Dissertation Proposal:

Neurophenomenology of Settlement Morphology

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Front Cover Image: This is a conceptual model for proposed development of the "universal township" of Auroville in India. Auroville was first conceived by Sri Aurobindo and his consort the Mother as a living laboratory for the evolution of consciousness. Officially inaugurated on 28 February 1968 with the full encouragement of UNESCO and including the participation of representatives of 124 nations, Auroville has grown into "an internationally endorsed ongoing experiment in human unity and the transformation of consciousness, also concerned with – and practically researching into – sustainable living and the future cultural, environmental, social and spiritual needs of [human]kind" (from website at www.auroville.org).

The conceptual model of Auroville, a plan not yet fully realized in physical reality, was selected to front-piece this Dissertation Proposal because it is a preeminent example of the chosen theme: Neurophenomenology of Settlement Morphology. Auroville is destined to eventually assume this "galaxy" morphology, and this morphology is expected to contribute to the evolution of consciousness that is the settlement's purpose. One can imagine cosmic or universal energy being captured at the outer rings of the spiral and then channeled toward the center where is positioned the "Matrimandir," a large spherical temple that becomes a potent core of spiritual energy.

Can configurations of the built environment actually influence consciousness, as the Aurovilleans propose? If this potential exists, what does that imply for configurations of the built environment that have already been constructed? Are people being influenced unknowingly, yet nevertheless demonstrably, by the qualities and characteristics of the environments through which they live and move daily? If data can be collected to support this thesis, how can these be incorporated into criteria for design at settlement scale? These are the kinds of questions I wish to explore in my Dissertation towards a Ph.D. in the Human and Organizational Development doctoral program of the Fielding Graduate University of Santa Barbara.

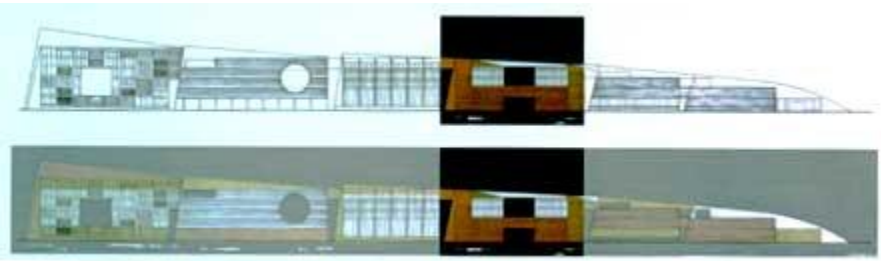

Fig. 1 – Elevation for one of the proposed galactic arms at Auroville (from www.auroville.org)

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Introduction

According to Gazzaniga, *et al.* (2009, p. xvii):

> [C]ognitive neuroscience [the biology of the mind] has blossomed in spectacular fashion. We can measure this progress in many ways. Leading universities have undertaken major initiatives to develop dedicated cognitive neuroscience programs, providing researchers with the tools of the trade and opportunities that promote interdisciplinary research. New journals are introduced each year, dedicated to new specialties within the cognitive neurosciences, with the number of papers in the field increasing at an exponential rate.

Quantifying this last statement, a PUB MED search for publications pertaining to cognitive neuroscience research utilizing functional Magnetic Resonance Imaging technology (fMRI) reveals the following trajectory: 1994 – 17 papers published, 2004 – 2449 papers published, 2009 – 6057 papers published (Jantzen, 2011). Clearly, in recent years there has been an explosion of new information regarding the brain and its nervous system, and their association with mind. Integrating all this new information into existing fields is bound to enhance interdisciplinary appreciation for the ubiquitous presence of mind and its underlying biological substrate (Deacon, 2012; Edelman, 1992; Edelman & Tononi, 2000).

One fascinating application of discoveries in cognitive neuroscience is to the design professions, especially those focused on environmental design. Quick to recognize this potential was John Zeisel as reported in his book *Inquiry by Design: Environment/Behavior/Neuroscience in Architecture, Interiors, Landscape, and Planning* (2006). Significantly, Zeisel situates his inquiry within existing Environment-Behavior (E-B) research, and explains:

> Place, personalization, territory, and wayfinding are four topics that form the core of E-B theory and practice. They also play a central role in the evolution of the brain in all animals, including *Homo sapiens*. Therefore these concepts are particularly robust and strategic for exploring what a neuroscience perspective can add to traditional E-B approaches (p. 356).

Here, then, is an instance of applying neuroscience to an established field: "To identify how greatly the neurosciences contribute to E-B studies and design, we can look at the example of design of and research on neonatal units for premature infants" (Zeisel, p. 359). Neuroscience research has established that there are genetically determined processes of fetal development comprising "three major structural elements: sequence, timing, and stimulus" (ibid, p. 360). Detailed knowledge of these developmental cognitive processes can result in the

design of neonatal environments that may facilitate as much as possible normal, healthy development; whereas failure to integrate this neuroscience information results in standard intensive care situations where the neonatal environment actually wreaks permanent damage on the premature infant. This example demonstrates that it is possible to "link environments with neuroscience research to support brain development and functioning" (ibid, p. 364).

Another valuable connection between cognitive neuroscience and the design professions has been made by accomplished architect John Eberhard (2007, 2009). Furthering the interdisciplinary research potential mentioned above by Gazzaniga, *et al*., Eberhard opens his 2009 book *Brain Landscape* with the following proposition:

> The goal of this book is to invite the neuroscience community to devote a portion of their research agenda to architectural hypotheses. These hypotheses are framed by questions of why the mind – with its organ, the brain – produces specific cognitive experiences for humans in the spaces and places designed for their use (p. 1).

This proposition is an appeal for long-term collaboration (could this be called *applied* cognitive neuroscience?) with definite didactic implications: "In the future, architects will need an understanding of how to integrate knowledge of neural networks and their organization into the practice of architecture. This will include how attention and conscious awareness regulate and reconfigure the actions of the neurons in those networks affected by the built environment" (ibid, p. 9). This project sounds to me to have the potential of a "final frontier," a vast new horizon empirically exploring the relationship between actively conscious nervous systems and the structural configurations to which they are coupled.

Like Zeisel, and befitting an architect, Eberhard includes some applied contemplations in his exposition. For example, there are chapters expounding the implications of neuroscience research in the design of educational places, memorials, sacred places, workplaces, and facilities for the aging. In conjunction with a profound appreciation for the motherlode Eberhard appears to have tapped, I do have one recurring critique: As a trained architect, he tends to limit his conceptual scope to the scale of the *individual building*; whereas in my coming Dissertation I am more interested in the consequences of neuroscience research at the scale of the "settlement," which is, by definition, an *ensemble* of buildings, along with associated streetscapes, amenities, and ecological features – in other words a much more complete and encompassing gestalt geometry. It's also interesting to note that *Brain Landscape* (2009) contains an Appendix written by Zeisel, while Zeisel's *Inquiry by Design* (2006) contains a Foreword written by Eberhard, suggesting the inchoate formation of a research community. Also very important to mention in the context of this Dissertation Proposal is that Eberhard in 2003 founded the "Academy of Neuroscience for Architecture" (www.anfarch.org), meaning that there is an established scholar-practitioner forum for the presentation and collation of research of this kind.

One more contribution needs to be introduced here: Harry Mallgrave, professor of architecture at Illinois Institute of Technology, wrote *The Architect's Brain: Neuroscience, Creativity, and Architecture* (2011). Whereas Zeisel and Eberhard look primarily at how discoveries in cognitive neuroscience may be applied to environmental design, thus influencing the reciprocal relationships between brain functioning, behavior, and the structure of the built environment, Mallgrave directs his attention more specifically at the prospects and limitations inherent in the brain that is doing the designing. After an extended discussion of "neural plasticity," the observed capacity for synaptic connections to reconfigure over time as a consequence of experience, the assertion is made:

> Brain plasticity implies that with the right effort and the right influences we can make ourselves smarter to some extent, that we can enhance our creativity, and that the brain, as a living organ, neurologically changes over time. This transformation takes place over the course of a lifetime, but even more so over the course of generations as a host of environmental and cultural influences also come into play. Obviously one of the suggestions of this book is that the brain of the Renaissance architect or nineteenth-century architect was configured quite differently from the brain of the twenty-first century architect, for better or worse (2011, p. 207).

For better or worse? Mallgrave is being diplomatic here; for he does provide quite a pointed critique at the deleterious effects of a modern architectural education in which a newbie designer may achieve a degree without ever having drawn by hand, instead imagining and creating exclusively through the virtual process of clicking a mouse through pop-up windows in a computer aided drawing (CAD) program. Such educational training, and the cultural-environmental milieu in which it is embedded, implies a very different repertoire of sensorimotor connectivity in associated brain regions than would have been apparent, for example, in the Renaissance architect. Knowledge of cognitive neuroscience, then, can inform not only the design but the education of the designer, which, in the end, becomes another case of reciprocity.

Therefore, for my Dissertation towards a Ph.D. in the Human and Organizational Development doctoral program at the Fielding Graduate University of Santa Barbara, I wish to contribute to the burgeoning research program exemplified by the work of Zeisel, Eberhard, Mallgrave, and the Academy of Neuroscience for Architecture; that is, I wish to make a statement concerning how discoveries in cognitive neuroscience may inform the environmental design professions.

As the title of my Dissertation – Neurophenomenology of Settlement Morphology – indicates, I propose conducting research at the scale of the "settlement." As mentioned previously, this is the scale of *ensembles* of buildings, associated streetscapes, amenities, and ecological features. This scale was said to offer a more complete and encompassing "gestalt

geometry." Additionally, settlement scale will enable a more thorough incorporation of core Environment-Behavior themes such as place and wayfinding. Among the distinguishing characteristics of settlement scale it is the *morphology* that I am particularly keen on exploring. Morphology can be translated as 'form' or 'structure' yet it also implies a definite movement, change, growth, or development.

Based on insight provided thus far, it is now possible to formulate a preliminary research question:

- Can a correlation be hypothesized between settlement morphology and the neural patterning of people residing therein?

This is a question for cognitive neuroscience; it can be approached using existing knowledge of brain functioning. However, in order to make this knowledge useful for the design professions a human behavior aspect also needs to be addressed. Therefore, intimately associated with the first research question is its phenomenological counterpart:

- Can a correlation be demonstrated between settlement morphology and the conscious experience of people residing therein?

Obviously, if both of these questions can be answered in the affirmative, then an explicit correspondence is being inferred between "neural patterning" and "conscious experience." This could be translated in interdisciplinary terms as the innate correspondence between Cognitive Neuroscience and Phenomenology. For that reason, the research methodology proposed for this study is *Neurophenomenology*, as introduced by Francisco Varela in his 1996 paper "Neurophenomenology: A Methodological Remedy for the Hard Problem." According to Varela, "Neuro-phenomenology is the name I am using here to designate a quest to marry modern cognitive science and a *disciplined approach* to human experience, thus placing myself in the lineage of the continental tradition of phenomenology" (1996, p. 330, original emphasis). Hence, Neurophenomenology is the proposed research methodology for this Dissertation because it provides the means for theoretically correlating discoveries in cognitive neuroscience with first-person accounts of experience – and conscious experience can only be revealed through first-person accounts.

Eberhard (2009, pp. 5-7) laments the "intellectual gap" that presently exists between the neuroscience and architectural communities. I would suggest that Neurophenomenology is the very tool to bridge that gap. Neurophenomenology can provide the language to elucidate correspondences between the qualitative ways people experience places – that is, distinguishable patterns of the environment imbued with meaning – with the underlying neural events associated with those experiences. Consequently, the potential exists to formulate

criteria for designing places – even whole settlements – that may facilitate optimum neural development based on discoveries in cognitive neuroscience.

