Sustainable Architecture and its Transdisciplinary Origins

STEVEN A. MOORE
The University of Texas at Austin

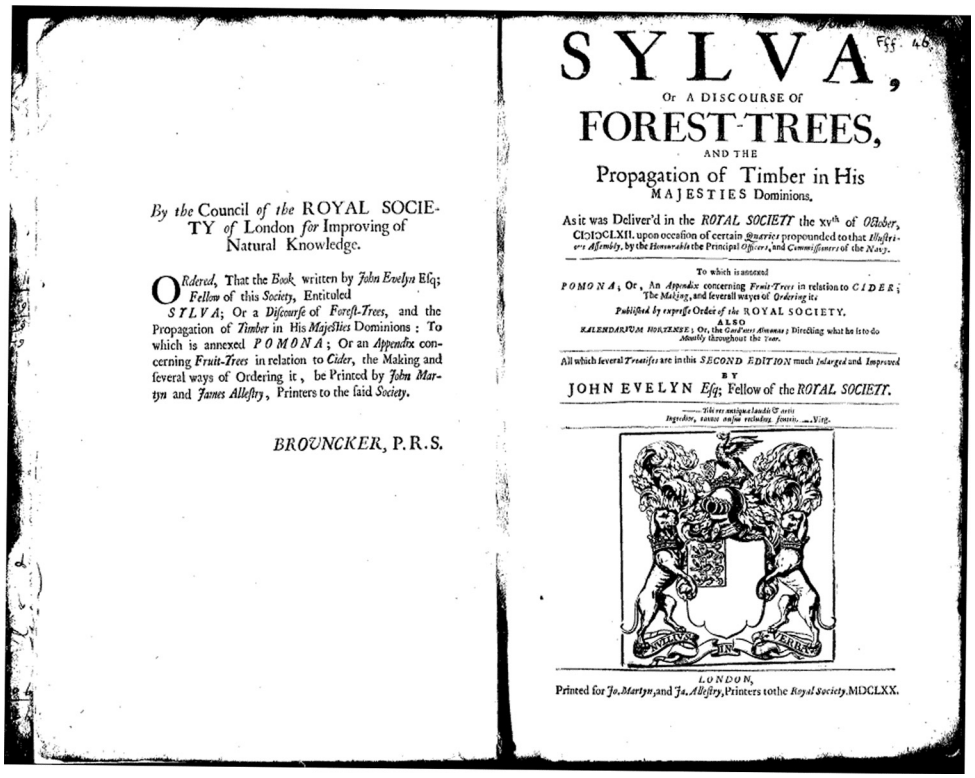
INTRODUCTION

Every discipline, be it medicine, law, or football, tends toward autonomy. Human beings naturally like to talk about the things we know and do best. Architects are no different — as in those other disciplines we tend to limit what gets talked about by emphasizing those variables we can best, or more enjoyably control. After all, why talk about the agony of budget reductions, environmental degradation, or labor disputes when we can talk about the delights of light, texture, or space. One result of this phenomenon is that disciplines develop specialized vocabularies, with terms like ''brutalism'' or ''blob,'' that describe an exclusive discourse, or set of concerns shared principally by the initiated. The point here is that she who controls the vocabulary of any given discipline gets to control its very aspirations.

Of greater interest at the moment, however, is what happens when these quasi-autonomous disciplines, architecture among them, encounter powerful external vocabularies that emerge in response to bigger cultural conflicts. The emergent discourse of ''sustainability'' is such an encounter. It has challenged the autonomy not only of architecture, but that of nearly every other modern discipline. I'll hold that new vocabularies, like that associated with the discourse concerning sustainability, emerge out of cultural conflict. Or phrased another way, new cultural conditions require new words to describe them. Thirty years ago words now routinely associated with sustainable development, like ''throughput,'' ''carbon-balancing,'' ''carrying-capacity,'' and ''feedback-loop'' existed only in the texts of pioneers such as Eugene (1913-2001) and Howard (1924-2002) Odum, or in the obscure field of *general systems theory*.[1] The concept of sustainability, then, is first a critical realization that present conditions are *un*-sustainable. More productively, the concept is an attempt to describe how future ecological, economic, and social conditions might become sustainable. This encounter with new terms is significant for the discipline of architecture because our principal role in society is to materialize those new conditions imagined in language by our fellow citizens. We are asked to imagine the forms, materials, technologies, and processes that will materialize a yet undefined vocabulary.

