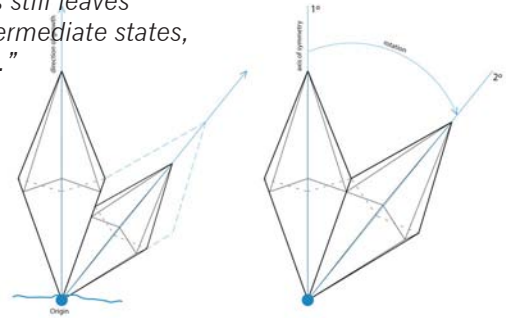


2. Crystalline Systems and Symmetries

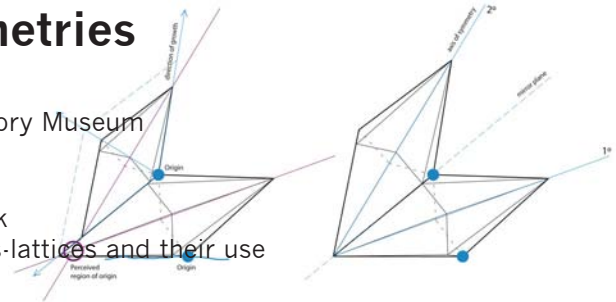
“We took as our point of departure cases of this kind on the geological stratum, the crystallin stratum, and the physichemical strata, wherever the molar can be said to express microscopic molecular interaction (“the crystal is the macroscopic expression of a microscopic structure”; the “crystalline form expresses certain atomic or molecular characteristics of the constituent chemical categories”). Of course, this still leaves numerous possibilities, depending on the number and nature of the intermediate states, and also on the impact of exterior forces on the formation of expression.”
Deleuze & Guattari, A Thousand Plateaus



2. Crystalline Systems and Symmetries

Fri, 9.10.: 10am: Visit Mineral Collection, National History Museum
hand-out of overall brief

Mon, 12.10.: 2 – 4 pm: Rules: **ideal** / Input by Toni Kotnik
Introduction into the mathematics of Bravais-lattices and their use for the classification of crystal structures



Wed, 14.10.: 10am / all day: work in unit space & individual tutorials
3.30 - 5 pm: seminar **‘Objectivity is romantic’**
presentation by Akis, Alan and Sunny

Fri, 16.10. : 10am / all day: work in unit space / individual tutorials

Mon, 19.10.: 10am: work in unit space & individual tutorials
2 – 4 pm: Rules: **real** / Input by Toni Kotnik
Vector-based methods of comparison between ideal and real crystal structure and extraction of rules of deformation

Wed, 21.10.: 10 am – 4 pm: Digital **modelling** / Input by Toni Kotnik
Workshop on digital modelling of the rule set of the crystal under consideration and possibilities of contextual concatenation

