Reflecting on Fancy-Cut Diamond Patterning

GIA®   **CONVERGE**

Cut Space
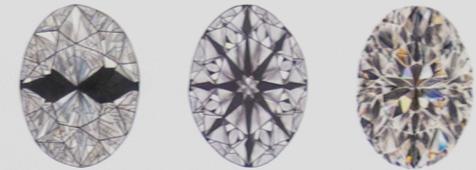### An Enumeration Algorithm for Producing Symmetrical Diamond Designs

Generating Graphs

Crown
(0,1,1,1)

Pavilion
(2,1,0,0)

Key
(left, middle, right, girdle)
○ Left
○ Middle
○ Right
○ Girdle
○ Corner Points of Fundamental Domain and Culet
  (Simple graph has 1 corner point
  Standard graph has 2 corner points)

Fold symmetry divides the diamond into repeating sectors (fundamental domain), each defined by a **generating graph**. From a single graph, diamonds of any symmetry can be formed with 4-digit codes specifying where vertices appear within each sector.

Symmetry

| Rotational 3 | Dihedral 2 | Dihedral 4 | Dihedral 8 |

Every diamond has one of the following types of symmetry:
1. None
2. Dihedral (D_n): n-fold symmetries
3. Rotational (R_n): n-fold rotation with no fold symmetries

Generating Graphs + Symmetry

1100 1020 1011 1010   0120 0111 0110 0102

Generating Graphs

Degree 4 Symmetry
Degree 5 Symmetry
Degree 6 Symmetry
Degree 7 Symmetry
Degree 8 Symmetry

Any crown and any pavilion diagram can be paired to create a 3D diamond model using a lifting algorithm. The model's dimensions can then be optimized.

Virtual Facets
Fundamental Units of Diamond Design
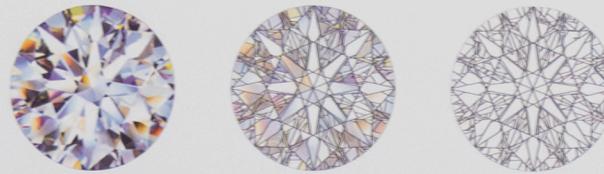
Photography and Art by Jim Caudill

Anatomy of a Virtual Facet
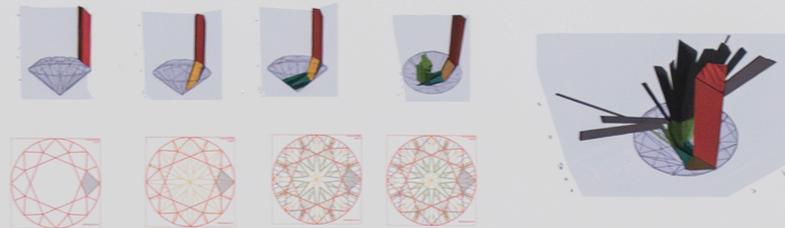
The red beam refracts, creating a second yellow beam, striking the pavilion. The yellow beam splits and reflects into 13 green sub-beams. The second reflection further splits the sub-beams, redirecting towards the crown. The beams refract and exit the crown.

Virtual Facet Maps

Crushed Ice Map
Size of Virtual Facets
Small   Medium   Large

Obscuration Map
Obscuration Potential (Contrast)

K-Flector Map
Number of Light Bounces

Crushed ice describes a diamond pattern where virtual facets appear as many tiny sparkles rather than large flashes.
Obscuration occurs when illumination sources are blocked by the viewer, creating darker zones.
K-flector maps are color coded according to the number of internal reflections comprising each virtual facet.

Bow Tie Study
Cut Designs Can Be Optimized According to Pattern Aesthetics

Pavilion: 38, 39, 40, 41, 42, 43, 44
Crown: 30, 31, 32, 33, 34, 35

Bow ties are mostly controlled by pavilion angle. Shallow pavilions are good for reducing bow tie.