The economic, ecological, and social conditions that now demand more sustainable development did not suddenly spring into being in 1980 — the date when the term was first used in its current context.[2] Rather, sustainability is only the most recent (and perhaps most potent) critique of modern technology that has emerged since seventeenth century authors began to question our relation to nature. Attempting to define a sustainable human relation to nature is, then, a continuing project. To critically evaluate our contemporary architectural discourse, however, requires a broader historical understanding of the vocabulary we wish to interrogate. A historical view is important because, in some circles, sustainability is thought to be a recuperative project — a movement to restore pre-modern conditions. In what follows, however, I hope to demonstrate that sustainability is an inherently contemporary idea. Without the intellectual accomplishments of the modern period we could not imagine the world we wish to sustain.

First, it is essential to recognize that there can be no autonomous architectural discourse that can capture the concept of sustainable development as our own. Rather, the knowledge upon which the concept is founded, and which architects must employ, emerged over several centuries within no fewer than six related disciplines: Philosophy, physics, biology, politics, eco-



By the Council of the ROYAL SOCIETY of London for Improving of Natural Knowledge.

Ordered, That the Book written by John Evelyn Esq; Fellow of this Society, Entituled SYLVA; Or a Discourse of Forest-Trees, and the Propagation of Timber in His Majesties Dominions: To which is annexed POMONA; Or an Appendix concerning Fruit-Trees in relation to Cider, the Making and several ways of Ordering it, be Printed by John Martyn and James Allestry, Printers to the said Society.

BROUNCKER, P.R.S.

SYLVA,

Or A DISCOURSE of

FOREST-TREES,

AND THE

Propagation of Timber in His MAJESTIES Dominions,

As it was Deliver'd in the ROYAL SOCIETY the XVth of October, CIↃIↃCLXII. upon occasion of certain Queries propounded to that Illustrious Assembly, by the Honorable the Principal Officers, and Commissioners of the Navy.

To which is annexed

POMONA, Or, An Appendix concerning Fruit-Trees in relation to CIDER; The Making, and several ways of Ordering it.

Published by expresse Order of the ROYAL SOCIETY.

ALSO

KALENDARIUM HORTENSE; Or, the Gardners Almanac; Directing what he is to do Monthly throughout the Year.

All which several Treatises are in this SECOND EDITION much Inlarged and Improved

BY

JOHN EVELYN Esq; Fellow of the ROYAL SOCIETY.

—— Tibi res antiquæ laudis & artis
Ingredior, sanctos ausus recludere fontes. —Virg.

LONDON,
Printed for Jo. Martyn, and Ja. Allestry, Printers to the Royal Society. MDCLXX.

Fig. 1. Title page from John Evelyn's Sylva: A Discourse of Forest, Trees, and the Propagation of Timber*, 1614.*

nomics and public health. Each of these disciplines developed prerequisite hypotheses that inform what we now tentatively refer to as sustainable architecture. In this view, sustainability is an inherently inter-disciplinary, or trans-disciplinary concept.[3] A very brief review of the concerns that emerged in these six related disciplines will, I think, help architects to frame the terms of our future discourse.