Fri, 23.10.: 10am: all work in unit space / individual tutorials

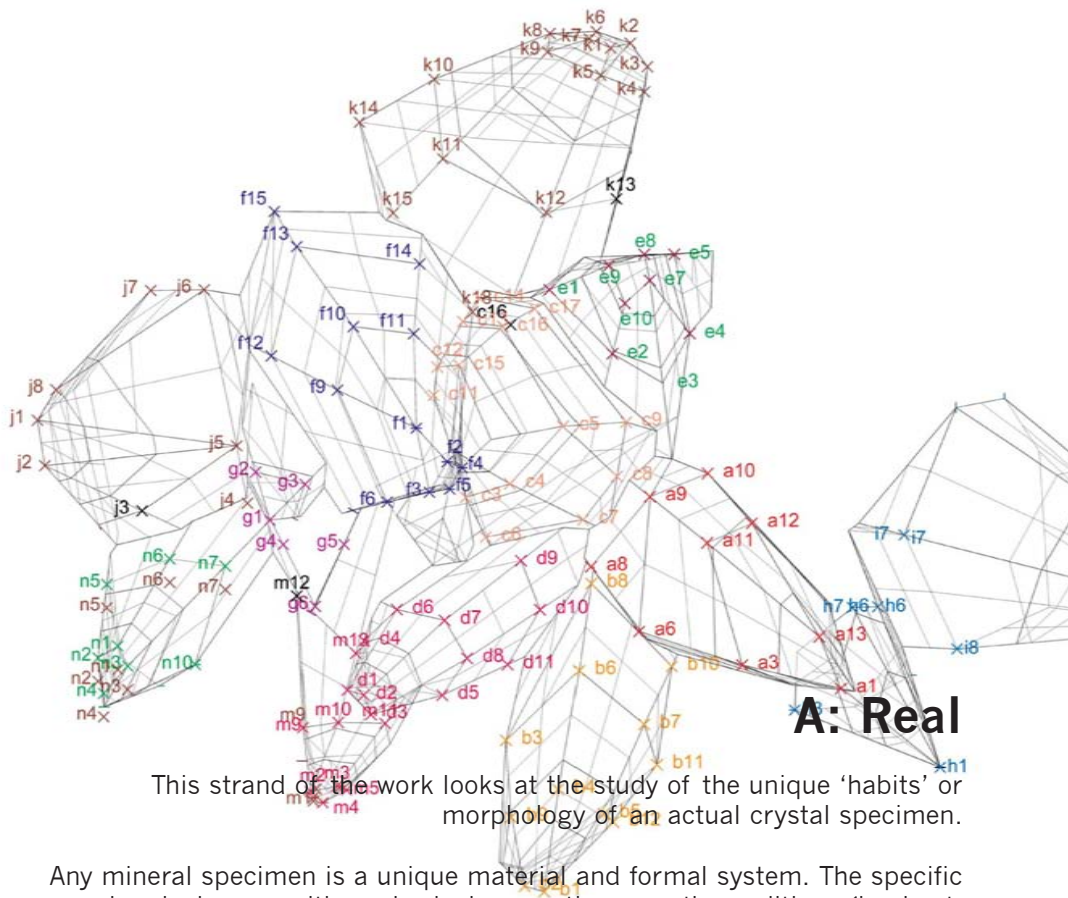
Mon, 26.10.: individual tutorials

Wed, 28.10.: individual tutorials

Fri, 30.10.: individual tutorials

Mon, 2.11.: Pin up

2. Crystalline Systems and Symmetries



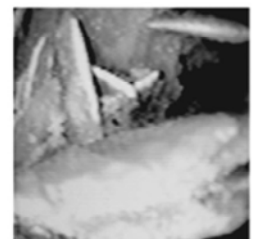
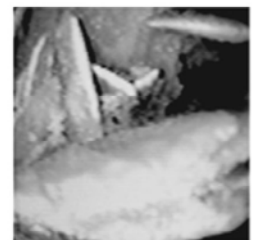
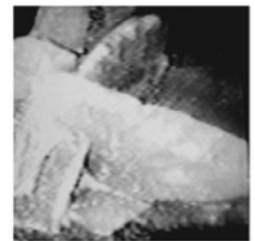
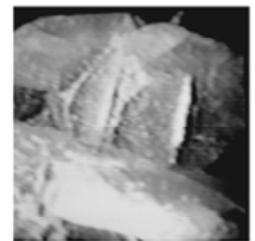
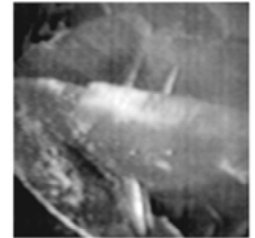
This strand of the work looks at the study of the unique 'habits' or morphology of an actual crystal specimen.

Any mineral specimen is a unique material and formal system. The specific chemical composition, physical properties, growth conditions (i.e. heat, pressure, space) and formation environments it was subjected to gave rise to a unique articulation reflecting these. In mineralogy the description of the appearance or 'habit' of a crystal is often the starting point in the recognition and identification of specimens.