Bow tie study for a 7-main pear. Crown and pavilion angles were set for facets at the belly, keeping everything else as constant as possible. Depicted are obscuration maps across a range of crown and pavilion angles.
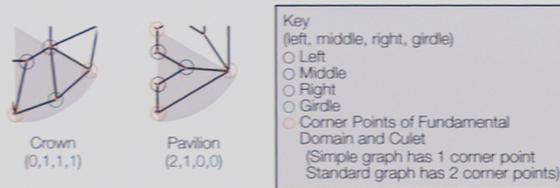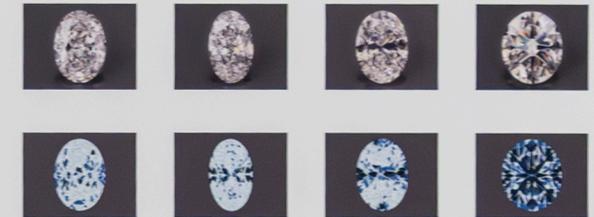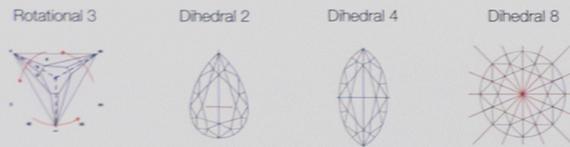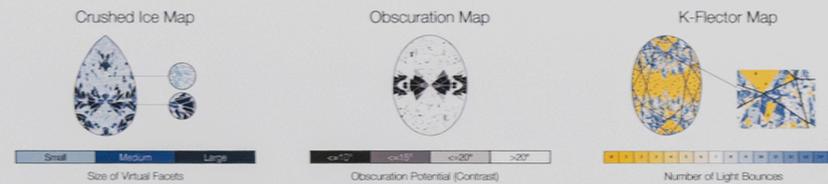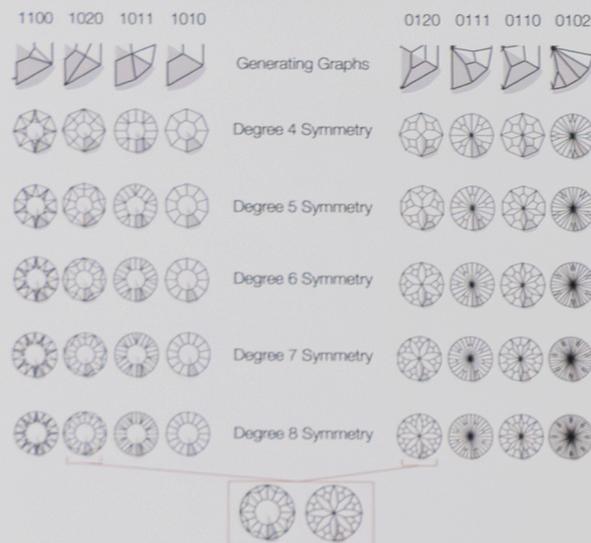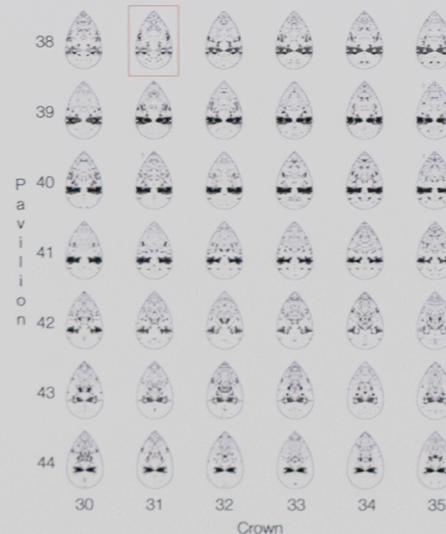
Design Patterning
The Intersection of Personality, Precision, and Performance

Colored Pencil Drawings by Natalie Maddy

Diamond Flights

Crushed Ice: Same Shape, Varying Personalities

Obscuration: Fold and Rotational Symmetries

Crushed Ice: Personalities Across Common Shapes

Obscuration: New Frontiers in Cut Space