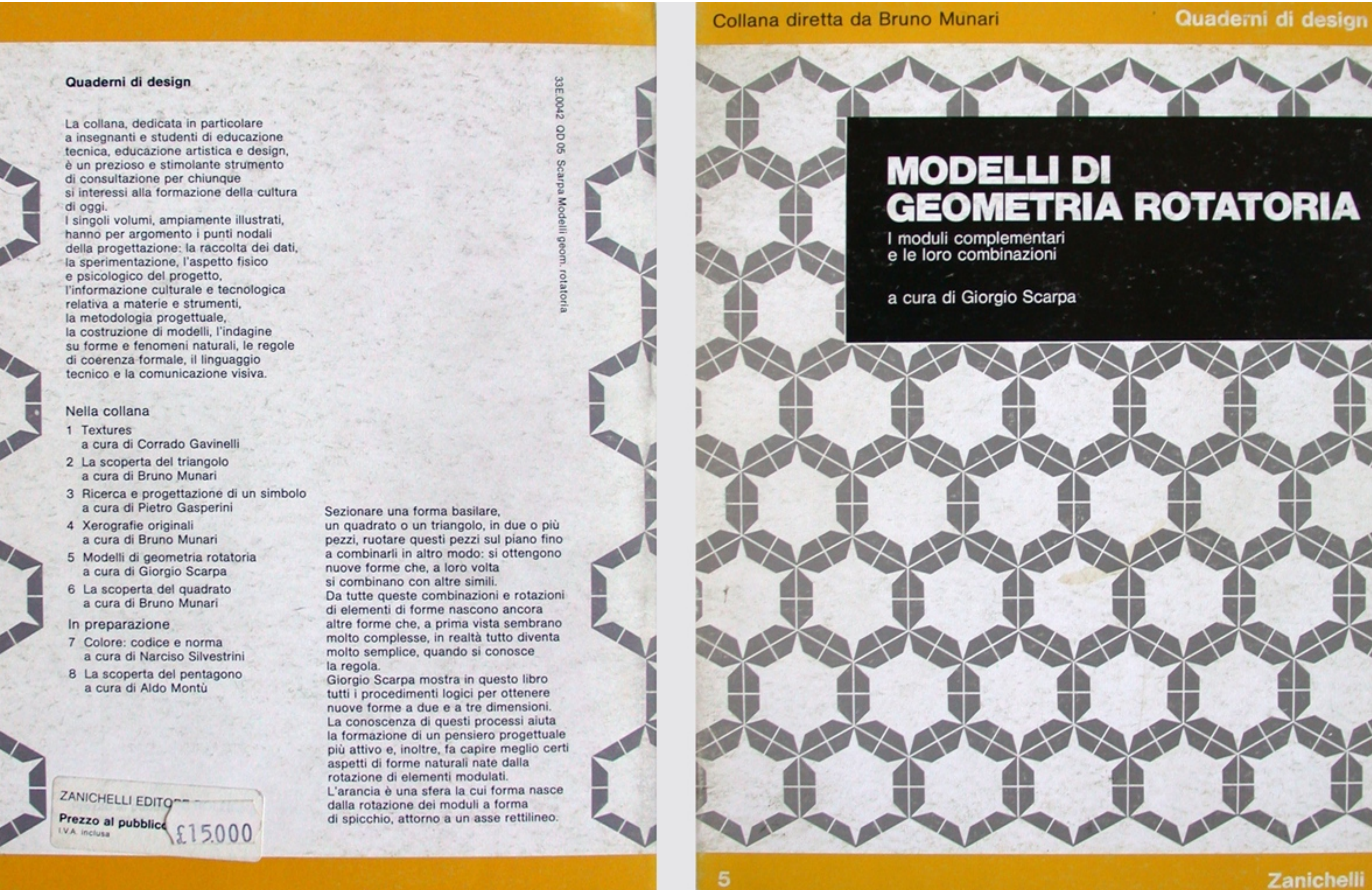
PINO TROGU – SAN FRANCISCO STATE UNIVERSITY

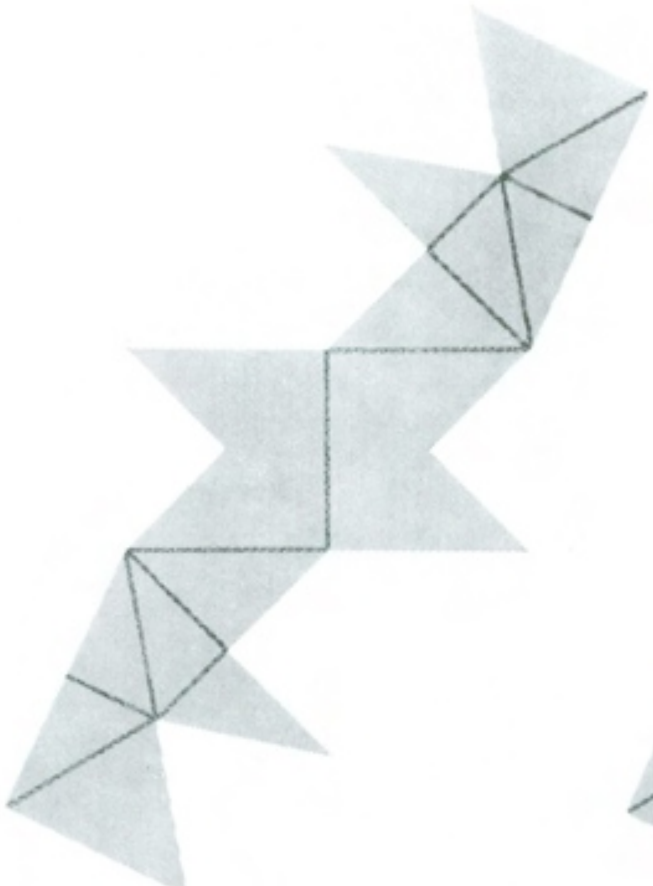
SIXTH INTERNATIONAL CONFERENCE ON DESIGN PRINCIPLES AND PRACTICES

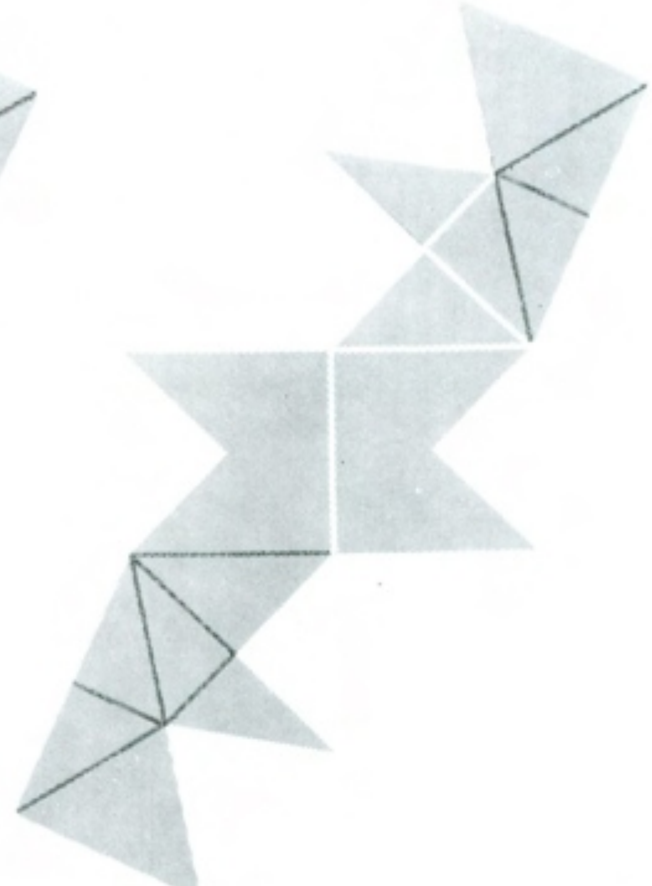
LOS ANGELES, JANUARY 21, 2012



go to last slide


Quaderni di design
La collana, dedicata in particolare a insegnanti e studenti di educazione tecnica, educazione artistica e design, è un prezioso e stimolante strumento di consultazione per chiunque si interessi alla formazione della cultura di oggi.
I singoli volumi, ampiamente illustrati, hanno per argomento i punti nodali della progettazione: la raccolta dei dati, la sperimentazione, l'aspetto fisico e psicologico del progetto, l'informazione culturale e tecnologica relativa a materie e strumenti, la metodologia progettuale, la costruzione di modelli, l'indagine su forme e fenomeni naturali, le regole di coerenza formale, il linguaggio tecnico e la comunicazione visiva.
Nella collana
1 Textures a cura di Corrado Gavinelli
2 La scoperta del triangolo a cura di Bruno Munari
3 Ricerca e progettazione di un simbolo a cura di Pietro Gasperini
4 Xerografie originali a cura di Bruno Munari
5 Modelli di geometria rotatoria a cura di Giorgio Scarpa
6 La scoperta del quadrato a cura di Bruno Munari
In preparazione
7 Colore: codice e norma a cura di Narciso Silvestrini
8 La scoperta del pentagono a cura di Aldo Montù
ZANICHELLI EDITO
Prezzo al pubblico
I.V.A. inclusa
£15000
Sezionare una forma basilare, un quadrato o un triangolo, in due o più pezzi, ruotare questi pezzi sul piano fino a combinarli in altro modo: si ottengono nuove forme che, a loro volta si combinano con altre simili.
Da tutte queste combinazioni e rotazioni di elementi di forme nascono ancora altre forme che, a prima vista sembrano molto complesse, in realtà tutto diventa molto semplice, quando si conosce la regola.
Giorgio Scarpa mostra in questo libro tutti i procedimenti logici per ottenere nuove forme a due e a tre dimensioni.
La conoscenza di questi processi aiuta la formazione di un pensiero progettuale più attivo e, inoltre, fa capire meglio certi aspetti di forme naturali nate dalla rotazione di elementi modulati.
L'arancia è una sfera la cui forma nasce dalla rotazione dei moduli a forma di spicchio, attorno a un asse rettilineo.
33E.0042 QD 05 Scarpa Modelli geom. rotatoria
Collana diretta da Bruno Munari
Quaderni di design
MODELLI DI GEOMETRIA ROTATORIA
I moduli complementari e le loro combinazioni
a cura di Giorgio Scarpa
5
Zanichelli





ROTAZIONE-PIEGATURA DEGLI SVILUPPI

I collegamenti degli sviluppi di superficie esterna coi piani interni dell'esaedro determinano, come abbiamo visto, nuove configurazioni, nuovi sviluppi, ripiegando i quali, e passando quindi dal piano allo spazio, si ottengono moduli tridimensionali.
Il passaggio da due dimensioni a tre dipende:

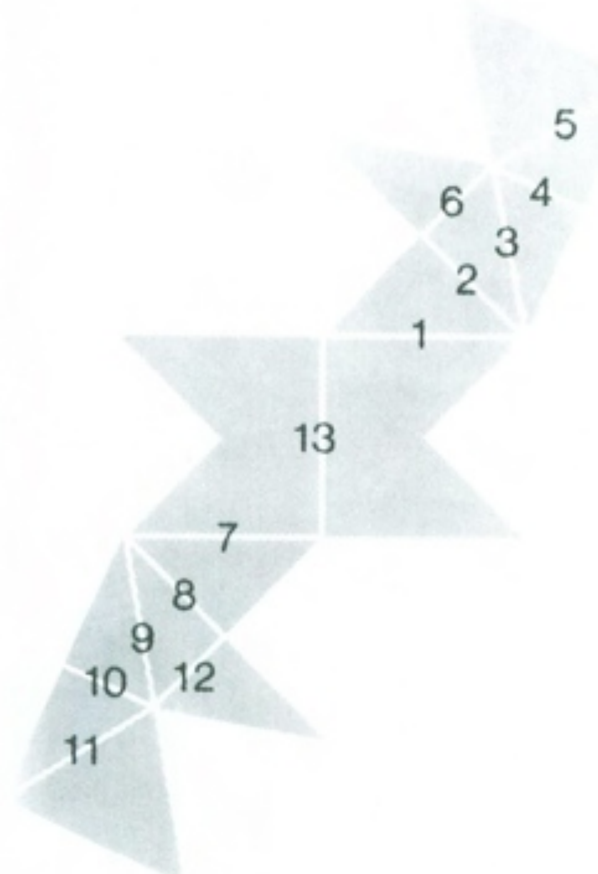
1. dal far assumere la funzione di assi di rotazione a linee che dimensionano le superfici degli sviluppi;

2. dall'individuare lungo queste configurazioni lineari, sequenze di piegatura costituenti determinati percorsi;

3. dalla scelta dei percorsi più logici ed economici;

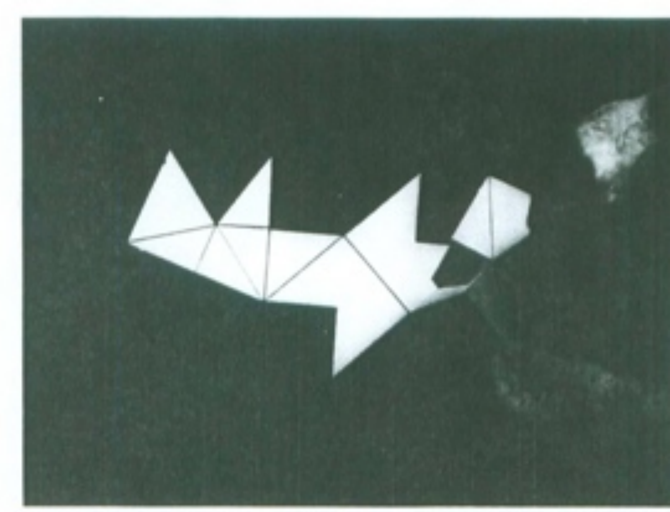
4. dal ruotare (piegare) secondo determinati angoli, parti del modello intorno a queste linee (assi);

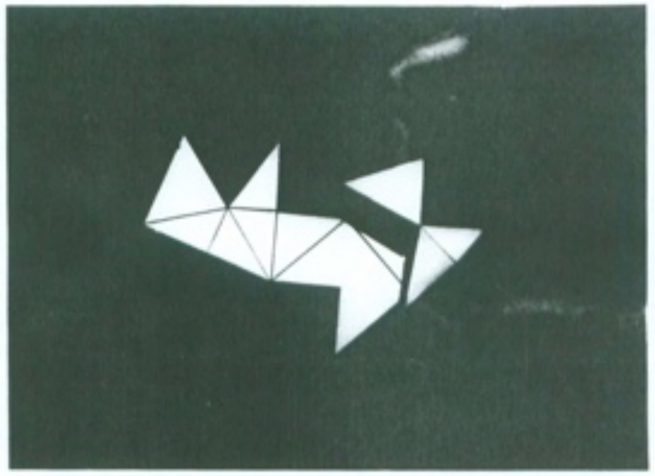
5. dal regolare numero e tipo di operazioni in riferimento a schemi di organizzazione formale.



cella cubica a cui riferire le sequenze di piegatura del modello.

Esempi:
ordine di piegatura indicato sulle linee interne dai numeri 1-13, relativo alla definizione del modulo;



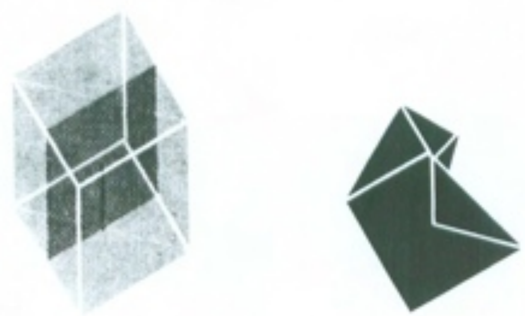


Il percorso lineare intorno al quale ruotare
i piani del modello è il seguente:

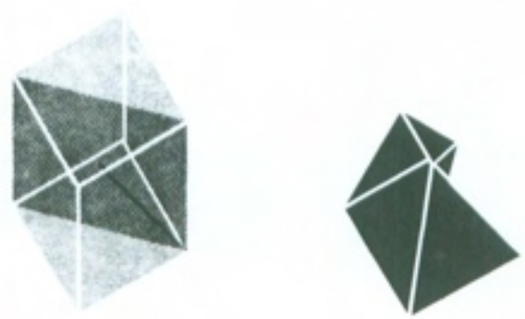
1. spigolo del cubo

2. metà diagonale di una faccia

3. metà diagonale interna



4. metà asse interno



5. metà diagonale interna

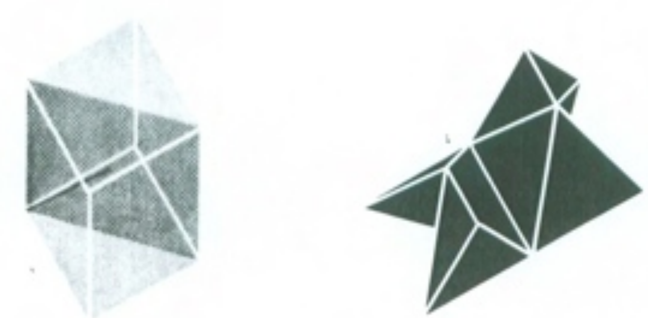
6. metà asse interno

7. spigolo

8. metà diagonale di una faccia

9. metà diagonale interna

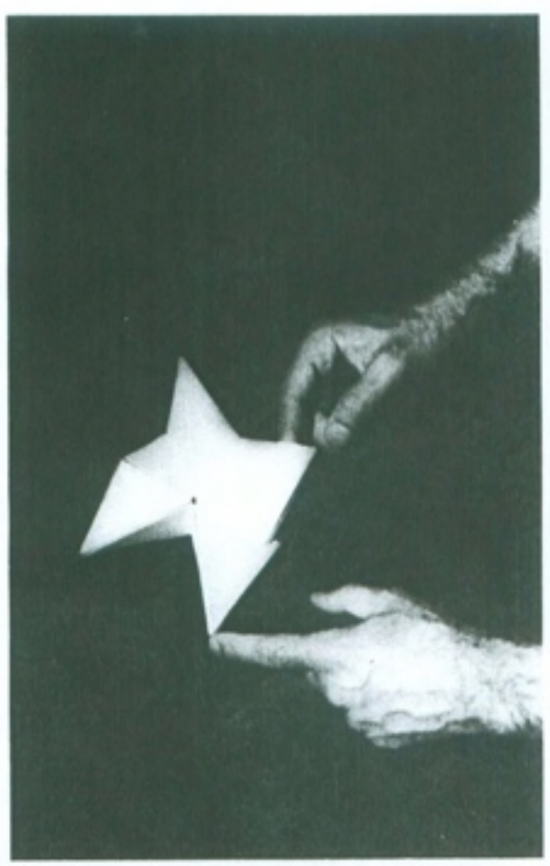
10. metà asse interno

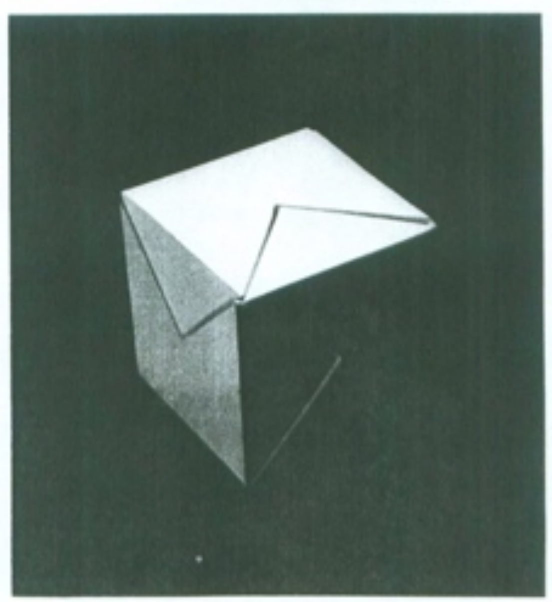


11. metà diagonale interna

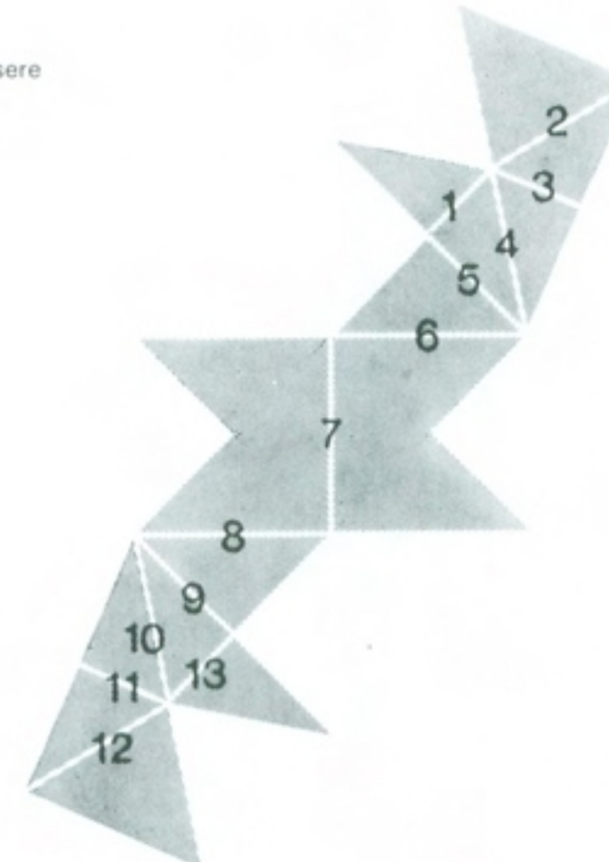
12. metà asse interno

13. spigolo
Le rotazioni sono di 90°.

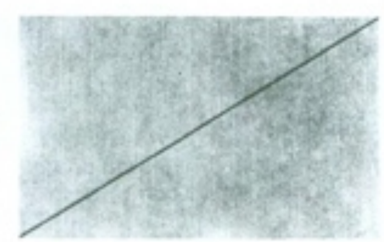




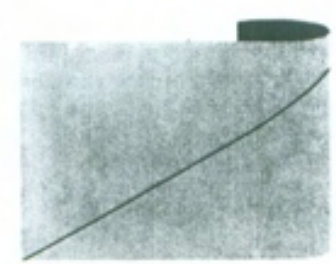
Uno stesso sviluppo può essere
variamente ripiegato.



A

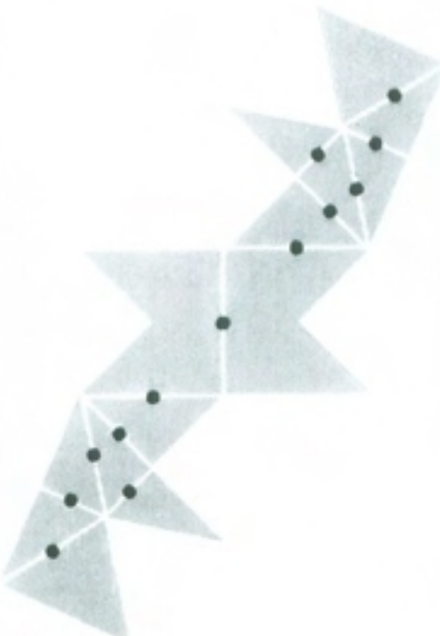


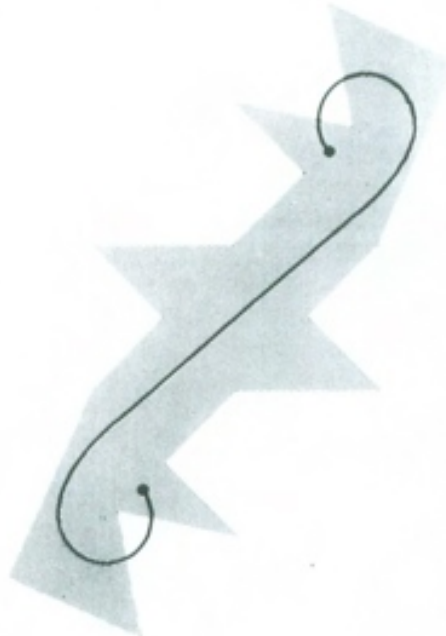
B

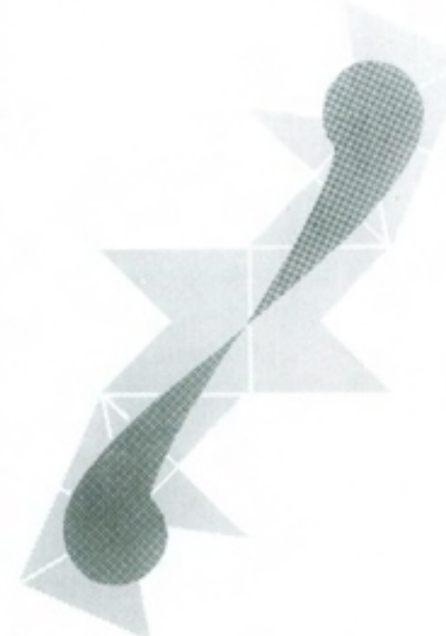


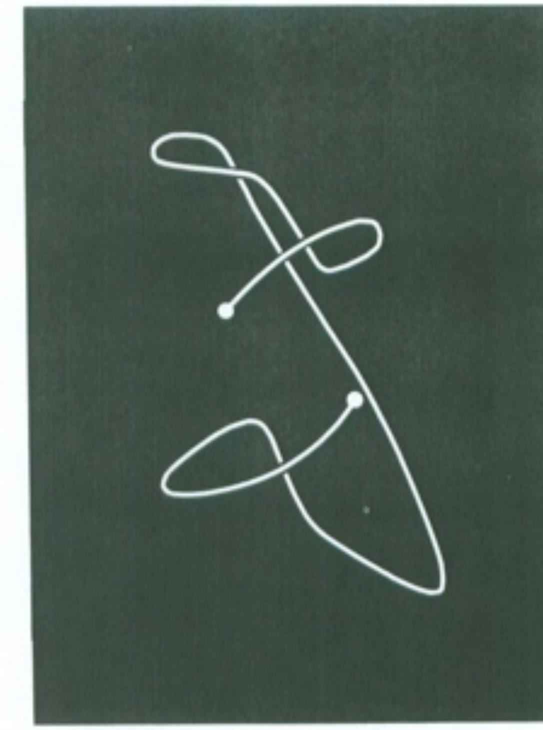
Che cos'è un'elica? è la curva spontanea
disegnata nell'aria dai semi del tiglio quando
si staccano dalla pianta;
o dalla terra, che ruotando nello spazio intorno
al Sole si sposta sull'asse di avanzamento del
Sole verso la stella Vega;
è per il pittore Paul Klee "...la più pura forma
di movimento pensabile".
In geometria, è nella sua forma più semplice,
lo sviluppo cilindrico della diagonale
di un rettangolo.