My Dissertation may uniquely contribute to this momentum with the following agenda:

1) Collecting disciplined phenomenological data of the experience of moving through various settlement morphologies
2) Correlating this data with existing neuroscientific knowledge concerning such neural phenomena as: a) cognitive maps, b) functional isomorphic topologies, c) synchronous distributed neural networks, and whatever else may be revealed through this course of study
3) Drawing hypotheses elucidating the reciprocal relationship between settlement morphologies and these neural phenomena
4) Based on hypotheses drawn, suggesting design criteria at settlement scale for the optimization of neural functioning, a condition understood as contributing to the "evolution of consciousness"

The body of this Dissertation Proposal will now elaborate upon the essential conceptual constituents of this study. The following sections will include more detailed discussion about:

1) Settlement Morphology
2) Neurophenomenology
3) The Embodied Mind
4) Methodological Considerations
5) Situating the Dissertation in a Field
6) Research Design
7) Literatures to Access, and
8) Epilogue

I will close now this Introduction with an assessment from Fred "Rusty" Gage, the prominent neuroscientist from the Salk Institute who discovered neurogenesis in the early 1990s. Signor Gage delivered the keynote address at the 2003 AIA Convention in San Diego from which the Academy of Neuroscience for Architecture was inaugurated. Here is an excerpt from that address:

> As neuroscientists, we believe that the brain is the organ that controls behavior, that genes control the blueprint, the design, and the structure of the brain, but the environment can modulate the function of genes, and ultimately the structure of our brain. Changes in the environment change the brain and therefore they change our behavior. Architectural design changes our brain and our behavior (as quoted in Zeisel, 2006, p. 11).

Settlement Morphology

"Settlement" is the blanket term used by Human Geography to denote areas of the landscape modified for human habitation. In a classic study, Hudson (1970, p. 3) provides a useful overview:

> Whether the unit of settlement is the individual farm, the village, town, city or conurbation, there is plenty of variety in its spatial setting. The settlement is central to all human geography, modifying as it does the natural environment by intruding a cultural element. Any settlement can be studied in either a world or a regional context, but any settlement, if it is to be adequately appreciated, must be correlated with other facts of geography, *e.g*. relief, climate, geology and social and economic conditions.

One thought-provoking way to look at settlements is in respect to their *morphology*, that is, their structure and form. Morphology is related to 'pattern;' yet, whereas pattern may refer to a more or less static arrangement at any given time, or even to active components in a typology of design (Alexander, *et al.* 1977), morphology implies definite stages of *development* and thus movement and change. In this regard, it's interesting to observe that morphology is also a term native to Biology, especially in its variation *morphogenesis* – "the generation of form" (Ebert & Sussex, 1970, p. 10). According to the textbook *Biology* (Mader, 1990, p. 678), "Development requires growth, differentiation, and morphogenesis. When an organism increases in size, we say that it has grown…Differentiation occurs when cells become specialized with regard to structure and function…Morphogenesis goes one step beyond growth and differentiation. It occurs when body parts become shaped and patterned into a certain form." Applying this understanding to Human Geography, we could say that "settlement morphology" is an evocative way of focusing attention on how any particular human habitation system, at whatever scale, has developed over time into its current form – and, recalling the famous Bauhaus motto, it will be instructive to remember that "Form follows Function;" or, as Frank Lloyd Wright later redefined it, "Form and Function Are One" (Papanek, 1995, p. 140).

Kostof (1991, 1992) provides some of the best analyses available of settlement form. In *The City Shaped* (1991), he lists four main varieties: "Organic" Patterns, The Grid, The City as Diagram (e.g. circles and polygons), and The Grand Manner (i.e. Baroque). Since these last three are all 'abstract' patterns, that is, idealizations based on some prevailing preferred geometric arrangement, it could be asserted that there really exist only two kinds of settlement morphology: those that conform to the existing landscape and topography and those that

reshape the existing landscape and topography to conform to one of the idealized geometric forms – and yes, Kostof is able to translate each of these forms into a particular function.[1]

For the purposes of this Dissertation study, I will simply the scope of settlement morphology to the two most predominant forms: the organic pattern and the grid. By focusing on just these two, the emphasis of the study becomes a contrast between a morphology that conforms to the landscape and topography and one that imposes an idealized pattern onto the landscape and topography. To review, the research questions are: 1) Will these two different morphologies result in different neural patterning? and 2) Will these two different morphologies result in different conscious experience for the users? Another way to phrase these questions would be: 1) Do people living in a grid morphology have different neural patterning than people living in an organic morphology? and, 2) Do people living in a grid morphology have a different sort of conscious experience than people living in an organic morphology? Once again, the research program of Neurophenomenology will be the most appropriate tool with which to approach these questions.

Since "settlement morphology" is so much a study of pattern, structure, and form, it is very informative to be able to step back a bit and survey from a bird's eye (or satellite) perspective. For example, when speaking about the galactic arms at Auroville, being able to regard the diagram of the conceptual model as a whole gives a much better feel for its energetics and movement than would simply relying on the image produced from reading printed word. For that reason, throughout this study I will include visuals of settlement morphology to complement the narrative. Beginning here, I introduce the 'grid:'

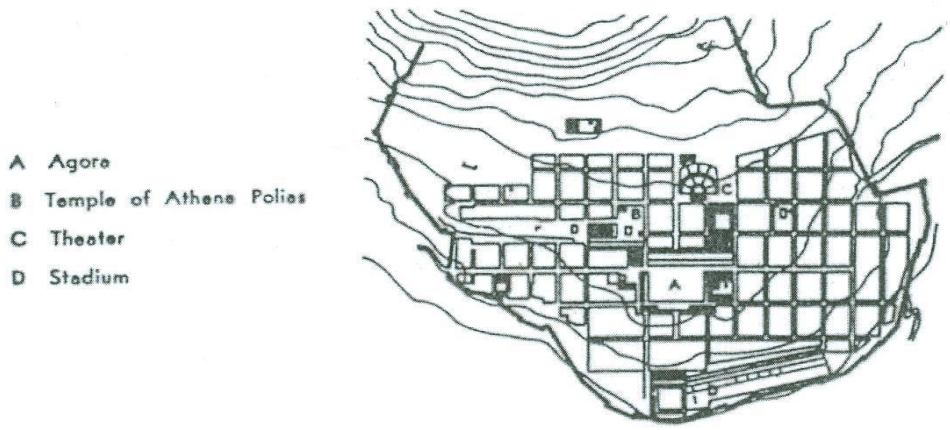

Fig. 2 – Priene, Asia Minor, from Eisner, Gallion, Eisner, 1993, p. 64

[1] I would add 'suburban' as another settlement form. The suburban pattern is every bit as abstract as these idealized geometric forms. While often conforming to a curvilinear shape, and thus appearing 'organic,' the pattern is nonetheless purposely configured to maximize individual lot placement. The design sequence takes place offsite; indeed, it is not necessary for the designer to ever actually see the site. Development property lines are first established and then the street and lot outlines are molded within. The land is then graded to conform to the plot plan instead of the plot plan conforming to the land; thus, the suburban pattern is another abstraction.

Priene is a good place to begin because it is the first recorded example of use of the grid. Priene was a Greek colony on Asia Minor established 4th century B.C. This Dissertation Proposal is not the appropriate context in which to conduct neuro-psychological analysis of this morphology; such an analysis will be reserved for the actual Dissertation, and will be based upon the phenomenological data received. Nevertheless, a couple pertinent objective facts are worth mentioning here: 1) the grid was first used in conjunction with colonization; and 2) the grid was introduced during the ascension of Greek rationalism. In the above diagram it is easy to see why I would characterize the grid as an abstraction: The site chosen for Priene, as revealed by the contour lines, was a 3-dimensional promontory yet the site plan for the settlement was a 2-dimensional orthogonal (meaning composed of right angles) arrangement. The site plan is a geometric idealization that has only tangential relationship with the actual geophysical qualities of the site. It's also worth mentioning that the right angle does not occur in Nature except in the form of a few crystals.

Another example will help to reinforce this sense of abstraction. As imperialistic colonizers, everywhere the Romans went they would lay down a square grid to assert territorial control. Here is the generic plan of a Roman colonizing settlement:

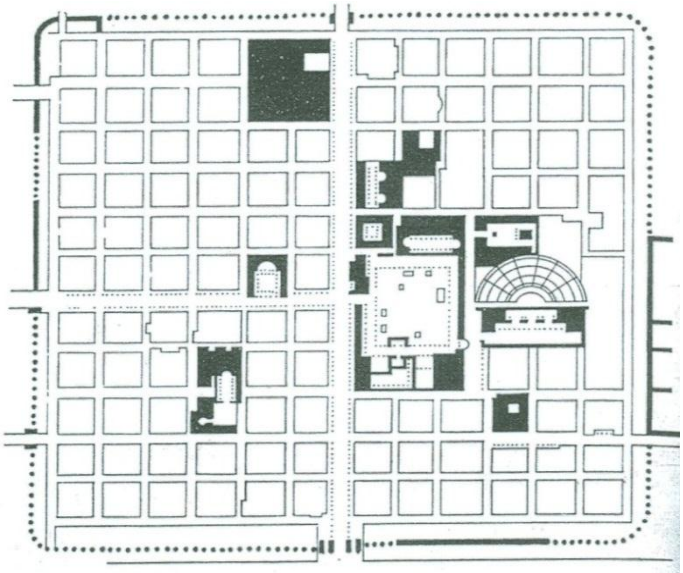

Fig. 3 – Generic plan of Roman settlement, from Eisner, Gallion, Eisner, 1993, p. 72

Whether in Verona or Lyon, London or Aleppo, it didn't matter what the existing landscape topography might be; the Romans would deliberately impose their 2-dimensional, 'pre-packaged' orthogonal grid. What would be the phenomenological experience of moving through such a settlement morphology? Militarily, it's easy to imagine the efficiency of posting a few sentries at strategic line-of-sights to keep watch over the entire settlement. Here's what the generic Roman plan looks like situated in a landscape, looking rather alien if I might add:

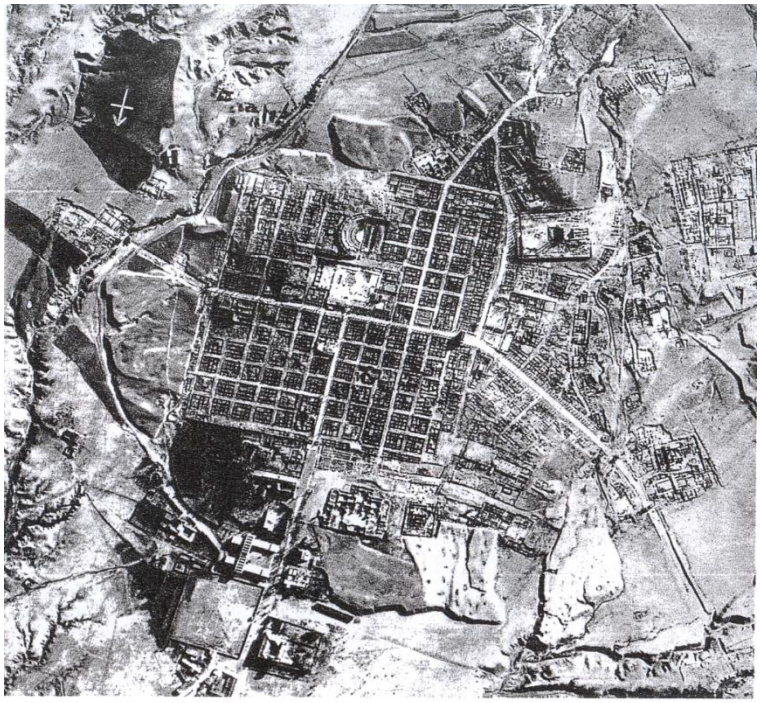

Fig. 4 – Timgad, Algeria, colonized circa AD 100, from Kostof, 1991, p. 106

Let's fast-forward now to the colonization of "America."[2] Everywhere the colonizers landed they would lay down another abstract orthogonal grid. There are a multitude of examples. In order to establish a story-line, I begin with the settlement of Savannah, Georgia:

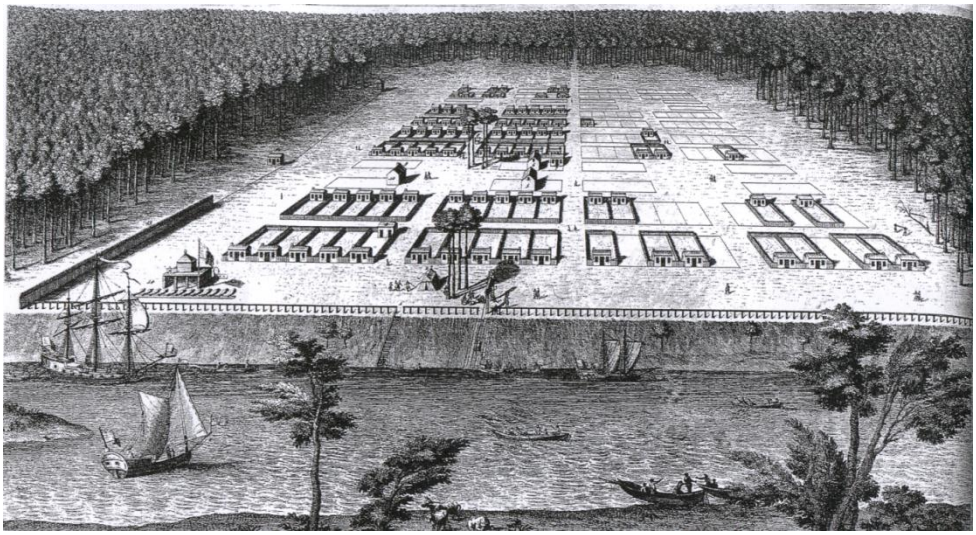

Fig. 5 – "A View of Savannah as it stood the 29th of March, 1734," from Kostof, 1991, p. 98

[2] Although in general parlance "America" is meant to refer to the territorial-mythological experience of one particular nation-state – the United States of America – "America" in actuality is an entire *hemisphere*: There is a North, South, and Central America. Hence, Peru and Guatemala, as examples, are just as much a part of America as is the United Sates. Interestingly, grid morphology predominates throughout the post-contact Americas.