Task: Replication

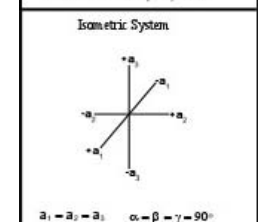
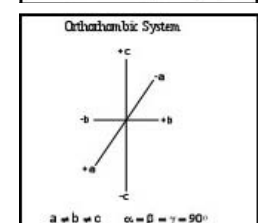
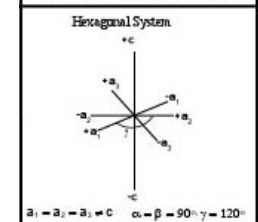
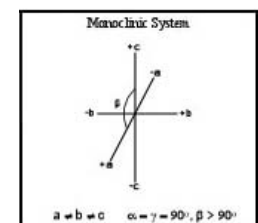
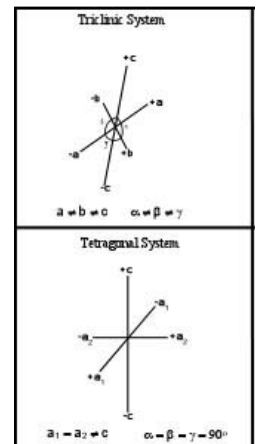
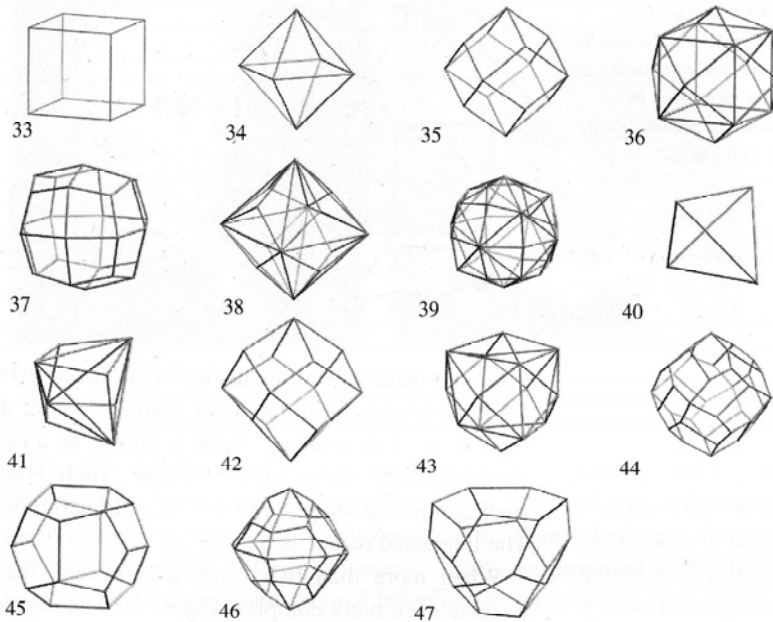
Produce accurately drawn and physically and / or digitally modelled descriptions of the unique habits or formal behaviours of your crystal specimen.

You will have to devise ways of systematically measuring, drawing and modelling your specimen. Build up a vocabulary that names and describes the habits (i.e. tree-like, needle-like, bladed, lenticular, corral-like, branched, layered, twinned, packed, di- or polymorph) - as well as clarifying the base shapes involved (i.e. pyramids, prisms, polyhedra) etc. Analyse the geometric operations involved in its growth, its regularity or order and where that breaks down.



2. Crystalline Systems and Symmetries

5.4 Crystal forms



B. Ideal

Whereas habits reflect the actual unique formation of crystalline matter, crystal geometry is based on an ideal or fictional context.

This strand of the work looks at the extraction of a rule-based geometric system within an abstract environment.

Task: Rule-based System

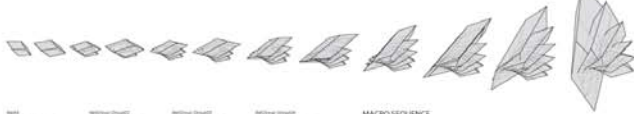
Classify your crystal system.