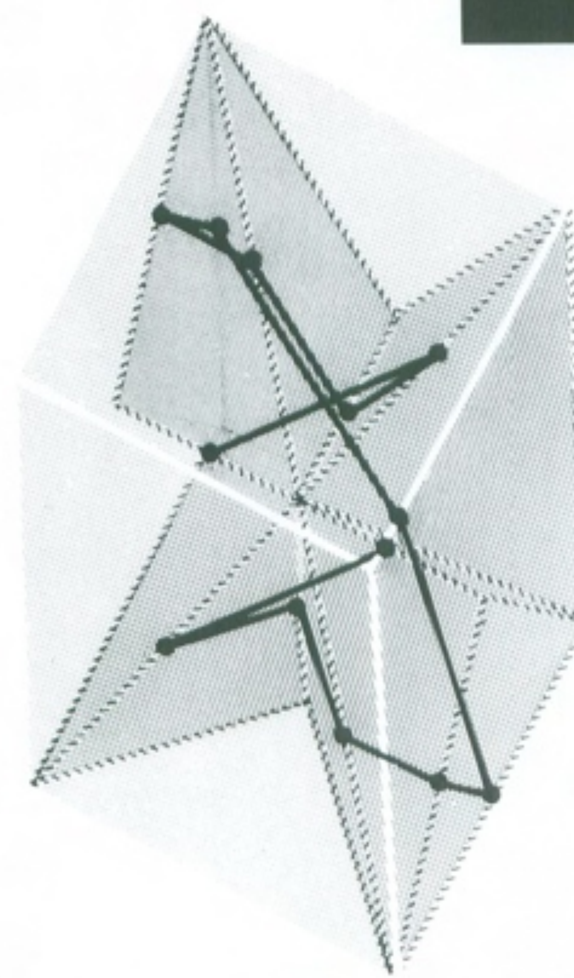
41







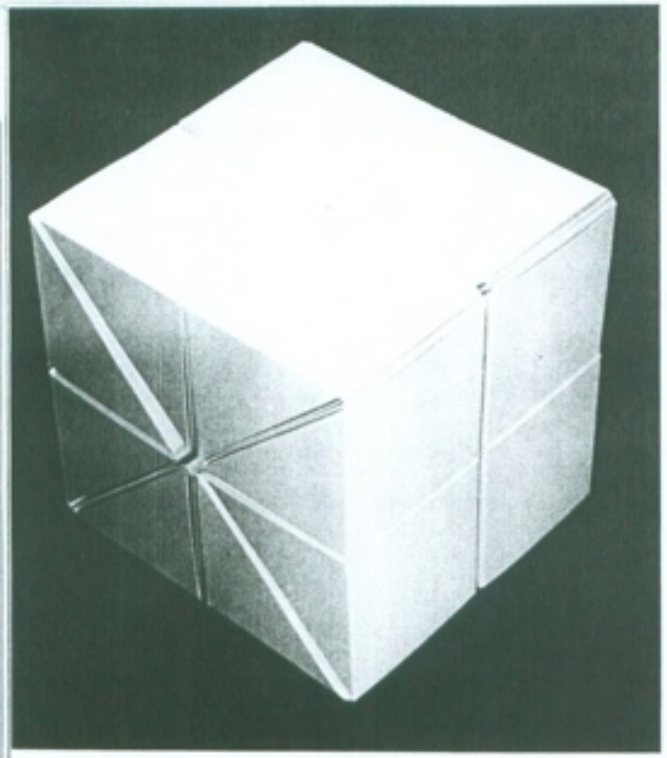




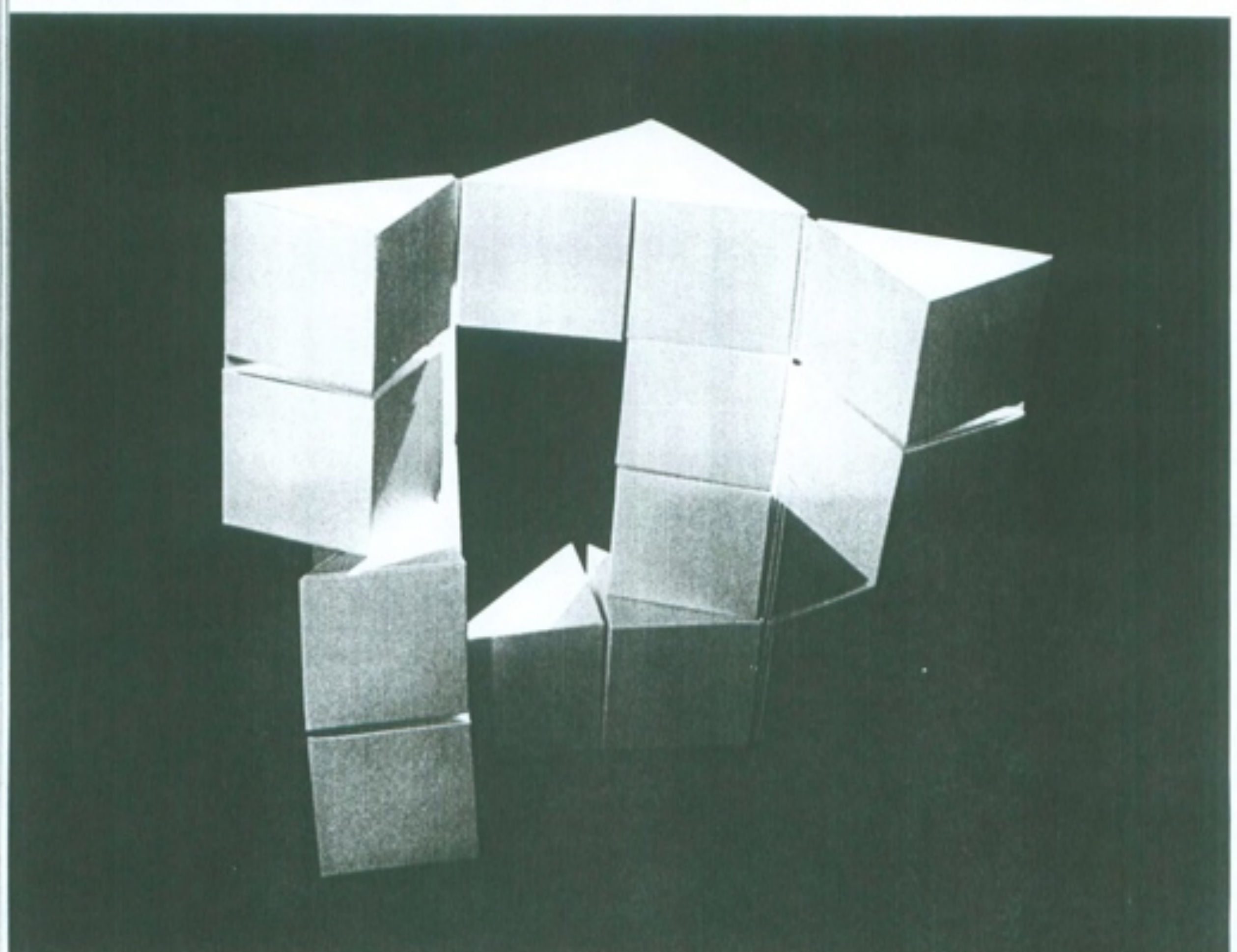
Consideriamo i piani articolati in due raggruppamenti (1-7 e 7-13, v. pagine precedenti) intorno al centro di rotazione 7; la loro forma complessiva è simile ad una *esse* che risulta più visibile se con una linea curva raccordiamo tra loro i punti da 1 a 13, o disegnamo due regioni che delimitano il tracciato puntiforme, accentuando l'andamento ciclico a due bracci dello sviluppo.
La composizione dei movimenti di piegatura con cui portiamo nello spazio i piani, ruotandoli intorno agli assi 1-13, dà come risultante una traiettoria a forma di elica.
Con questa mappa spaziale che unifica la successione dei movimenti, definiamo lo sviluppo in terza dimensione.
La rappresentazione di mappe dei movimenti di ripiegamento deve avere come fine il controllo dell'intero processo, in vista della sua semplificazione.

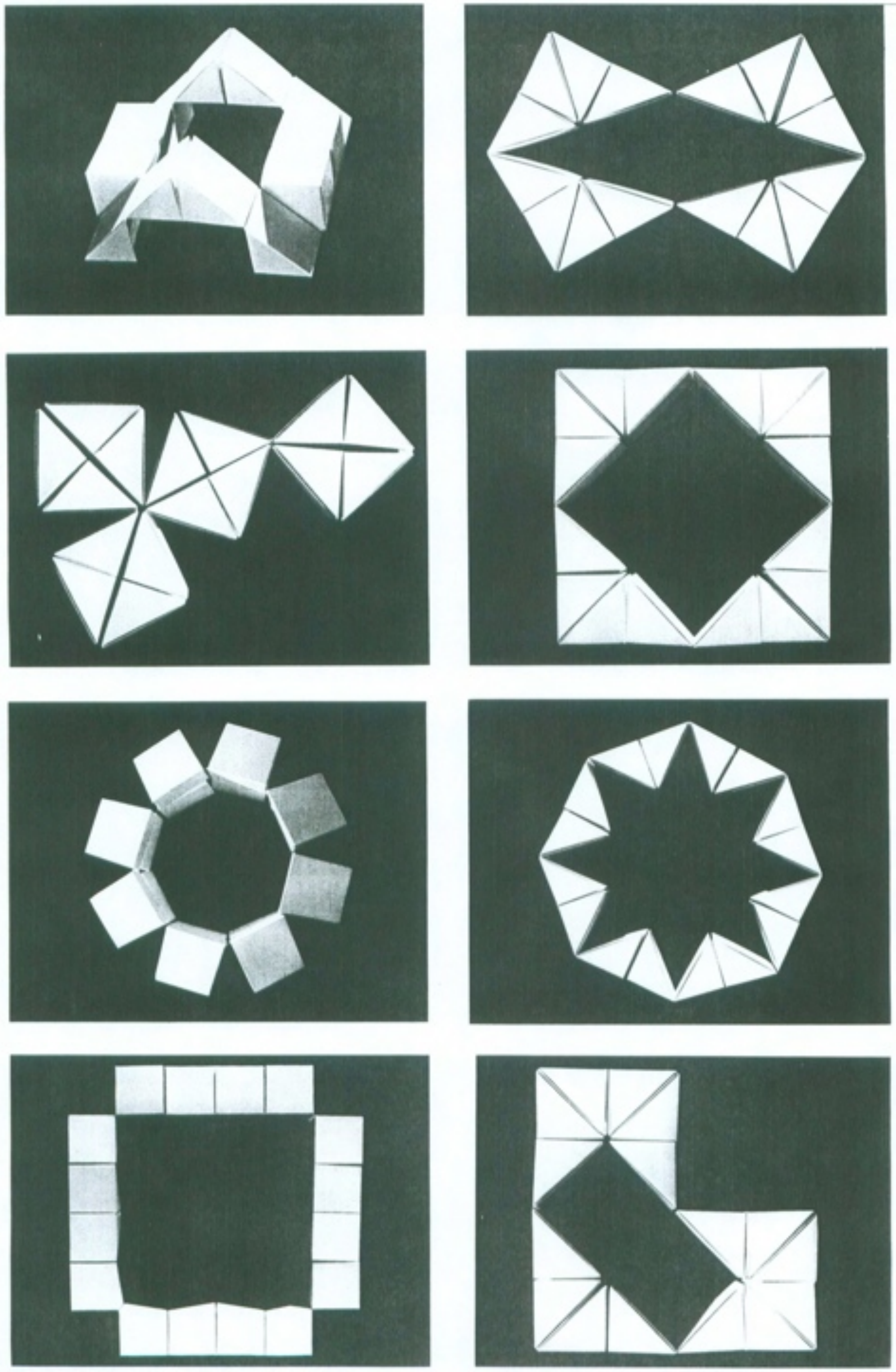
42

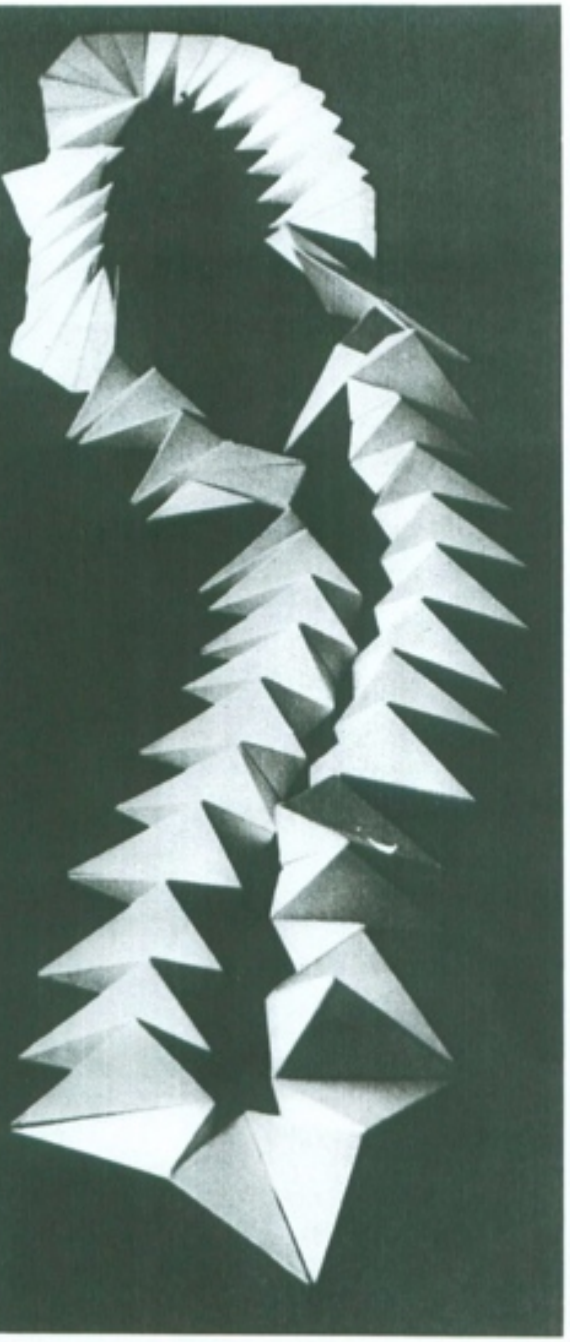
43

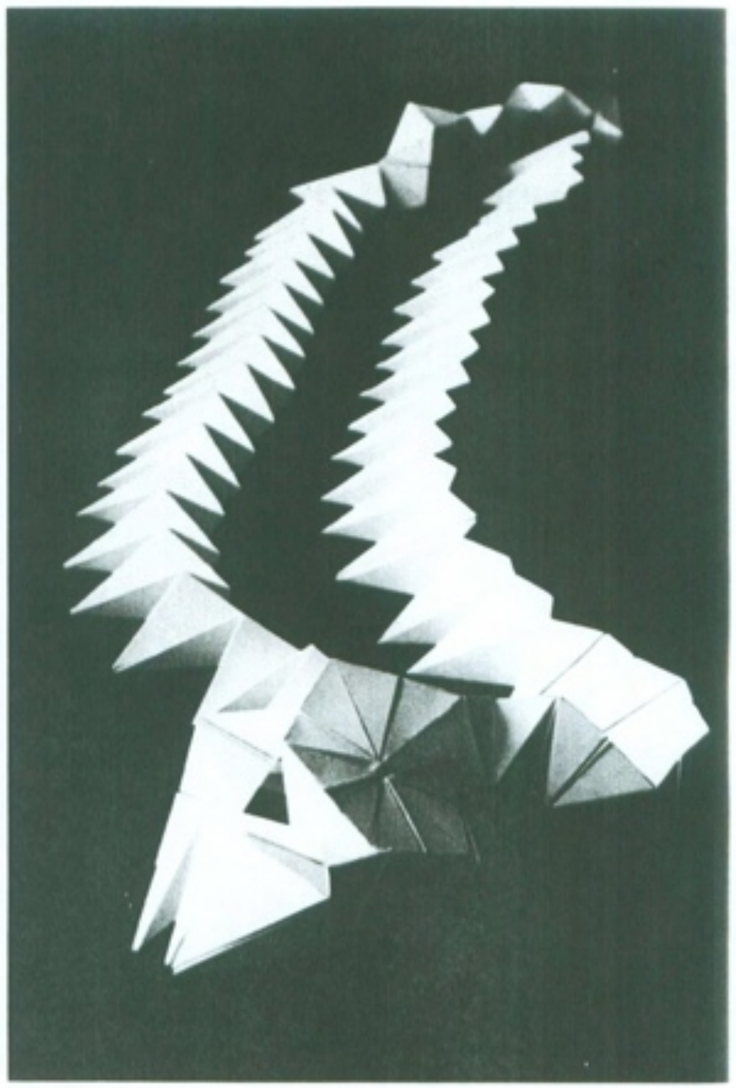


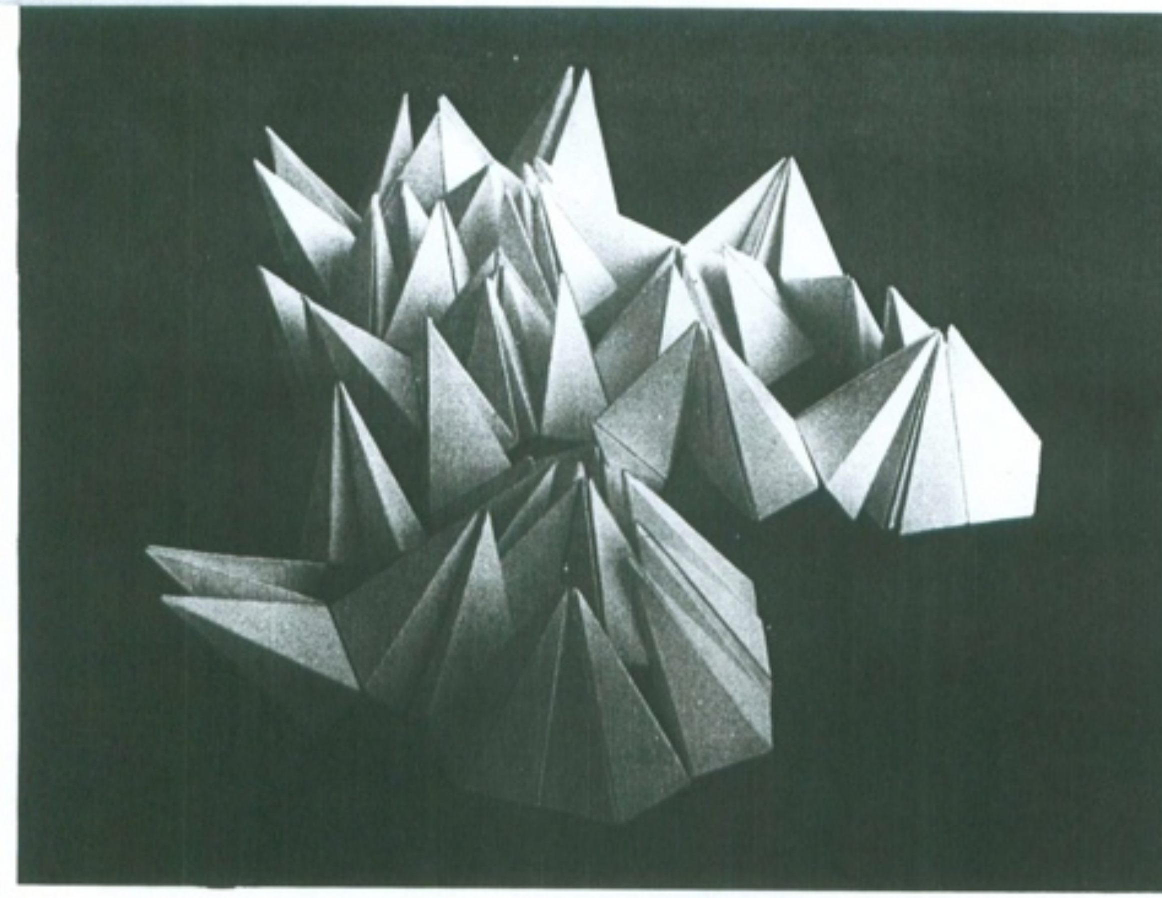
Rotazioni di catene esaedriche.