SIX EXTERNAL DISCOURSES

The dominant characterization of modern philosophy is that, beginning with Rene Descartes (1596-1650), Europeans understood themselves to exist outside of nature. Such convenient distancing from other species allowed humans to exploit nature without concern for its well-being. Although this overly simple characterization has some merit, it suppresses the existence of a counter-tradition in which early modern thinkers attempted to construct a vision of human life as inherently related to natural conditions. For example, the first scholarly book on sustainable practices to be published in English may be John Evelyn's, *Sylva*: *A Discourse of Forest, Trees and the Propagation of Timber,* published in 1664. In a slightly later example of 1713, Hans Carl von Carlowsky used the term ''nachhaltigkeit,'' translated from the German as, ''sustainability,'' in *Silvacultura Oeconomica: the directive for wild tree-breeding in accordance with nature*.[4] Both of these examples document that, within the discourse of natural philosophers, the concept of a sustained yield realized through the human management of natural resources was well understood if not universally practiced. We might, then, credit the natural philosophers of seventeenth century Britain and eighteenth century Germany with initiating the modern discourse on sustainable practices. That discourse was imported to North America by Gifford Pinchot (1865-1946), who was named Chief Forester of the U.S. Forest Service by President Theodore Roosevelt. Pinchot later became Governor of Pennsylvania.

In the discipline of physics, Rudolph Claussius (1822-1888) is generally credited with development, in 1865, of the Second Law of Thermodynamics, commonly referred to as *entropy*. Based upon his observation of thermal transfer, Claussius argued that one couldn't finish any real physical process with the same amount of energy as which one started. Once energy is expended, changing it from a usable to an unusable form, it can't be replaced. In any closed system — like our own solar system — entropy measures the amount of energy not available to do work. By the 1920's this modern understanding of basic physics prompted natural scientists to develop the doctrines of *energy economics*. These doctrines express various ethical and economic imperatives to expend energy as efficiently as possible

thus delaying the inevitable chaos associated with advanced states of entropy. In the 1960's, architects Victor and Aladar Olgyay applied the implications of entropy to architecture in their seminal book, *Design With Climate*.[5] However, it was not until the OPEC energy crisis that began suddenly on 19 October 1973 that most architects began to appreciate the salience of Clausius' research to the design of buildings and cities.

With regard to the discipline of biology, we are accustomed to saying that the 1859 publication of Charles Darwin's *On the Origin of Species* introduced the concept of evolution. This is not exactly correct. Although there were highly respected scientists, such as Harvard's Louis Aggassiz, who tenaciously argued that nature was immutable and unchanging, there were other contemporaries of Darwin, the English philosopher Herbert Spencer and the French naturalist, Jean-Baptiste Lamarck, for example, who had advanced the idea that nature evolves over time. What was so radical about Darwin's book, then, was not the idea of evolution per se, but the idea that the changes in nature were not guided by supernatural intelligence. The idea that evolution was determined, not by God, but by random chance, introduced the possibility of *anthropogenesis*, or human-created conditions that would subsume natural order. With the intellectual possibility of an anthropogenic world came an ethical and pragmatic crisis that was not confronted until the mid-twentieth century.[6] Without Darwin (1809-1882) we could not have the contemporary discipline of environmental design.

Only a few years after the publication of Darwin's book the term *ecology* was coined by the German zoologist, Ernst Haekel (1834-1919). In his *Generelle Morphologie* of 1866, Haekel did not fully develop the scientific concept as it is understood today, but he did help to popularize the notion that biological entities cannot be understood outside their natural environment. Haekel reasoned from a philosophically monist position that is opposed to the Cartesian dualist assumptions of Western science. It is not surprising, then, that the latter-day supporters of ecology, awakened by the 1962 publication of Rachel Carson's S*ilent Spring,* would reject a purely quantitative approach to the conservation of nature. It is this holistic approach to design that was adopted in the 1960's by pioneers such as the landscape architect and planner Ian McHarg.

