

Morphogenesis in action

D'Arcy Thompson, L.L. Whyte and the experimental in *Leonardo* 1960-2007

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In 1956, in an article published in the *Journal of Aesthetics and Art Criticism*, Rudolph Arnheim reviewed a book by Lancelot Law Whyte discussing the predominance of form as an analytical, but also epistemological category, as it promised, according to the author, to transform the nature and practice of science in the years to come. *Accent on form, an anticipation of the science of tomorrow* was the title of Whyte's book which, even though clearly targeted the realm of science and the use of form in scientific analysis, according to Arnheim, carried implications also for the realm of art practice and the nature of art practice itself. It was precisely Whyte's definition of form as process the site which offered itself to possibilities for the construction of analogies between art and science, Arnheim emphasized.

"If western thought moves towards the principle of process one might well speculate whether this trend will lead to a corresponding predominance of the time arts-music, motion picture, dance, literature-over the timeless figurations of the painter and sculptor",¹ Arnheim contemplated, concluding with the implicit in the turn towards process and Whyte's definition of form aesthetic consequences. Whyte maintained that beauty "is in the forming power rather than in the resulting static form", Arnheim asserted while, in expressing openly his disagreement to this formulation he proposed an even more radically distributed notion of form. Taking up the turn to process in western thought in the realm of the arts entailed for Arnheim a new understanding of

form clearly dynamic and almost statistical. “The work of art can be called beautiful”, Arnheim observed, “only by way of approximation and because the resulting form is not static.”²

Biology, art practice and the theory of art education: LL. Whyte as mediator

Arnheim’s and Whyte’s interest in form as process can be taken back a few years from the 1956 review and placed in 1951 in the context of an exhibition and symposium organized at the ICA in London as part of the Festival of Britain 1951. *Aspects of Form*³ was the title of the symposium and the publication which accompanied it edited in fact by Whyte himself. ‘On growth and form’, was, in turn, the title of the ICA show which took place in the same year and curated by later to be pop-daddy Richard Hamilton. Both Whyte and Arnheim contributed to the symposium and the edited volume along with the famous art historian Ernst Gombrich and the well known biologist C.H. Waddington among others⁴, Whyte’s contributions being the ‘introduction’, a ‘chronological survey of form’ but also a ‘bibliography on form’ which appeared at the end of the book. Whyte’s advocacy of science as a realm significant for art practice and aesthetic questions in the above examples are far, however, from isolated examples in Whyte’s trajectory and writings.

In an article published by Ernest Mundt in the *College Art Journal* on the question of art education it becomes clear that by 1951 Whyte’s inspirational and forward looking writings on the future of science and the future of humanity were seen as relevant and indeed useful sites for the reformulation of art practice and art education in particular. While discussing ‘scientific and artistic knowledge in art education’,

Mundt, for example, approached Whyte's *The next development in man* as clearly relevant to the question of art practice and for the reformulation of art education.⁵

A dualism between education targeting "the possession of concepts" leading into "knowledge" and an educational philosophy concerned with "intimate knowledge" derived from "improvisation"⁶ had long tormented western education, Mundt wrote in quoting Whyte. Whyte himself employed "biological evidence" in making his claims, Mundt asserted and went on to clearly outline the consequences implicit from Whyte's 'dualism' for the realm of art education. Two conflicting educational models had emerged Mundt observed paraphrasing Whyte: a system of education leading into the production of "analytical or symbolic knowledge" and the "so-called academic art"⁷ and another concerned with the "ability to follow the stimulation of rhythms without hesitations imposed by traditional criteria, and on this ability to state this experience *while having it*".⁸

A preference for a dynamic understanding of form and the advocacy of a structural perspective as the basis for interdisciplinary and revisionist educational and research agendas both in art and science will comprise a consistent theme in Whyte's writings following 1951 and well into the 60s. Such a revisionist agenda routinely in his writings will be connected to quasi-utopian theoretical and ethical programmes aiming at the enhancement of human life and concerned not with the present but primarily the future of humanity.