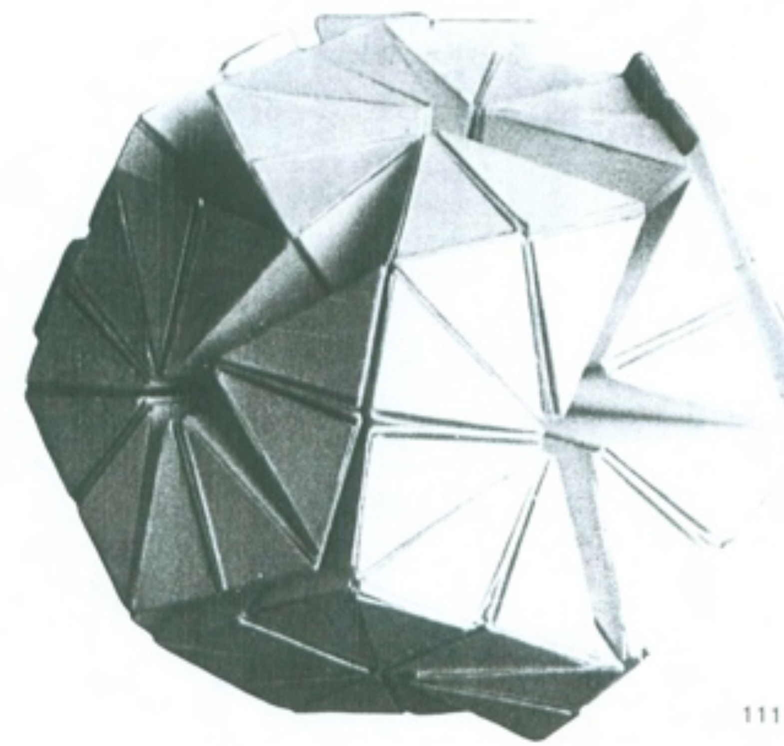








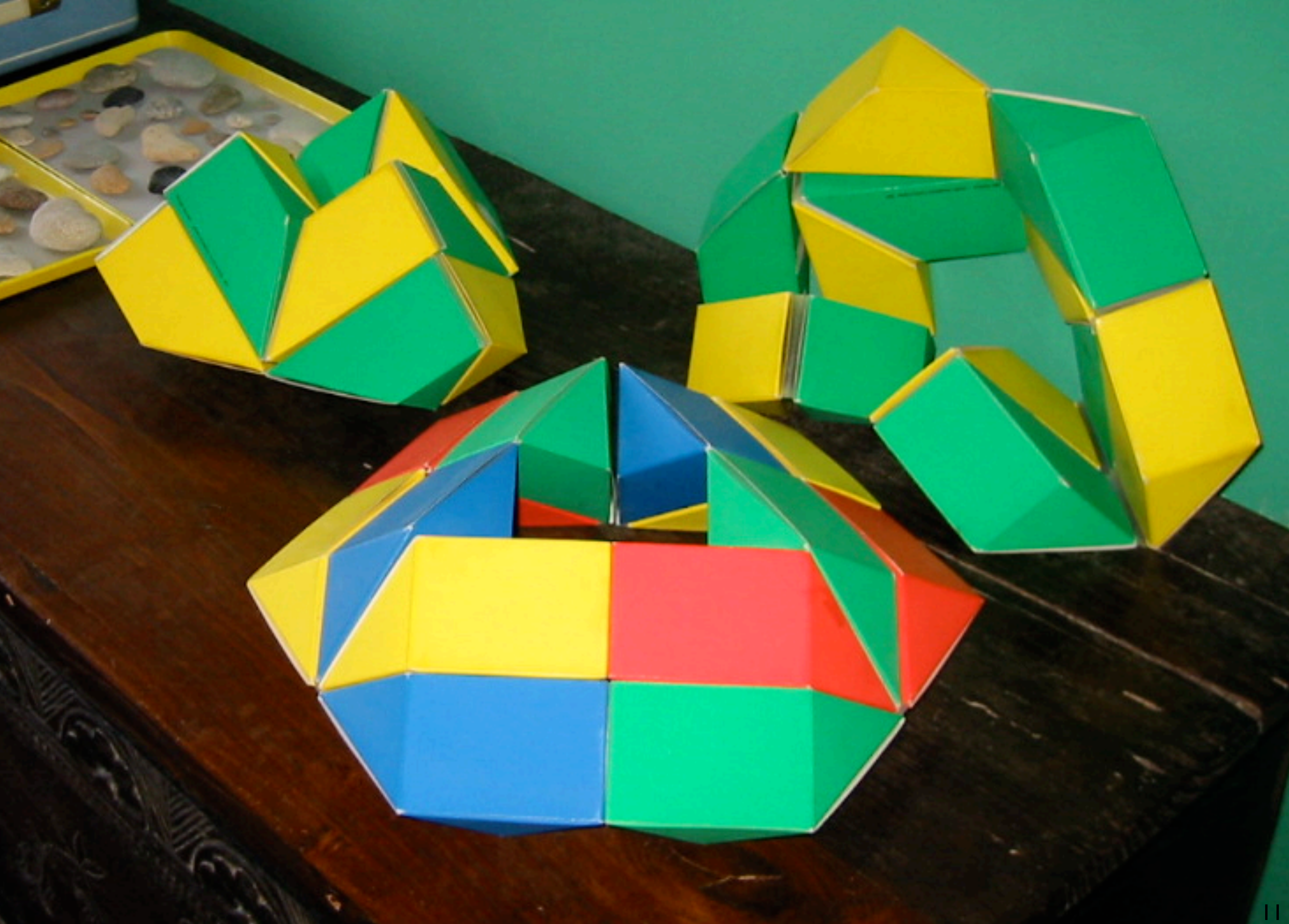




110

111


Museum of Art
HB
CONTE
PILOT SUPER GRIP 0.5



TWIN SECTION

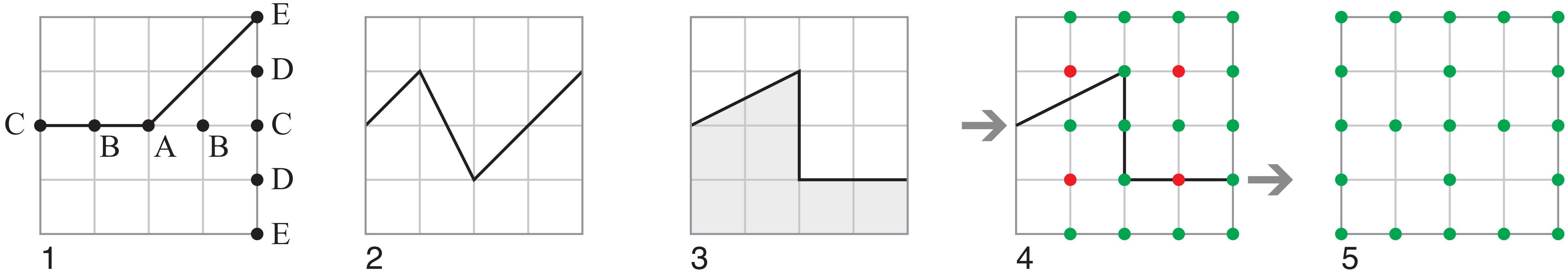


Fig. 1

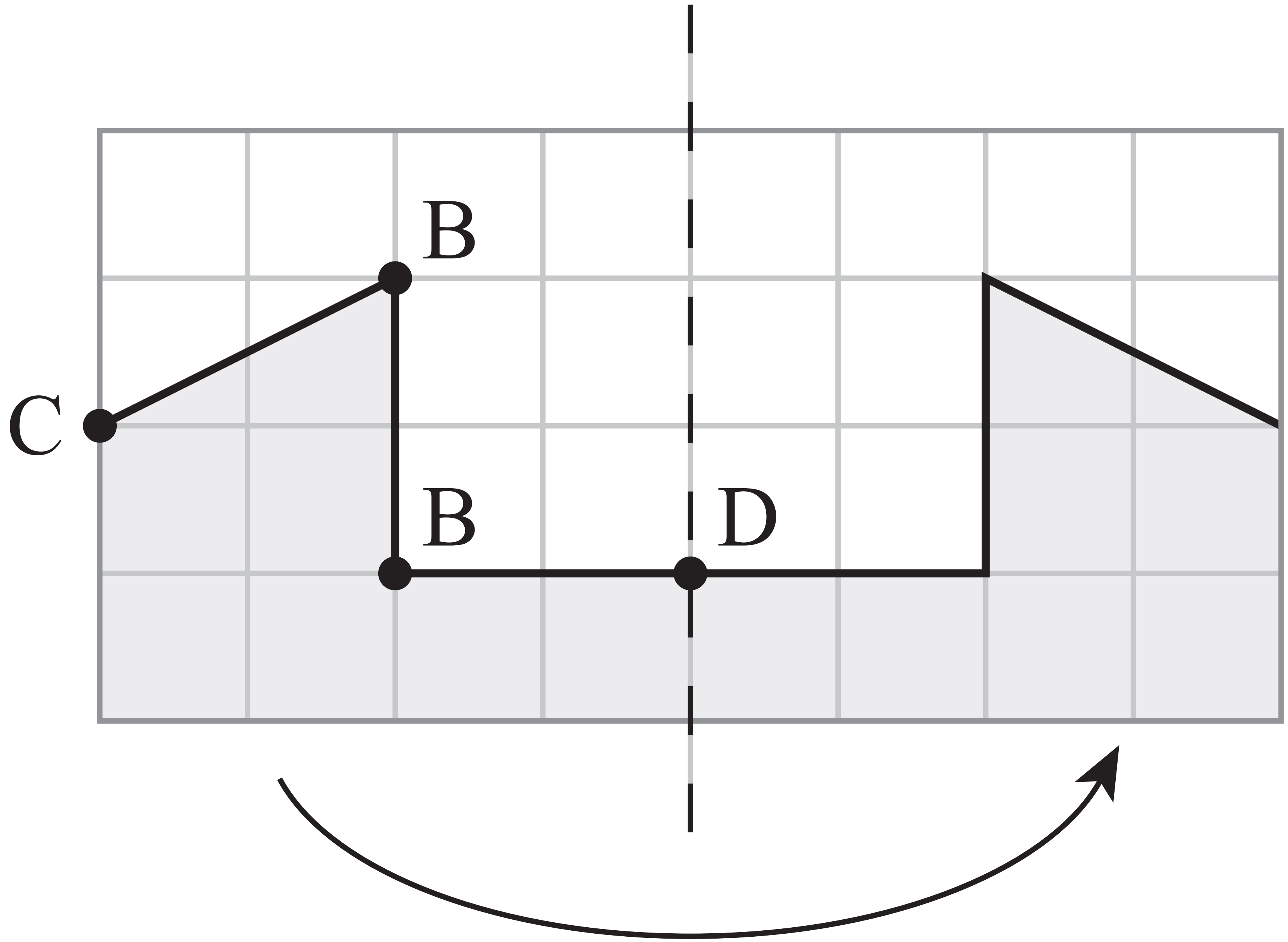


Fig. 2

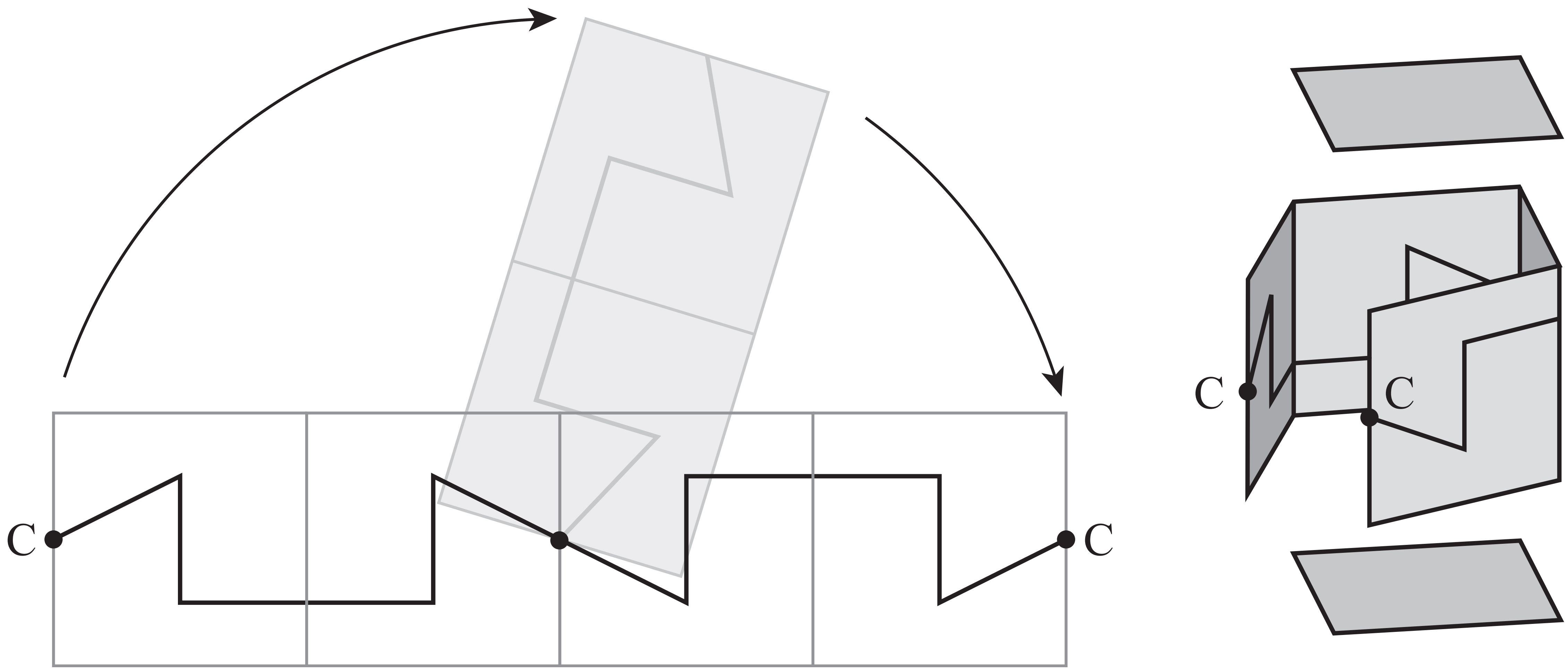


Fig. 3

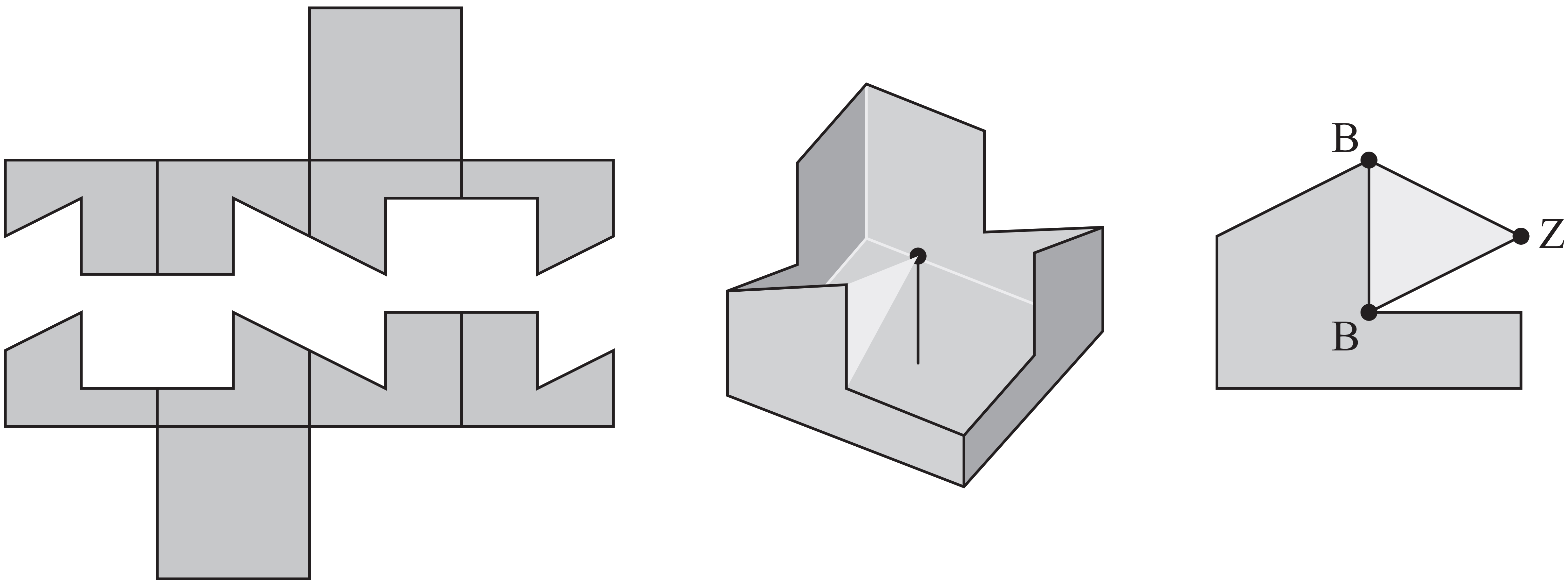


Fig. 4

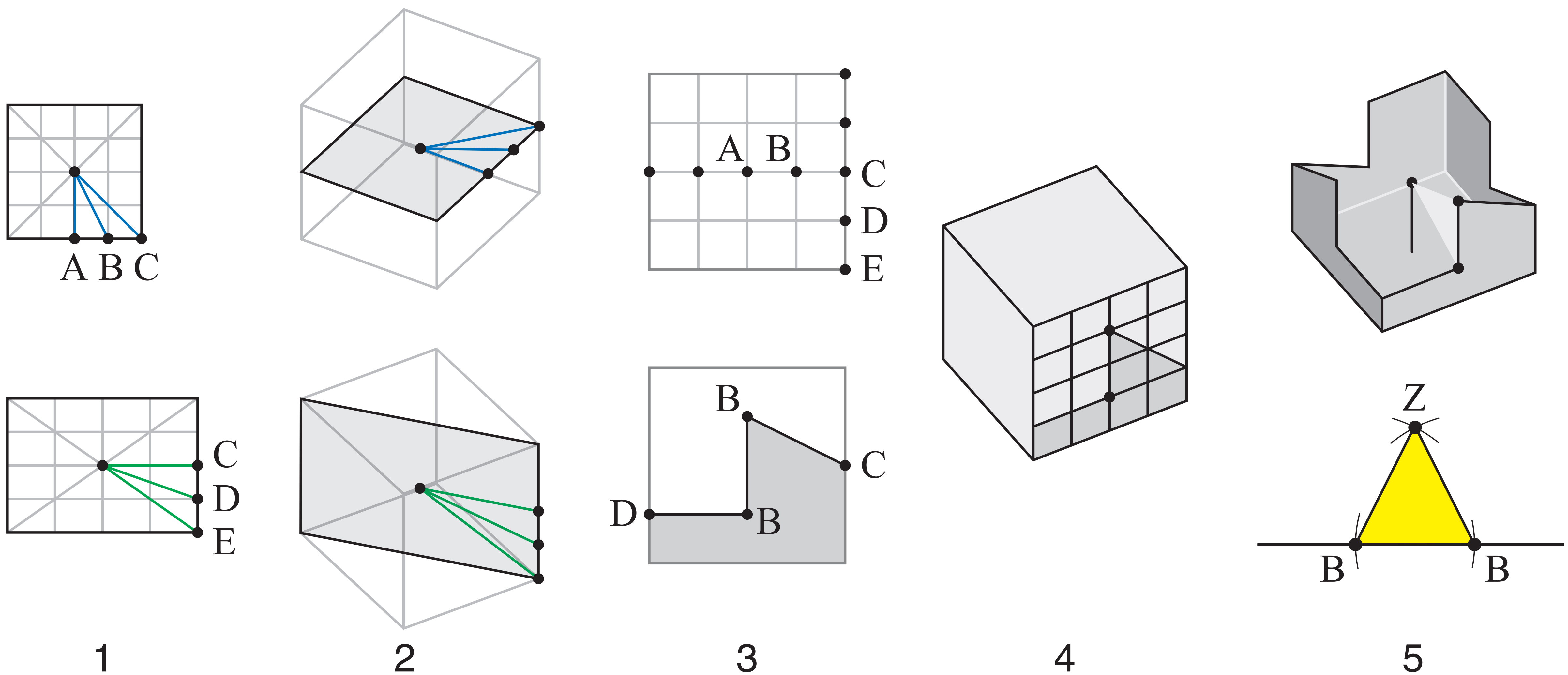


Fig. 5

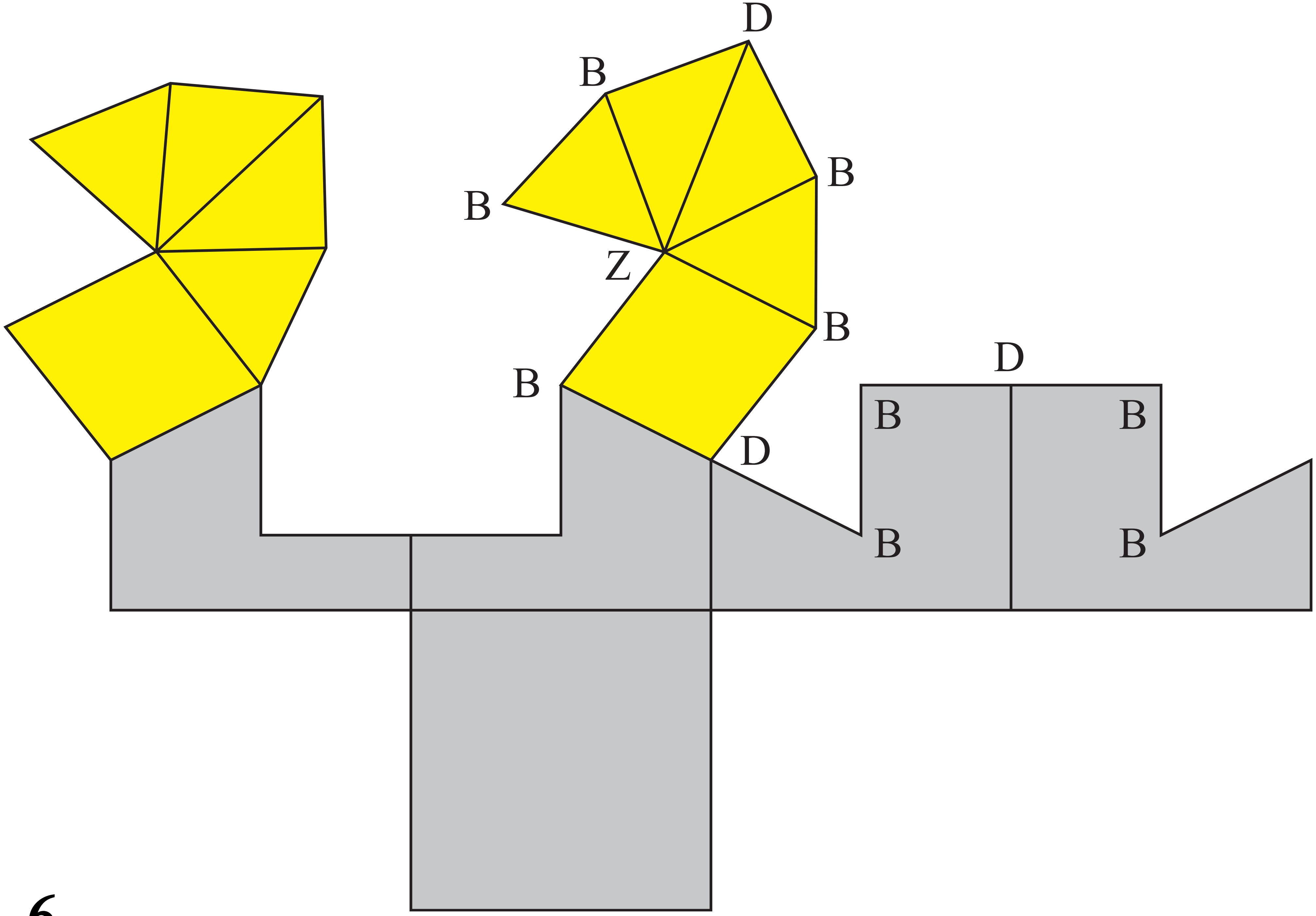


Fig. 6

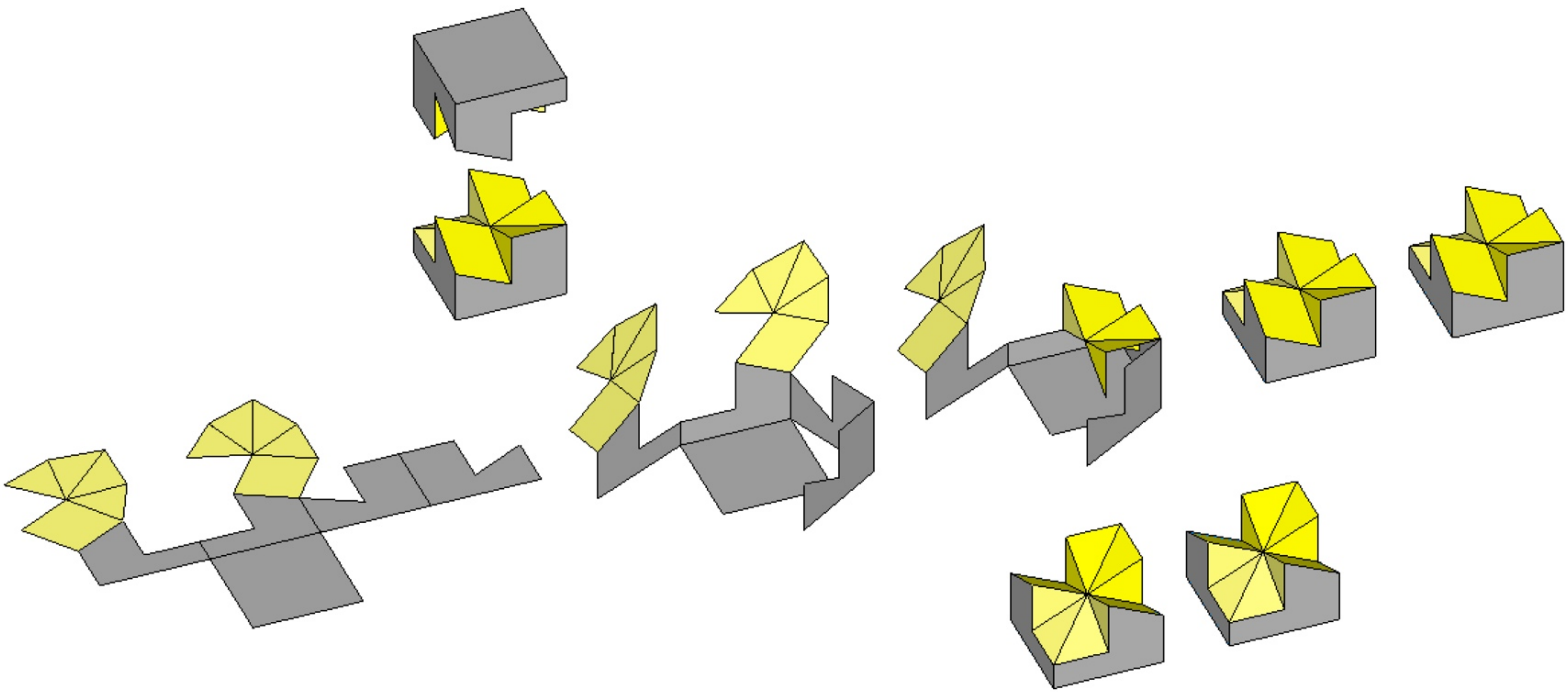
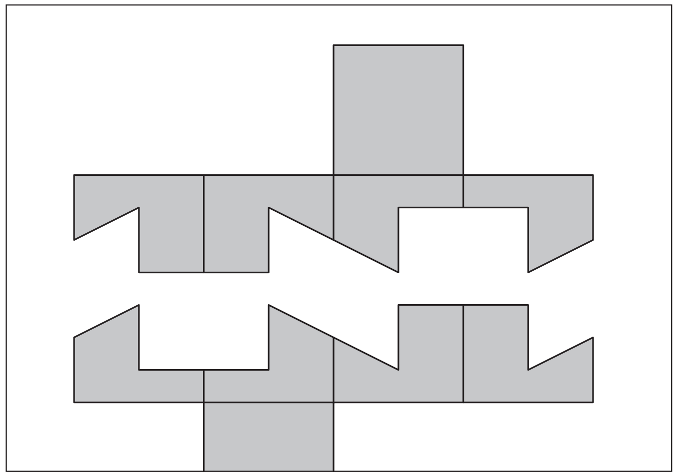
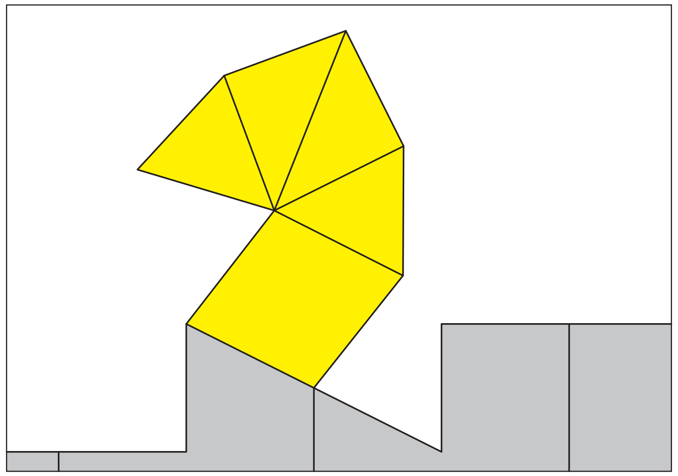