In the discipline of politics, the linked concepts of ecologism and sustainability can be partly understood as a continuation of the Enlightenment project of *rights-extension*. The Scottish Enlightenment in particular, under the influence of John Locke (1632-1704), introduced the notion that all men, not just the landed-aristocracy, are possessed of natural rights. From that early beginning western societies have gradually extended rights to an ever-increasing list of beings — First, men of color, then women, and in contemporary society, organizations such as Earth First and PETA (People for the Ethical Treatment of Animals) argue for the natural rights of various plants and animals.[7] The field of environmental ethics is, however, divided over the granting of such rights. While some, like PETA, argue for the rights of individual animals, others, like Deep Ecologist Arne Naess, argue for the superior rights of the ecosystem as a whole. It is this latter view that has had much influence upon the late twentieth century projects of architects such as Brenda and Robert Vale in England and New Zealand.

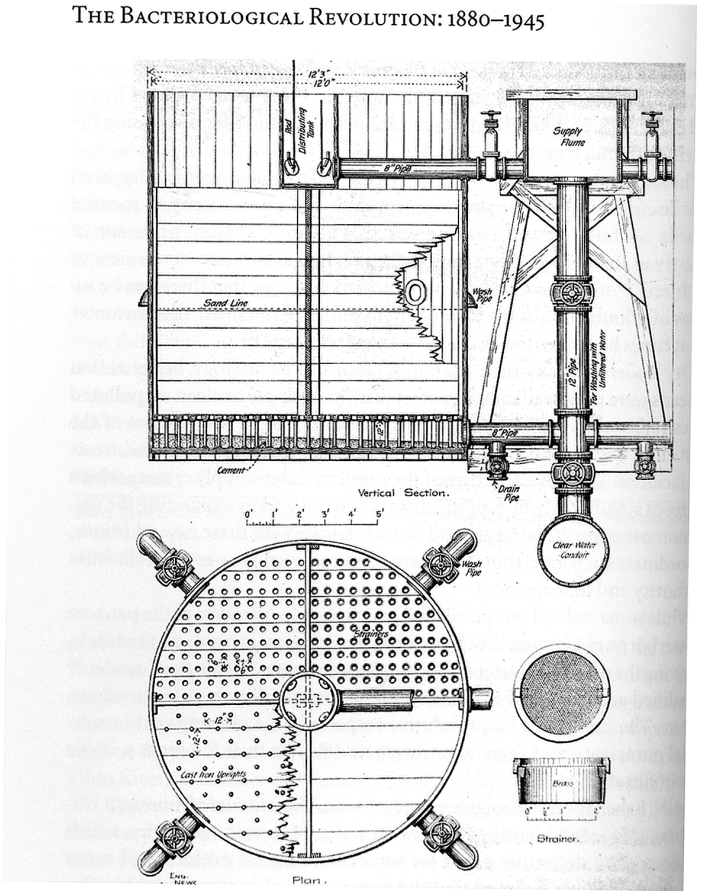


Fig. 2. Mechanical Water Filter of the 1880's. From, Martin V. Melosi, The Sanitary City: Urban Infrastructure in America from Colonial Times to the Present *(Baltimore: Johns Hopkins University Press, 2000) p. 140.*

From the discipline of economics, architecture has inherited not only the ''bottom line'' but, the neo-classical model of economy that derives from Adam Smith (1723-1790). In this tenaciously held doctrine, nature was viewed as little other than the source of free

	Philosophy	Physics	Biology	Politics	Public Health (medicine and engineering)
primary concepts	Sylva culture (1664) Deep Ecology (1980's) Social Ecology (1980's)	entropy (1865) energy economics (1920's)	evolution (1859) ecology (1866)	Enlightenment project of rights extension	"the sanitary idea" (1850) germ theory (1880) new ecology (1945)
major figures	John Evelyn (1620-1706) Martin Heidegger (1884-1976) Arne Naess (1925?-) Murray Bookchin (1925?-)	Rudolph Claussius (1822-1888)	Charles Darwin (1809-1882) Ernst Haekel (1834-1919)	John Locke (1632-1704) Karl Marx (1818-1883)	Edwin Chadwick (1800-)
objective concerns	human relation to nature	emergent chaos	reproduction and biological diversity, anthro-pogenesis	individual rights Vs ecosystem health, distributive equality	civic economy, sanitation, and technological choice
objective indicators	the instrumental degradation of nature	global warming	species loss, loss of choices	relative rates of consumption, environmental racism	environmental and technological threats to public health