Through a series of drawings and models, identify and speculate on the particular order your system displays by relating it to the internal atomic structure of your specimen.

This second series of drawings and models should speculate on the underlying logic present in your system and examine its geometric operations, i.e. symmetry operations, angles correspondences, scalar relationships, groupings of planes, axis or points and other identifiable geometric features. The aim is to arrive at a rule based system - a type of crystalline script.

2. Crystalline Systems and Symmetries

CRYSTALLINE GROWTH AND FORM SCRIPTING AND MACROS



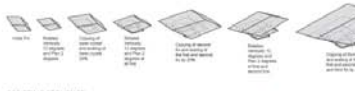
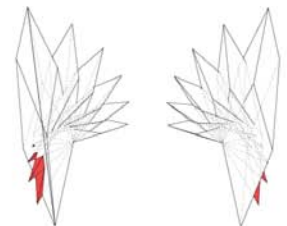
Macro	Macro Sequence	Macro Sequence	Macro Sequence
Macro 1: [Code]	Macro 1: [Code]	Macro 1: [Code]	Macro 1: [Code]
Macro 2: [Code]	Macro 2: [Code]	Macro 2: [Code]	Macro 2: [Code]
Macro 3: [Code]	Macro 3: [Code]	Macro 3: [Code]	Macro 3: [Code]
Macro 4: [Code]	Macro 4: [Code]	Macro 4: [Code]	Macro 4: [Code]
Macro 5: [Code]	Macro 5: [Code]	Macro 5: [Code]	Macro 5: [Code]
Macro 6: [Code]	Macro 6: [Code]	Macro 6: [Code]	Macro 6: [Code]
Macro 7: [Code]	Macro 7: [Code]	Macro 7: [Code]	Macro 7: [Code]
Macro 8: [Code]	Macro 8: [Code]	Macro 8: [Code]	Macro 8: [Code]
Macro 9: [Code]	Macro 9: [Code]	Macro 9: [Code]	Macro 9: [Code]
Macro 10: [Code]	Macro 10: [Code]	Macro 10: [Code]	Macro 10: [Code]

MACRO SEQUENCE

Having analysed the relationship and alignment of the fins I became interested in joining the individual of the forming growth pattern. I began off by making various observations, the first of which was that the growth was in fact the central one and the others grew from that. The second observation that I made was that the way the fins grew was in fact the same as the scaling of the volume of the base. The first script that I produced dealt with joining the initial base to the growing fins by 10% percent, then scaling up by 10% percent and making the growing volume around the central point. These sequence were then applied to the introduced to and repeated with a 10% degree repeat upon each volume within.

PROTRUDING FINS

As the fins rotate around a central point the fins of the first start to protrude through the base of the original fin. After assembling the original volume it appeared that the way, in an accurate translation. When initially analyzing the Curve Phenomenon after observing I had obtained some of the smaller protruding parts of the fins as they grew out, however having done the test there is a possibility that there were in fact part of some of the larger fins. After this an interesting observation and something I have to build into a script I had that the scaling up of the fins by the percent in the sequence will be if the scale is fixed or a more accurate rate of growth than the proportions would be seen appear in each iteration.



SCRIPTING SEQUENCE

```

macro(0) = Base Surface Area (A)
Call Base Surface Area (A)
macro(1) = Base Surface Area (B)
Call Base Surface Area (B)
macro(2) = Base Surface Area (C)
Call Base Surface Area (C)
macro(3) = Base Surface Area (D)
Call Base Surface Area (D)
macro(4) = Base Surface Area (E)
Call Base Surface Area (E)
macro(5) = Base Surface Area (F)
Call Base Surface Area (F)
macro(6) = Base Surface Area (G)
Call Base Surface Area (G)
macro(7) = Base Surface Area (H)
Call Base Surface Area (H)
macro(8) = Base Surface Area (I)
Call Base Surface Area (I)
macro(9) = Base Surface Area (J)
Call Base Surface Area (J)
macro(10) = Base Surface Area (K)
Call Base Surface Area (K)

```

Define the rotation axis and angle of the fins here.