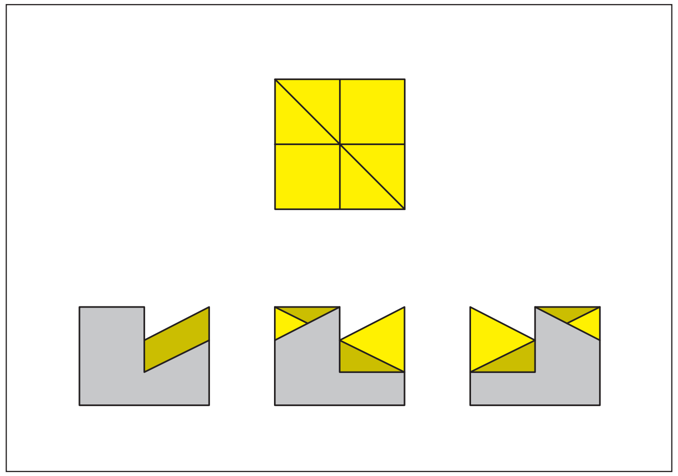
Fig. 7



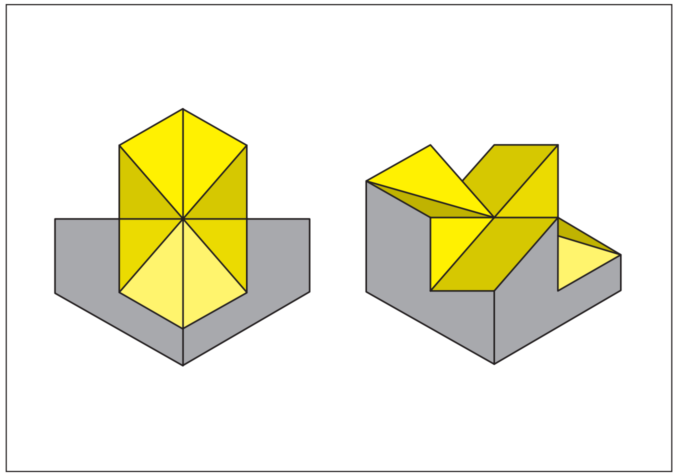
8



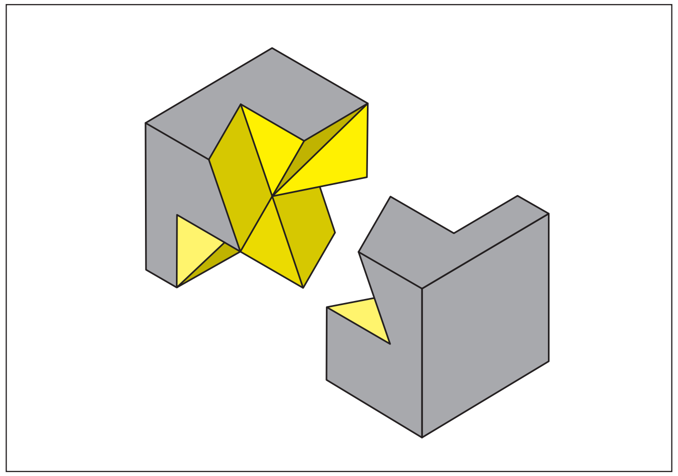
9



10



11A



11B

Fig. 8-11

TRIPLET SECTION

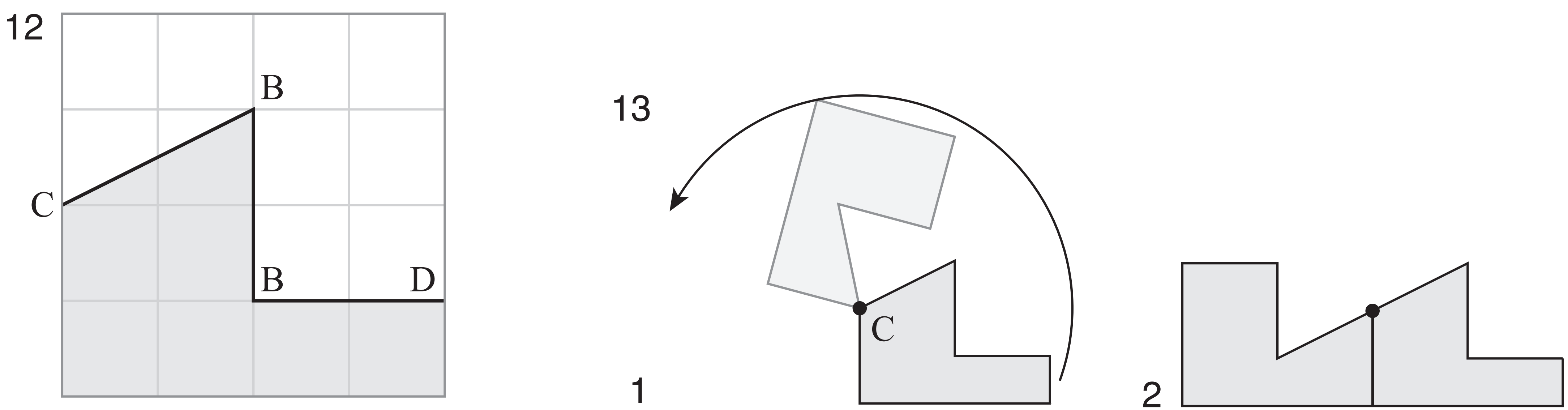


Fig. 12-13

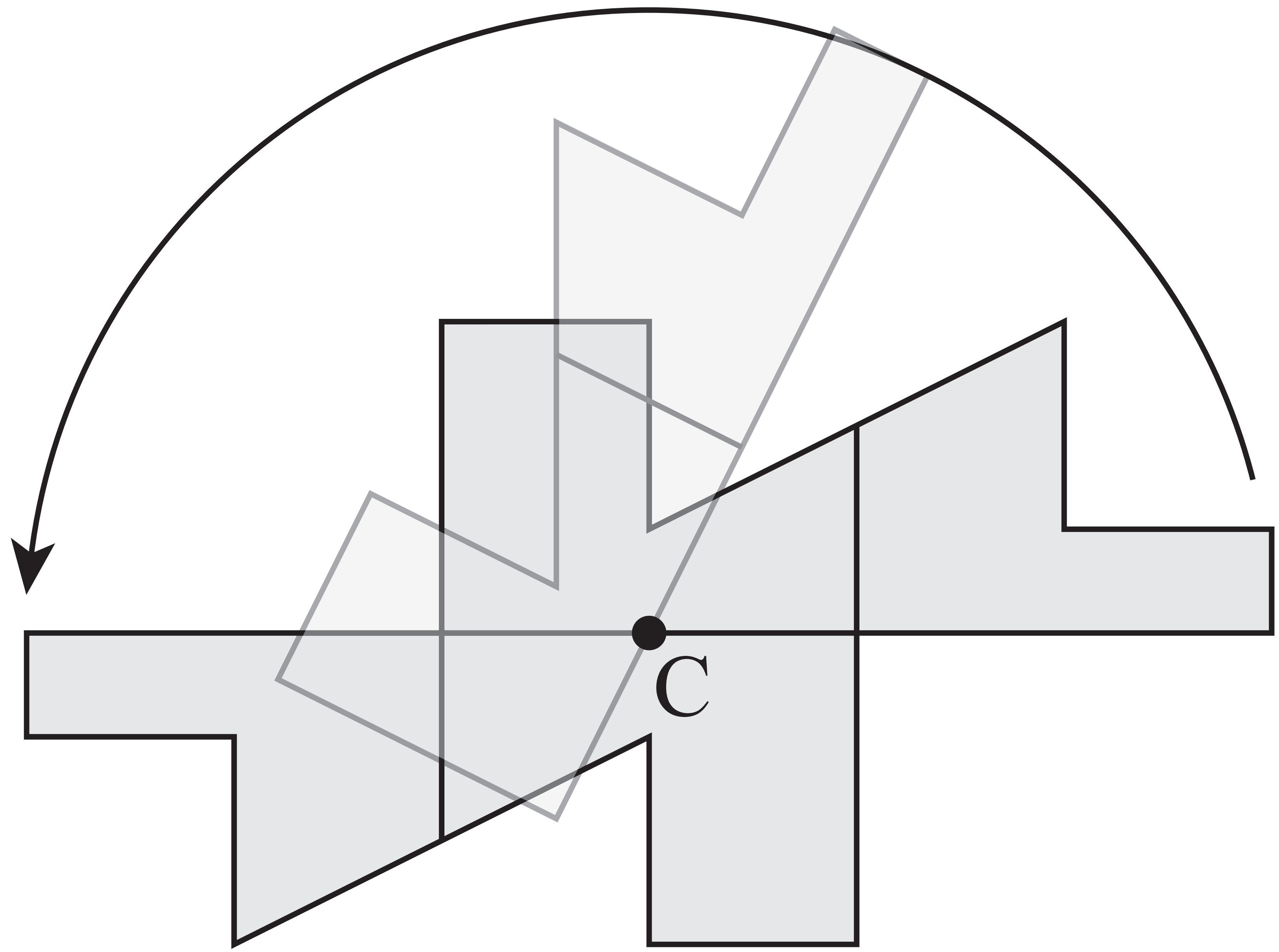


Fig. 14

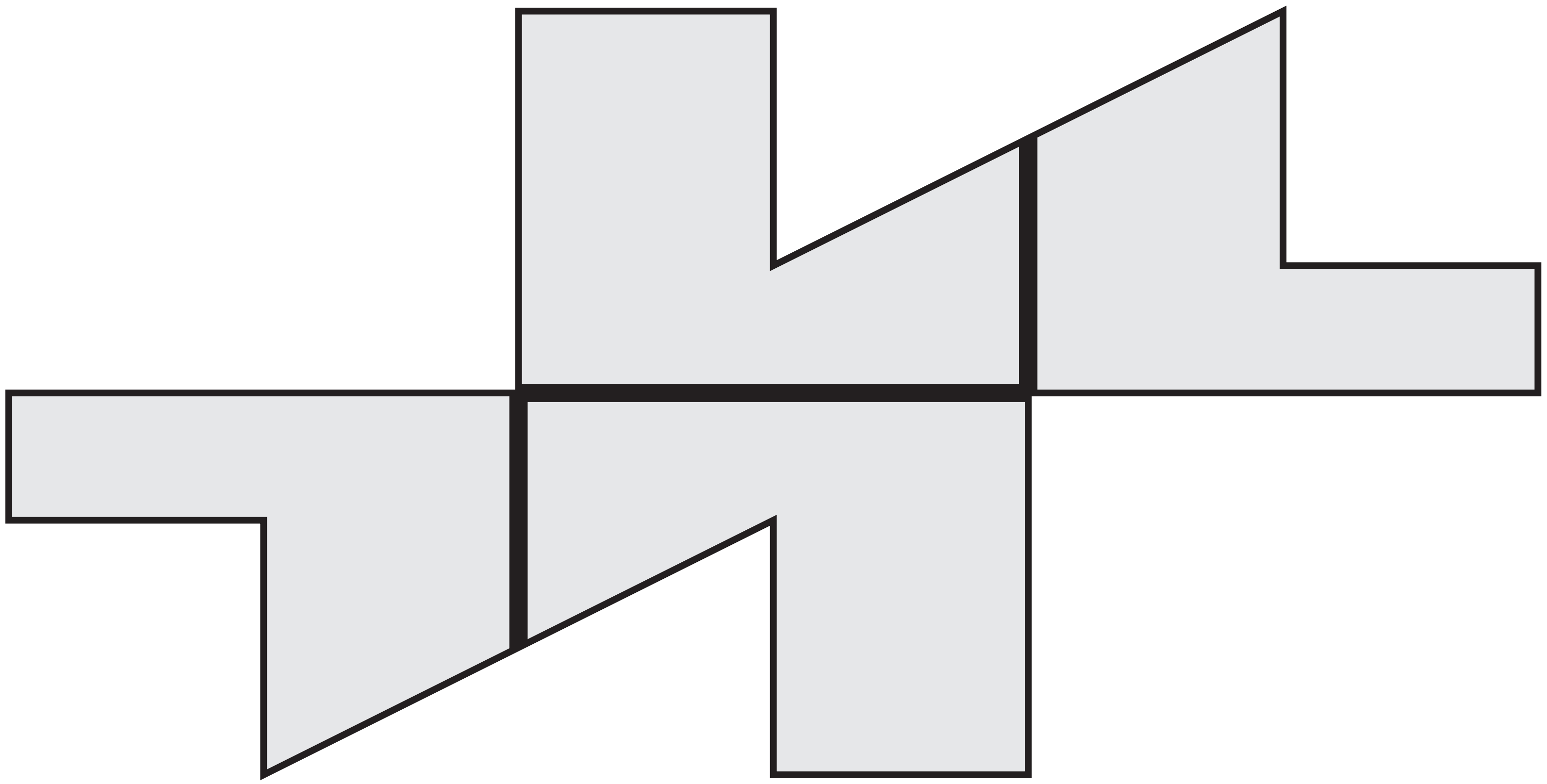


Fig. 15

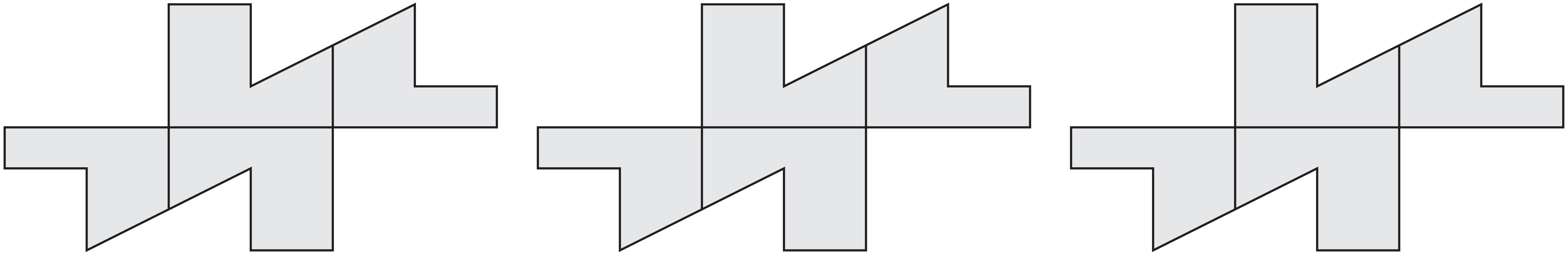


Fig. 16

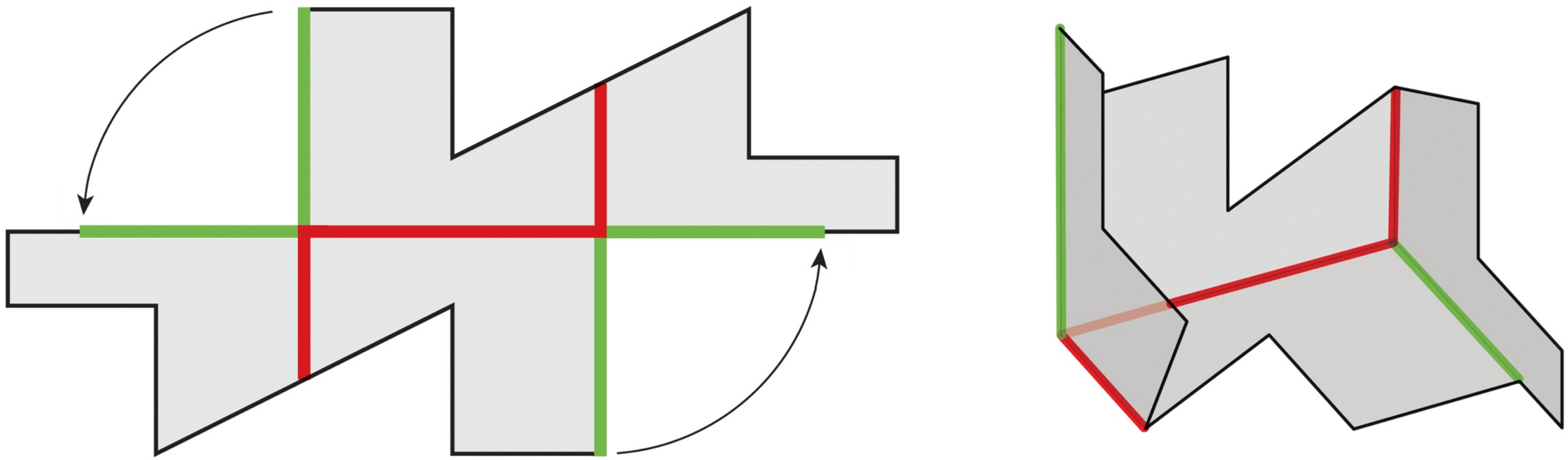


Fig. 17

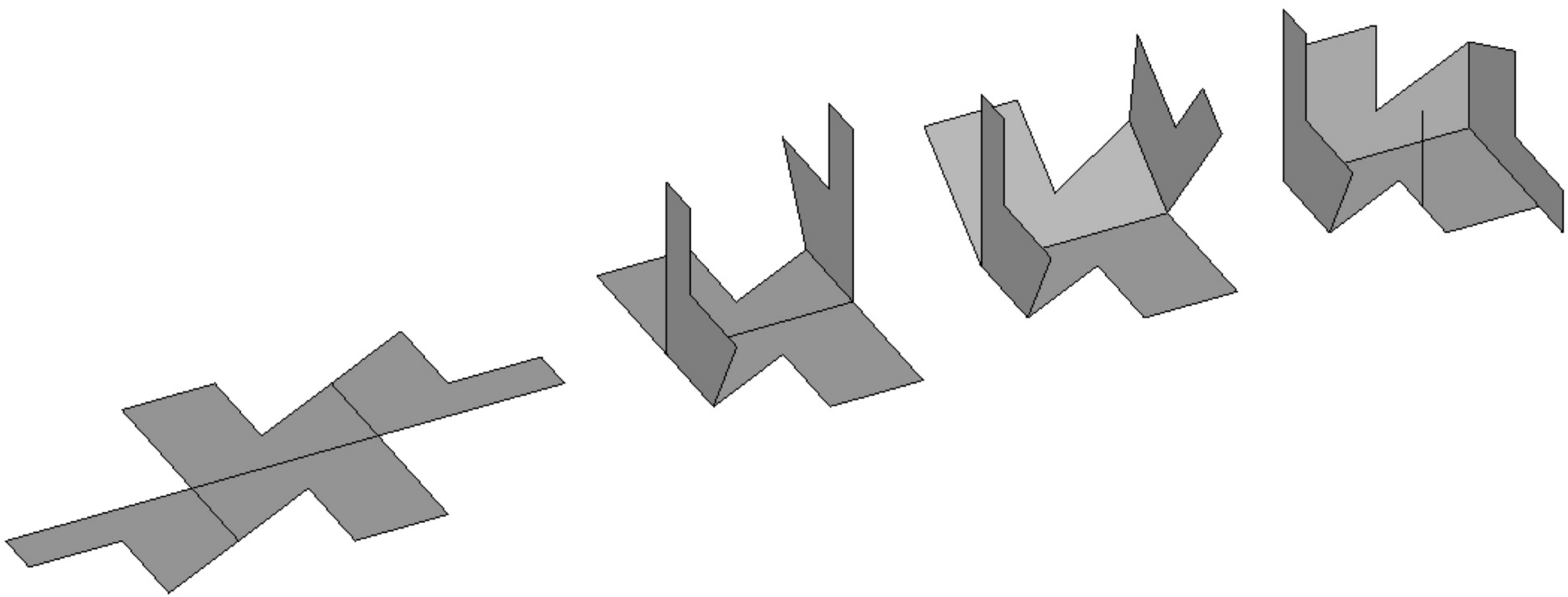


Fig. 18

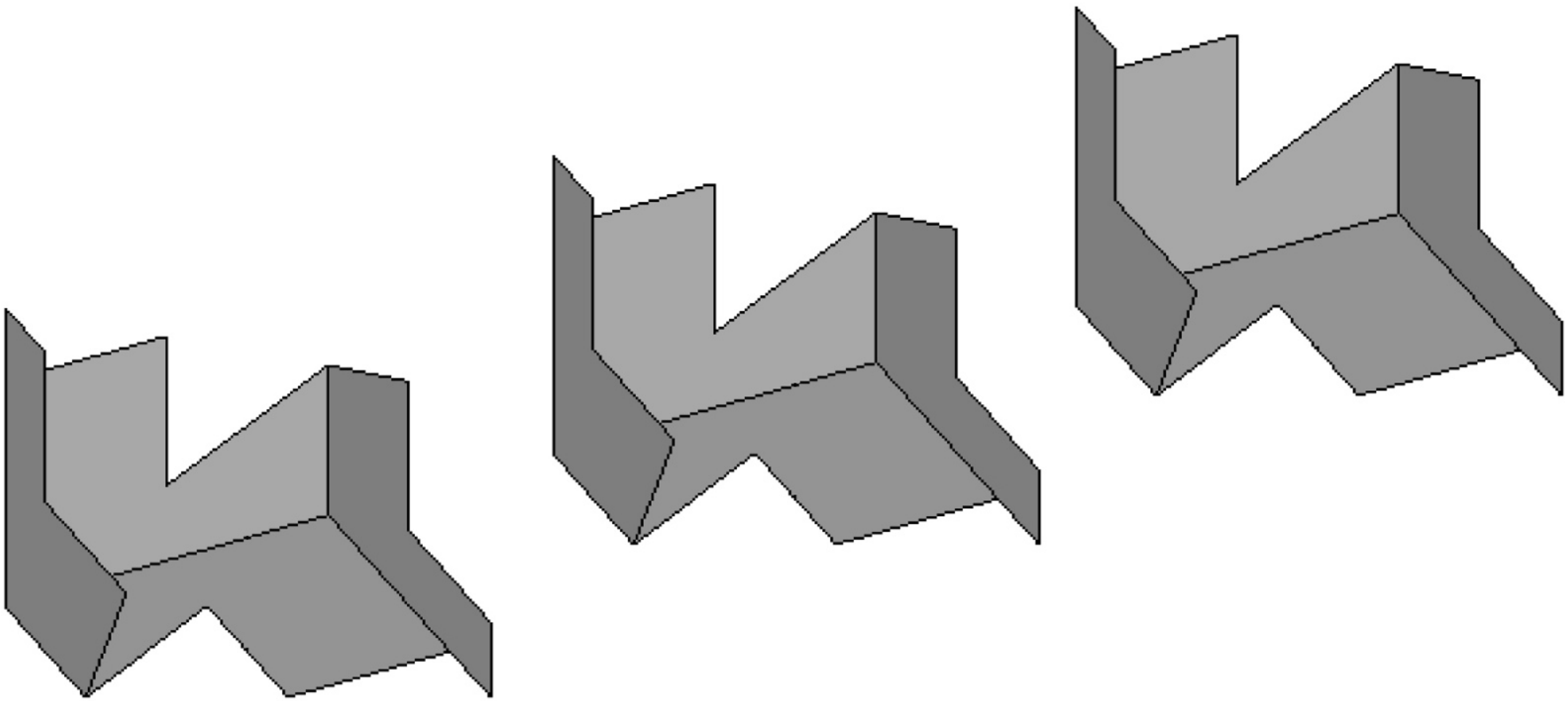


Fig. 19

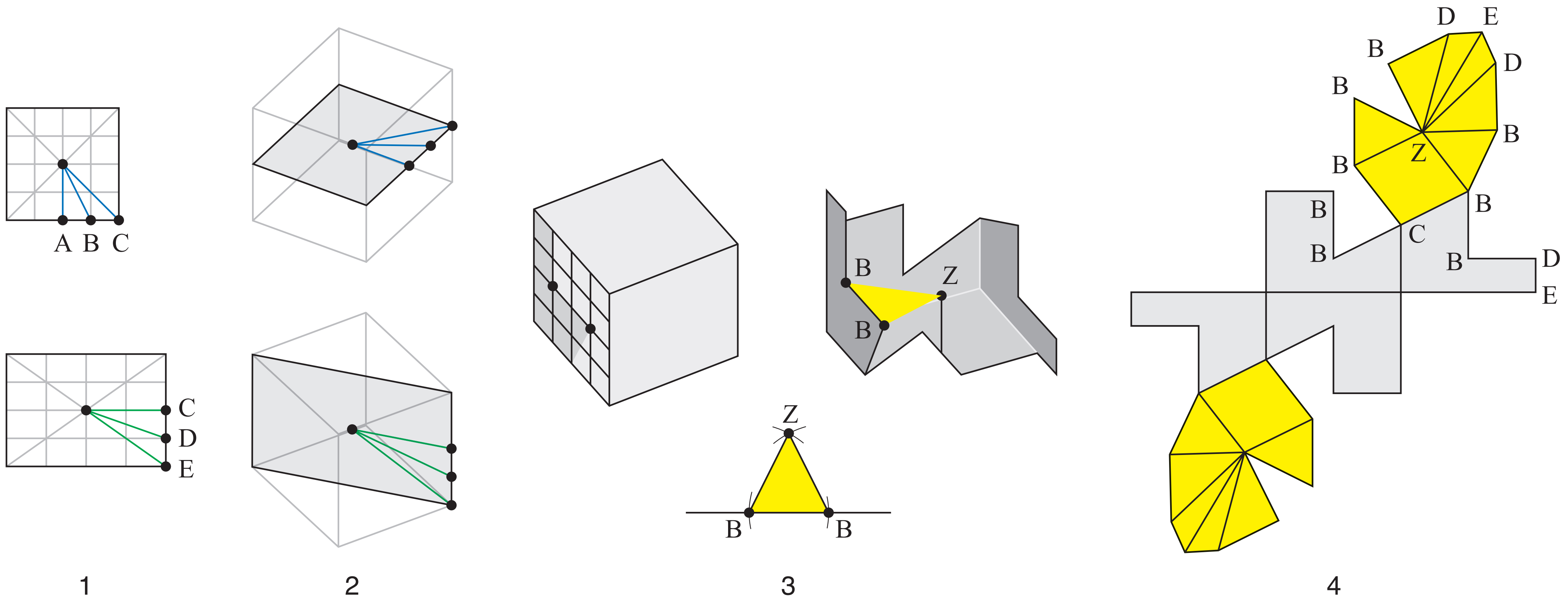


Fig. 20

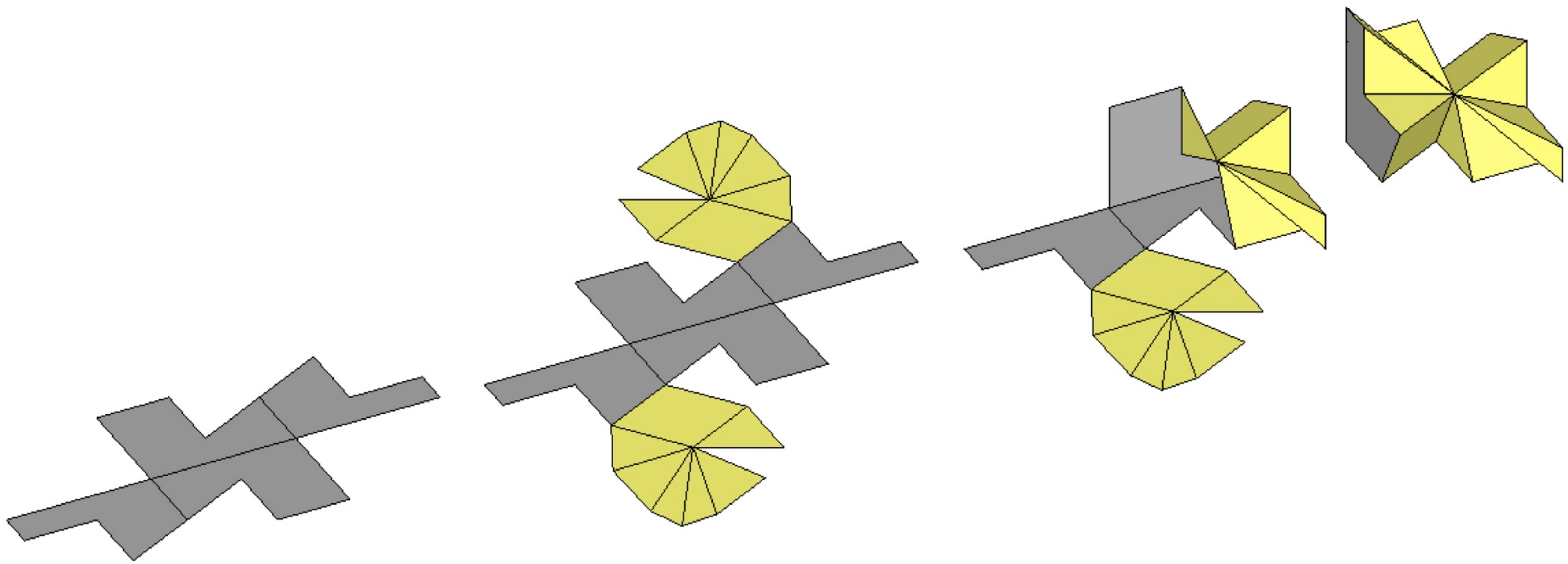


Fig. 21

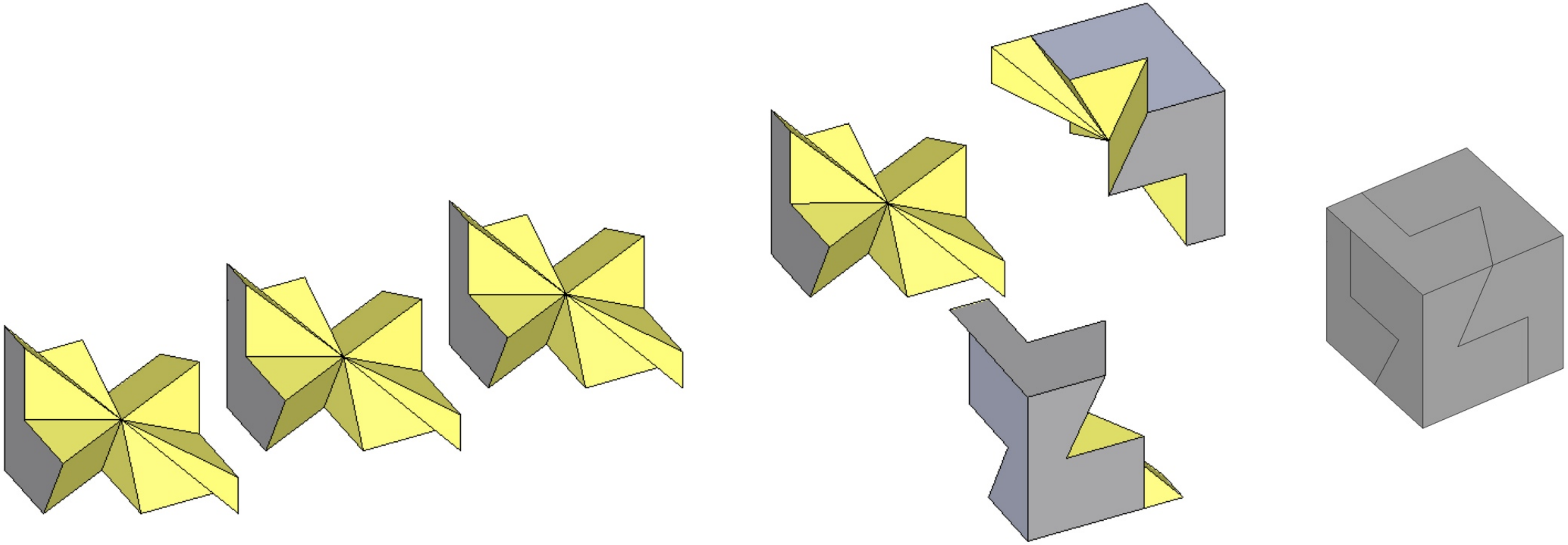


Fig. 22

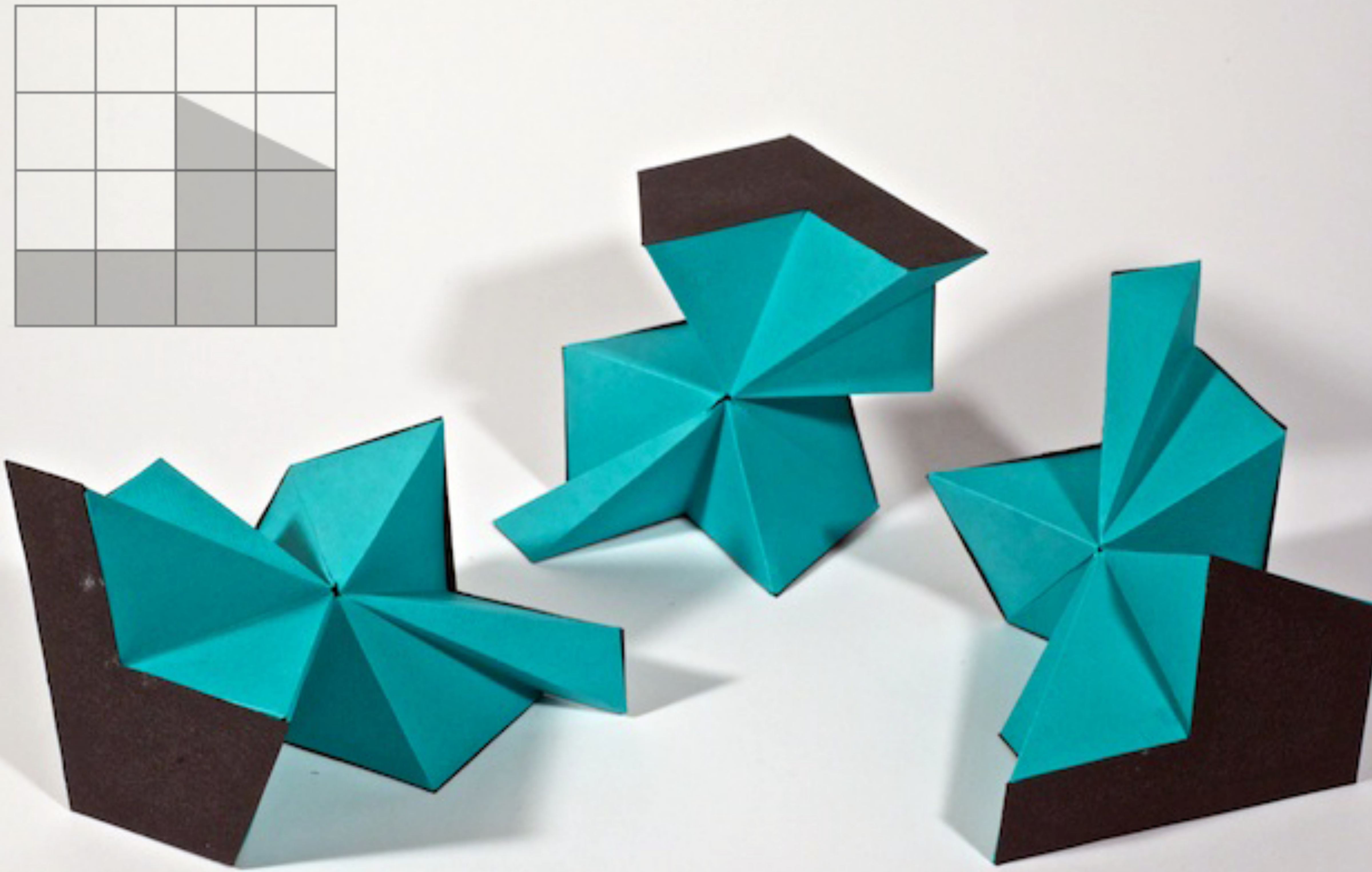


Fig. 23

HINGES AND ROTATIONS

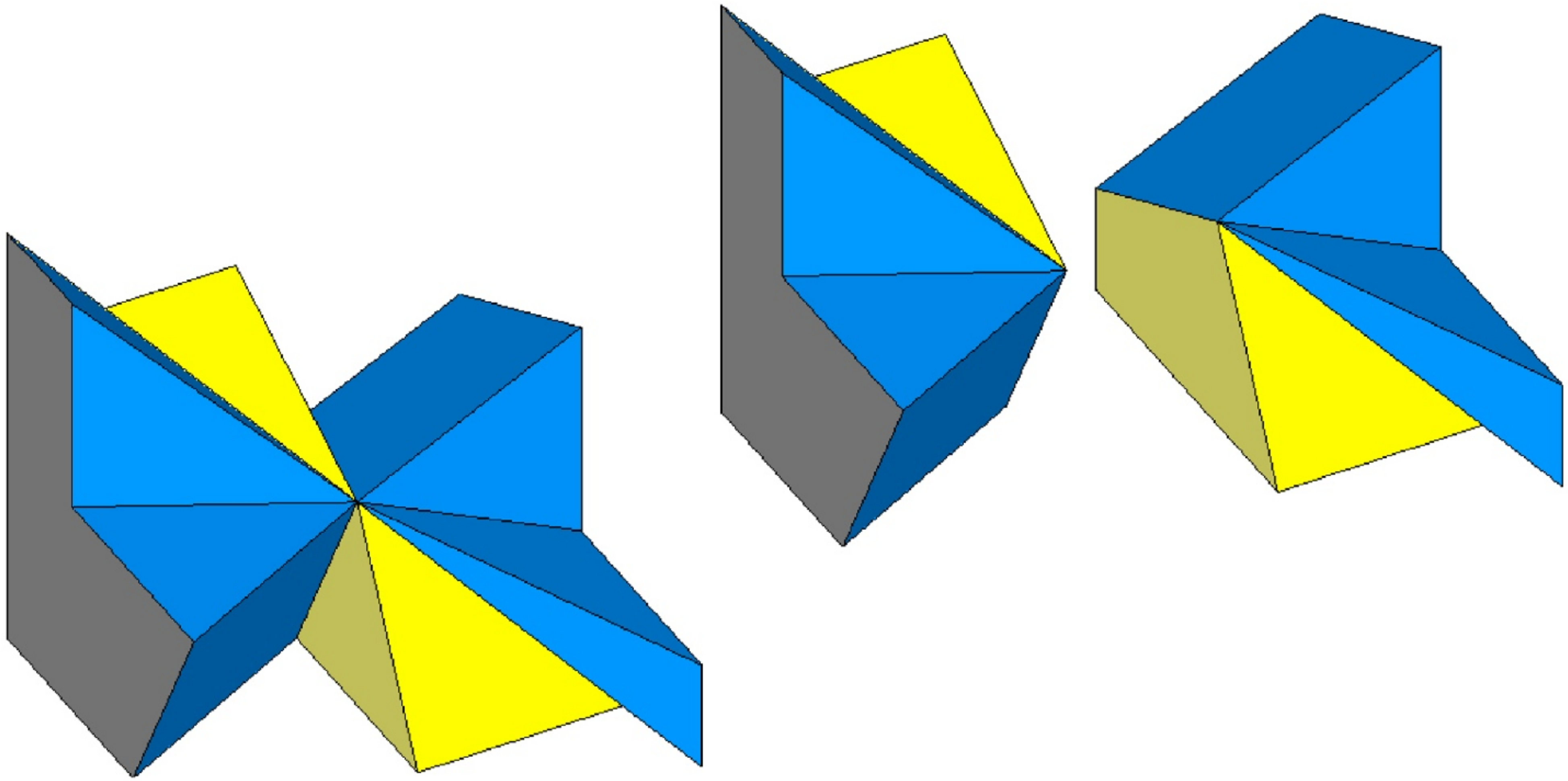


Fig. 24

THE CHAINS OF PAIRS OF SPECULAR MODULES

1. The tetrahedron, the cube..., all polyhedra, can be considered as one of the numerous three-dimensional configurations resulting from the folding of flexible chains of modules.