Fig. 3. The Transdiciplinary Origins of Sustainable Development

raw materials and a place to dump wastes. The ecological consequences of the neo-classical, or ''throughput'' economic model has, however, been challenged by contemporary economists such as Herman Daly. Daly argues that the human economy exists within a larger natural economy. To fail to account for the ecological costs of ''sources'' (natural resources), or the costs of disposing of ''waste'' in natural ''sinks,'' is only to delude oneself that such costs are ''external'' to the economic system. The implications of such emerging economic theory for architecture are enormous.[8] In this evolving mode of economic thought, the research of UT architecture Professor Michael Benedikt, and UT planning Professor Michael Oden, point to transformed models of valuing architecture.[9]

The discipline of public health is, of course, a hybrid of medicine and engineering that first appeared in nineteenth century England under the leadership of Edwin Chadwick (1800-1890) who was directly associated with the Utilitarian philosophers Jeremy Bentham (1748-1832) and John Stuart Mill (1806-1873). In contrast to the prevailing social privatism of that time, these social activists argued that a healthy economy requires public investment in the health and productivity of its citizens. The threats to the public health in the nineteenth century were those now rare diseases like yellow fever, diphtheria, and smallpox. By the end of WWII, however, the English ''sanitarians'' and those who inherited that tradition in the west had largely eliminated such epidemic diseases. By the early 1960's the developed world realized that, although common bacterial threats to public health were likely a matter of the past, new