Morphogenesis in *Leonardo*

Dynamic form and the structural perspective will express the basis not only for experiments in art practice and theory of art education, but also the elements pre-

requisite, according to Whyte, for an irreducibly humanist vision of art and science. Throughout his life Whyte will retain the self image of a scientist in dialogue with the artist while from 1968 and the inception of the MIT Journal *Leonardo* he will be honorary editorial advisor to the journal.⁹

In 1973 in a 'Letter from a scientist to an artist' published in *Leonardo* Whyte reviewed the changes which had taken place in science up to the given moment, commenting also on the shape of scientific research in the near future. The history and future of science in this context expressed a significant junction, Whyte argued, also for the future and the present of art practice and the nature of the art work itself.

Whyte's comments on the history of science concerned the recent turn to biology in scientific research and the methodological and epistemological but also aesthetic consequences the latter entailed. Discussing the nature of biological explanation and inquiry Whyte contrasted it to that encountered in physics.¹⁰

The biological and the set of problems which accompanied it expressed a very different set of problems and methodological approach in science to that associated with physics, he asserted. Given that the discussion on historical transitions in scientific research concerned specifically the potential of science to the arts, the turn to biology, and the turn from the simple to the complex it entailed, could be seen to comprise also a turning point in artists' engagement with form in their own practice, he suggested.

"Research is increasingly concerned with complex phenomena", Whyte wrote, in contrasting the association between biological and complex phenomena to "physical theory" which, up to that moment, as he argued, had placed "the primary emphasis on simple systems and two-term relations, like the distance between two points."¹¹ Given that Whyte's "complex systems" could be best represented in the example of "living

cells”,¹² the question of “order” and the “discovery” of the “state of order”, in his view, comprised the new privileged sites of research both in science, and biology in particular, but also, by extension, the arts.¹³ “Order” and the “state of order” as the new sites of scientific and aesthetic inquiry expressed, in Whyte’s definition, “any kind of arrangement which is not chaotic, or random, but displays some regularity or organization, like the gestalts of the psychologists.”¹⁴

From Whyte to Thompson: *On Growth and Form* 1917

Whyte’s *Aspects of Form* despite the consecutive editions it followed up to 1968 was not seen at all times as a positive, worthwhile or feasible effort. Bonner, for example in his review of the book in 1953, expressed the view that the *Aspects of Form* comprised a curious compilation of writings which at times, such as Waddington’s paper, juxtaposed sculpture with biological material and concepts for no obvious reason.¹⁵

Bonner’s choice as a reviewer of *Aspects of Form*, on the other hand, was far from coincidental given the subject matter of the symposium and Bonner’s own interests. Both Whyte’s *Aspects of Form* and the ICA show ‘On growth and Form’ 1951 had in fact a key point of reference in the same source, D’Arcy Thompson’s 1917 *On Growth and Form*, a book which Bonner will abridge as a later edition which is currently available today from Cambridge University Press and has been part of the architectural school curricula until today as the reading lists of AA shows.¹⁶

Adopting a mathematical language which privileges topological principles and explanations, Thompson’s beautifully illustrated book narrates growth in nature as a phenomenon which takes seriously physical forces and the environment in an attempt

to understand irreducibly visual problems: why natural but also artificial forms look the way they do.¹⁷ Using various examples ranging from Dürer's heads (Fig. 1) to the Forth Bridge as a diagram of forces, but also examples from the living world, such as species from the animal kingdom, splashes of water and radiolarians after Haeckel's illustrations (Fig. 2), Thompson uses visual conventions such as the grid to show how transformations occur relying also on modern imaging techniques in representing aspects of matter and the behaviour of matter at very small scales and in precise fragments of time sequences.