2. The chains are costituted by pairs of modules in which one component is the mirror image of the other.

Fig. 25

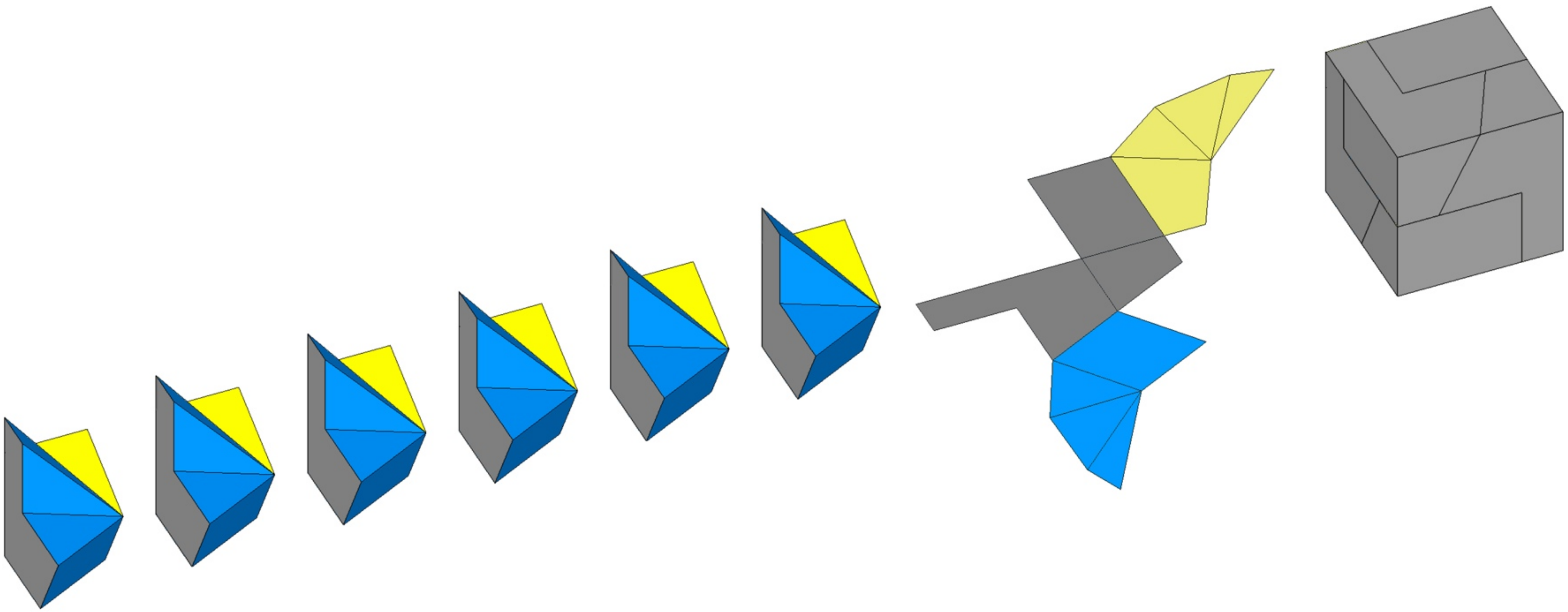


Fig. 26

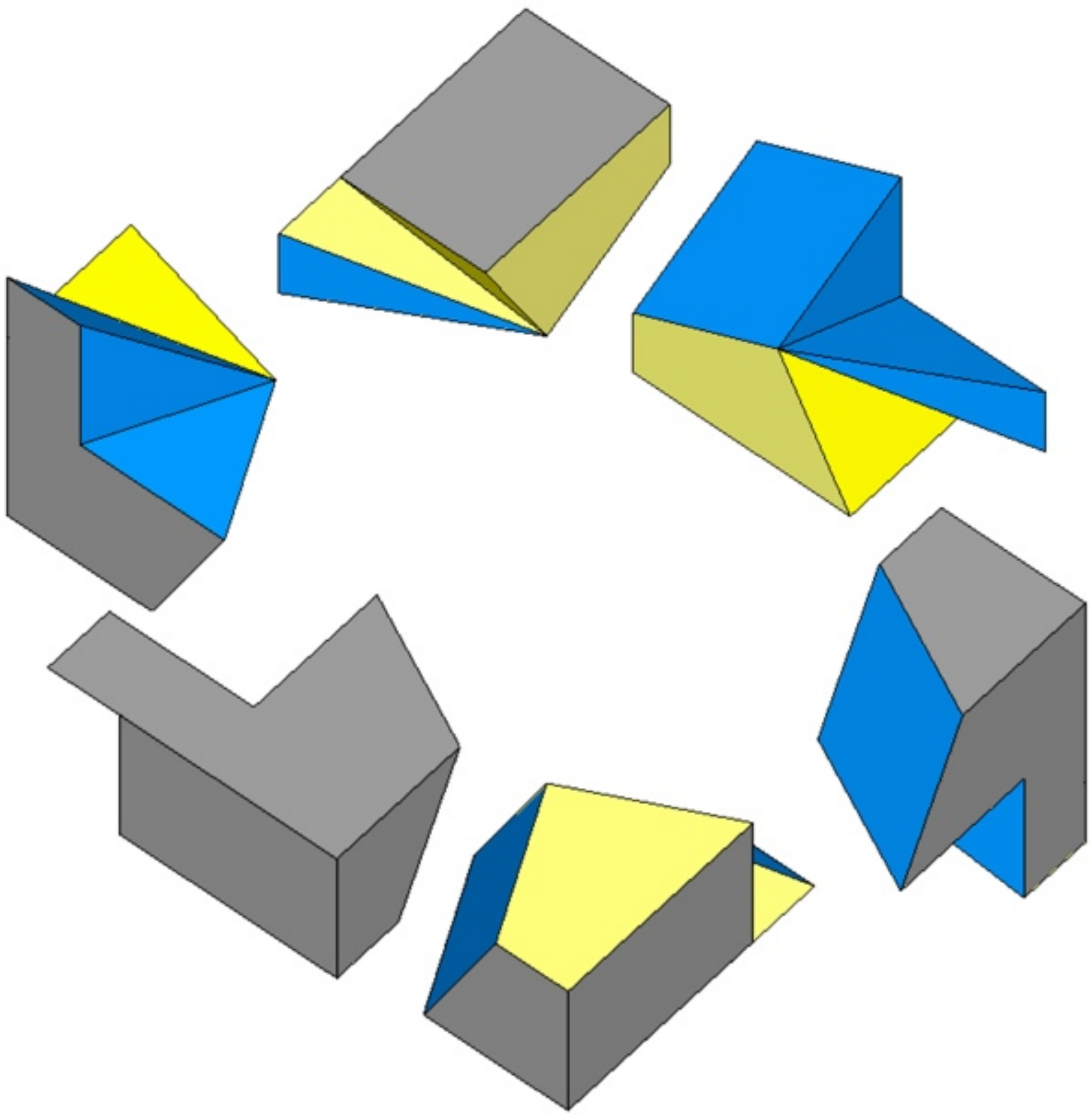


Fig. 27

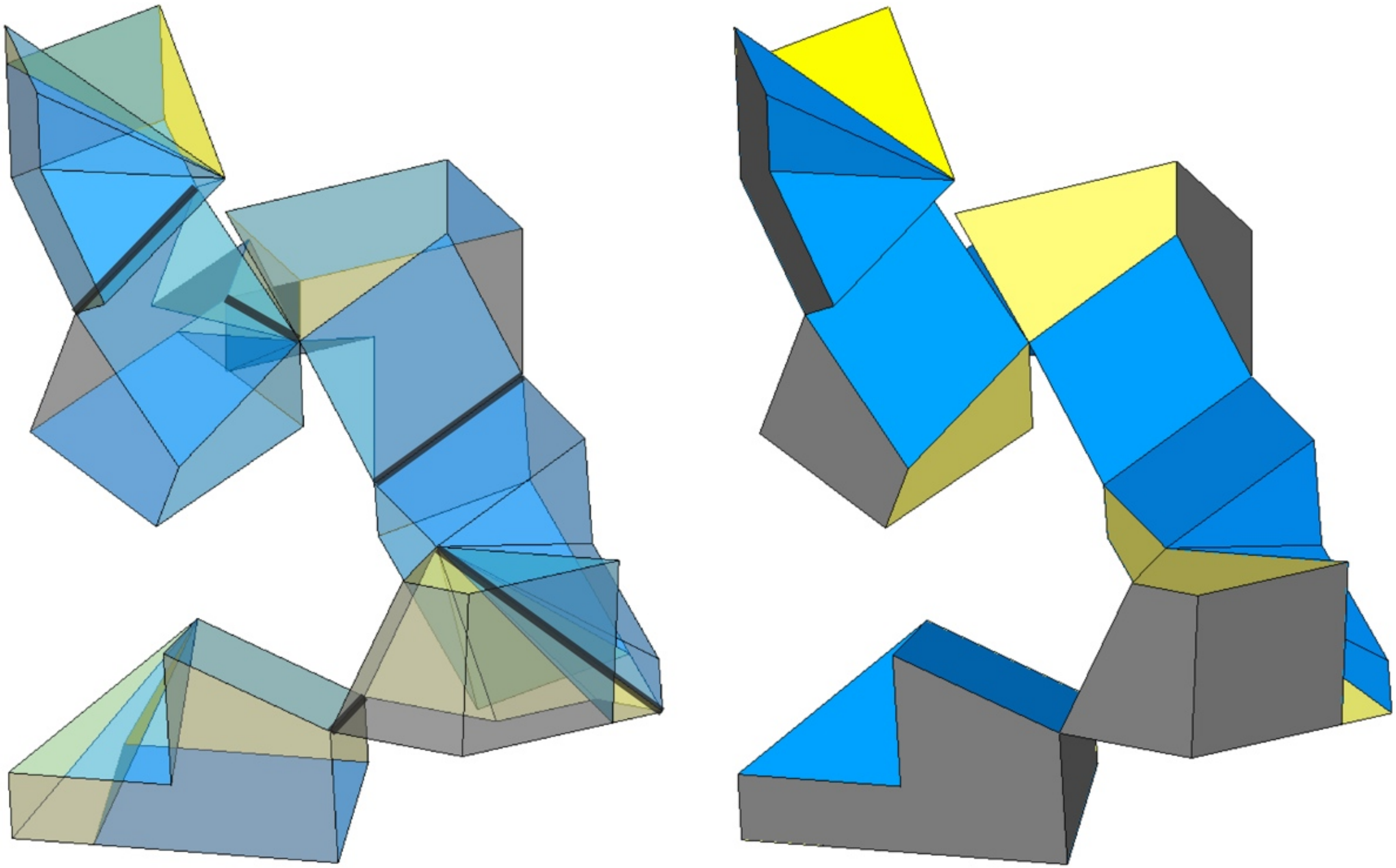


Fig. 28

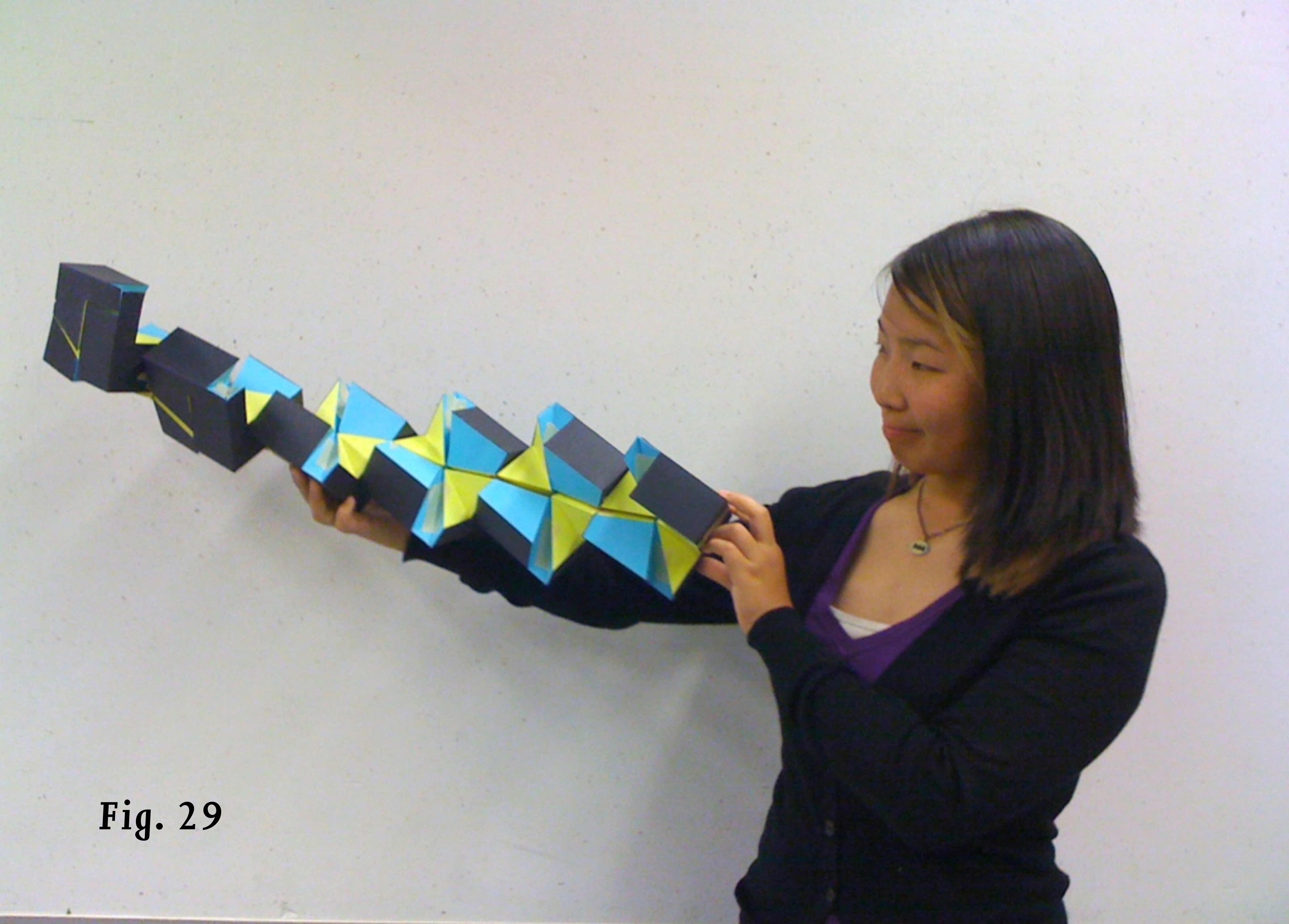