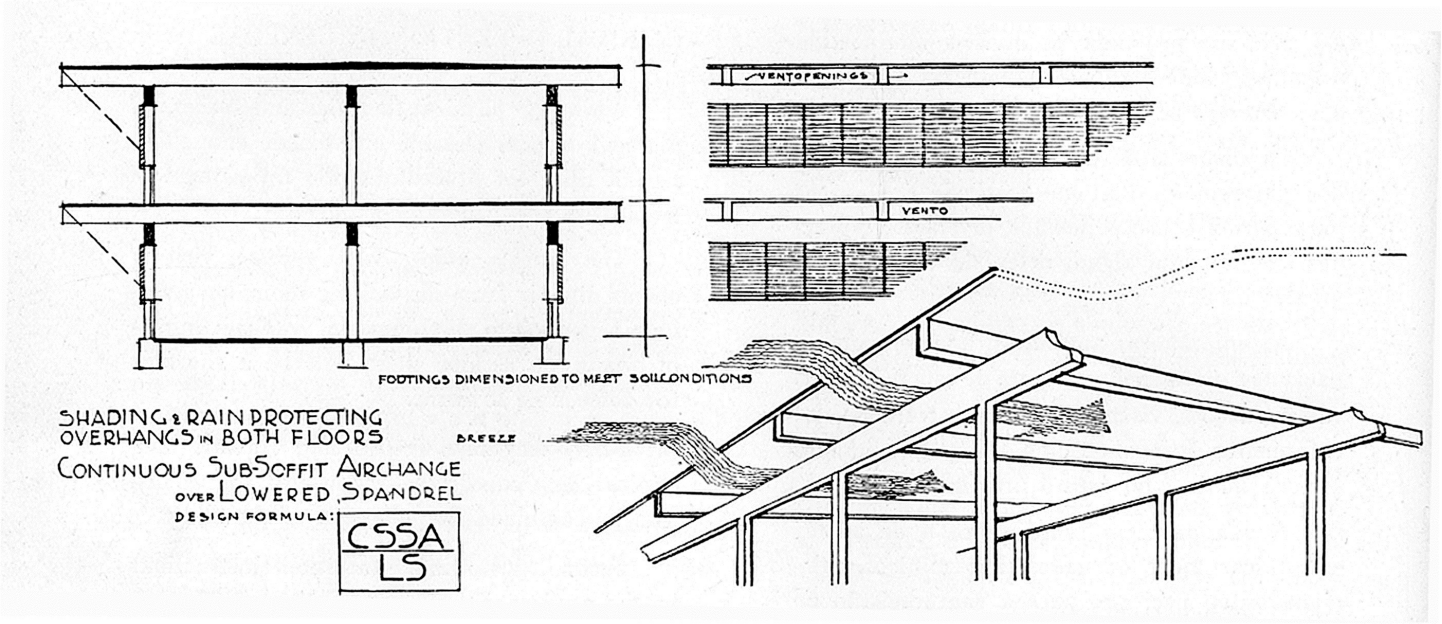


Fig. 4. CSSA/LS, or, Continuous Sub-Soffit Airchange over Lowered Spandrel. Richard Neutra's 1948 proposal for passive ventilation. From, Architecture of Social Concern in Regions of Mild Climate *(Sao Paulo, Brasil: Gerth Todtmann, 1948), p. 126.*

threats to public health, such as polluted ground water and fouled air, had emerged as the unintended consequences of industrial development. The concept of sustainability is a direct descendent of Chadwickian public health theory.

Those discourses external to architecture that are responsible for the social construction of sustainable development as a concept are as summarized as in figure 3.

Architecture itself has certainly contributed to the emergent concept of sustainability. The texts of Marcus Pollio Vitruvius, (first century b.c.) and the architecture of Andrea Palladio (1508-1580) are archaic exemplars of what I'd like to call *proto-sustainability*. Even modernist architects, who are now much maligned by contemporary romantics, created enduring places that are responsive to local ecological and cultural conditions, are energy-efficient, and socially just. The projects of Richard Neutra are, I believe, particularly noteworthy in this regard. His Tremaine House of 1948 at Montecito, California and the projects described in his third book, *Architecture of Social Concern in Regions of Mild Climate*, employ a variety of technologies that document the social and environmental sensitivities of accomplished modern architecture.[10] The natural ventilation system that Neutra designated as ''CSSA/LS,'' or, ''continuous sub-soffit airchange over a lowered spandrel'' (Figure 4) is an architectural technique that was much ahead of its time.

Likewise, Neutra's proposal for rainwater harvesting to supply a prototypical rural school resembles very recent developments related to water scarcity (Figure 5). Such design inventions realize the interdisciplinary concerns discussed above. The architecture of Richard Neutra might, then, be understood as one way to materialize the broad cultural concerns articulated by philosophers, physicists, biologists, politicians, economists, and public health advocates over the past four hundred years.[11]

CONCLUSION

Although I have gone to some length here to outline the broader cultural origins of sustainability as a concept, the principal goal of architectural educators is to nurture critical designers and thinkers who have encountered and internalized the competing concerns of the various disciplines described above. If in ten or twenty years our society agrees with my colleague, Kevin Alter, we may no longer need the word ''sustainability'' because we will have redefined the meaning of ''good architecture'' as inclusive of the concerns of those related disciplines discussed above. For the moment, however, the cultural controversy that surrounds the social construction of this new vocabulary provides an ideal context for the education of those architects, urban designers, landscape architects, planners, preservationists, interior designers, and historians who wish to redefine the aspirations of our discipline.

