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The Case for Teaching Geometry before Algebra

*Support from Peter J. Snow's
'Charting the Domains of Human Thought'*

There is an interesting isomorphism in the developmental models of consciousness in two papers in Volume 10 of the *Journal of Consciousness Studies*. In P.J. Snow's paper, 'Charting the Domains of Human Thought' (Snow, 2003) he presents a developmental model of consciousness as it relates to the sequential activation of certain areas of the prefrontal cortex of the brain. In Figure 3, opposite page 7, he calls these stages 'archetypes of human cognition'. These four stages are: Psychosocial, Practical, Abstract, and Temporal.

These stages are characterized by a shifting focus on persons, objects, algorithms, and temporally sequenced processes, so I would prefer to call them: Personal, Instrumental, Formal, and Dynamical. In the first stage, education is through parents, day care providers, and kindergarten teachers. In the instrumental stage, the child extends its sense of the body into a wider space through bicycles, musical instruments, and computers. In the third stage, fair play, justice, and formal reasoning emerge, and in the final stage of long-term planning and career goals, the dynamics of identity and performance of the self emerge. As Piaget commented, many teenagers envision a future in which they are famous and their statue is already in the park.

Snow's sequencing of these 'archetypes of human cognition' is isomorphic to my 'Literary and Archetypal Mathematical Mentalities in the Evolution of Culture' (Thompson, 2003). My cultural progression is that of Arithmetic (or Ancient), Geometric (or Classical), Algebraic (or Medieval), and Galilean Dynamical (or Modern). The focus of the Arithmetic mentality is on the generative function of how the One becomes many, and its icon is the statuary of the Great Mother. The focus of the Geometric mentality is the articulation of objects in space and its archetypal expression is the temple and ceremonial centre. The

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focus of the Algebraic mentality is the sacred code and its archetypal expression is found in algebraic algorithms, calligraphy, musical notation, and medieval allegory and alchemy. The focus of the Galilean Dynamical mentality is objects in motion in time (Galileo), as well as the movement of money in currency (capitalism), ballistics in weaponry (Leibniz), blood in the human body (Harvey), and planets in space (Copernicus and Newton).

The chaos mathematician Ralph Abraham (University of California, Santa Cruz) and I have argued that the teaching of algebra before geometry is out of its natural sequence in adolescent development and creates the American plague of 'math anxiety'. Snow provides another neurological window into the prepubescent brain as to why certain abstract processes of reasoning should be postponed for later instruction. If geometry is taught before algebra in its classical Euclidean formulation to children in the context of artistic objects (architecture and sculpture), the concrete focusing on objects in Snow's stage two — the practical — will be respected. The embedding of mathematics in its historical artistic mentality provides the young student with ways of appreciating the articulation of the object in space that will prepare it for more abstract and formal operations in its later years.

In our work in designing an evolution of consciousness curriculum for the Ross School in East Hampton, New York, Ralph Abraham and I have tried to convince teachers of the necessity of respecting mathematics' relationship to literature and art in the sequencing of Arithmetic, Geometric, Algebraic, Galilean Dynamical, and Complex Dynamical mentalities. Surprisingly, we have met with great resistance from teachers who wish to teach in the way they have been trained — the rote memorization of abstract algorithms taken out of their historical context and denuded of cultural meaning. Peter. L. Snow provides new neurological insight into the stages of brain growth and development that gives us further evidence as to why this approach to primary and secondary education is flawed.

References

- Snow, P.J. (2003), 'Charting the domains of human thought', *Journal of Consciousness Studies*, **10** (11), pp. 3–17.
- Thompson, W.I. (2003), 'Literary and archetypal mathematical mentalities in the evolution of culture', *Journal of Consciousness Studies*, **10** (8), pp. 58–70. Reprinted in the author's collection of essays *Self and Society* (Exeter: Imprint Academic, 2004).