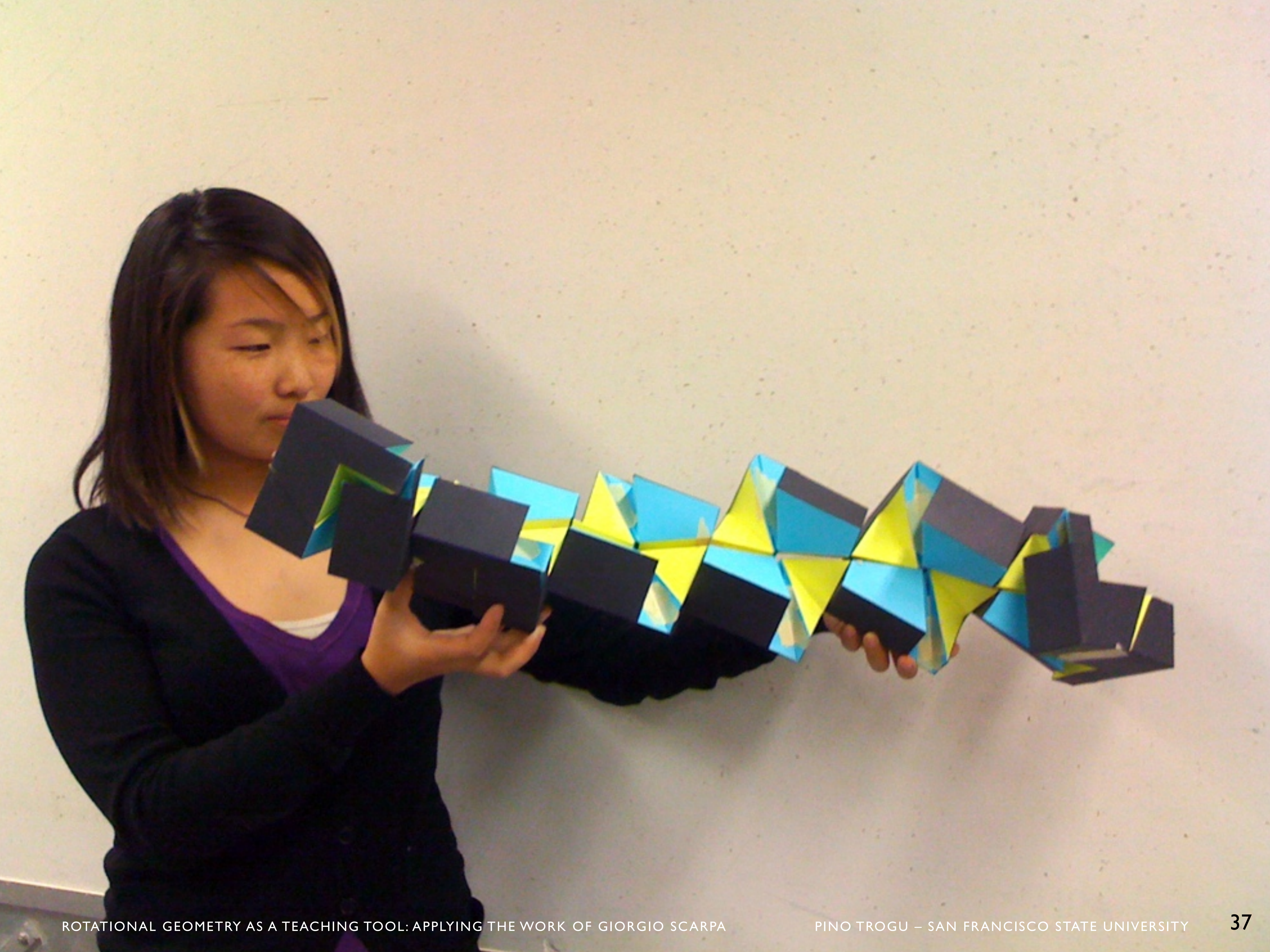
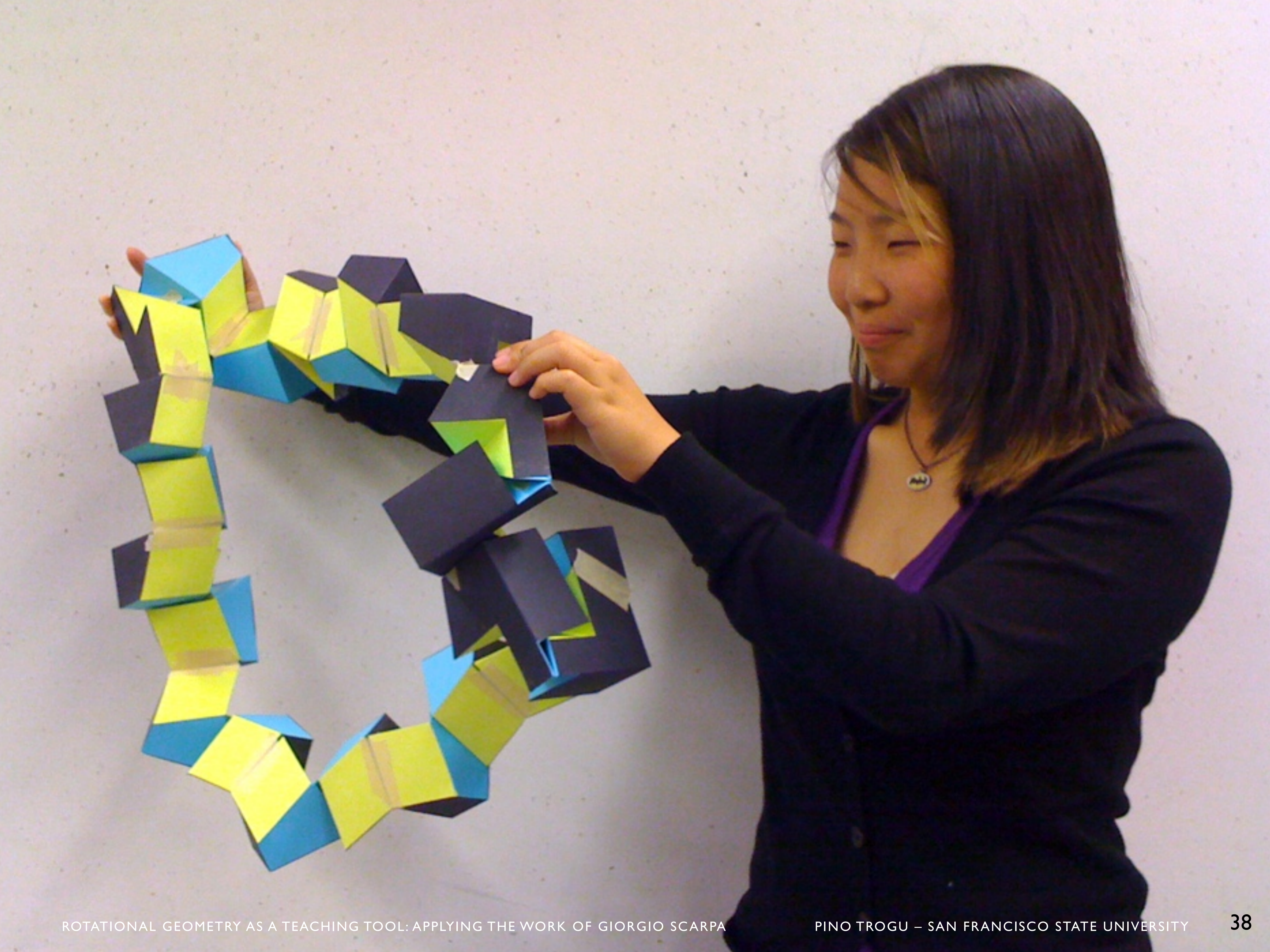
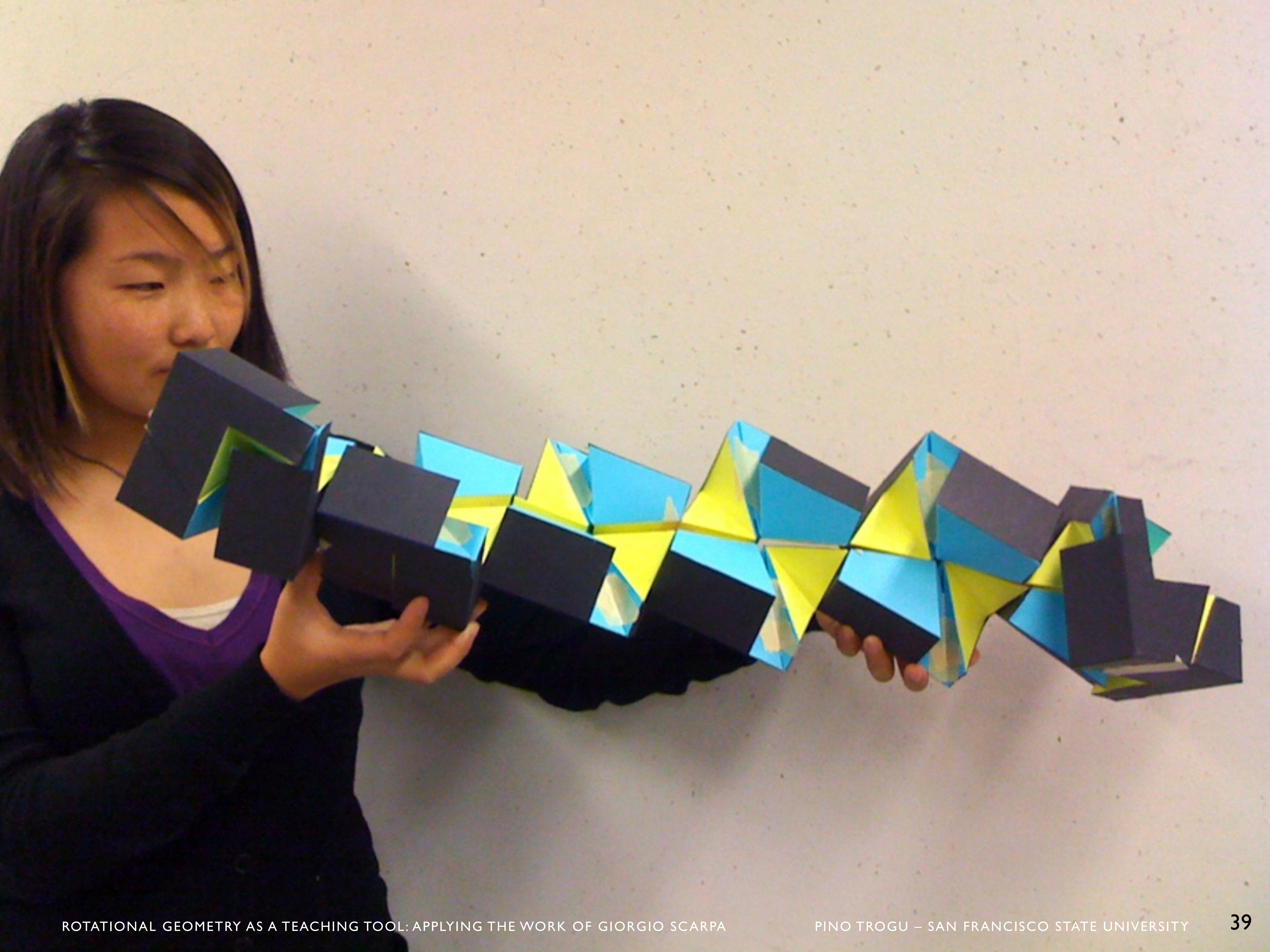


Fig. 29







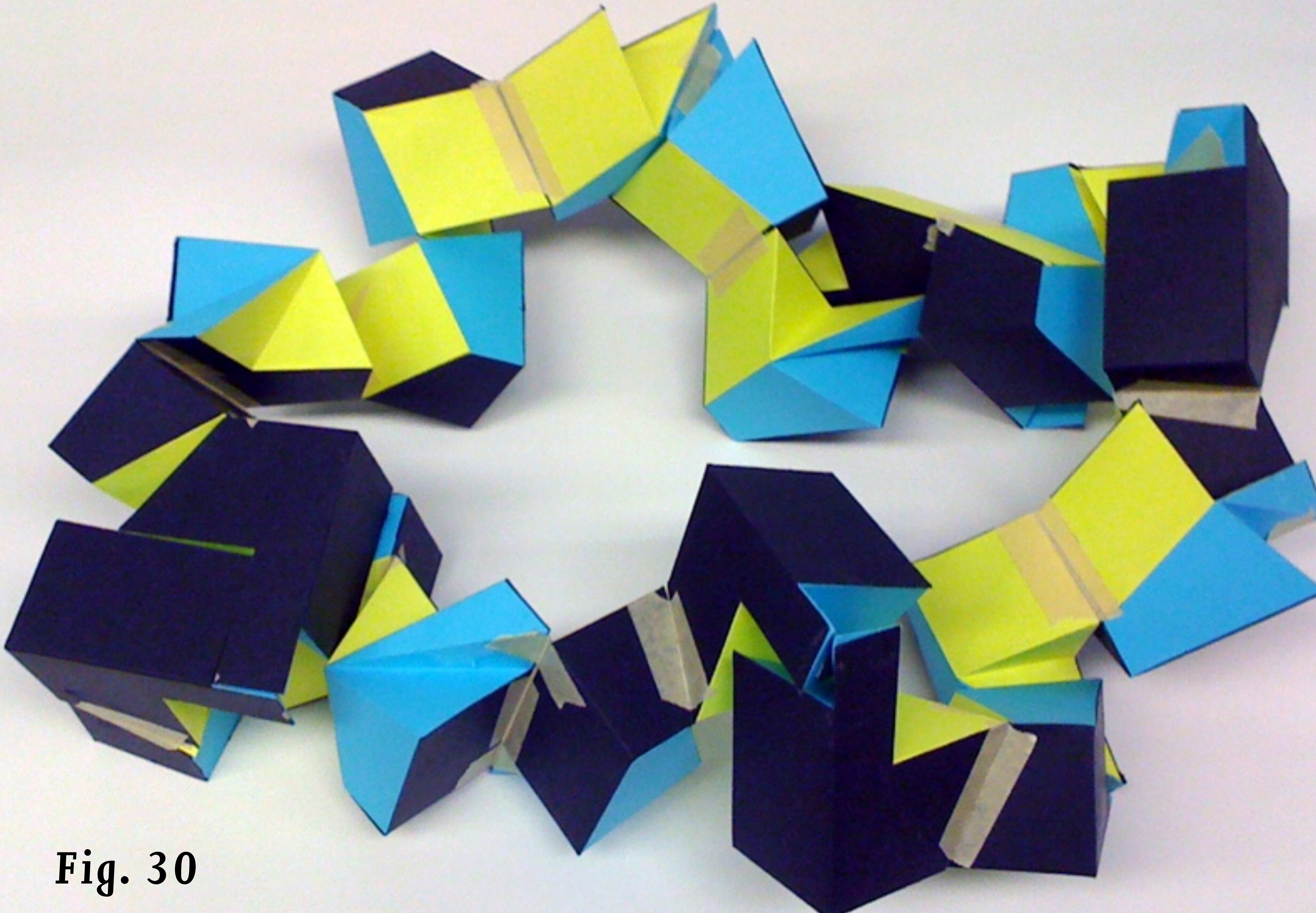
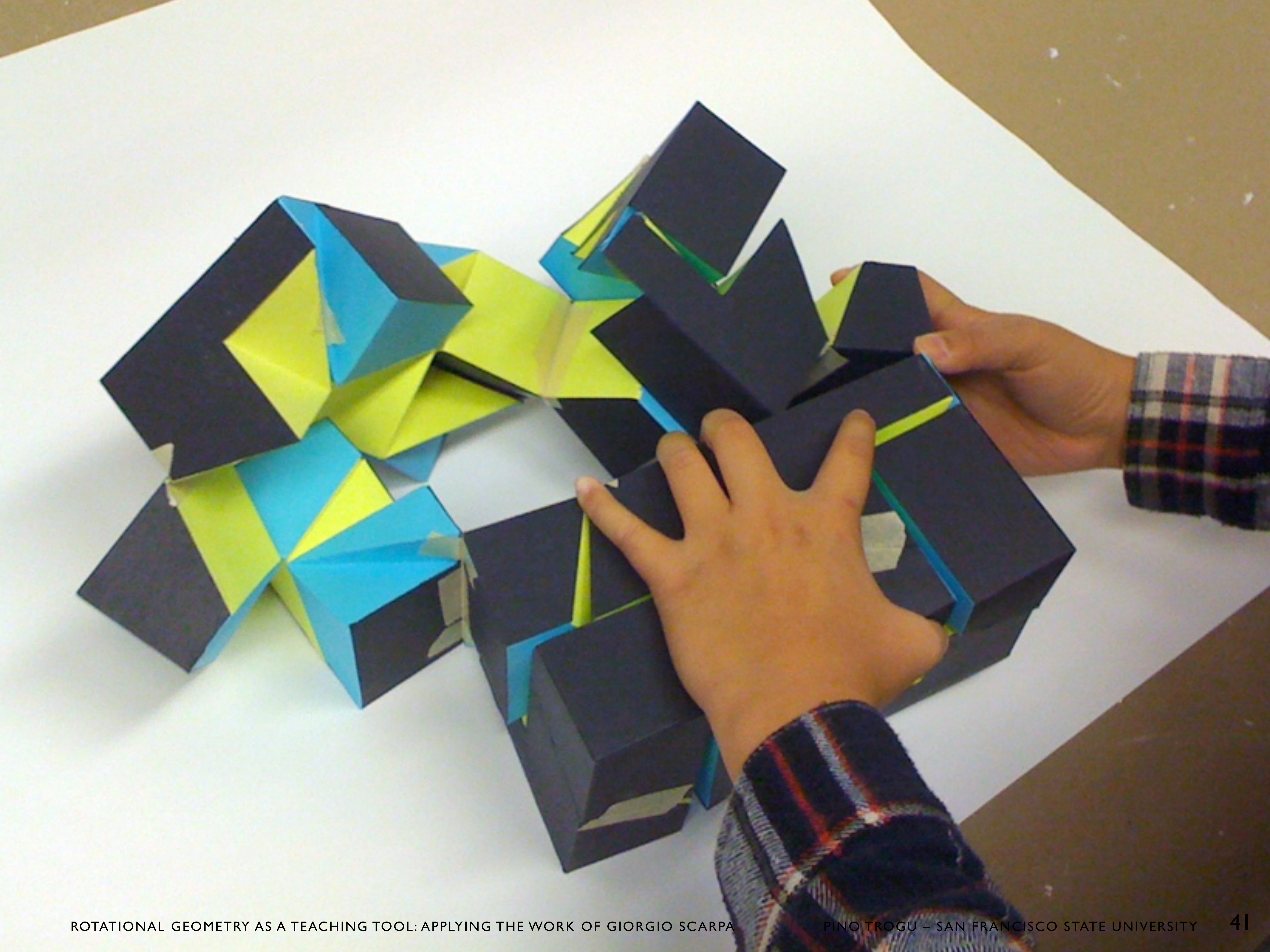
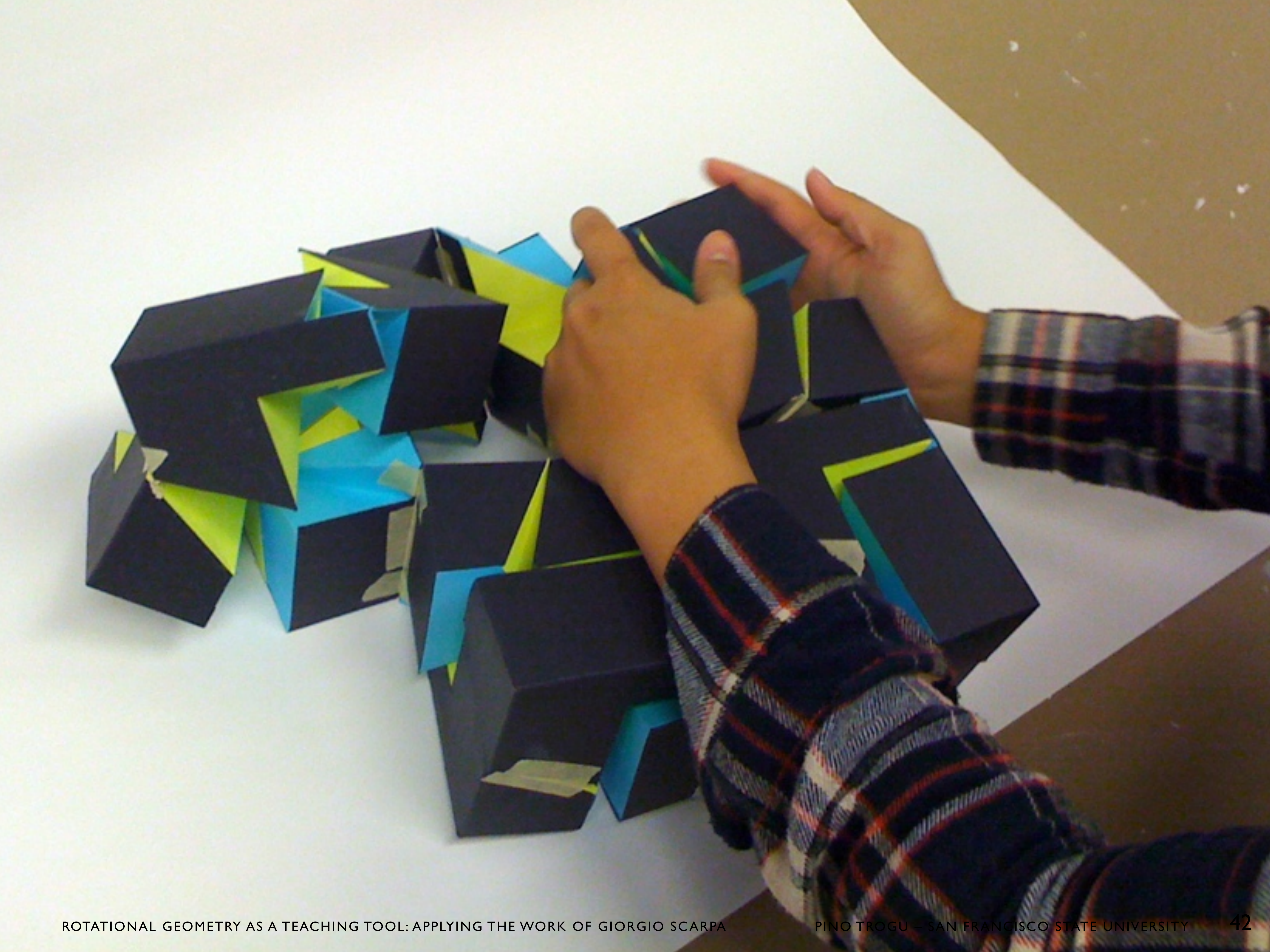
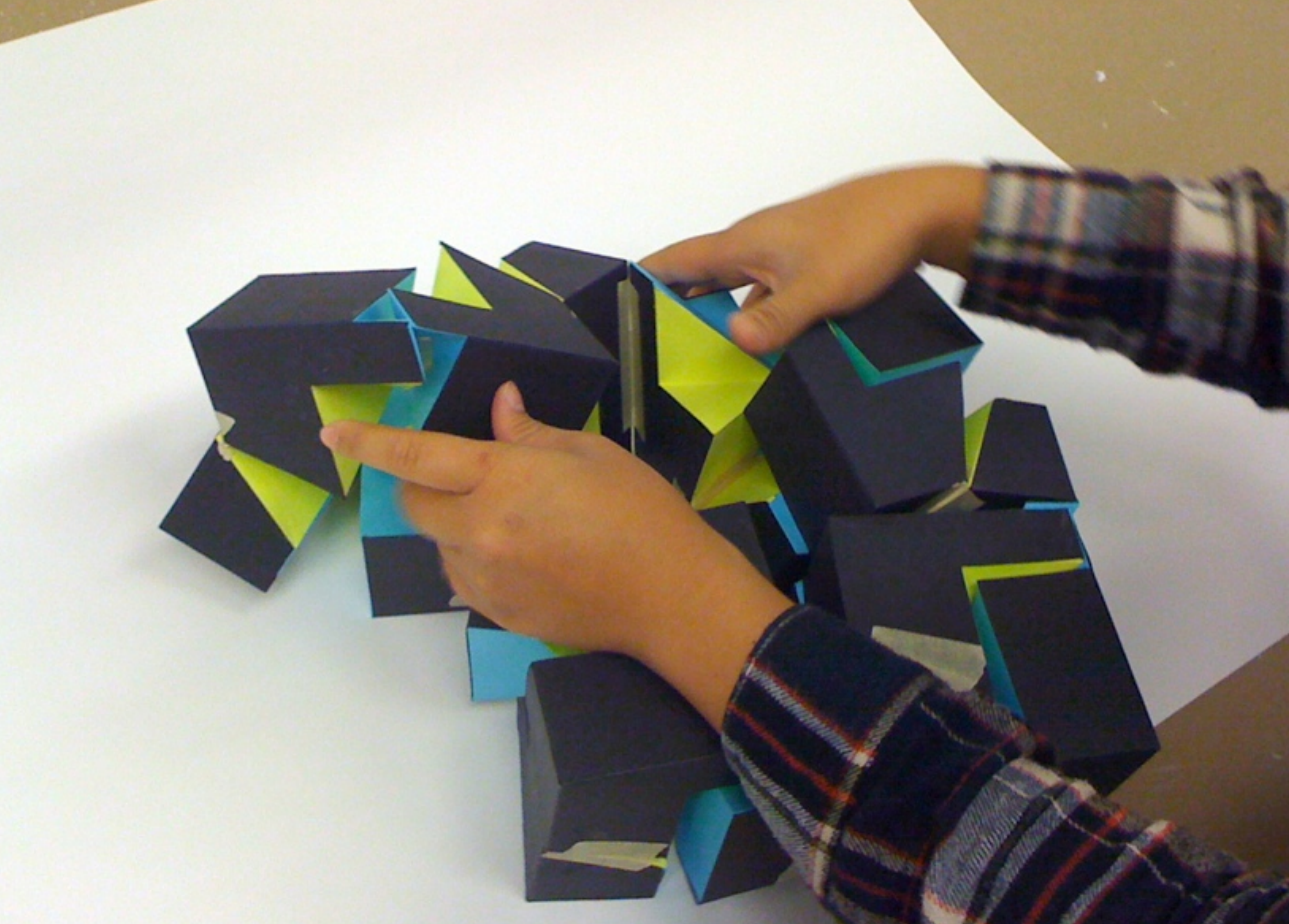
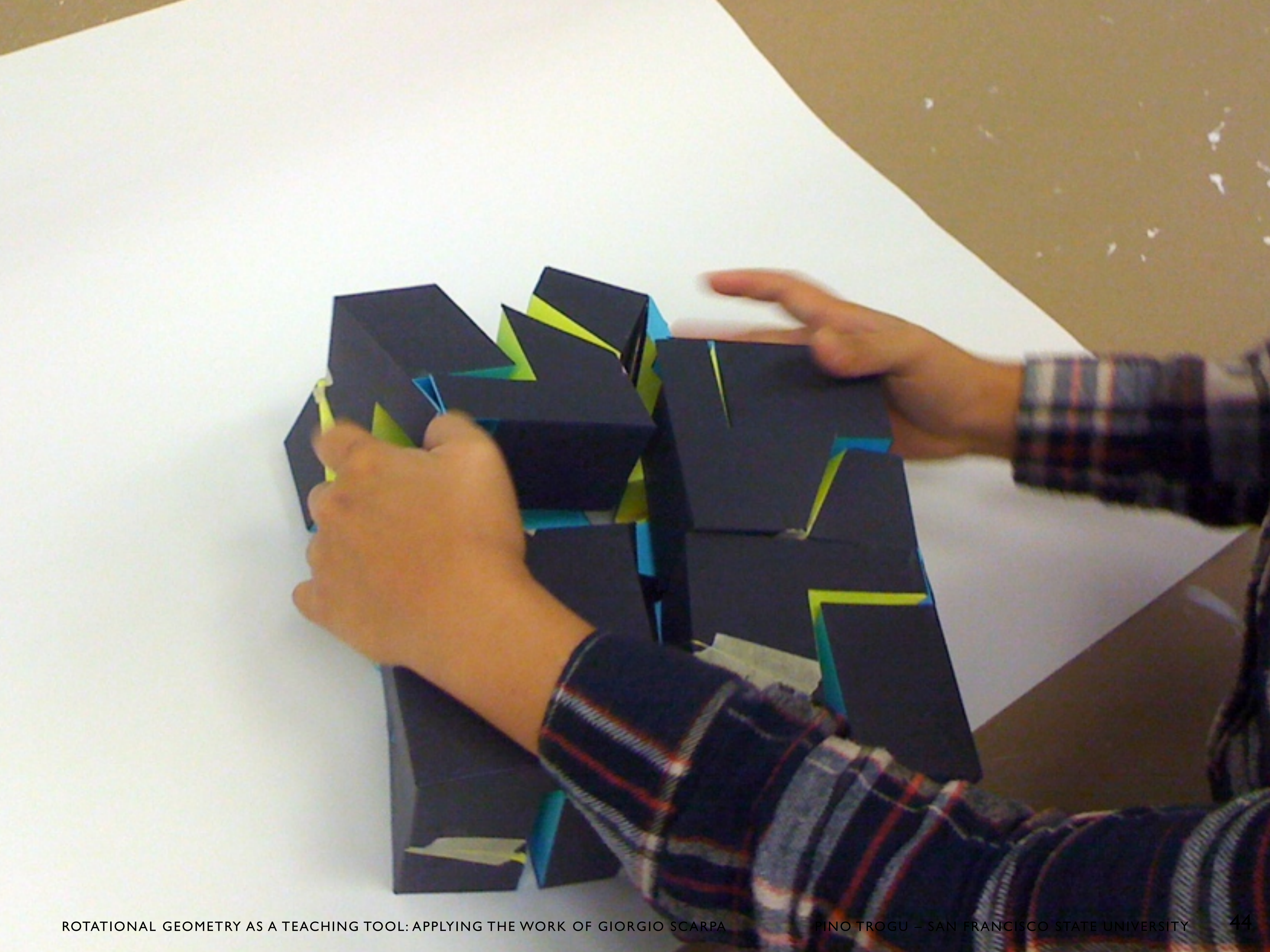


