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OBITUARY

CYRIL STANLEY SMITH
honorary member of ISIS-Symmetry
1903 - 1992

Interactions between the arts and the sciences

Dr. Cyril Stanley Smith was my friend and mentor. We met face-to-face when he first invited me to his summer home near Concord, New Hampshire. It was the perfect spot for a long discussion between this fine arts professor and this brilliant metallurgist, structuralist and so much more.

Dr. Smith's academic career had earned him the title of Institute Professor at the Massachusetts Institute of Technology which distinguished him as a faculty member whose work transcended individual departments and disciplines. His analysis of the boundary patterns between metal grains had inspired his general theory of structure which led him to found the Philomorph Society, a group of Harvard and MIT professors studying form and structure. He was the author of more than 200 articles and books. Among his awards was the Presidential Metal of Merit, presented with colleagues Enrico Fermi, Harold Urey, Samuel Allison and Robert Stone, for his work at Los Alamos, NM, directing preparation of the fissionable metal for the atomic bomb.

Dr. Smith and his wife, Alice, owned an early 19th century salt-box summer house at the end of a gravel road and with a view of the White Mountains. His study was a small, separate wooden building reached by walking a path bordered with juniper. This first meeting had followed earlier correspondence. We talked and drew diagrams for each other – always we drew for each other – for several hours and ended the day with cocktails on the lawn with our wives. He recognized immediately my new self all-space filling polyhedron and facilitated its publication in LEONARDO, Journal of the International Society for the Arts, Science and Technology.

The first meeting of ISIS-Symmetry in Budapest, Hungary, allowed me a whole week of the pleasure of his company. Dr. Smith's conversation was always stimulating and full of surprising insights. We even passed notes and drawings on the bus trip to Lake Balaton.

I last saw Dr. Smith in June before he died in August, 1992, at his home in Cambridge, Massachusetts. He was ill with cancer but his wife insisted that I visit and graciously said it would give him a boost. Again, we talked and drew for each other and enjoyed lunch together with our wives and their daughter, Anne Denman.

I had the pleasure of visiting with his widow, son, daughter, son-in-law and his "computerized" grandson at that same New Hampshire house in June, 1994, following the ART/MATH conference at SUNY, Albany. Mrs. Smith, who always referred to Dr. Smith and I as "offbeat professionals", is now residing at a retirement home near her son, Stuart, in southern California.

Perhaps the best way to remember him is to quote from our correspondence that spanned years. His letters were full of wisdom and insight that should be shared. Most of his letters and even postcards included drawings. His letters meant everything to me and encouraged me to continue with my research.

Dr. Smith and Bob Wiggs in the office at his summer house in New Hampshire, 1985.

QUOTATIONS FROM DR. SMITH'S LETTERS

There are two ideas that reoccur persistently in his letters to me – lines and their junctions and things that don't fit.

1989: "I still can't decide whether the polygon, edge or the vertex is the most important, for all are essential. Mondays, Wednesdays and Saturdays, I believe in polygons, open spaces; Tuesdays, Thursdays and Fridays in vertices and lines; and on Sundays I worship the trinity. Vertex and polygon are the same except for scale and resolution in either space or time, and edge is simultaneously connection and separation."

1990: "Bob, I'm still obsessed with polyhedra and, ever since you discovered your octahedron with four triangles and four squares, I've been looking for other forms that are space fillers. Conclusion: space filling has nothing whatever to do with polygons or polyhedra but simply the lines and their junctions."

1990: "After years of insisting on the corpuscular approach as the most basic, in the last several months I have come to see that the only definite, countable things in natural and artificial structures are the LINES where corpuscular surfaces meet, and that all differences in what is usually called dimensionality disappear or rather merge into a substructure of connections and separations of lines."

1991: "I think we've got to abandon the idea of polyhedra entirely. For purposes of calculation, all structure seems to be reducible to lines – out-lines, in-lines and boundary-lines – and all history to kissing, missing and merging. No infinitesimal or differential, but simple arithmetical topology of separable lines and their junctions at unresolved vertices."

1985: "All problems of perception and understanding reduce to a scale of separation, junction and inclusion – and here's where our views join exactly – this can be demonstrated with lines and their junctions. Euclid prevented us from seeing that the trihedron with three diagonal faces is a regular polyhedron if one doesn't insist on the straight edges and plane faces required by geometric symmetry (ugh)."

1987: "The only things that 'count', i.e., that can be distinguished, are open spaces and the junctions of the lines separating them. This requires only the simplest Eulerian topology, not higher mathematics. No sines or cosines, no irrationals or transcendentals, no powers of square roots of minus one; in fact, no multiplication and division, only addition and separation are involved."