This diagram reveals the typical pattern of settlement: First, the land is cleared of existing vegetation and features to create a 'blank slate,' as it were, and then an arbitrary starting point is chosen by a surveyor to begin laying down the orthogonal grid. At this stage of American development, the colonizing settlement was still very much a military outpost of Roman prototype: the colonizers were intent on securing territorial control from which to begin, as rapidly as possible, an economic process based on converting natural resources into pecuniary instruments. Still not wanting to prematurely insert psychological evaluations in the interest of objectivity, I can nevertheless assert that early Savannah looks to me more like a barracks or a modern industrial "park" than a cozy place to call home.

This process of laying down orthogonal grids proceeded across the entire continent during westward expansion. The Great Plains and the Great Basin were temporarily bypassed in order to secure California and the Oregon Territory first. An aerial view of the plan for early San Francisco highlights once more the inherent abstracting nature of the grid:

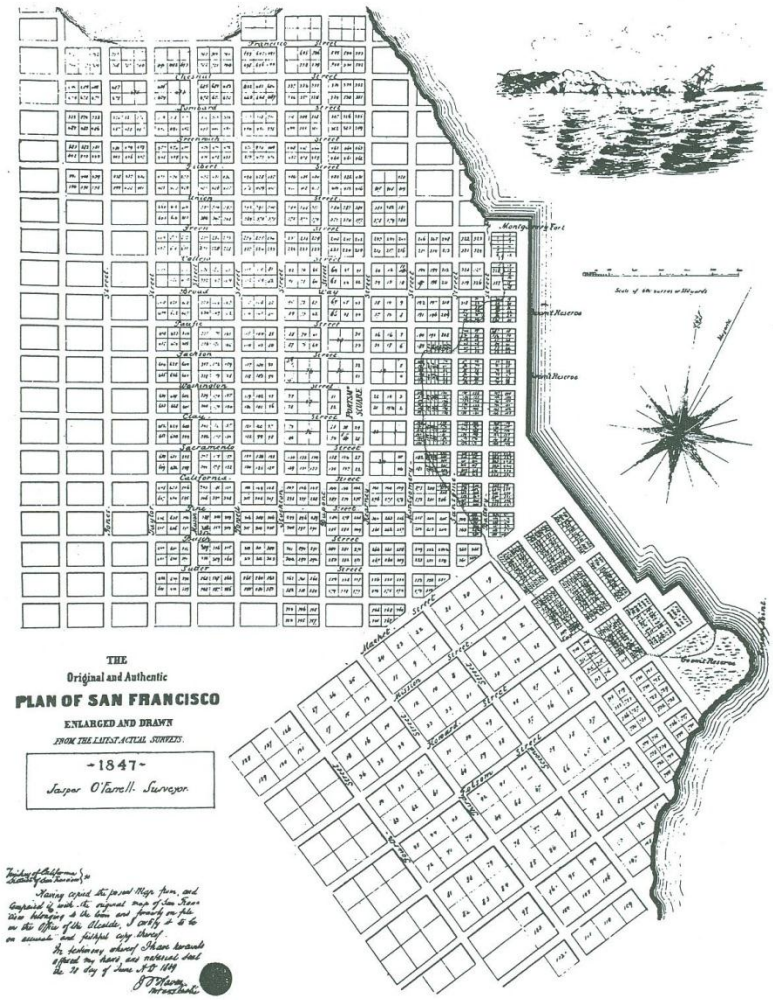

Fig. 6 – 1847 Plan for San Francisco, from Browning, 1998, p. 165

Within the confines of San Francisco lay seven large prominent hills; yet, an examination of this plan reveals absolutely no indication where those hills might be – thus, the plan is another 2-dimensional abstraction of 3-dimensional space, offering no concern for or acknowledgement of the underlying geophysical properties of the site.[3] Indeed, take a closer look at the shaded area center-right: This shows a portion of the Bay that was infilled to conform to the plan instead of the plan conforming to the existing outlines of the Bay!

I want to look at one more example of settlement morphology in North America: This one could be called "Anywhere, USA" but instead bears the name "Chariton, Iowa:"

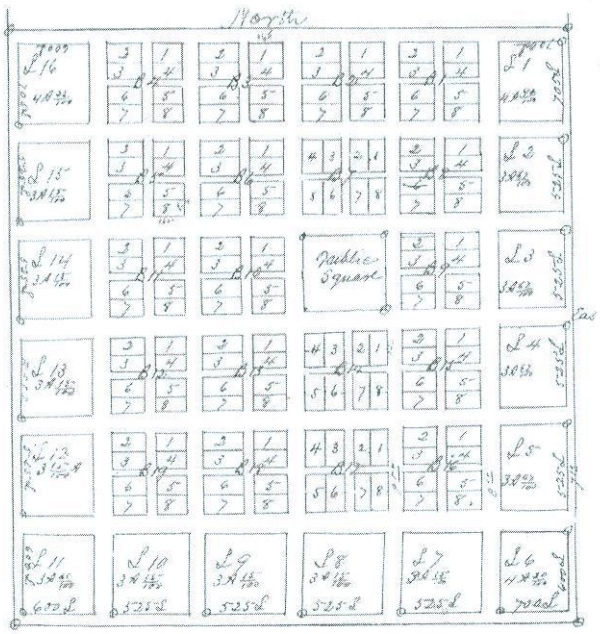

Fig. 7 – Original plat of Chariton, Iowa, from Schmiedeler, 2007, p. 134

Here's a typical orthogonal plan that was laid down all over the interior of the continent. Schmiedeler (2007) explains that the birth of these new "towns" would follow the rail lines. Every twenty miles or so, spaced so that livestock or produce from the interior could arrive at a convenient loading dock, the rail company would lay down another square grid. The employees doing the surveying didn't necessarily need an education in urban design or city planning – they didn't need any education at all! All that was required was the ability to locate an arbitrary starting point somewhere close to the tracks and begin laying down the grid. Existing features such as topography, tree groupings, rock outcroppings, brooks or streams, view corridors, etc. – features that would have *determined* the shape of an organic morphology – were ignored or subdued. The purpose was simply to create a strict 2-dimensional orthogonal plan. The reason for this vapid lack of imagination was not, as in Roman times, to establish a military outpost

[3] This critique could be taken a step further by insisting that the existing site was *4*-dimensional space, considering that geophysical properties include ecological succession proceeding over time.

with sentries at the street-ends; no, the reason was because the railroad barons planned to sell all these little squares to new residents! That's right; it was much easier to determine the price of a lot that is, say, an exact 50 x 100 feet then it would have been to determine the price of an irregular lot following the contour or topography. Strict financial profit expediency – that's what determined the settlement morphology of the USA.[4]

Now that I've reviewed the grid as settlement morphology through time, objectively speaking, with diagrams, I wish to recall the complementary research questions: 1) Can a correlation be hypothesized between settlement morphology and the neural patterning of people residing therein? and 2) Can a correlation be demonstrated between settlement morphology and the conscious experience of people residing therein? In order to access these questions, I would propose a *phenomenological* study of moving through this morphology, followed by an interpretation based on existing neuroscientific knowledge. What is it like to approach one of these right angles? What is it like to look down a straight street that seems to perpetuate on the horizon? What is it like to move through a geometrically idealized abstraction? What is it like to have no more options than to proceed straight ahead or to turn obliquely at one of the right angles? These sorts of questions can only be answered from a subjective, first-person experiential (i.e. phenomenological) perspective. Once the phenomenological data has been recorded, the next step can be taken to correlate these data with existing neuroscientific knowledge to produce a *neurophenomenological* hypothesis – that is, an account of first-person perspective explained according to the parameters of objective, third-person scientific knowledge. The potential is nothing less than to produce informed criteria for design at settlement scale that may influence the evolution of consciousness.

With this potential in mind, therefore, it will be important to ascertain and contrast the direct lived experience of moving through a grid morphology with that of moving through an organic morphology. "Moving through" is the crucial experience to be recorded here because, from an evolutionary perspective, that is how neural patterning is imprinted (Oakley & Plotkin, 1979). The human nervous system evolved through long years of "moving through" variegated landscapes in support of a hunting-gathering lifestyle (Leakey, 1994). The brain is essentially a sensorimotor organ whose synaptic connections are continually configured and re-configured according to the details of environmental experience (Pascual-Leone *et al.* 2005). This sensorimotor substrate has direct influence on higher cognitive capacities, including emotion, perception, and reasoning (Munakata *et al.* 2004). Consciousness, or the ability to be aware of

[4] But that's not all: all these individual town grids are superimposed on top of a giant continent-wide grid that was produced by an effort called the National Survey. You can see the effects of this Survey while flying over the continent: the entire landscape is ordered according to this grid in mile-square sections whose interstices are commonly called, at the local courthouse, 'range' and 'township.' Occasionally you can witness a little winding creek with the temerity to cut through just one tiny corner of one of these giant squares. This presents a real problem – who will own the rights to this one tiny filament of creek?

being aware, and hence to have foresight and a recurring sense of self, is produced by the synchronous firing of multiple "reentrant pathways" from diverse distinct brain regions (Edelman, 1992; Edelman & Tononi, 2000), including, no doubt, the sensorimotor substrate. This line of thinking is the justification for hypothesizing that "moving through" contrasted settlement morphologies will subsequently manifest in different qualities of consciousness. As mentioned in the Introduction, my Dissertation will examine the phenomena of "cognitive maps," "functional isomorphic topologies," and "synchronous distributed neural networks" to further substantiate these claims (references to be provided).

So, then, what would be the phenomenological experience of moving through an "organic" settlement morphology? Consistent with the aphorism that "a picture is worth a thousand words," I close here with an image of my favorite settlement morphology, and one for which I have direct experience (Mare, 2012): the immensely beautiful *citta* of Siena in Tuscany: My mind enters a flowing creative dance just mesmerizing on the image:

Fig. 8 – Siena in Tuscany, from Kostof, 1991, front cover

Neurophenomenology

Francisco Varela inaugurated the research program of Neurophenomenology in his seminal paper "Neurophenomenology: A Methodological Remedy for the Hard Problem" (1996). And, we might ask, what is this "hard problem?" According to Chalmers (1995, p. 201, original emphasis), "The really hard problem of consciousness is the problem of *experience*" – or, as elaborated by Shear (1995, p. 359), "The 'hard problem' of explaining consciousness…is that of giving an intelligible account of why experience exists at all, and also of why it is found in intimate association with individual physical systems such as the nervous systems of human beings and other sentient creatures." Varela sought to address this so-called "hard problem" with the introduction of his new research program: "Neuro-phenomenology is the name I am using here to designate a quest to marry modern cognitive science and a *disciplined approach* to human experience, thus placing myself in the lineage of the continental tradition of phenomenology" (1996, p. 330, original emphasis).[5]

In order to comprehend why there was a problem at all, it will be necessary to backtrack a bit so as understand the position of this "modern cognitive science" to which experience is to be wed.