Fixed Horizontal Rotation = (0.0136 * Surface Area) = 02.005
 Vertical Rotation = (0.0481 * Surface Area) = 13.758
 Fin Rotation = (0.0081 * Surface Area) = 0.7586

Macro Sequence

Macro 1: [Code]

Macro 2: [Code]

Macro 3: [Code]

Macro 4: [Code]

Macro 5: [Code]

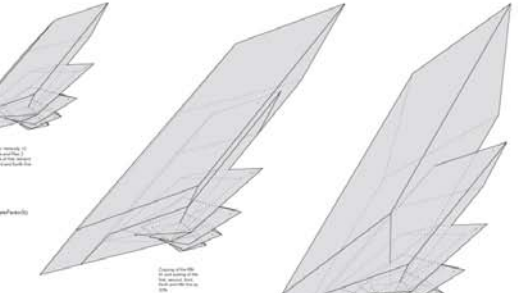
Macro 6: [Code]

Macro 7: [Code]

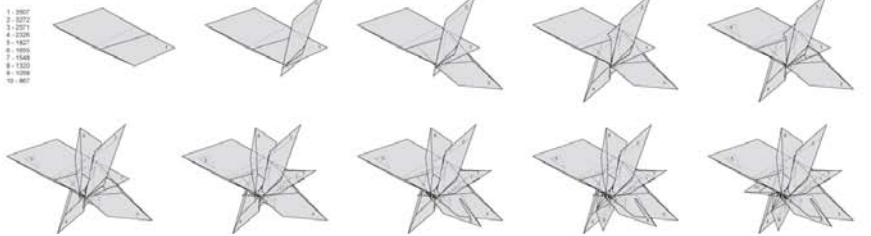
Macro 8: [Code]

Macro 9: [Code]

Macro 10: [Code]



VOLUMES OF SCRIPTED FINS



When I had taken all of the data from the 3d model and attempted to find the relationships within it there was inevitably a large amount of information but within the process I had to script, which involves in order to be able to transfer it into a piece of data and then then back into the script. One of the scenarios of such a situation was when I was trying to find a relationship between rotation and the volume of each fin, I was looking for a relationship between rotation and the volume of each fin, I was looking for a relationship between rotation and the volume of each fin, I was looking for a relationship between rotation and the volume of each fin. I had to transfer this into a script. Despite the fact of information I was a much more complex process that allows me greater control over the outcome of the form. One of the most interesting things about my form was the regularity and scale that occurred within the apparent chaos that the growth system has. Whilst in the macro I could only really address one aspect of the form the script allowed me to repeat an element of operations.

C. Transformations:

Building on the research that you have done so far, you are asked to subject your geometric system to a number of inputs in order to produce serial transformations.

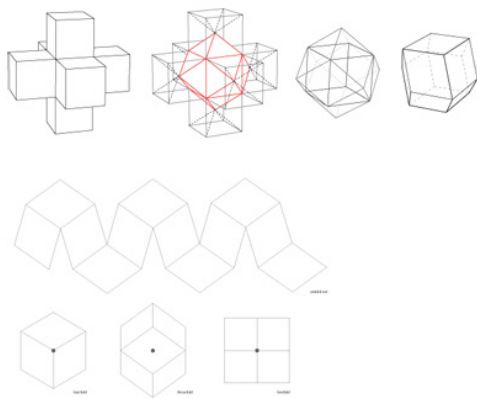
Once you have developed the underlying logic of your system as a series of geometric rule-based operations, you can always re-run these operations varying the rules. Only vary one rule at the time and observe the outcome. Go through "n" number of iterations rigorously, producing variations within your chosen method, documenting the relationship between the rule changes and changes in the geometric system.