1988: "Straight lines are almost nonexistent in nature and they are utterly irrelevant to the topology of the junction. The only thing that matters is the hierarchy of the sharing of lines and vertices between polygons and polyhedra."

1988: "One makes precise logical mathematical statements whenever one draws lines and counts their terminations, intersections and joinings: and it doesn't matter in the slightess how many bends and wiggles there are between junctions."

1988: "The human eye looking at something enjoys only those things that don't fit. I, like you, have been fascinated by linear opposition and junction and think that most of our problems with understanding have come from an over emphasis on straight lines and space-filling polyhedra on one hand and Newtonian structure-free calculus on the other. The simple symmetries of crystallography hide the fact that the world is an aggregate of things that don't fit."

1991: "The solid state physicists recent discovery of the importance of lattice imperfection is far more important.

GOD said let things be ODD
EVE'N so said MAN"

1990: "I am currently obsessed with the turbulent forms in 3-D fluids which, at least macroscopically, are non-polyhedral without vertices: one has to ask where is the beef between your canine and bovine dentures? Every morning early I think of an approach that may be significant; by evening, I have convinced myself that it was nothing. But at least life stays interesting as the search for structure continues."

With very different educational and cultural backgrounds, Smith's in the sciences and mine in the arts, we both arrived at more or less the same conclusions about structure and demonstrated it to each other with very clear and simple drawings, models and diagrams. Our ability to communicate with each other, in spite of our differences, is a testimonial to the innate reciprocity between the arts and the sciences when its potential essence is fully developed.

Robert A. Wiggs
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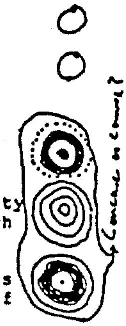
USA

Drawings by Dr. Cyril Stanley Smith

We drew for each other and made models to illustrate the structures we were discussing on scraps of whatever material was available and profusely upon all postcards and letters. These are a few of Dr. Smith's sketches along with some of the accompanying text of the letter.



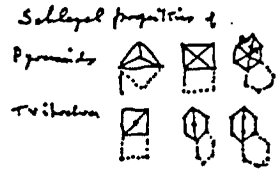
Conventional 3-D space filling is simply directional balance: Each line numerically marks a loss of freedom within the infinity of possibilities in universal unconstraint. Your sutures (which needn't be straight) say more than all the geometric cells of Euclidean polyhedra. Though its is useful to add divalent vertices which are both the beginning and the end of both things to connect and connections between things. My re-written form of Euler's law* says this, for the sum of [vertex valencies minus one] plus ONE is the sum of [polygons minus polyhedra] plus [lines], however distributed. The distinction between 2-D and 3-D space is a qualitative idea, applicable only to a local situation of countable (i.e. observable) beginnings and endings, of those ~~of~~ separations and connections, that are to be included or excluded within an arbitrary boundary.

The small Wigg's octahedron with concave lines that sits on our living-room table and has been commented on and enjoyed by our visitors more than any of the other "art" objects around.

Keep up the good work!

7 Sept 1990

V_r is no. of vertices of valence r



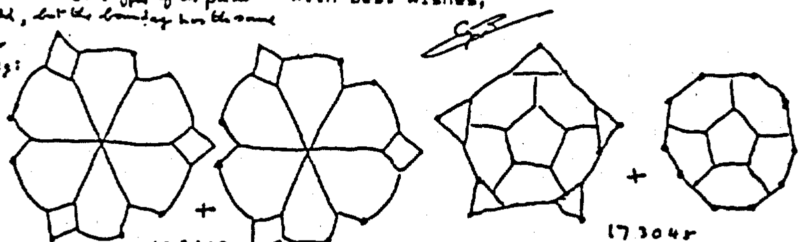
*Euler $\rightarrow (P-C)+V = E+1$ let $E = \Sigma r V_r/2$, hence $\rightarrow \Sigma(r-2)V_r = 2(P-C)$

$\Sigma(r-1)V_r + 1 = P - C + E$

It was your octahedron that first made me realize the importance of prismatic space rather than polyhedra in crystal lattices. Thanks!

With best wishes,

* the two "halves" differ if the polar cap is odd, but the boundary has the same no. of sides in both, e.g.:



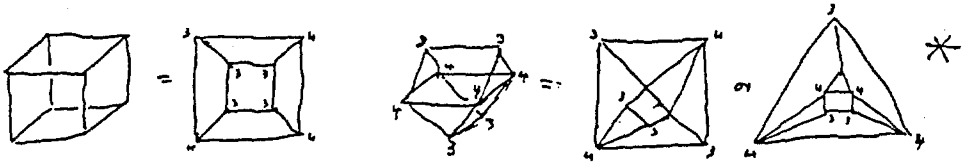
18 2642

17 3048

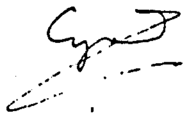
(both have $V_8 = 15$)

I didn't need [3 ...] you that only the vertex valence matters, not the lengths or disposition of the lines.