Greg Lynn's contemporary discussions of Thompson is perhaps most illustrative of the way in which this early 20th century text may be seen to have profoundly influenced architectural theory and practice as far as design for complexity is concerned, in specific. Not only architects but computer artists working with emerging environments frequently reference Thompson as one of their source of influence. Later editions of Thompson's *On Growth and Form* 1917 however may be seen to have found significant applications in the writings and experiments of avant-garde artists already from 1951 and even since the early 30s writings associated with the Bauhaus school include Thompson and his seminal work as a key point of reference in aesthetic discussions but also questions of art practice.¹⁸

Literary morphogeneses: Thompson in *Leonardo*

It is *Leonardo*, however, the Journal of the MIT institute, where Thompson's impact on artists and theorists post 60s may be observed in its most systematic and abundant manner. Biological explanations expressed through topological conventions which narrate change in form across time and space from Thompson's book are put into

action in a number of visual examples, art works but also theoretical discussions in the context of submissions to *Leonardo* journal from the 60s onwards (Fig. 3).¹⁹

Thompson's use of geometry in discussing biological form and phenomena of growth gives rise in the context of *Leonardo* to a number of papers discussing the application of complex geometry and topology in art from the 60s until today (Fig. 4).²⁰ Such work even though visually might be seen at times to depart from the aesthetic of modernist and avant-garde art of the 50s or indeed is itself visually diverse, underlying artists' engagement with Thompson's idea of growth across periods and art historical art categories one may find the same attention to pattern and preoccupation with aspects of matter at very small scales (Fig. 5).

The uses of imaging techniques in revealing and representing novel aspects of the behaviour of matter at very small scales very much in the spirit of Thompson's book, expresses, in turn, a preoccupation shared among artists such as Eduardo Paolozzi, Nigel Henderson and Richard Hamilton associated with the 1951 ICA show *On growth and form*, as the Tate Gallery archive and the Henderson papers show, and artists publishing their work in *Leonardo* post 1960s.²¹ Paolozzi's suggestion to Henderson to take up the imagery of the electron microscope in his photographic work which may be connected to a preference for the minute but also experiments in distortion and transformation in his photograms and 'stressed photography', away from naturalistic and realist renderings, is one example in support of this re-grouping and re-connecting of avant-garde art practices of the 50s and post 60s work associated with *Leonardo* in the light of Thompson's notion of growth.²² Artists publishing their work in *Leonardo* from the 60s onwards and Whyte's mediation between the two domains of art and science through his interdisciplinary methodological agenda, in conclusion, may be seen to have put Thompson's 'biological' premises into action,

creating vistas not of actual, but nevertheless possible realities retraced in the experimental domain of new art and the literary space of *Leonardo* journal.

¹ R. Arnheim, Review [Reviewed work: Accent on form, an anticipation of the science of tomorrow by Lancelot Law Whyte], *The Journal of Aesthetics and Art Criticism*, 14 (June, 1956), p 503.

² Ibid.

³ L.L. Whyte ed., *Aspects of Form: a symposium on form in nature and art* (London, 1951).

⁴ E. H. Gombrich, 'Meditations on a hobby horse, or the roots of artistic form', L.L. Whyte ed., *Aspects of Form: a symposium on form in nature and art* (London, 1951), pp. 209-228; C.H. Waddington, 'The character of biological form', L.L. Whyte ed., *Aspects of Form: a symposium on form in nature and art* (London, 1951), pp. 43-56.

⁵ E. Mundt, 'Scientific and artistic knowledge in art education', *College Art Journal* 10 (Summer 1951), pp. 333-336, p. 333.

⁶ Ibid., p. 334.

⁷ In the article, Mundt drew on the work of Sir Arthur Eddington, *The Nature of the Physical world* and Eddington's assertion on the existence of two types of knowledge. Knowledge derived from one's consultation of "wave mechanics" and mathematical equations correlating certain functions of water is fundamentally distinct from one's insights derived from one's direct experience of the phenomena while, at the same time, he or she recalls "some lines of poetry". Ibid., p. 333.

⁸ Ibid., p. 334.

⁹ "Lancelot Law Whyte, philosopher, scientist and investment banker, was a *Leonardo* Honorary Editorial Advisor from the inception of the journal in 1968. His death is a great loss for those who have a vital concern for bringing art and science close together", wrote the footnote in Whyte's 'Letter from a scientist to an artist' which appeared in *Leonardo*, Vol. 6 (Autumn, 1973), pp. 351-354, p. 351.