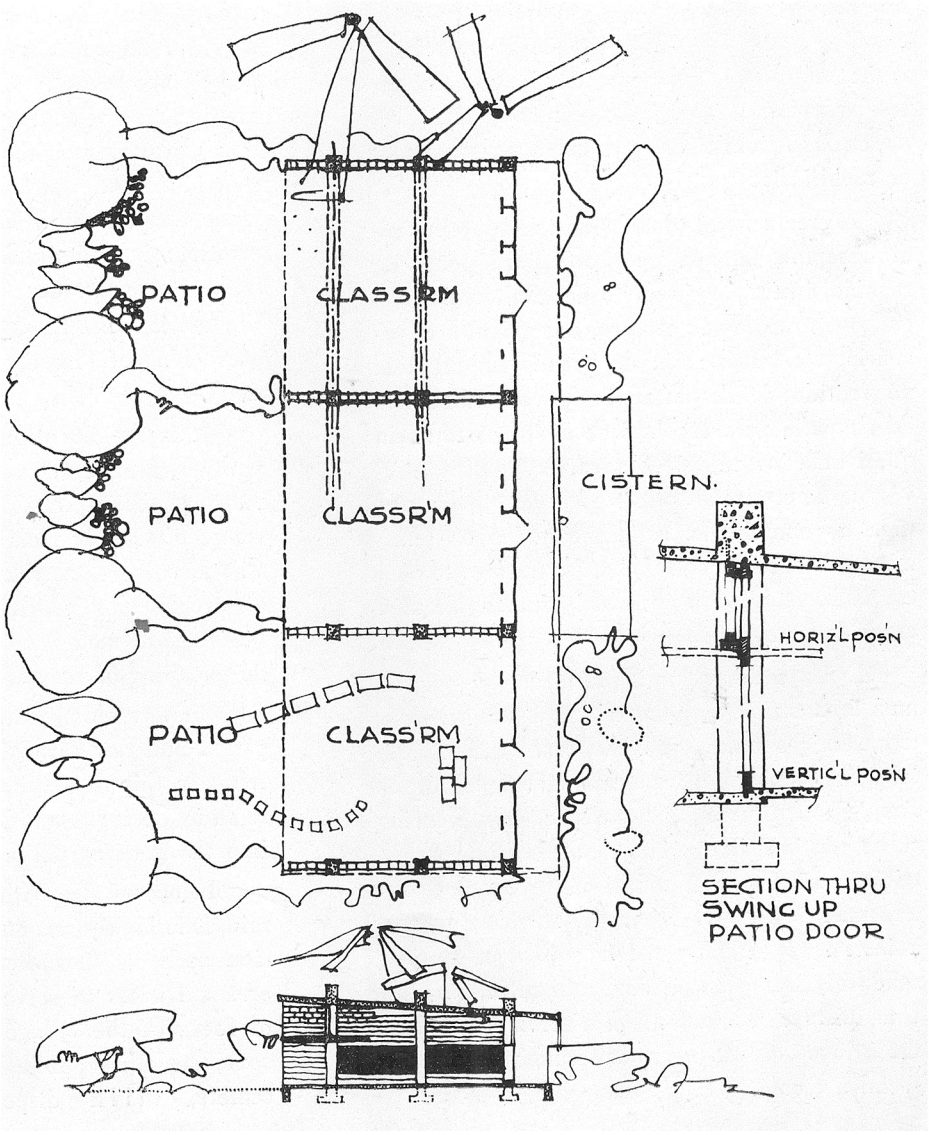


Fig. 5. Richard Neurta's 1948 design for a prototypical rural school utilizing rainwater harvesting. From, Architecture of Social Concern in Regions of Mild Climate *(Sao Paulo, Brasil: Gerth Todtmann, 1948), p. 49.*

The philosopher, Karsten Harries, has argued that history has committed a kind of category mistake by understanding the philosophy of architecture to be a sub-topic of aesthetics, or the philosophy of art. In the realm of aesthetics, Harries argues, the principal concern of architectural production is the problem of representation. Following Heidegger, Harries finds it more helpful to understand the philosophy of architecture as derived from the philosophy of technology. In his view the principal concern of architectural production would be, then, how we are going to live in the world.[12] I will not suggest here that we abandon aesthetics or the traditional concerns of architectural composition. I am, however, suggesting that our compositional concerns are a necessary but insufficient palette for ''good'' architecture. Or better, that the variable of our compositions need to include those ''objective concerns'' and ''indicators'' articulated in Figure 3 and that derive from the six disciplines reviewed above. By expanding our palette we would necessarily understand architecture as a material setting *for* life, not as a representation *of* it.