Cognitive science arose originally as a reaction to the prevailing Behaviorism of the early 20th century, which was itself an attempt to provide a purely scientific foundation for the emerging field of Psychology (Watson, 1913). Since Behaviorism positioned itself as 'scientific,' and thus modeled upon the objectivist epistemology of Physics, it proclaimed that the psychology of human beings could be studied most effectively by detached, independent observers without resort to intangible, distracting, even messy considerations such as 'mind' or 'consciousness.' In the words of one of its founders:

> Psychology…is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent upon the readiness with

[5] I don't know if Varela was aware of it but several years prior to his paper a team comprising Charles D. Laughlin Jr., John McManus, and Eugene G. d'Aquili assembled an intriguing book entitled *Brain, Symbol & Experience: Toward a Neurophenomenology of Human Consciousness* (1990). This book introduced such important concepts as "biogenetic structuralism" and "neurognosis," and the value of approaching the study of states of consciousness as a "mature contemplative." Laughlin, McManus, and d'Aquili situate themselves as anthropologists, which would place them in a different research community than Varela – and recalling that back in the early 90s there were no internet search engines, it is possible that Varela was unaware of this previous usage of the term neuro-phenomenology. In any case, I have not seen the anthropologists' book referenced in any of Varela's writings; though I shall have more to say of it later. See also Laughlin & Throop (2009) "Husserlian Meditations and Anthropological Reflections: Toward a Cultural Neurophenomenology of Experience and Reality."

> which they lend themselves to interpretation in terms of consciousness (Watson, 1913, as quoted in Thomas, 2001, p. 13).

What resulted was the dubious "black box" approach, where inputs and outputs are diligently recorded but where the whole process in between – mind – is duly disregarded.

By the 1950s and early 1960s Behaviorism was losing its edge with the rise of computer science and its associated formal languages and interpretivist analytic philosophy. A new paradigm of Psychology, heralded as the "cognitivist revolution," alleged that the inner workings of the "black box" could indeed be studied with these new tools:

> The cognitive position was to adopt notions derived from logical and formal analysis, putting an emphasis on syntax. In this view, the mind, like a computer, is organized by rules and operates by mental representations. Meanings or semantics are supposed to arise by mapping these rules onto classically categorizable events and objects. Unlike behaviorism, this view allowed one to look into the mind but then described it as if it were a formal system. This description floated more or less free of the detailed structure of the brain (Edelman, 1992, p. 67).

This whole "computer metaphor" – an abstract "computationalism" where the brain is accepted as the generic "hardware" upon which any suitable proprietary "software" of mind can be run – may sound very familiar; yet, Edelman, a Nobel Laureate, declares elsewhere (p. 14) that the whole cognitivist enterprise is "incoherent," "[resting] on a set of unexamined assumptions." One of its most glaring oversights is that "it makes only marginal reference to the biological foundations that underlie the mechanisms it purports to explain. *The result is a scientific deviation as great as that of the behaviorism it has attempted to supplant*" (ibid, added emphasis). According to Edelman, any viable theoretical construction of mind or mental processes must be based upon and reflect the actual physical structure of the brain. "What is special about brains that computers, and material particles, and atoms, and *res cogitans* all lack is *evolutionary morphology*" (ibid, p. 29, added emphasis) – "the minimum condition for the mental is a specific kind of morphology" (ibid, p. 34).

This finding certainly makes an interesting correlation with the study of settlement morphology; for, what I am endeavoring to present here is the notion that specific kinds of morphology do indeed promote different qualities of brain functioning.

In a later book co-authored with Guilio Tononi, Edelman presents further evidence from his research to delegitimize the computer metaphor. Once again, what appears most significant in the construction of mental processes is the evolutionary "organization principles" among various components of the nervous system:

> [A] quick review of neuroanatomy and neural dynamics indicates that the brain has special features of organization and functioning that do not seem consistent with the

> idea that it follows a set of precise instructions or performs computations. We know that the brain is interconnected in a fashion no man-made device yet equals. First, the billions and billions of connections that make up a brain's connections are not exact: If we ask whether the connections are identical in any two brains of the same size, as they would be in computers of the same make, the answer is no…Although the overall pattern of connections of a given brain is describable in general terms, the microscopic variability of the brain at the finest ramifications of its neurons is enormous, and this variability makes each brain significantly unique (Edelman & Tononi, 2000, p. 47).

The authors go on to explain further that the uniqueness of each brain results from "the consequences of both a developmental history and an experiential history" (ibid); thus, personal experience is indubitably implied in the mental functioning of each individual. What's more, at the level of consciousness, or subjective experience, neuronal connectivity is never "hard-wired," to use a favorite mechanistic metaphor: new synaptic connections are made with each new experience while existing connections wither and fade with disuse – and this variability compounds on a daily basis. The picture that is painted by recent findings in cognitive neuroscience portrays a nervous system of dynamic adaptability, both shaping and shaped by its everyday lived experience. No machine could ever match this evolutionary dynamism. For that reason, it is disappointing to hear prominent spokes-people still clinging to the outworn mechanistic metaphors. For example, the respected neuroscientist Michael S. Gazzaniga, in a recent issue of *Brain in the News* (2011, p. 5), says flatly, "I think we will get over the idea of free will and accept we are a special kind of machine, one with a moral agency which comes from living in social groups."

And so, with the epistemological assumptions that guided early cognitive science – and in many cases still linger – it becomes easy to comprehend why the "hard problem" would arise: the cognitivist enterprise has been intrinsically and emphatically *disembodied*. The living body is the very locus of experience – experience is *being* (Thompson, 2004, p. 382), the type of being that comes from subjectively inhabiting a body. Each body, each nervous system, each brain is unique, shaped by its own personal developmental history. For that reason, universal generalizations do not apply: discoveries at the level of neuroscience must be correlated with subjective accounts. For too long, the cognitivist enterprise dismissed the subjective in its zeal to forward purely objective, scientific explanations. Varela, in his new research program of neurophenomenology, sought to find verifiable (and thus scientific) common ground between subjective (i.e. phenomenological) and objective accounts not by abandoning altogether the cognitive enterprise but by introducing a "methodological remedy" that could "bridge the gap" (Roy*, et al*. 1999), thus lending respectability to both. In his own words: "At the very least, the hypothesis presented here provides an explicit avenue to conduct research in cognitive science as if both brain physiology and mental experience mattered" (1996, p. 344). "[W]e have in front of us the possibility of an open-ended quest for resonant passages between human experience

and cognitive science. The price however is to take first-person accounts seriously as valid domain of phenomena" (ibid, p. 346).

And in my coming Dissertation, I propose to do just that: "take first-person accounts seriously." That's the very reason Husserl formulated his philosophy of phenomenology back at the beginning of the 20th century: he was duly concerned with the consequences of a worldview in which the objective abstractions of mathematical science were considered more 'real' than the perceptions of direct, subjective lived experience. Says Husserl:

> The *naivete* of speaking about "objectivity" without ever considering subjectivity as experiencing, knowing, and actually concretely accomplishing, the *naivete* of the scientist of nature or of the world in general, who is blind to the fact that all the truths he attains as objective truths and the objective world itself as the substratum of his formulae (the everyday world of experience as well as the higher-level conceptual world of knowledge) are his own *life-construct* developed within himself – this naivete is naturally no longer possible as soon as *life* becomes the point of focus (1970, p. 96, original emphases).

How true. How sublime. And is it not also true that the life of human beings is lived within the mutually-defining constructs of their built environment – their "life-world" in the terminology of phenomenology? Then, as intuited by Zeisel, Eberhard, Mallgrave, and the Academy of Neuroscience for Architecture, does not this lifeworld, as the substratum of experience, duly influence whatever is conceived – indeed, influence whatever is *possible* to be conceived? It is based on these ruminations that I am concerned with the "life-constructs" of human beings living out their daily lives in abstractions, objective rational formulae concretized in the morphology of orthogonal grids. Can we separate the life-constructs – the very worldview – from the morphology of the lifeworld in which they were conceived? I think not; they cannot be separated for they are co-evolutionary, co-determining, and co-specifying; to do so would be another abstraction. I also think there is enough information available in contemporary cognitive neuroscience to support these considerations. Whatever information is available, however, must be supported by first-person accounts.

The Embodied Mind

In a recent summation entitled *Embodied Cognition* (2011, p. 54) – which appears to me at times as a somewhat disguised effort to revive credibility in the cognitivist enterprise by demonstrating recent advances in artificial intelligence and *robotics*[6] – Shapiro states: "Within embodied cognition, Varela, Thompson, and Rosch's *The Embodied Mind* (1991) is often regarded as an *urtext*" (meaning "a basis for variants in later texts" (Dictionary.com)). After explaining that the authors "reject the traditional view of cognition as computation over representation, choosing instead to conceive of cognition as "embodied action,"" Shapiro selects the following paragraph to encapsulate the message of *The Embodied Mind*:

> By using the term *embodied* we mean to highlight two points: first, that cognition depends upon the kinds of experience that come from having a body with various sensorimotor capacities, and second, that these individual sensorimotor capacities are themselves embedded in a more encompassing biological, psychological, and cultural context. By using the term *action* we mean to emphasize once again that sensory and motor processes, perception and action, are fundamentally inseparable in lived cognition (Varela, Thompson & Rosch, 1991, p. 173).

I initially encountered *The Embodied Mind: Cognitive Science and Human Experience* during a study of Living Systems Theory back in my Whole Systems Design program, a study in which I first read Maturana and Varela's (1987) *The Tree of Knowledge: The Biological Roots of Human Understanding.* I must say, I have been profoundly influenced ever since, for I can no longer take body for granted. Both these important texts, and the understandings they convey, can be considered as predecessors to Varela's program of Neurophenomenology. Of particular relevance to a "Neurophenomenology of Settlement Morphology" are three key terms: "autopoiesis," "structural coupling," and the "enactive approach" to cognitive science.

Autopoiesis is understood as the dynamics of "self-organization." All living systems are considered as "autopoietic unities" in that they are *self*-organizing, *self*-maintaining, *self*-repairing wholes. All organisms, for example, are certainly living systems but not all living systems need be organisms, and could include such autopoietic unities as ecosystems or even

[6] As is Andy Clark's *Supersizing the Mind: Embodiment, Action, and Cognitive Extension* (2011). Both authors are willing to apply a growing acceptance of "embodiment" within cognitive science to robotics research, which seems to me a misapplication. "Clark's position seems to be that cognitive science might retain the [computational] framework, but would do well to focus its energies on understanding the extent to which body and world are factors in cognitive processes (Shapiro, 2011, p. 66). Yes, this is the right language, but it seems to me inappropriate to apply it to machines; or rather computationalism can *only* be applied to machines.

traditional villages. Laughlin, *et al*. (1990, pp. 70-5) emphasize that individual neurons are also self-organizing, a process they call "neurognosis," and thus are capable of intentional behavior. "The most striking feature of an autopoietic system is that it pulls itself up by its own bootstraps and becomes distinct from its environment through its own dynamics, in such a way that both [entities] are inseparable…Living [systems] are characterized by their autopoietic organization. They differ from each other in their structure, but they are alike in their organization" (Maturana & Varela, 1987, pp. 46-7) – an organization with the ultimate purpose of maintaining long-term viability in relationship to environment (i.e. *sustainability*).

The essential point here is one of *autonomy* – self-direction or self-management. This point becomes clearer when contrasting autopoietic *living* systems with *mechanical* systems, which are characterized as being "allopoietic," or organized from without. A computer, for example, can never self-organize but must be constructed by technicians. And whereas a traditional village is certainly self-organizing, in the sense that it is constructed and maintained by the people who live there, most modern settlements, such as suburban subdivisions or downtown business districts, need to be constructed and maintained by outside contractors, which means that the settlement loses autonomy. Such a condition also indicates that settlements like this are just more allopoietic mechanical systems. When a mechanical system breaks down, who will repair it? Living systems repair themselves.