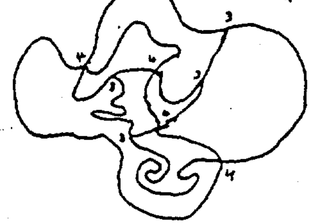
You would, I think find it very instructive to play with Schlegel projections of polyhedra. In these 2-D diagrams all the vertex valencies remain unchanged and the "missing" polygonal face has simply become the space outside the boundary, which, of course isn't a boundary when on the surface of a 'hedron. Thus, the cube and Wiggs8dron are depicted like this:

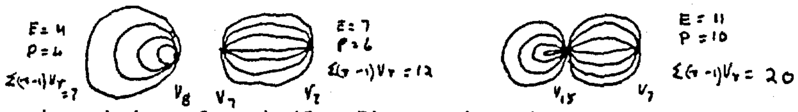


Warmest regards from Al and to Betty.



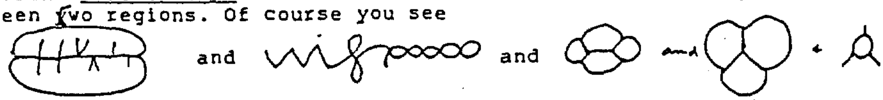
Or, equally correct:



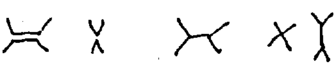


I'm using chains of such (P + E) groupings to prove some interesting things in number theory though I don't expect mathematicians to do anything but laugh at the attempts of a metallurgist to penetrate their logical fences.

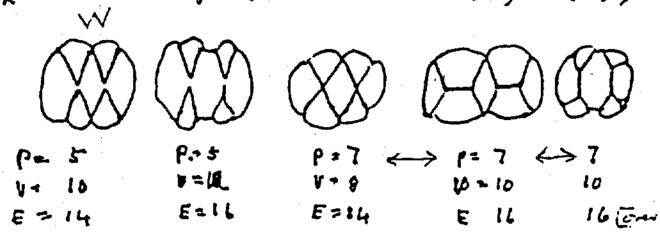
When does a bend become an abrupt change of direction? How finely sharpened is your pencil and how sharp your eyesight? A circle is a chain of particles related to each other and any junction is a change in direction of two surfaces. A line in a 3-D structure can become either a kink or contour in a 2-D surface, or it can be a "real" junction between two or more surface films. In either 2- or 3-D, a vertex is the junction of lines and there can be any number of lines joining -- the valence of the vertex being the number of detectably different separations of direction. Your sutures are simply two different basic forms of junction, two different associations of vertices on the (cellular) boundary between two regions. Of course you see

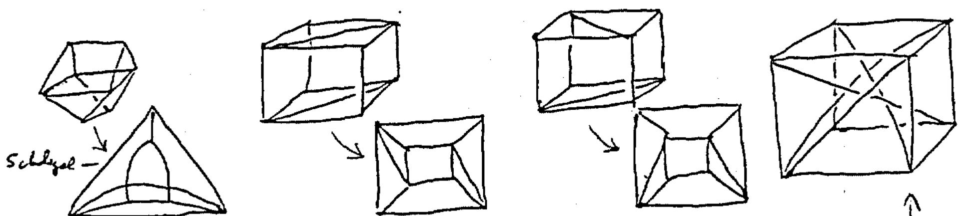


everywhere. The >–< is the Feynman diagram of the physicist.



I should have mentioned in my letter yesterday that your cannic & bronic questions X &)-(do not change in any way the number of polygons or 'hedra or regions that are meeting, $(\Sigma(v-2)V_v$ is unchanged) — CSS





Two other octahedra, closely related to yours, each have four P-4, four P-3, four V-3 and four V-4 -- they are cubes with two opposite faces divided into two trigons, in directions parallel or normal (twisted) in relation to each other. On stacking, these generate an assortment of vertices of valence between 6 and 12 and may or may not add V-4s in the middle of faces depending on choice of orientation and whether the lines can be bent to bypass each other. The merest convention prevents one from regarding as a space-filling unit the net of 8 quadrivalent vertices (2E = 32) internally joined by bent diagonal lines that don't intersect, but it is a fine dense filler of space, made even more dense by internal junctions, the straightest being at a single vertex of valence 8 as in a body-centered cubic lattice.

All good wishes,

Cyril Smith

Dr. Smith and Bob Wiggs at ISIS-Symmetry, Budapest, 1989.