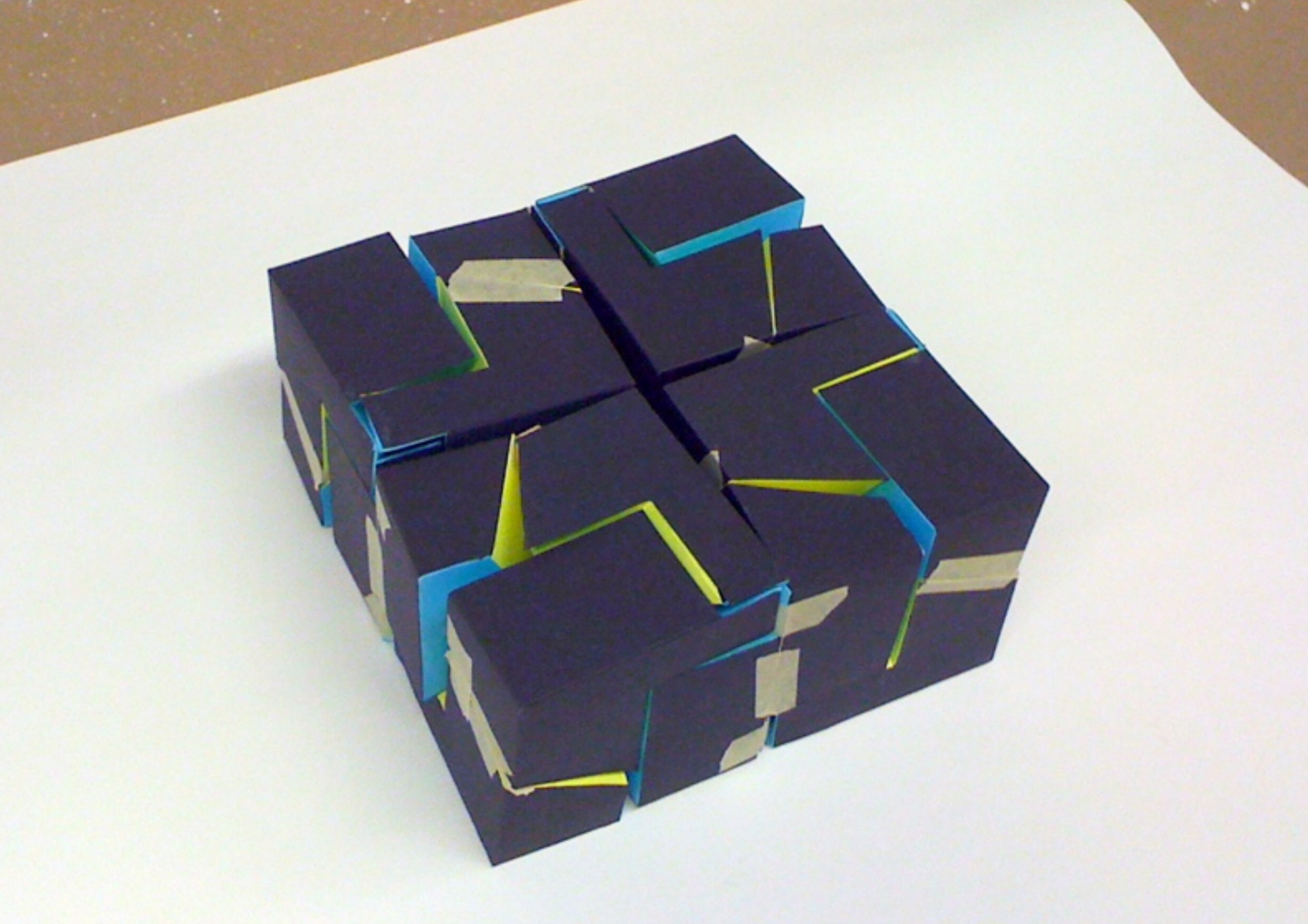
Fig. 30







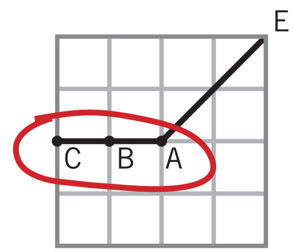




CUBE SECTION – INTERNAL SURFACE

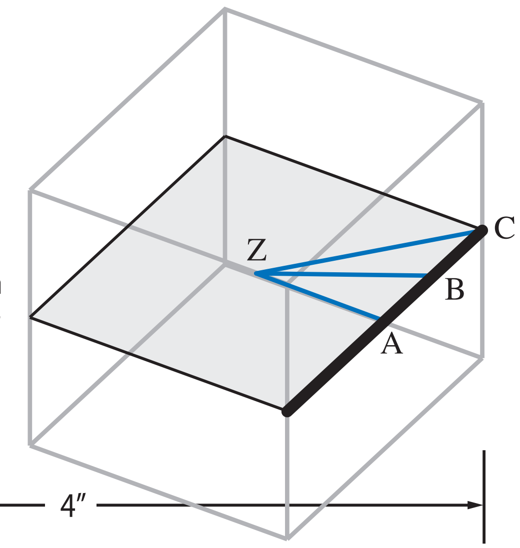
Step 4 Use the given letters to mark any external points of the section that are either on the median or...

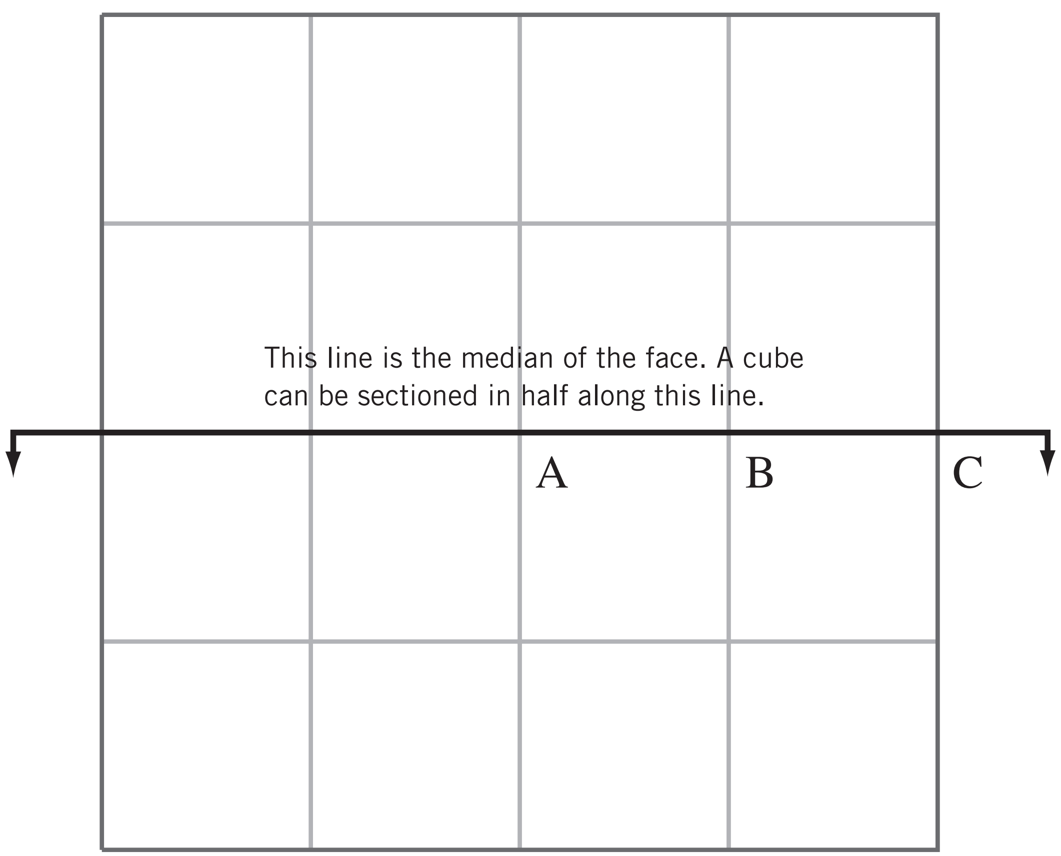
NOTE: when printing, select Page Scaling: NONE. Check your drawing after printing to verify dimensions. Check both axes: vertical and horizontal.



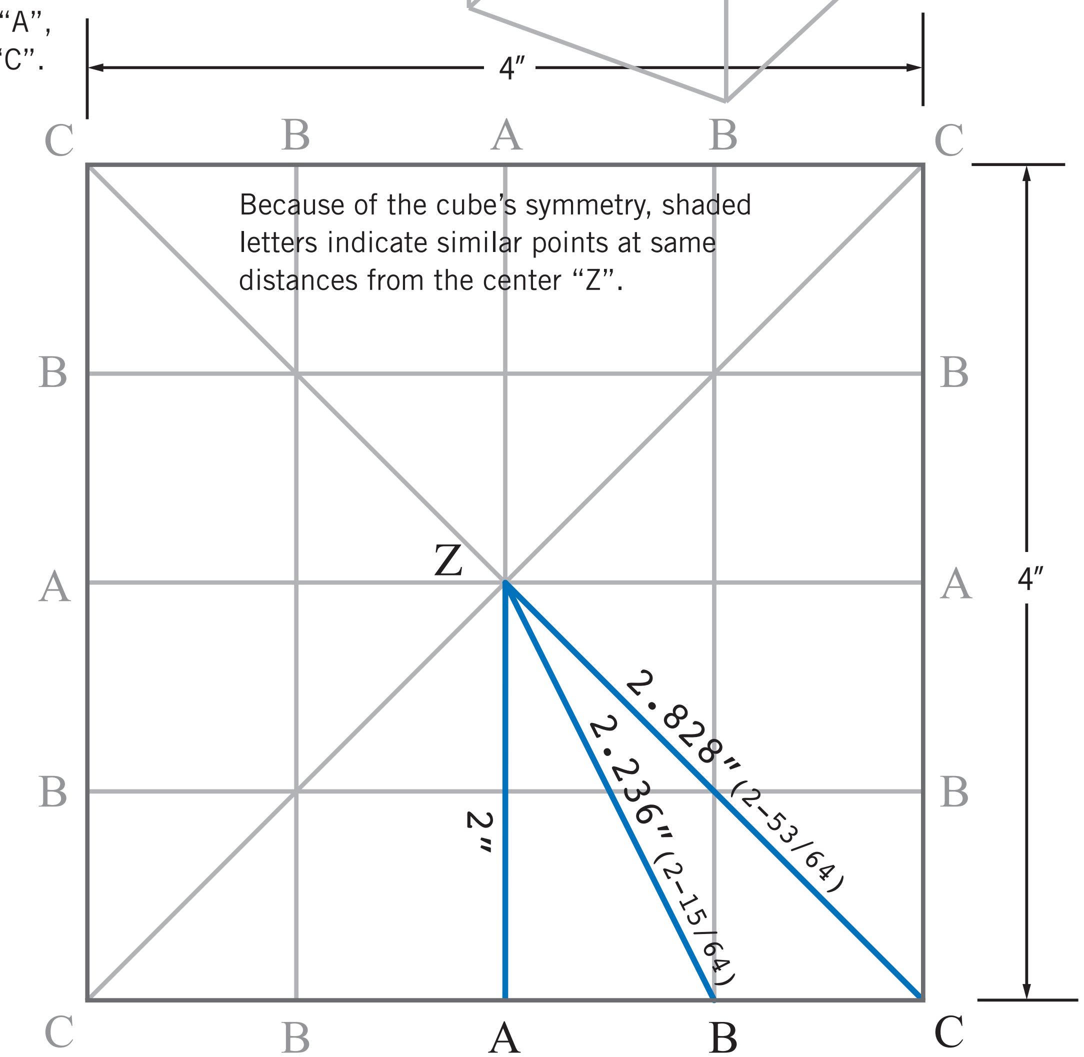
Use this page to find distances for points “A”, “B”, and “C”.

Distances from points on the median to the center of the cube “Z”.





Face of the cube sectioned along the median.
NOTE: You can use this grid to draw your section at full scale.

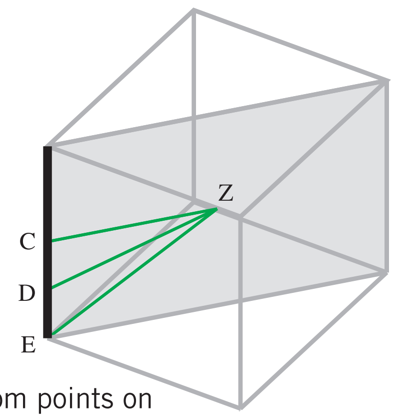


TRUE distances from points on the median to center “Z”.
Use these distances for the construction of the internal section.

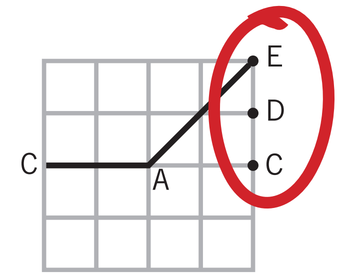
CUBE SECTION – INTERNAL SURFACE

Step 4 ...the edge of the face/cube.

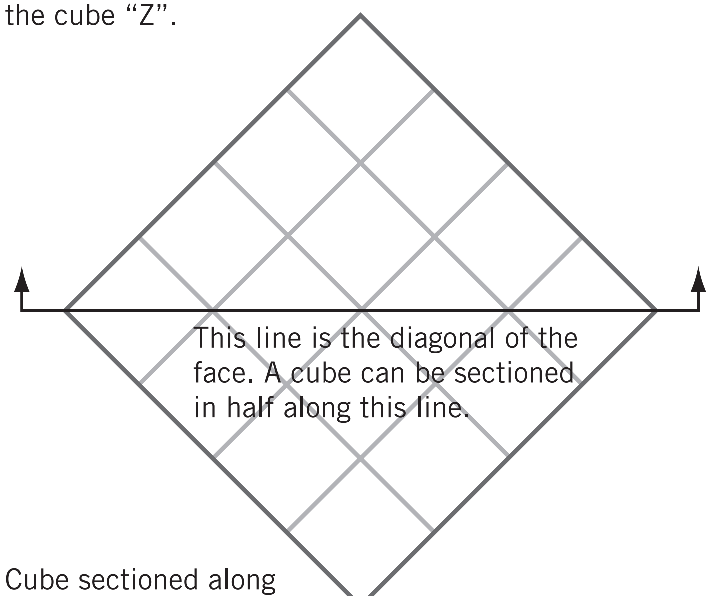
NOTE: when printing, select Page Scaling: NONE.
Check your drawing after printing to verify dimensions.
Check both axes: vertical and horizontal.



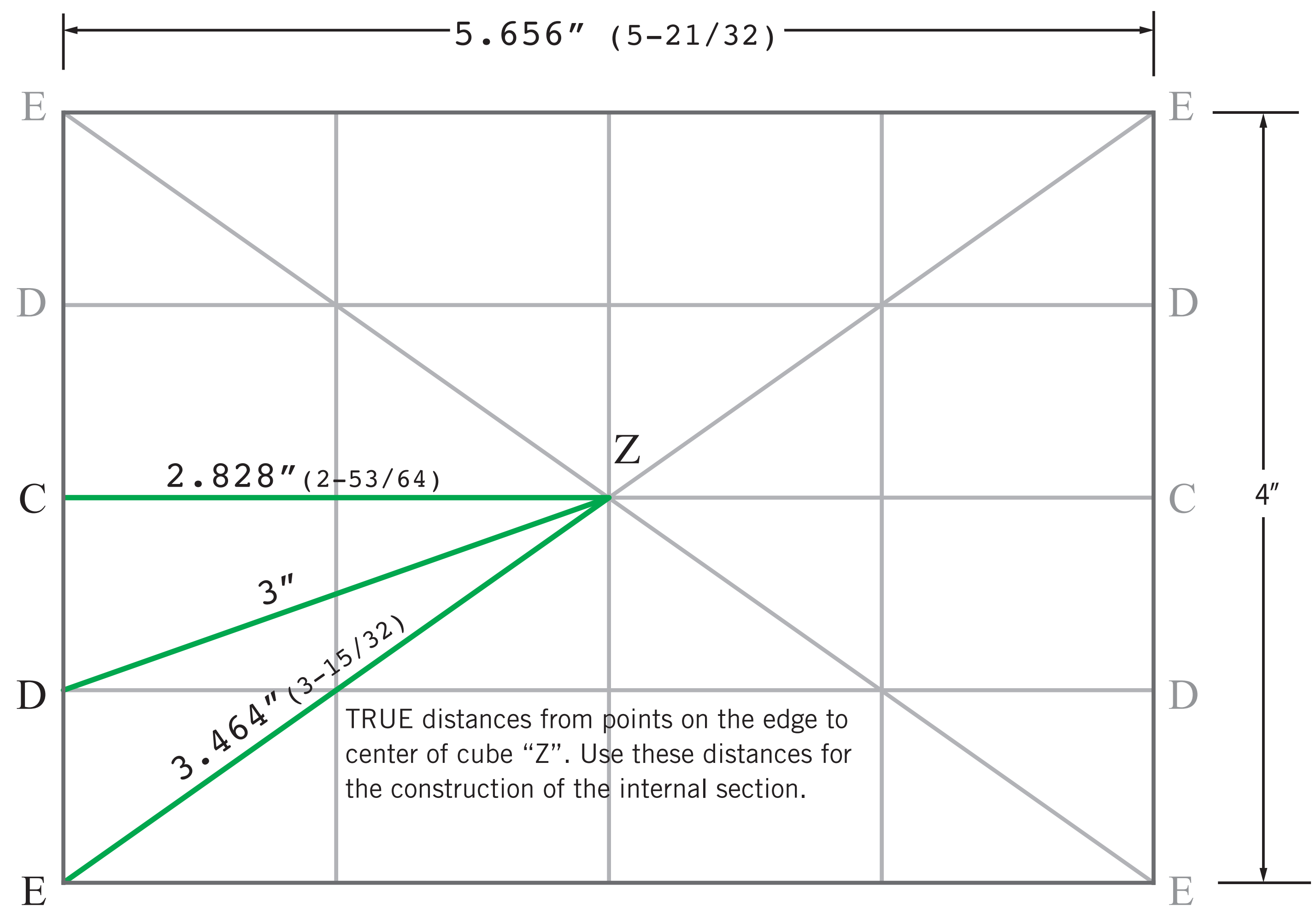
Distances from points on the edge to the center of the cube “Z”.

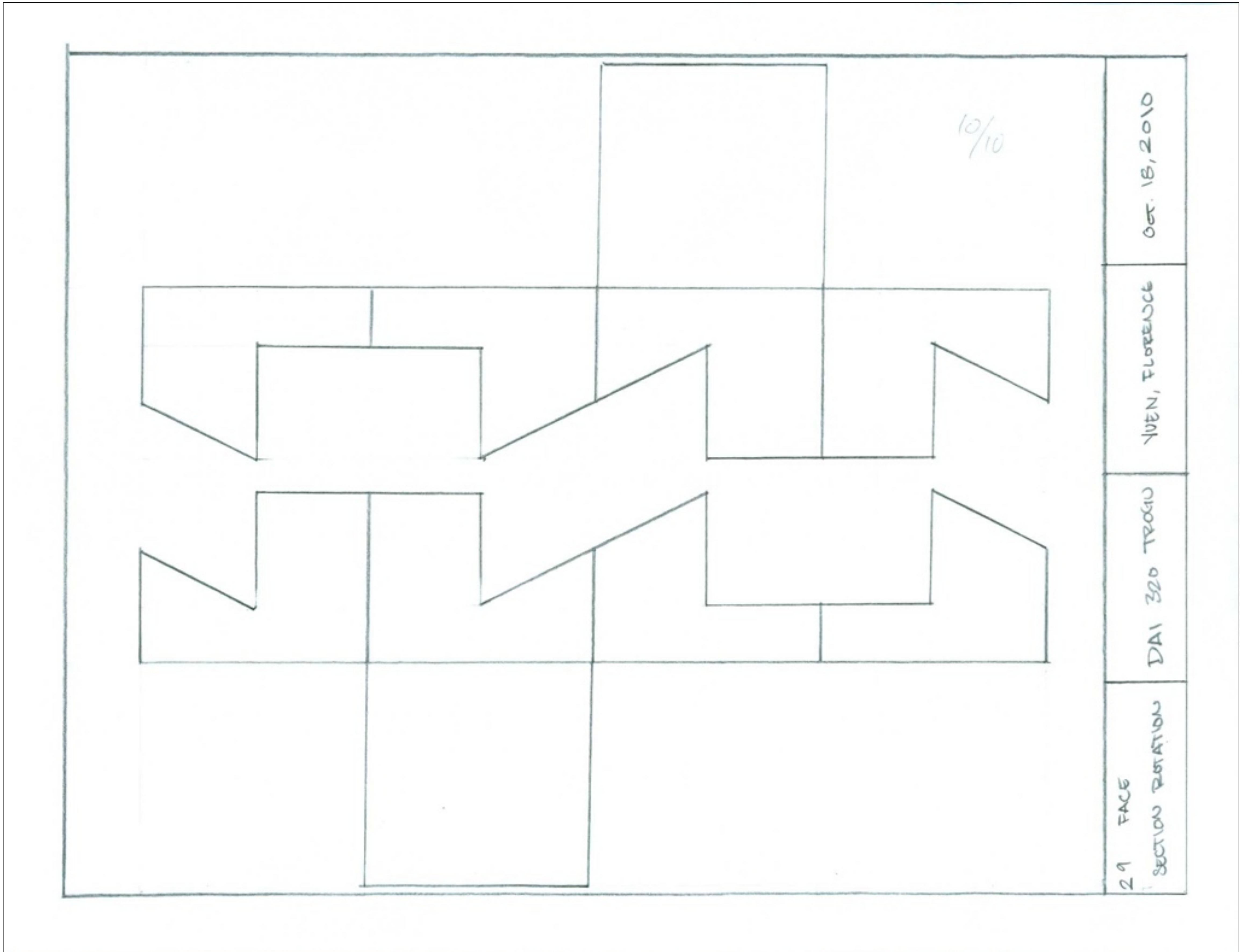


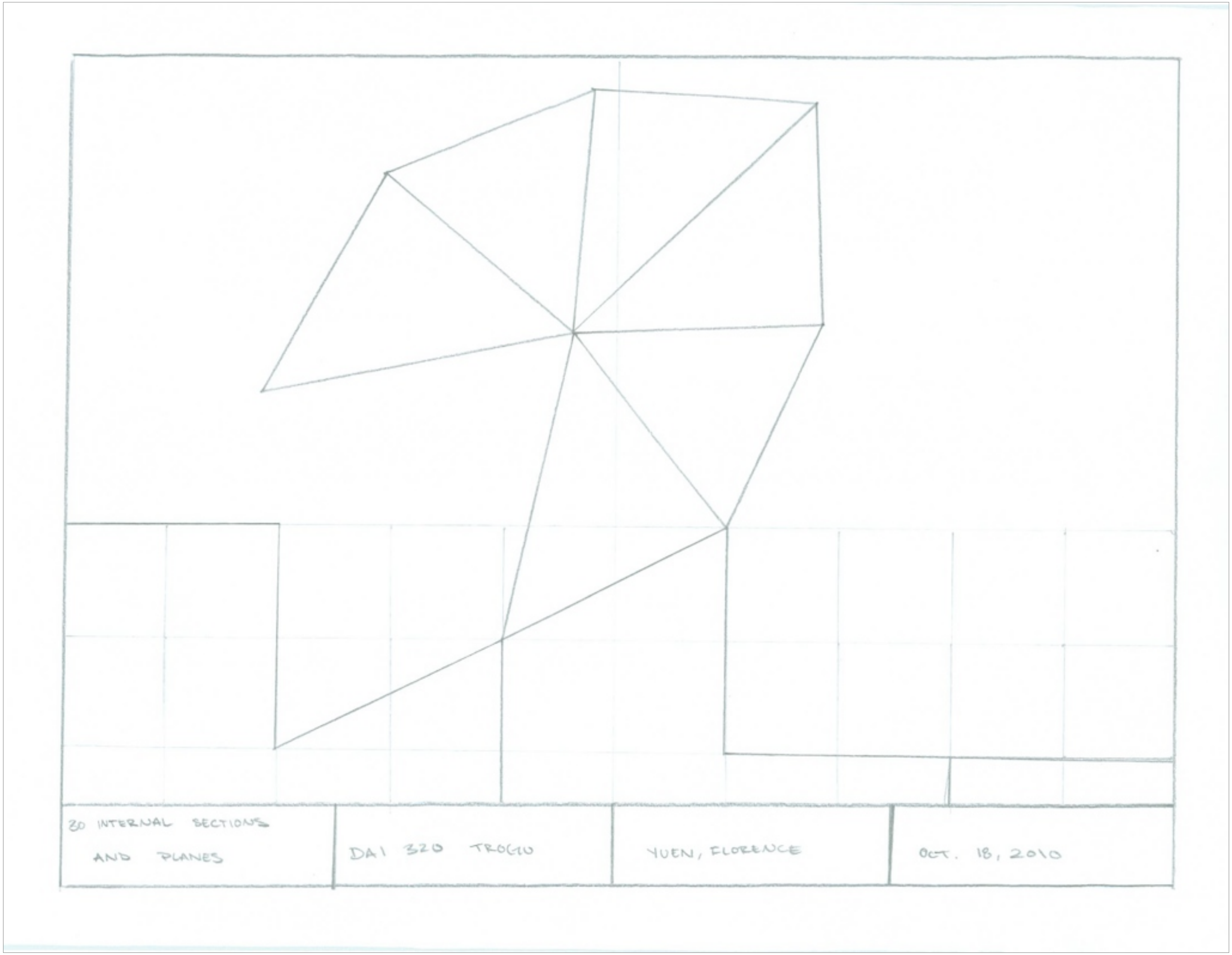
Use this page to find distances for points “C”, “D”, and “E”