Structural coupling is a very important consideration. In the words of the founders: "We speak of structural coupling whenever there is a history of recurrent interactions leading to the structural congruence between two (or more) systems" (Maturana & Varela, 1987, p. 75). If I may paraphrase, *the organism structurally influences the environment as much as the environment structurally influences the organism* – they are *co*-evolutionary, *co*-determining, and *co*-specifying. This brings up an important question raised earlier: If human beings co-evolve with an environment through a history of structural coupling, could not the quality and characteristics of that environment – perhaps even its *morphology* – influence the potentials of the human beings residing therein? I believe this possibility has not been adequately addressed in the literature, so I will return to it; for now, let's take a look at the "enactive approach," which is congruent with the concept of structural coupling.

"We propose as a name the term *enactive* to emphasize the growing conviction that cognition is not the representation of a pregiven world by a pregiven mind but is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs" (Varela, Thompson & Rosch, 1991, p. 9). "We are claiming that organism and environment are mutually enfolded in multiple ways, and so what constitutes the world of a given organism is enacted by that organism's history of structural coupling" (ibid, p. 202). "Consequently, cognition is no longer seen as problem solving on the basis of representations; instead, cognition in its most encompassing sense consists in the enactment or bringing forth of a world by a viable history of structural coupling" (ibid, p. 205).

These ideas stir my imagination. If cognition is indeed "bringing forth a world," then it must be possible, through disciplined training of the cognitive processes – that is, thinking, feeling, concentrating, imagining, visioning, etc. – to bring forth a *desired* world. This would be, in the language of phenomenology, *intentionality* – or, from another school, the open-ended creativity inherent in *design*. We *can* design the world we would choose; we do not need to passively accept a pregiven world 'out there,' any old world that's been handed down to us. And, with an understanding of the ultimate implications of structural coupling, we can design this world (*a* world, multiple worlds) to set the stage for and facilitate our conscious evolution. What could be more enlivening than that? The first step, it would seem, almost paradoxically, is to turn inward and become fully *embodied*, fully present in the body, for that is where mind emerges, a clear and purposeful mind, mind as the emergent cognitive interface between embodied being and nurturing environment. This is the potential of *The Embodied Mind*; and this is perhaps why the authors include a detailed discussion of Buddhist meditative practice in the book.

Thompson and Varela (2001, pp. 423-4), collaborating once again ten years after the publication of *The Embodied Mind*, appear to have sensed these possibilities:

> The nervous system, the body and the environment are highly structured dynamical systems, coupled to each other on multiple levels. Because they are so thoroughly enmeshed – biologically, ecologically and socially – a better conception of brain, body and environment would be as mutually embedded systems rather than as internally and externally located with respect to one another.

"Mutually embedded" indeed, an integrated unification, to the degree that modification or transformation in one will inevitably initiate change in the others. Move from a cantankerous inner city to a verdant garden landscape and you are bound to produce new thought patterns!

And what about this phenomenon of movement? Having a body or being embodied implies mobility, getting around and exploring the environment, looking for "affordances" (Gibson, 1979), that is, *opportunities for enaction*. The authors do address this issue in their new collaboration, suggestively entitled "*Radical* Embodiment: Neural Dynamics and Consciousness" (added emphasis), an apparent reference to an evolved viewpoint, and I quote the full paragraph to integrate the new language:

> Situated activity takes the form of cycles of sensorimotor coupling with the environment. What the organism senses is a function of how it moves, and how it moves is a function of what it senses. The substrates of these cycles are the sensorimotor pathways of the body, which are mediated in the brain by multiple neocortical regions and subcortical structures. Transient neural assemblies mediate the coordination of sensory and motor surfaces, and sensorimotor coupling with the

> environment constrains and modulates this neural dynamics. It is this cycle that enables the organism to be a situated agent (p. 424).

When I first read that I made a little note in the margin: "What about people in cars?" For it seems that what's being evoked here is the genesis of neural patterning, the instantiation of neural networks, as a function of the movement cycles of the organism. Structural coupling, then, becomes more completely apprehended as a history of *sensorimotor* coupling. A theoretical person sitting in a chair in a dark room their whole life will not embody the same neural dynamics as one actively out exploring the environment. The mind is not a "black box;" nor is it pregiven but rather is continually constituted and re-constituted with each new passing adventure. From this perspective, the person in a car, virtually immobilized with arms and legs stretched forward in an unnatural posture, encapsulated within a metallic shell, shielded from the multitude of sensory information vibrating as energy in the environment, will have limited opportunities for developing complex and sophisticated sensorimotor neural dynamics – and likewise, I would assert, for a nervous system constrained by mobilizing in an orthogonal grid.

And so I need to return to my recurring question: Is not the specific structuring of the environment being imprinted somehow in the neural patterning of the brain simply through the sensorimotor act of mobility? Does this not imply that different modes of mobility will produce different neural patterning resulting in different brain dynamics and thus, ultimately, different ways of perceiving the world (i.e. different worldviews)? Or, alternately, would not the movement through different settlement morphologies, even via the same mode of mobility, consequently produce different neural morphologies in the developmental cycling sequences explicated by Edelman? If not entirely isomorphic, could not the relationship between settlement morphology and brain microstructure be at least reflective? With these questions it is time now to turn to the particular research issues of the neurophenomenology of settlement morphology. In preparation, I close this section with the thoughtful contemplations of Evan Thompson, gifted son of Lindisfarne, who has contributed so much to our appreciation of the embodied mind:

> For neurophenomenology…the guiding issue isn't the contrived problem of how to derive a subjectivist concept of consciousness from an objectivist concept of the body. Instead, it's to understand the *emergence of living subjectivity from living being, including the reciprocal shaping of living being by living subjectivity.* It's this issue of *emergence* that neurophenomenology addresses, not the Cartesian version of the hard problem (Thompson, 2004, p. 385, original emphases).

Isn't it curious that Thompson still feels the need to reference the "hard problem," as a point of contrast – especially considering that some thirteen years earlier, in *The Embodied Mind*, he was writing: "we discussed how cognitive science has slowly drifted away from the idea of mind as an input-output device that processes information toward the idea of mind as

an emergent and autonomous network" (1991, p. 151). It seems that the shadow of the Cartesian mind/body split endures even after so much evidence acquired to repudiate it. How to explain this phenomenon? Could Cartesian proponents embody different neural dynamics? Could this be the result of structural coupling with environments that perpetuate Cartesian dualism? Is an orthogonal grid of abstract Cartesian coordinates the idealized geometric locus from which to entertain disembodied thoughts?

Fig. 9 – Modernist Dystopia, from Bacon, 1967, p. 316

Methodological Considerations

Lutz and Thompson (2003, p. 31) distinguish two levels to the neurophenomenology research program: "At a theoretical level, neurophenomenology pursues an embodied and large-scale dynamical approach to the neurophysiology of consciousness (Varela, 1995; Thompson and Varela, 2001; Varela and Thompson, 2003). At a methodological level, the neuro-phenomenological strategy is to make rigorous and extensive use of first-person data about subjective experience as a heuristic to describe and quantify the large-scale neurodynamics of consciousness (Lutz, 2002)." This is the marriage of cognitive science and a disciplined approach to human experience – objective data correlated with subjective accounts – that Varela envisioned in his seminal article of 1996.

Lutz (2002) conducted a classic pilot study that demonstrates the essential interplay between these theoretical and methodological levels, between cognitive science and the philosophy of phenomenology. Explains Lutz:

> This recent work (Lutz, et al., 2002) studies the correlation between on-going conscious states and brain coherent dynamics during a simple perceptual task and illustrates how accounts of experience by trained subjects and experimental data from these experiences can share an explicit relation of "mutual or reciprocal constraints" (Varela, 1996). The first claim is that the basic study discussed here already validates this research program because it produces new data and illuminates their relation to subjective experience (pp. 133-4).

In Lutz's study, participants were guided through a well-known illusory depth perception task, which consisted of fixing on a "dot pattern containing no depth information" (Lutz, 2002, p. 144). After this preparation period, "the random dot pattern was changed to a slightly different random-dot pattern with binocular disparities (autostereogram). Subjects were readily able to see a 3-D illusory geometric shape (depth illusion)" (ibid, pp. 144-5). Finally, participants were asked to press a button when the geometric shape had completely emerged. While all this was going on, electrical brain activity was being recorded with an electroencephalogram (EEG). After each test run, or alternately *during* the test run, participants provided a verbal phenomenological account of the experience. Two to three sessions were recorded for each participant so that singularities might emerge and be compared against the backdrop of a collective mean.

The results proved to be very interesting, "validating" the research program as indicated. Lutz and his team felt the need to divide the trials into several "phenomenological clusters," categories of subjective experience based on self-reported degrees of readiness for

the task. The phenomenological clusters were then compared with scientific data from EEG signals looking for correlation. Among the findings (Lutz, 2002, pp. 148-9):

> We found that the preparatory state, as reported by the subjects, modulates both the behavioral performance and the brain responses that follow. The reaction times were dependent on the degree of preparation reported by the subjects: they were longer when the subjects were less prepared. The induced response…was modulated in amplitude in posterior electrodes (visual areas) in function of the degree of preparation…In this particular example of clusters we can see a similar topographical pattern of large-scale synchrony during the motor response in the prepared versus the unprepared pattern…This later pattern of synchrony correlates in the unreadiness cluster of trials with longer reaction times.

Lutz is quick to point out: "This simple case study is just a first-step but already illustrates how fertile this approach could be to identify biophysical properties and to understand their relation to experience…The objective is to pay more meticulous attention to the intimate and direct knowledge that a subject has about his/her experience and to access this knowledge in a sufficiently controlled manner so that it is compatible with the more traditional methods for the collection of neural data" (2002, p. 149). A first evaluation is: "Further refinement is needed to capture the potential richness of even this simple perceptual experience. This depends primarily on the possibility of working with subjects trained to discriminate and stabilize their experience" (ibid).

I have two observations to make in regard to this pilot study:

First, I wonder if participants sitting in a chair and gazing into a computer screen, as I am assuming is the case here, will effectively stimulate the same sensorimotor capacities activated during actual lived experience? That is, I wonder if the neurodynamics data, as measured on the EEG, is already influenced by the artificial laboratory conditions? Such artifice is commonplace in cognitive neuroscience research due to the specialized, complex, and very expensive equipment involved. For example, Cupchik, *et al*. (2009, p. 84) "sought to determine how cognitive control and perceptual facilitation contribute to aesthetic perception along with the experience of emotion." Their method was to have participants lie in a functional Magnetic Resonance Imaging (fMRI) scanner whereupon they were shown a series of images of representational paintings. Brain areas that "lit up" during the experiment were assumed to correlate with aesthetic perception. There *may be* a connection; yet, the appreciation of artwork is usually more of a whole body affair, a gestalt, as viewers tilt their head this way or that, or physically move to various viewing positions to gain different perspectives or lighting affordances. I know that the new neuroscience technology is providing fascinating insight, and the studies continue to multiply, yet I also sense a tendency toward reductionism. Enactive and embodied proponents continually emphasize the essential *sensorimotor* component to cognition (Gallagher, 2005; Johnson, 2007; Noe, 2006; Sheets-Johnstone, 2011; Thompson,

2004, 2005; Thompson & Varela, 2001; Varela, *et al*. 1991), as perhaps exemplified in Thompson's skillful statement (2006, p. 226): "The central idea of the embodied approach is that cognition is the exercise of skillful know-how in situated action." With that in mind, maybe the best way to conduct cognitive neuroscience research would be to have brain imaging scanners mounted in helmets (if that could ever be arranged), allowing participants active mobility in everyday lived experience while they were being scanned. Wouldn't that be a more complete and authentic method for revealing underlying neural dynamics than the immobile simulations in laboratories?

The second observation regarding Lutz's study is that Varela (1996), in his inaugural paper, already anticipated the need for training in a "disciplined approach" to first-person accounting in order to substantiate neurophenomenology. Accordingly, the authoritative compilation *Naturalizing Phenomenology* (1999) – where "naturalizing" is understood as aligning phenomenology with the natural sciences, as in the project of neurophenomenology – makes repeated reference to Husserlian phenomenology and its essential technique of the *epoche*, or "transcendental reduction," a "bracketing" of habitual attitudes so that essences may be perceived. Similarly, an entire issue of the *Journal of Consciousness Studies*, reprinted in book form (with commentaries) as *The View from Within: First-person Approaches to the Study of Consciousness* (1999), was devoted to a discussion of first-person methodologies. In this book, Natalie Depraz, an Husserlian scholar, contributed a pragmatic article entitled "The Phenomenological Reduction as *Praxis*," in which she explains, "the *epoche* corresponds to a gesture of suspension with regard to the habitual course of one's thoughts, brought about by an interruption of their continuous flowing" (p. 99). Additionally, it ought to be remembered that *The Embodied Mind* incorporated detailed description of Buddhist mindfulness meditation, a technique for investigating consciousness with inherent "phenomenological precision" (Thompson, 2006, p. 228). With all this conscientious preparation, it seems a bit of oversight for Lutz to exclaim in his evaluation: "Further refinement…depends primarily on the possibility of working with subjects trained to discriminate and stabilize their experience" (2002, p. 149). That could have been anticipated and rehearsed ahead of time.