¹⁰ Whyte, 'Letter from a scientist to an artist', p. 351.

¹¹ Ibid.

¹² Ibid.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ J.T. Bonner, 'Review' [*Aspects of form* by Lancelot, Law Whyte], *The Quarterly Review of Biology* 28 (March, 1953), pp. 37-38, p. 37.

¹⁶ An image after Dürer is combined thus with an illustration of the 'Forth bridge as a diagram of tensions'.

¹⁷ See my article in the Proceedings of the Design and Evolution conference at Delft TU, edited by T. de Rijk and J.W. Drukker in digital form: 'Engineering, design and biology outside the evolutionary perspective? D'Arcy Thompson's 1917 *On Growth and Form* in the context of Design History'. The article traces also the reception of Thompson's work in Bauhaus theory, and the writings of Maholy-Nagy in particular, and the appropriation of Thompson's principles by British artists and art historians such as Herbert Read.

¹⁸ Most of the artists included in Leonardo reference a 1952 edition of Thompson's book.

¹⁹ See for example, in a chronological order of appearance: G. Wise, 'Quantities and qualities: some notes on working ideas in art', *Leonardo* 1 (January, 1968), pp. 41-50; S.W. Hayter, 'The making of a painting', *Leonardo* 1 (October, 1968), pp. 347-350; J. Holloway, 'Implementation of notions of science in some of my reliefs and drawings', *Leonardo* 11 (Winter, 1978), pp. 9-12; A. Garrett, 'Collages of wood engravings on Japanese handmade paper', *Leonardo* 12 (Spring, 1979), pp. 123-4; R. Dixon, 'The mathematics and computer graphics of spirals in plants', *Leonardo* 16 (Spring, 1983), pp. 86-80; J. Rowan, 'Tetrahedron modeling: art/science metaphors for order in space', *Leonardo* 17 (1984), pp. 253-260; E.K. Levy, 'Visualizing evolution', *Leonardo* 20 (1987), pp. 3-8; R.A. Wiggs, 'Lines and junctions and the topology of space', *Leonardo* 20 (1987), pp. 65-70; A. d'Angelo, 'The search for real form', *Leonardo* 22 (1989), pp. 39-46; C.O. Perry, 'On the edge of science: the role of artist's intuition in science', *Leonardo* 25 (1992), pp. 29-252; A.C. Bliss, 'Mathematics for the garden of mind', *Leonardo* 26 (1993), pp. 19-22.

²⁰ Discussions on art and mathematics precede the discourse and work emerging from the 50s onwards which I discuss in this paper with regard to Thompson's influence. For a discussion on art and topology see the article of Max Bill 'The mathematical way of thinking in the visual art of our time' reprinted in M. Emmer, *The Visual mind: art and mathematics* (Cambridge Mass. and London), pp. 5-9. In the context of this paper I limited my approach and examples to the work of artists participating in Leonardo. At the level of theory, there are significant contributors who fuel the writings and work of artists on the relation between art and science in a 'Thompsonian' light. Their articles did not always appear in *Leonardo*, they form nevertheless important references in articles which appeared in the journal looking from one or many perspectives matters relevant to Thompson's discussion of growth in forms. Thus in discussing theory and theorists, one should mention the names of Gyorgy Kepes, S.J. Gould, Rudolph Arnheim, L.L. Whyte, Cyril Stanley Smith, Arthur Loeb and Phillip Ritterbush among many others.

²¹ I make the case in my paper 'Imagining techniques and the development of modernist aesthetics in British avant-garde art,' presented at the Science and the Public Conference, Imperial College, London, May 18th, 2007.

²² Hamilton, on the contrary, in his work will focus on traditional renderings of Thompson's discussions at the level of concepts and the representation of these concepts through media such as painting and languages such as figuration.

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Fig. 5: Exaglyph derived from photomicrograph from Holloway, 'Implementation of notions of science in some of my reliefs and drawings', *Leonardo* 11(Winter, 1978)