Specifically allow input from the real into the ideal system and vice versa and experiment. The following might be possible:

"After first rejecting the juxtapositional techniques of collage as accumulations of the merely different, we posit either an unchanging unit deployed along a variable trajectory or the single repetition of a variable unit. In both cases transformation is a quality perceived through deployment in quantity." Reiser & Umemoto, Atlas of novel tectonics.



2. Crystalline Systems and Symmetries



Rhombicuboctahedron

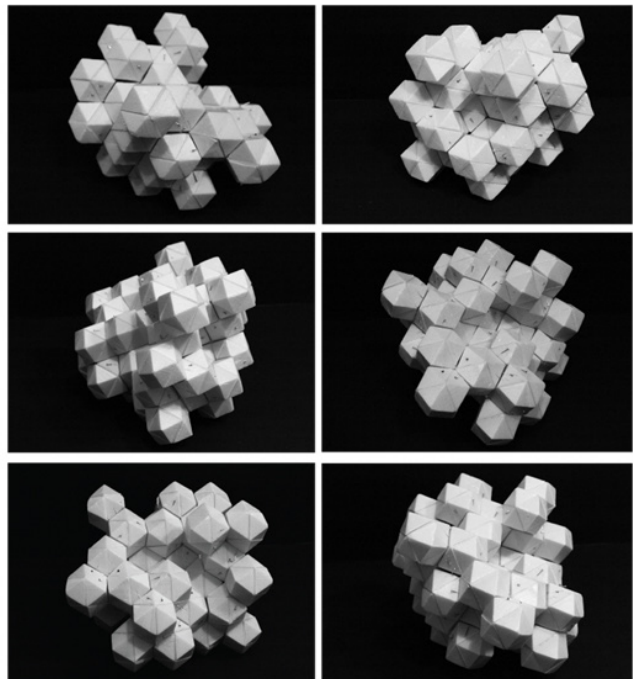
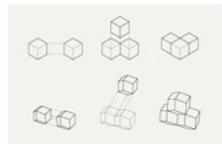
It is the polyhedral dual of the cuboctahedron, and a trapezohedron. The length of each face is exactly 3/5 times the length of the short diagonal so that the acute angles are each $\cos^{-1}(3/5)$ or approximately 71.57° .

Being the dual of an Archimedean polyhedron, the rhombicuboctahedron is face-transitive, meaning the symmetry group of the solid acts transitively on the set of faces. In chemistry terms, this means that for any two faces A and B there is a rotation or reflection of the solid that leaves it occupying the same region of space while moving face A to face B.

The rhombicuboctahedron is one of the nine edge-transitive convex polyhedra, the others being the five Platonic solids, the cuboctahedron, theicosidodecahedron and the rhombicuboctahedron.

Face type	Abundance
Faces	14
Edges	24
Vertices	26
Dihedral angle *	120°

*As given by the angle between two planes in which face A meets face B.



Output:

This exercise is about process. Rather than a final result, you are asked to develop a series of techniques and methods that can inform your design methodologies. The aim is to develop an understanding and control of the 'habitual' logic of these types of systems, build a vocabulary of modes of description or analysis and advance these into generative tools for further use.

- Measuring

In order to produce the drawings and models asked for, you might have to go through other media such as photography, digital modelling etc.

Possible tools might include Camera, Scanner, Caliper, X-Ray, Microscope, Ruler, Point digitiser, Loupe / magnifier

- Drawing

Drawings to be annotated scaled line drawings only.

- Modelling

Modelling in this context is understood as a working method and not a mode of representation. Always work in series, developing a suite of objects that explore a coherently developed logic.

Digital models should not be rendered and maintain an analytical quality.

Physical models should display clear decisions on the technique of modelling, e.g. as a solid model, a surface model or as a type of space frame. This will lead to material choices: non-directional amorphous materials such as foam, resin or plaster for solids, sheet material such as paper, card, acrylic or metal sheets for surface investigations, stick materials such as timber sticks, plastic or metal tubes to look at idealised frame systems.