The citation of one more study will help to round out this look at methodological considerations. Varela's contribution to *Naturalizing Phenomenology*, besides editing, was a piece entitled "The Specious Present: A Neurophenomenology of Time Consciousness." His purpose was "to propose an explicitly naturalized account of the experience of present nowness based on two complementary approaches: phenomenological analysis and cognitive neuroscience" (1999, p. 266). His methodology was to review prior scholarly investigations of time consciousness, especially Husserl's conceptualization of *retention* and *protention*, add his own subjective experiences, correlate all these with recent research into the "dynamics of multistability" and the "geometry of nonlinear flows," and then finally develop his own hypothesis of "the four-fold structure of nowness," complete with diagrams (p. 303). The point

is that he developed a sophisticated neurophenomenological description without having to use any test equipment himself. As might be expected from the originator of the enactive approach, Varela at one point in the study provides the following context:

> As phenomenological research itself has repeatedly emphasized, perception is based in the active interdependence of sensation and movement. Several traditions in cognitive research have, as well and in their own way, identified the link between perception and action as key. It is this *active* side of perception that gives temporality its roots in living itself (p. 272, original emphasis).

I wish to take this active lesson to heart. As such, for my Dissertation I propose having research participants record their phenomenological experience of "moving through" the contrasting settlement morphologies of grid and organic. These data can then be correlated with existing neuroscientific knowledge – especially the phenomena of "cognitive maps," "functional isomorphic topologies," and "synchronous distributed neural networks" – seeking an explanation. This study, then, becomes similar to Varela's in that I will not need to access neuroscientific equipment myself but rather can rely on existing knowledge to produce, ideally, a sophisticated neurophenomenological description.

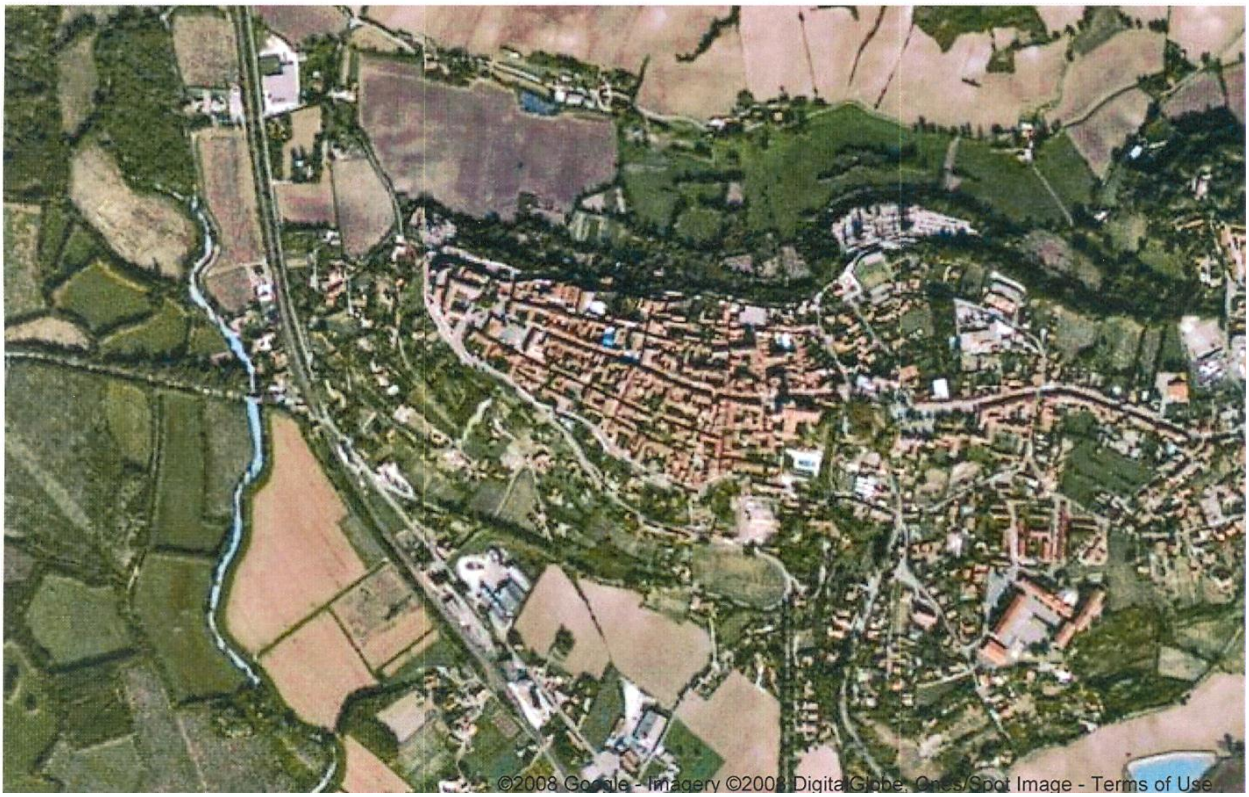

Fig. 10 – The village of Lectoure, France, from Google Earth, 2008. A reflection of neural patterning?

Situating the Dissertation in a Field: "Digging a Well"

There's been enough background information presented thus far to situate now my Dissertation within a particular scholar-practitioner field. I've been told that writing a Dissertation is like "digging a well," in that the purpose is to go very deep into one specific facet of one particular field thus contributing substantive knowledge to that field. Therefore, in what follows, I will first situate my research proposal within the existing field in which an understanding of "settlement morphology" may be considered vital knowledge. I will begin with a broad overview and then systematically narrow down the subject matter until a very specific facet may be revealed. This facet, to which allusions have already been drawn, will be the issue around which to collect research data. In the section thereafter, I will explicate the Research Design by articulating how the chosen methodology of "neurophenomenology" may produce substantive knowledge in the field through analysis of the collected data.

The impulse toward the Dissertation Study gradually unfolding on the previous pages came from long years developing self-designed, interdisciplinary education in an emerging field called Village Design. My concern has been that rising awareness of the need to embark on a path of "sustainability" often lacks context. Even when discussion turns more specifically to a need for "sustainable community" as, for example, within city planning departments, reference to whole systems design and details about relative scale, including patterns of usage and flows within and between scales, are usually neglected. The emerging concept of Urban Village (Mare, 2008) is a promising trend toward correcting these important oversights, yet much work still needs to be done. An exemplary example of forward thinking and practice may be found at the City of Bellingham (www.cob.org)

A key theory in the development of Village Design as a workable conceptualization toward "sustainable community" is that of Living Systems Theory – with Capra (1996) formulating perhaps the most useful synthesis According to Capra (pp. 160-93), all living systems embody three essential characteristics: 1) a pattern of *autopoiesis*, or self-organization; 2) a process of *cognition*, or maintaining self-organization through meaningful interaction with an environment; and 3) the structure of a *dissipative structure*, or one that operates far from dynamic equilibrium by importing ordered energy and exporting entropy. Applying Living Systems Theory to the design of sustainable communities, Capra (1996, p. 297) explains: "Reconnecting with the web of life means building and nurturing sustainable communities…The theory of living systems discussed in this book provides a conceptual framework for the link between ecological communities and human communities. Both are living systems that exhibit the same basic principles of organization."

While I would agree that ecological communities, as living systems *par excellence*, are the prototypical "sustainable" communities, considering that biological life has proceeded with

ever increasing complexity for some 3.5 billion years (Margulis & Schwartz, 1998, p. xiii), I do not support the notion that all human communities are living systems. This is because, as has been demonstrated throughout this Proposal, there are two fundamental contrasting morphologies available representing two very different functions. From that perspective, it is not correct to lump all human communities together as if they "exhibit the same basic principles of organization." The organic morphology has a very different principle of organization than does the grid morphology. While it's very natural to define the *organic* morphology as a "living system" I would argue that the *grid* morphology is more accurately defined as a "mechanical system." The following images will help to convey this impression:

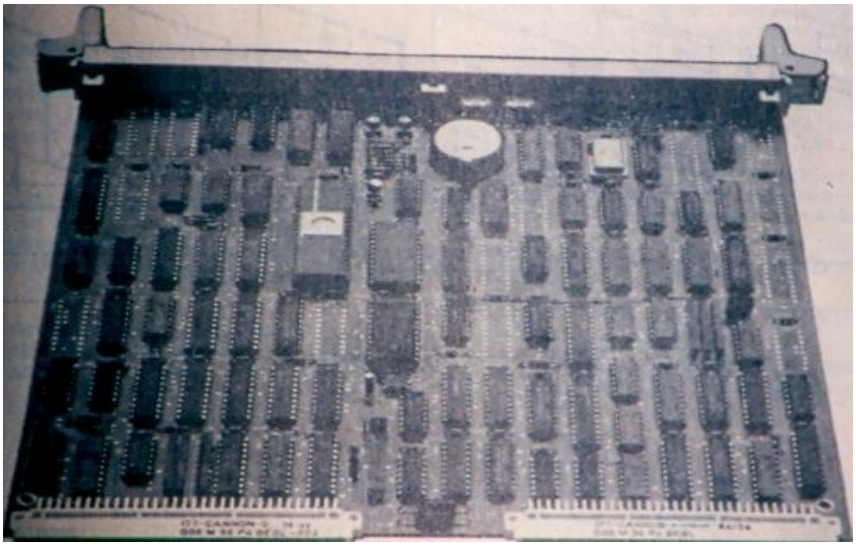

Fig. 11 – Printed circuit board, from author's collection, source unrecorded

Fig. 12 – Flying into SeaTac: Same basic morphology as printed circuit board. Photo: E.C. Mare, 2009

Another satellite image will help to reinforce the assertion that the grid is a mechanical system. How could the following brute imposition upon a once living landscape possibly be construed as a living system?

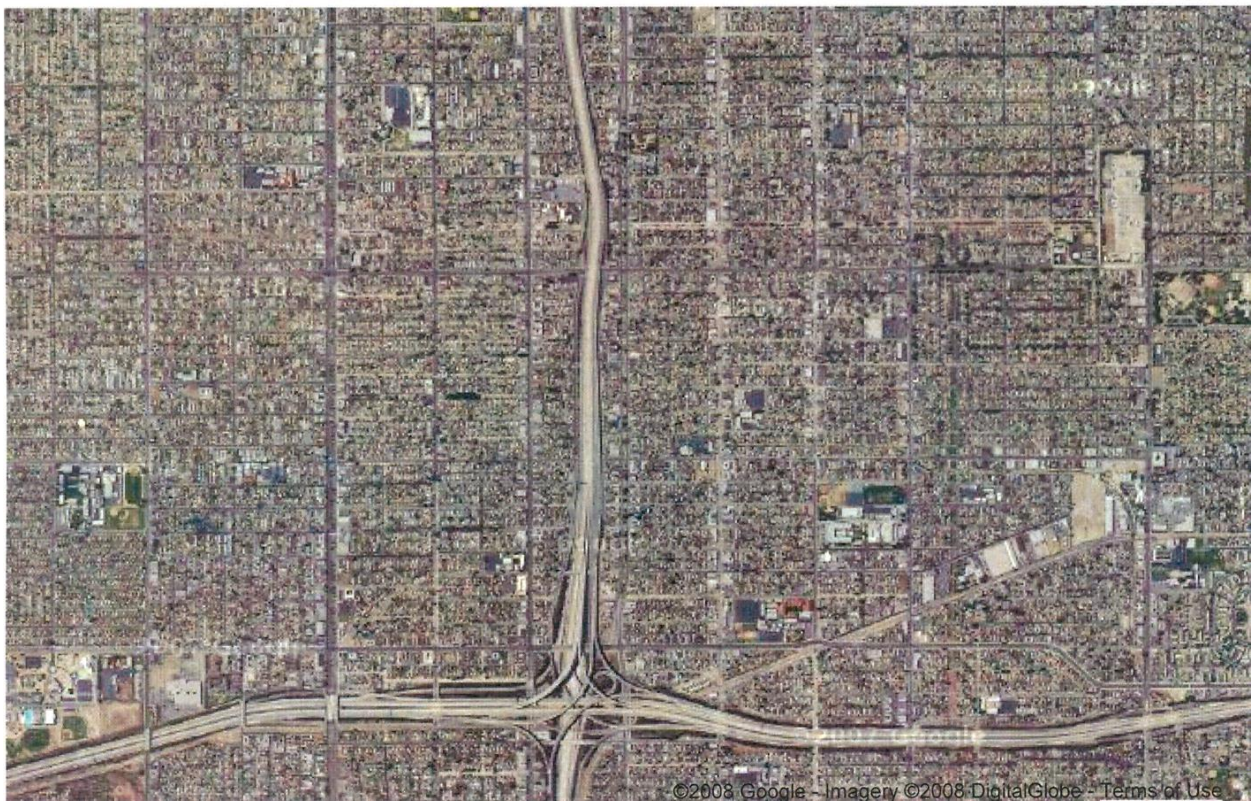

Fig. 13 – Somewhere in the Los Angeles basin. Source: Google Earth, 2008.
Where does "Torrance" turn into "Downey?"