In the view of contemporary environmental activists like David Orr of Oberlin College, architects are granted a license to practice by the State, which is a type of monopoly, in exchange for ''guarding the public health, safety, and welfare'' of the citizenry. The existence of architecture as a profession, then, depends upon our ability to design material solutions to those objective concerns that emerge from other social discourses. How we architects choose to define public health for the twenty-first century may well determine the social viability of our profession. Although the origins of our

contemporary discourse are clearly broader than architecture, architects must play an increasingly central role in materializing the aspirations of an emergent new, transdisciplinary language.

NOTES

[1] For example, see, Eugene Pleasants Odum and Howard T. Odum, *Fundamentals of ecology* (Philadelphia, Saunders, 1959) and, Howard T. Odum and Elizabeth C. Odum. *Energy basis for man and nature,* (New York : McGraw-Hill, 1976).

[2] The term ''sustainability'' was first used in its current environmental, economic and social context in ''World Conservation Strategy,'' a 1980 publication by the Union for the Conservation of Nature (IUCN). That document defined ''sustainable development'' to mean '''... those paths of social, economic, and political progress that meet the needs of the present without compromising the ability of future generations to meet their own needs.'' In the first decades of the twentieth century Gifford Pinchot used the term in the context of sustained-yield forestry, however, he did not yet anticipate the concerns of social equity that the term now incorporates.

[3] To distinguish between these terms, I'll define ''interdisciplinary'' as a discourse between professionals who recognize the autonomy of the respective disciplines engaged. ''Transdisciplinartity,'' however, refuses to recognize the boundaries between disciplines as anything other than a social convention that is based upon power relations.

[4] This literary discovery was made by Ralf Brand, a Ph.D. student in the UT Community and Regional Planning program at UT. Brand is investigating alternative, non-technological models of sustainable development.

[5] Victor and Aladar Olgyay, *Design with climate: bioclimatic approach to architectural regionalism*. (Princeton, N.J., Princeton University Press, 1963).

[6] Louis Menand, *The Metaphysical Club* (New York: Farrar, Straus, and Giroux, 2001), pp. 117-121.

[7] The relationship of Enlightenment rights-extension and contemporary ecologism has been studied by Timothy Beatley. See, Beatley, Timothy, *Ethical land use : principles of policy and planning* (Baltimore, MD: Johns Hopkins University Press, 1994).

[8] Daly has written extensively on this topic. His most recent contribution to the redefinition of economics is *Ecological economics and the ecology of economics : essays in criticism* / Herman E. Daly. (Cheltenham, UK ; Northampton, MA, USA : E. Elgar, 1999). On the early economic analysis of ''sources'' and ''sinks,'' see, Kenneth Ewart Boulding, *Beyond economics; essays on society, religion, and ethics* (Ann Arbor, University of Michigan Press, 1968).

[9] Michael Benedikt's long awaited book, *Value,* will be published this year by the University of Chicago Press. Under his direction, the UT Center for American Architecture and Design has published two volumes of its book series, *Center 9 and 10*, that investigate this topic.

[10] Richard Neutra, *Architecture of Social Concern in Regions of Mild Climate* (Sao Paulo, Brazil: Gerth Todtmann, 1948).

[11] See David Leatherbarrow, *Uncommon Ground: Architecture, Technology, and Topography* (Cambridge, MA: MIT Press, 2000), p. 57.

[12] Karsten Harries, *The Ethical Function of Architecture* (Cambridge, MA: MIT Press, 1997), p. 8.