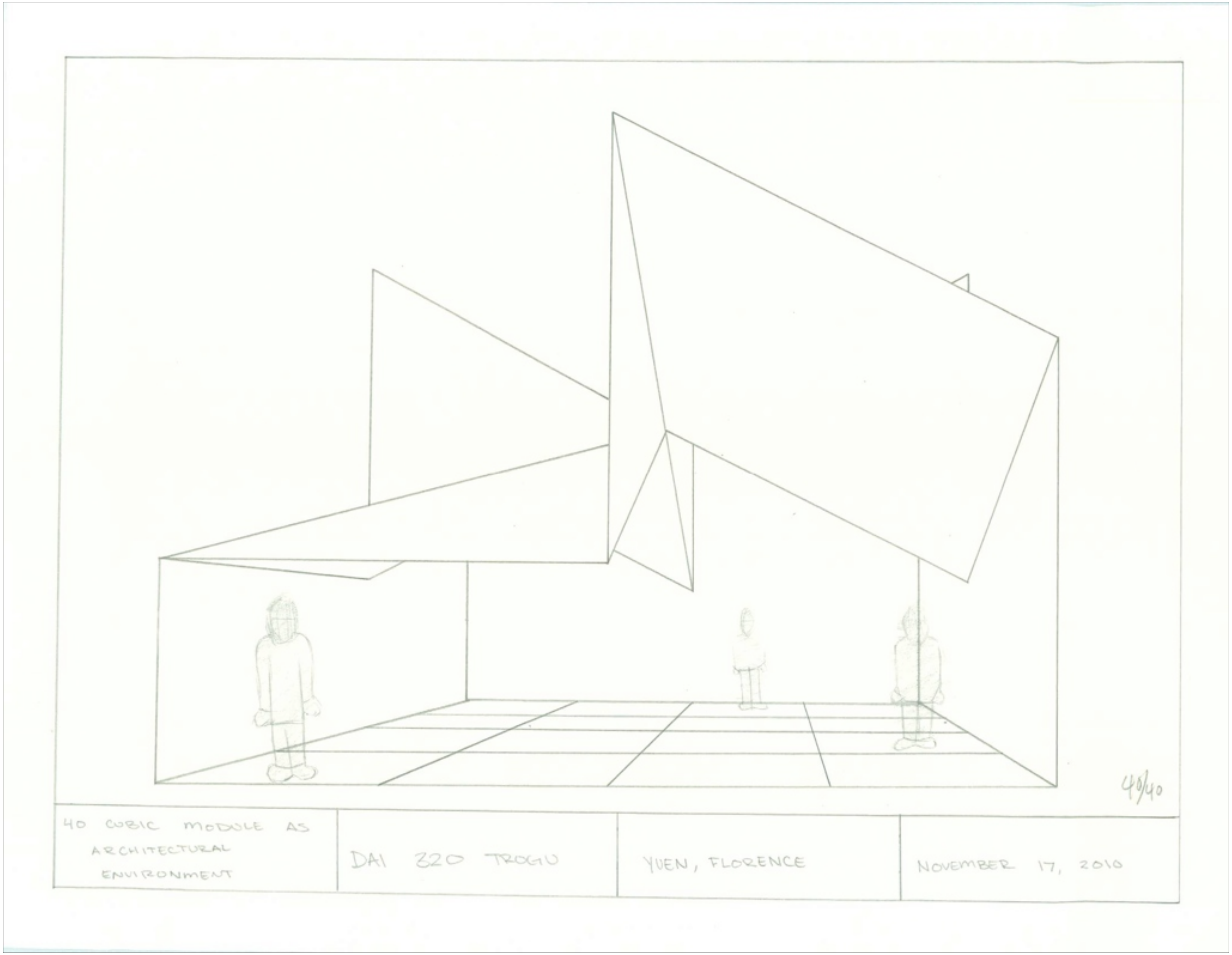


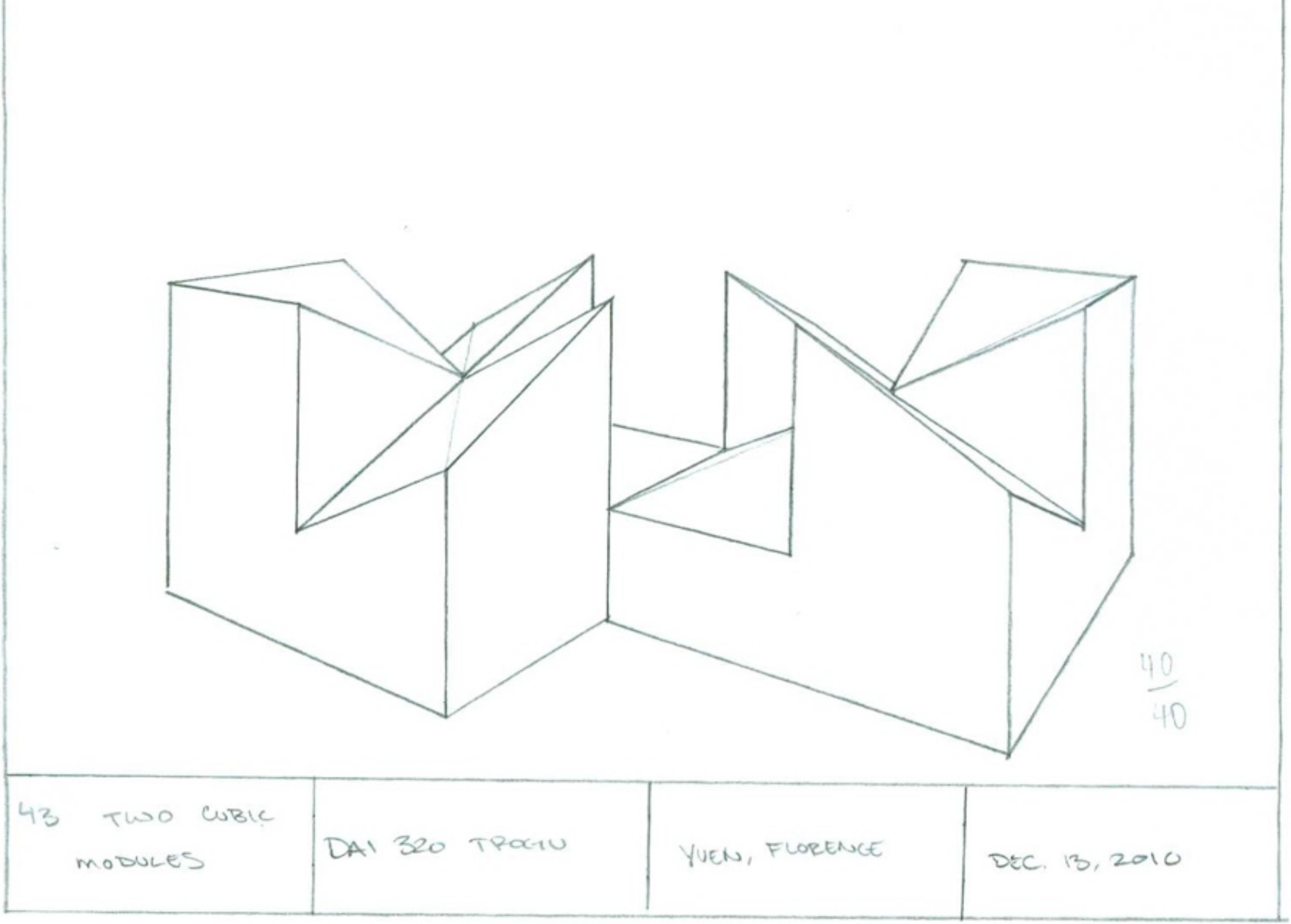
Cube sectioned along the diagonal.

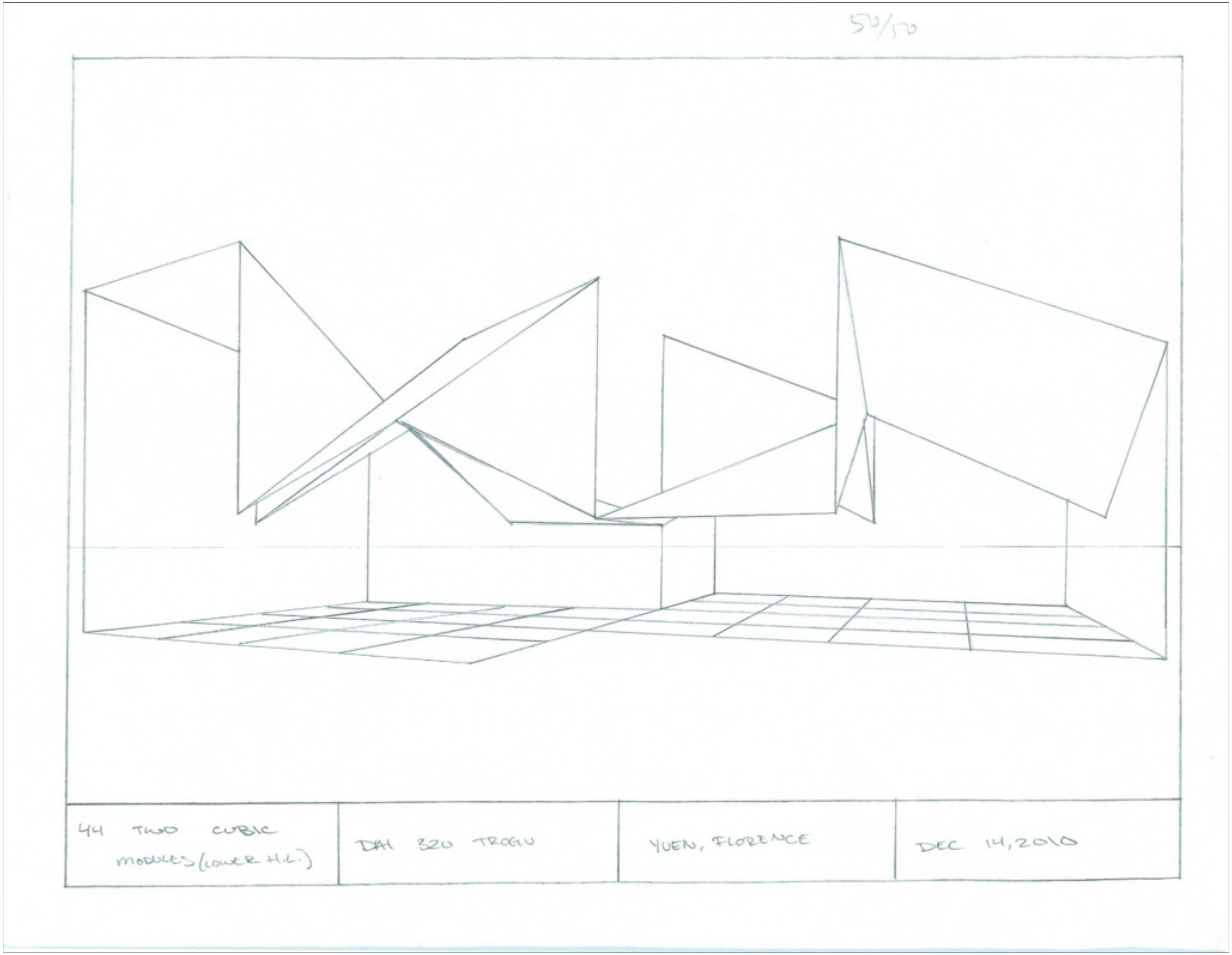


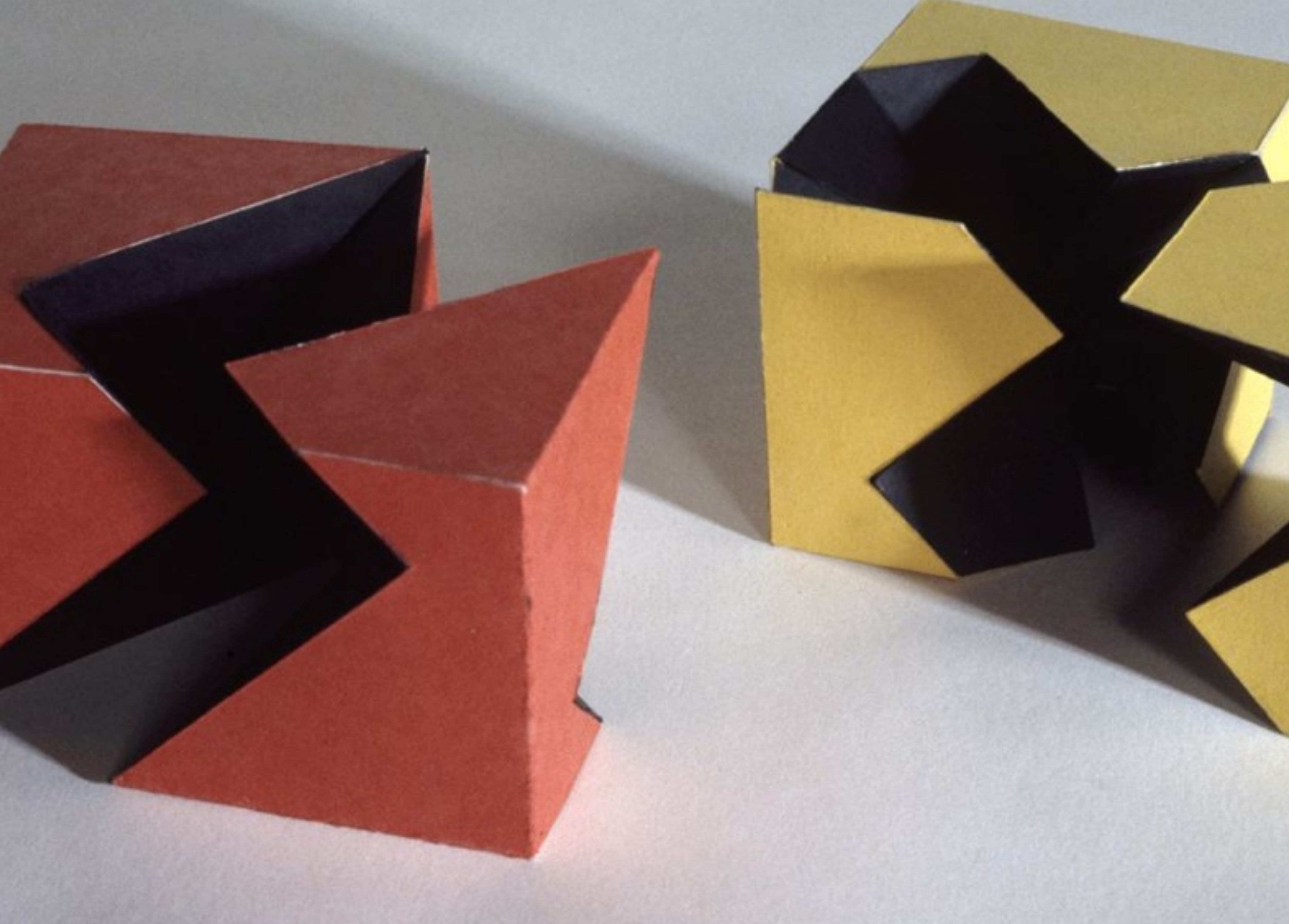

10/10
OCT. 18, 2010
YUEN, FLORENCE
DAI 320 TROGU
29 FACE
SECTION ROTATION

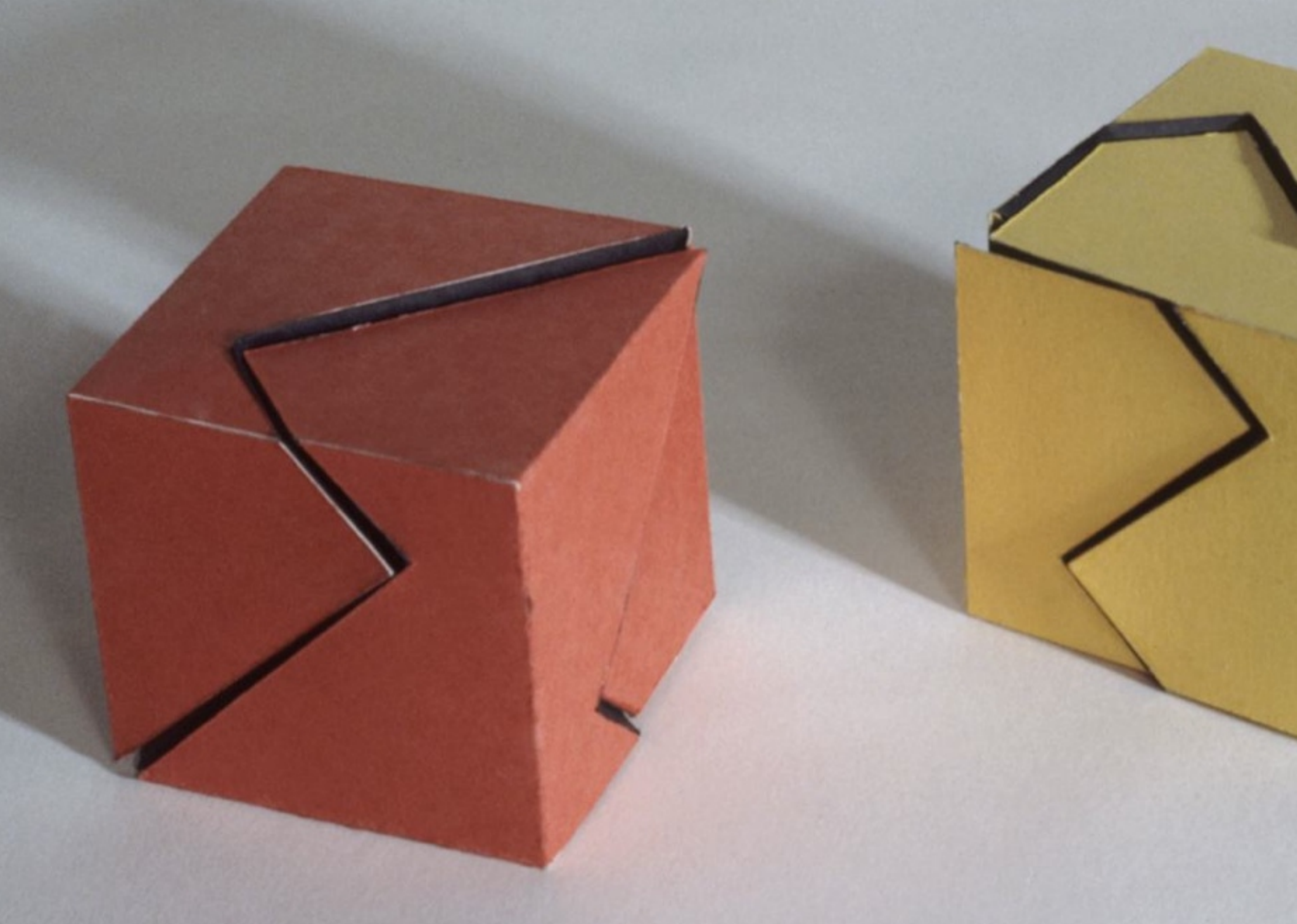

3D INTERNAL SECTIONS AND PLANES
DAI 320 TROGU
YUEN, FLORENCE
OCT. 18, 2010

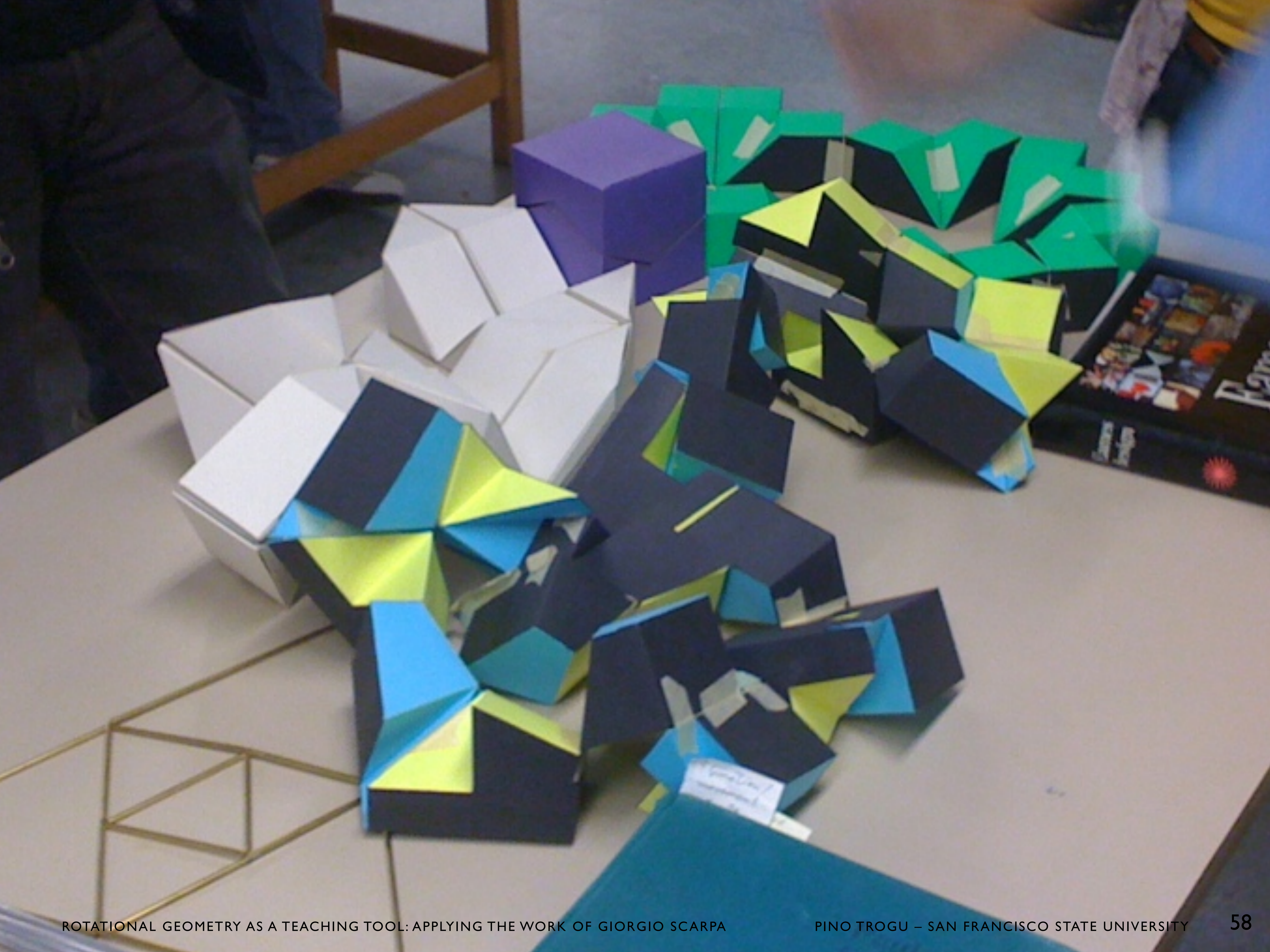

40/40
40 CUBIC MODULE AS ARCHITECTURAL ENVIRONMENT
DAI 320 TROGU
YUEN, FLORENCE
NOVEMBER 17, 2010

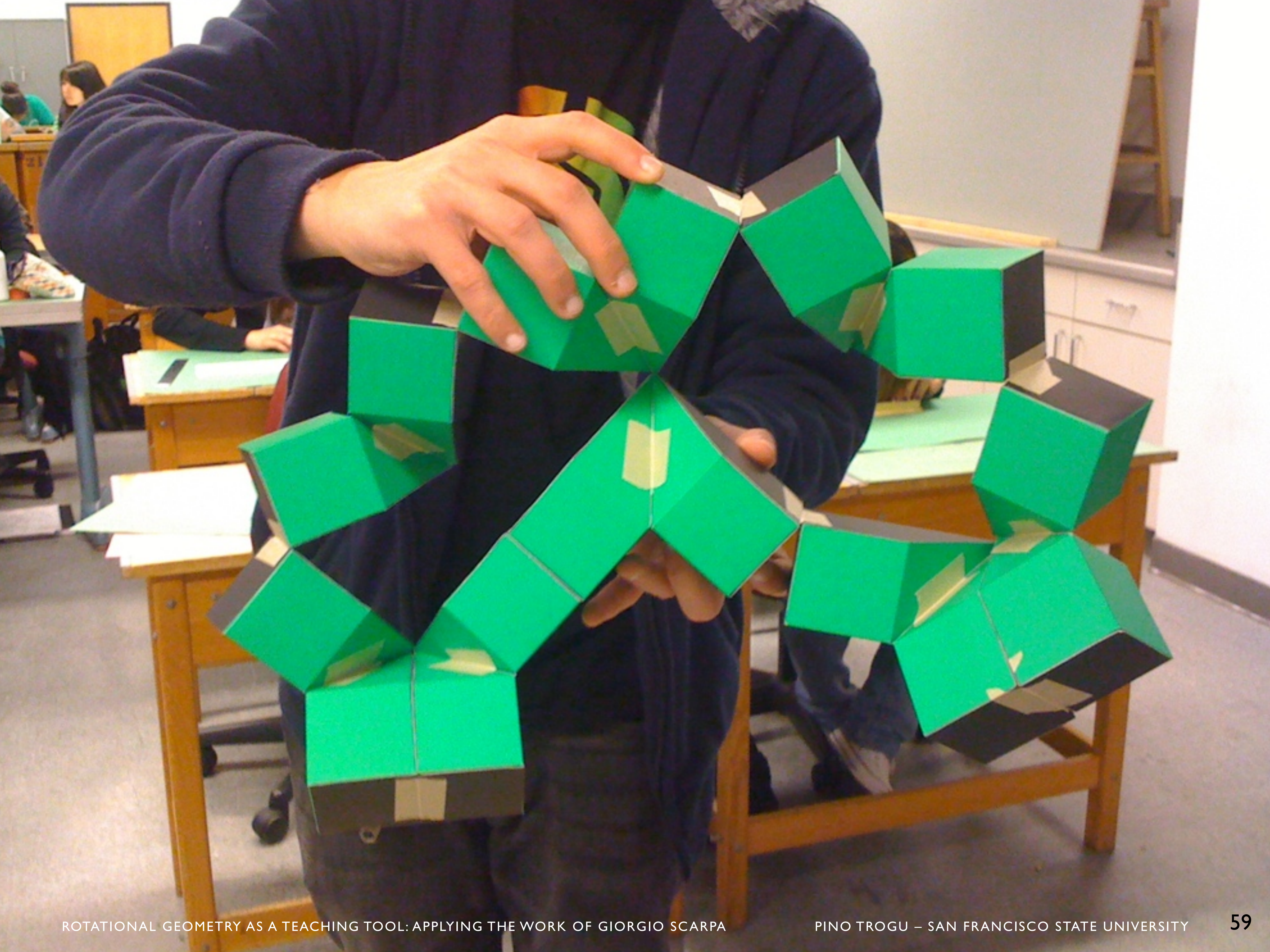

40
40
43 TWO CUBIC MODULES
DAI 320 TROGU
YUEN, FLORENCE
DEC. 13, 2010


50/50
44 TWO CUBIC MODULES (LOWER H.L.)
DAI 320 TROGU
YUEN, FLORENCE
DEC 14, 2010









REFERENCES & LINKS

Jürg Spiller, ed., *Paul Klee: The Thinking Eye*, trans. Ralph Manheim. Wittenborn, 1961.

Giorgio Scarpa, *Modelli di geometria rotatoria* [Models of rotational geometry] Zanichelli, 1978.

Erik D. Demaine and Joseph O'Rourke, *Geometric Folding Algorithms. Linkages, Origami, Polyhedra*. Cambridge University Press, 1997.

Cube Section trogu.com/projects/getProject/20051225082001/project_html
Giorgio Scarpa userwww.sfsu.edu/~trogu/scarpa

PDF of slides and handouts
trogu.com/Documents/conference/design-principles-and-practices

Contact

trogu@sfsu.edu   design.sfsu.edu   trogu.com

go to first slide

Music: il nuotatore, Giovanni Allevi