A closer look at the single most important property of a living system – autopoiesis – will help support this argument: "To find out whether a particular system…is alive, all we need to do is find out whether its pattern of organization is that of an autopoietic network. If it is, we are dealing with a living system; if it is not the system is nonliving" (Capra, 1996, p. 161) – and nonliving here means *mechanical*. A grid morphology is not *autopoietic*, or *self*-organizing, since it has always been laid down in one fell swoop by an outside agency such as a colonizing force, or later by railroad companies or developers in collusion with large banks seeking profit through mass sale of uniform properties. Mechanical systems are better termed *allopoietic*, meaning 'organized from without,' than *autopoietic*, or 'organized from within.' An autopoietic organic morphology will grow into form over an extended period of time, much as an organism grows to maturity, through the process of *morphogenesis*, shaped and molded by the generations of people who dwell there; whereas an allopoietic grid morphology is laid down all at once in an act of military or financial colonization. What's more, the grid morphology has no relationship with its underlying ecological community since it is, by definition, a 2-dimensional

abstraction of 4-dimensional space. The underlying ecological community is *the* defining living system with which to align: the organic morphology does this neatly, even at times artistically, whereas the grid morphology intentionally ignores this in its overriding mandate to impose control. For all these reasons, a grid morphology cannot be considered a living system but is better defined as a mechanical system – or, as the arch-modernist Le Corbusier was fond of saying, as *a machine for living* (as quoted in Hitchcock, 1958, p. 367).

Another comparison of images will help to reinforce this notion of the autopoietic organic morphology being a living system:

Fig. 14 – French village in Normandy: The morphology of millennia. Photo: E.C. Mare, 1998

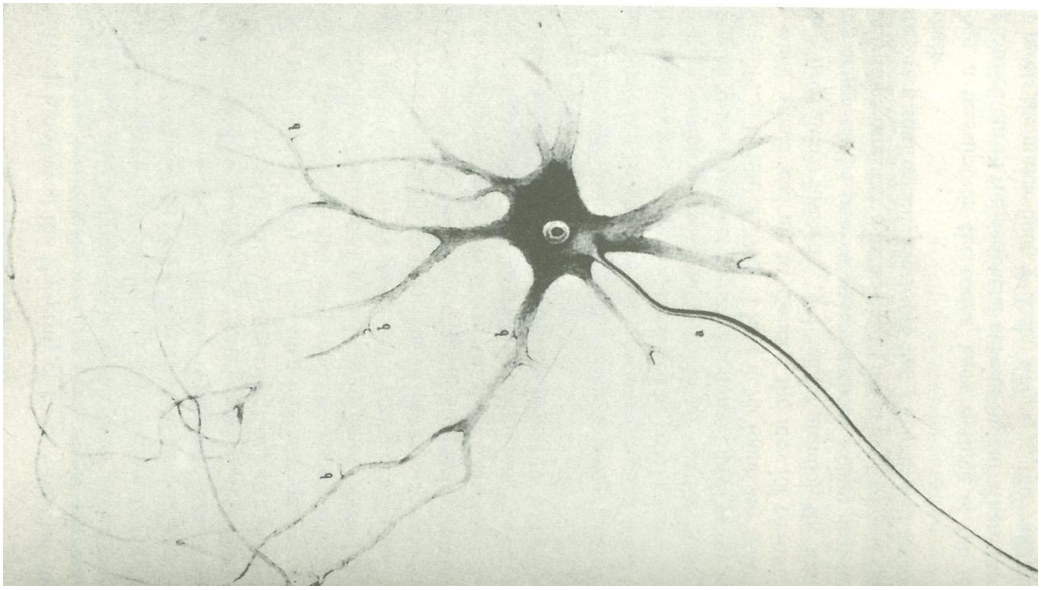

Fig. 15 – Drawing of a neuron: Primordial morphology. From author's collection, source unrecorded

I even wrote a paper entitled “The Ecovillage as a Living Cell” (Mare, 2002) within a self-designed study I called Biological Structures and Metaphors, in which I was able to describe the organelles and internal compartmentalization of the generic eukaryotic cell as metaphors for the internal structuring of the idealized ecovillage.

Yet what does all this have to do with sustainability? It should be fairly easy by now to accept the proposal that for human communities to be ‘sustainable’ – that is, able to be continued into the indefinite future in their current form – they must be organized as *genuine living systems*. As genuine living systems they will be modeled upon healthy ecological communities. This recognition on its own implies a massive retrofit awaiting the North American continent as all the multiple layers of mechanical grids will need to be gradually yet systematically converted into organic morphology. This is an entirely ‘natural’ process because organic (i.e. carbon based) Nature abhors a square! Witness what happened to the original precisely squared, rigidly regimented, Roman settlement grid at Verona:

Fig. 16 – Organicizing the grid at Verona. From Kostof, 1991, p. 107

As with an imperious personality, all the hard sharp edges get softened with time. Are we to expect this same organicizing process to commence straightaway in, say, rigidly regimented Manhattan? Maybe not (especially not on the abstraction called Wall Street!); but it would be

easy to begin on the Great Plains, for example, by erasing all those arbitrary, machine-like right angles at range, township, county and state levels. Doing so would prepare for re-organizing along natural biogeophysical boundaries, a process called "bioregionalism" (Andruss, *et al*. 1990). Consider this the first step toward lasting sustainability, not necessarily recycling your pop bottles.

This all may be interesting enough; yet I want to dig my dissertation well even deeper. In order to do that I need to re-introduce another very important key theory: that of "structural coupling" as introduced by Maturana & Varela (1987) and later refined and elaborated by Varela, Thompson & Rosch (1991). The phenomenon of structural coupling refers to the observation that "organism and environment enfold into each other and unfold from one another in the fundamental circularity that is life itself" (Varela, Thompson & Rosch, 1991, p. 217). In other words, organism and environment are *mutually*-defining and *co*-specifying: the environment influences the evolution of the organism as much as the organism influences the evolution of the environment. At the level of mental processes, Varela, Thompson & Rosch (p. 205) insist: "cognition in its most encompassing sense consists in the enactment or bringing forth of a world by a viable history of structural coupling." This enactment is enabled, I wish to emphasize, by the process of "moving through" various morphologies, natural and human-made, at various scales. That's precisely what Capra (1996) defined cognition as being: the process of maintaining autopoiesis through meaningful interaction with an environment. In other words:

> We propose as a name the term *enactive* to emphasize the growing conviction that cognition is not the representation of a pregiven world by a pregiven mind but is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs (Varela, Thompson & Rosch, 1991, p. 9).

I suspect that even the originators of this key theory of structural coupling did not realize the profundity of its design implications; for, if "organism and environment are mutually enfolded in multiple ways, [such that] what constitutes the world of a given organism is enacted by that organism's history of structural coupling" (ibid, p. 202) – that is, if organism and environment really are mutually-defining and co-specifying – then it must follow that the qualities and characteristics of the environment will be reflected in the qualities and characteristics of the organism. More specifically, at the level of the human nervous system, this phenomenon would seem to imply that the qualities and characteristics of the environment – including crucially its *morphology* – will be imprinted somehow on neural patterning. This is the basis for the neural plasticity that was mentioned at the very Introduction to this Dissertation Proposal.

Taking account of everything presented thus far, I continue to wonder if the neural patterning of people living in a grid morphology will be demonstrably different than the neural

patterning of people living in an organic morphology. Won't these disparate residents perceive and thus cognize differently as a result of repeatedly moving through the respective environmental structures to which they are coupled? If this is reasonable so far, than it would seem to suggest that people living in a grid morphology will have more difficulty comprehending the essential principles of sustainability – understood here as modeling human systems after the patterns, processes, and structures of natural living systems – simply because their nervous systems will not be patterned to resonate with such knowledge. Since they live in abstractions, residents of a grid might be expected to be satisfied with superficial measures, like changing light bulbs, without ever realizing that their pattern of living needs to change at a very fundamental level – ultimately, at a neural level.

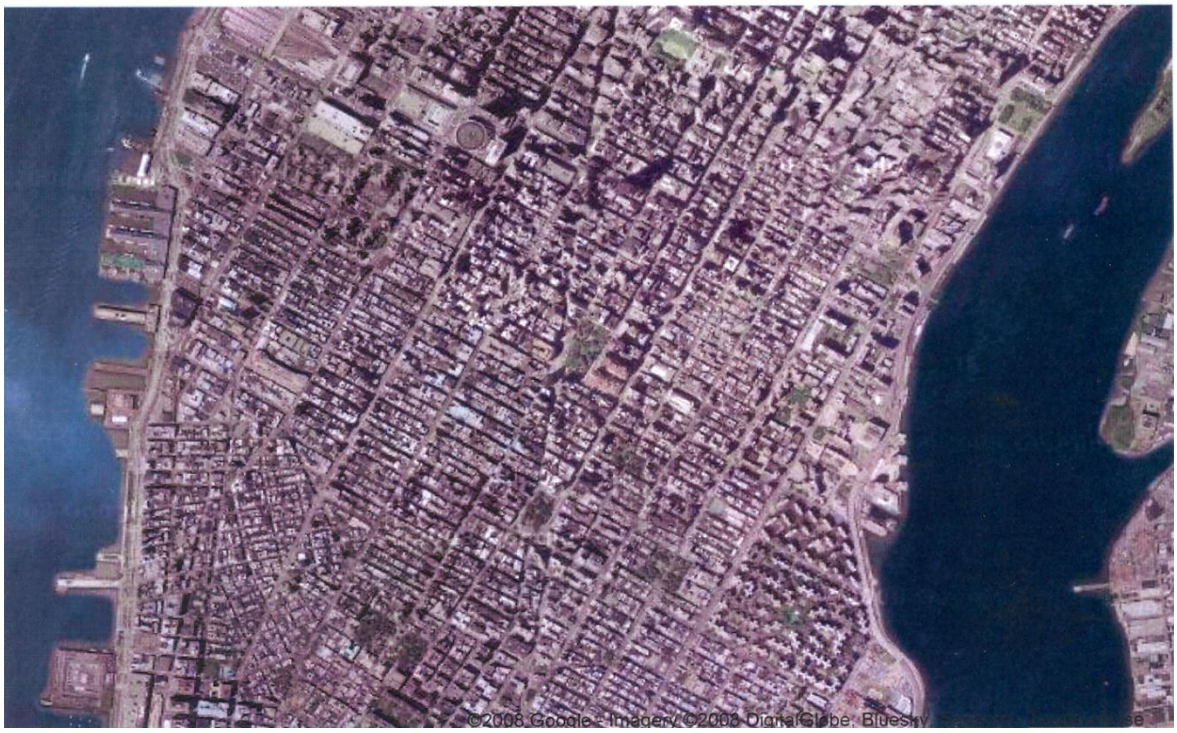

Fig. 17 – Midtown Manhattan. Will these residents embody different neural patterning than people living in a place like Siena? Will their architects have different neural patterning than the architects of the Renaissance? Will they have more difficulty comprehending the essential principles of sustainability? From Google Earth, 2009

Research Design

It is time now to articulate the Research Design for this Dissertation towards a Ph.D. in the Human and Organizational Development doctoral program at the Fielding Graduate University of Santa Barbara. At this stage, a review is in order:

1) I began by introducing the site plan for Auroville, India, a "preeminent example" of the chosen theme: "Neurophenomenology of Settlement Morphology."
2) In the Introduction, I presented Cognitive Neuroscience as a burgeoning field literally exploding with new information. Several key players – including John Zeisel, John Eberhard, Harry Mallgrave, and the Academy of Neuroscience for Architecture – are working to integrate this new information into the design professions. While enthralled with their accomplishments, I noticed a gap that presently exists in applying discoveries in Cognitive Neuroscience to design at *settlement scale*.
3) I then presented a concise overview to the fundamentals of "settlement morphology." Two contrasting morphologies – "grid" and "organic" – were offered as points of analysis. The grid was shown to have originated with a colonizing purpose while the organic was inferred to be the foundation of vernacular, place-based cultures.
4) Neurophenomenology was introduced as a research program to "bridge the gap" between discoveries in Cognitive Neuroscience and direct lived experience. Neurophenomenology arose because of the perceived inadequacy of objective science to account for the phenomena of consciousness and experience. Only by correlating third-person science with first-person phenomenology can the phenomena of consciousness and experience be properly understood, according to this research program.
5) The Embodied Mind was then presented as a valuable theoretical construct to begin approaching a "Neurophenomenology of Settlement Morphology." Three key theories were introduced: autopoiesis, structural coupling, and the enactive approach to cognitive science.
6) Since this is a Dissertation Proposal, methodological considerations are exceedingly important; therefore, I analyzed two case studies utilizing the research methodology of Neurophenomenology. I proposed to model my Dissertation upon the research study that correlated phenomenological data with *existing* neuroscientific knowledge. In this way, I will not need to access neuroscientific equipment myself.
7) The next step was to situate all this activity within an existing field, such that my Dissertation may contribute substantive knowledge to that field. Within the larger concern of 'sustainability' lies the field of 'sustainable community design.' Within this

field, I've been defining through academic coursework a concept called Village Design. Vital to understanding Village Design – and, I would assert, sustainable community design more generally – is the phenomenon of 'settlement morphology.' It is to this particular facet that I wish to apply discoveries in Cognitive Neuroscience – which finally leads back to the two research questions:

- Can a correlation be hypothesized between settlement morphology and the neural patterning of people residing therein?
- Can a correlation be demonstrated between settlement morphology and the conscious experience of people residing therein?

These questions are intended to be complementary: the aim is to discover if a particular quality of settlement morphology may produce a particular quality of conscious experience. By correlating this quality of conscious experience with existing neuroscientific knowledge, an hypothesis may be produced based on an understanding of neural patterning. This hypothesis will then be useful for environmental design professions, particularly in the context of 'sustainability.'

These intentions will become clearer with a detailed explanation of the stages of Research Design. I begin by restating the first question:

- Can a correlation be hypothesized between settlement morphology and the neural patterning of people residing therein?

This question is stated such that a yes/no answer will suffice. The question is stated in this way because, in all my preliminary study, I have seen this correlation inferred but not established forthright, indubitably. Therefore, the first step is to inquire "*can* a correlation be hypothesized?" I do believe that there is enough existing neuroscientific knowledge available to assert this hypothesis. This step will require a theoretical synthesis involving the three aforementioned areas of study: i) cognitive maps, ii) functional isomorphic topologies, and iii) synchronous distributed neural networks.

I took a big step in this direction in a preliminary paper entitled, appropriately, "Towards a Neurophenomenology of Settlement Morphology." In the Conclusion of that paper, I started drawing together the synthesis. I quote here the last few paragraphs as being directly relevant to this Research Design:

First, "the parietal lobes are critical for abstracting spatial relations" (Gazzaniga, *et al*. 2009, p. 481), so that would be a good place to look for neural dynamics during movement through a morphology:

> The supplementary motor area and the premotor cortex receive information from association areas of the parietal and temporal cortex…The dorsal stream [of the visual association cortex], which terminates in the posterior parietal lobe, is involved in perception of location – the "where" of visual perception. In addition, the parietal lobes are involved in organizing visually guided movements – the "how" of visual perception. Besides receiving visual information about space, the parietal lobe receives information about spatial location from the somatosensory, vestibular, and auditory systems and integrates this information with visual information. Thus, the regions of the frontal cortex that are involved in planning movements receive the information they need about what is happening and where it is happening from the temporal and parietal lobes…[T]he parietal lobes contain spatial information…(Carlson, 2010, p. 278).

If the parietal lobes contain spatial information, I'm curious to know if this information is "isomorphic" to its surroundings; that is, is there a one-to-one correspondence between spatial morphology and neural morphology? In other words, to be blunt, would gridded morphology in the environment be reflected as grid-like neural patterning (i.e. linear, orthogonal, digital)? And alternately, would organic morphology be reflected as organic neural patterning?

Apparently, this very issue was raised long ago by the gestalt psychologists. "In his 1947 book *Gestalt Psychology*, Kohler wrote: "The principle of isomorphism demands that in a given case the organization of experience and the underlying physiological facts have the same structure"" (Kohler, 1947, p. 301, as cited in Thompson, *et al*. 1999, p. 171).

> There are several points about Kohler's principle of isomorphism that deserve mention. First, by the phrase "have the same structure" Kohler had in mind structural properties that are *topological*. Although the concept of neural-perceptual isomorphism has often been taken to mean a geometrical one-to-one mapping, Kohler clearly intended the isomorphism concept to have a topological [i.e. configurationally descriptive in mapping] sense. For example, he argued that spatial relationships in the visual field cannot correspond to geometrical relationships in the brain; they must correspond rather to functional relationships among brain processes (Thompson, *et al*. 1999, p. 171, original emphasis, referencing Kohler, 1929, pp. 136-41; 1930, pp. 240-49).

Thompson, *et al*. (1999), after raising the issue to clarify their own research program, do not arrive at a definite conclusion but rather leave it as, "Whether there are either spatial/topographic or topological/functional neural-perceptual isomorphisms in any given case is an empirical question for cognitive neuroscience to decide" (p. 181). Indeed! Even so, a neural-perceptual topological isomorphism – with the spatial information in the parietal lobes influencing other thought processes – does seem to correspond to Edelman's theory of "global mapping" (1992, pp. 83-9) and Varela's formulation of "resonant cell assemblies" (1995), an approach which "aims to map the neural substrates of consciousness at the level of large-scale,

emergent and transient dynamical patterns of brain activity (rather than at the level of particular circuits or classes of neurons)" (Thompson & Varela, 2001, p. 418) […] It all comes back to the accepted, by now, observation: "Interactions with the world leave traces of experience in the brain. These traces are (partially) retrieved and used in the mental simulations that make up cognition. Crucially, these traces bear a resemblance to the perceptual/action [i.e. phenomenal] processes that generated them…" (Zwaan & Madden, 2005, p. 224, as cited in Adams, 2010, p. 624).

The above paragraphs from the preliminary paper point to the theoretical bases from which a synthesis can be drawn in support of answering the first research question. Truly, I believe all the information is out there; I just need to pull it all together in such a way that "settlement morphology" can be reflected explicitly in the hypothesis. The next section of this Proposal – Literatures to Access – will cite additional specific research papers that will be used in forming the synthesis.

And now for the second research question:

- Can a correlation be demonstrated between settlement morphology and the conscious experience of people residing therein?

While the first question was the "neuro" part of neurophenomenology, this second question is obviously the "phenomenology" part. While answering the first question requires constructing a theoretical synthesis, answering this second question will require collecting empirical data in accord with the phenomenological tradition. Subsequently, the empirical phenomenological data can be evaluated in accord with the theoretical synthesis, ideally producing a neuro-phenomenological hypothesis.

Here's what I have in mind for the phenomenology study: I have already written phenomenological protocols of moving through a grid morphology and an organic morphology (Mare, 2012, pp. 15-7). I would propose creating a collection of such protocols, perhaps 6 grids and 6 organics. Then, using standard phenomenological research techniques (Moustakas, 1994; Rehorick & Bentz, 2008; Smith *et al*. 2009; Van Manen, 1990), I will evaluate these protocols attempting to derive common themes. Since the purpose is to look for contrast between the direct lived experience of moving through the grid and organic morphologies, the next step will be to compare and contrast the respective common themes. As far as I know, this will be unique in phenomenological research: collecting two streams of data, deriving common themes within each stream, and then adding the meta-analysis of comparing and contrasting the themes from the two streams. This should contribute to depth of understanding.

I do perceive the potential 'conflict of interest' in maintaining purely objective phenomenological perception while moving through the morphologies, as I have made a study of settlement morphology integral to my education and have expressed definite opinions throughout this Dissertation Proposal. For that reason, performance of the *epoche* – or suspension of prior conceptual bias so that essence may be perceived – will become an important aspect of this study. Accordingly, I intend to give performance of the *epoche* special attention, more attention than I have observed from reading existing phenomenological research reports.

I would be very interested to hear how other researchers approach the *epoche*; I mean, I have read many descriptive reports of what the *epoche* **is**, or is intended to be, yet these usually seem to me to be describing an ideal. For example, Moustakas (1994, p. 22) explains:

> The researcher following a transcendental phenomenological approach engages in disciplined and systematic efforts to set aside prejudgments regarding the phenomenon being investigated (known as the Epoche process) in order to launch the study as far as possible free of preconceptions, beliefs, and knowledge of the phenomenon from prior experience and professional studies – to be completely open, receptive, and naïve…

This sounds great – especially considering that phenomenology is "the study of essences" (Merleau-Ponty, 1962, p. vii), and the above approach is preparation to perceive essences – yet how does it actually play out in practice? Can suspension of "preconceptions, beliefs, and knowledge" be suddenly willed? As the researcher launches the study will he or she affirm: "OK, now I am going to suspend all prior preconceptions, beliefs, and knowledge." Somehow this seems to me like wishful thinking; no matter how well-intentioned, I suspect that some prior judgment is bound to leak in. Like my mentor Guy Burneko, Ph.D. commented when he read my first protocols: "I get the sense the epoche is porous." (!)

Therefore, as a sub-study of this Dissertation, I intend to develop a more rigorous preparation for the *epoche*. Instead of simply willing it into being, I will practice a mind-body approach intended to develop the "open, receptive, naïve" state idealized in the descriptive reports. This approach is called Anapana meditation:[7] an exercise consisting of closing the eyes and focusing the entire attention on the breath as it enters and leaves the nostrils, taking special notice of any sensations that might be occurring in this limited area. Anapana is particularly well-suited as preparation for the *epoche* because:

[7] I learned Anapana meditation in conjunction with Vipassana meditation courses. During a 10-day course, Anapana is practiced for the first three days as a preliminary preparative exercise for the deeper meditation to follow. There are Vipassana centers at many locations around the globe; they can be located easily with an internet search.

1) It develops the habit of concentration: focusing the attention single-mindedly on a limited and circumscribed domain of experience.
2) Random thoughts that arise – including perhaps "prior preconceptions, beliefs, and knowledge" – are systematically disregarded. These thoughts are observed and acknowledged in their arising but no importance or attachment is given to them. The attention is continually returned to the exercise of focusing on the breath as it enters and leaves the nostrils.
3) The practice is concerned with perceiving sensations; thus, the mind develops acute sensitivity to the various sensations that may be perceived. Very subtle distinctions can begin to be made among and between the qualities of these sensations. This sensitivity can then be transferred to the exercise of perceiving essences in a phenomenological study.

I may also add, based on personal experience, that after an extended incidence of practicing Anapana meditation, perhaps for as little as a half hour or so, the mind becomes noticeably relaxed and still, a qualitative experience which easily corresponds to Moustakas' ideal of "open, receptive, and naïve." This state of mind also has the potential for third-person, objective, scientific verification as an Electroencephalogram (EEG) analysis should very discretely correspond with a shift in waveforms (Tang, *et al*. 2007; Tang, *et al.* 2009). This would be the ideal condition from which to enter a phenomenological study – in this case, commencing to move through a settlement morphology prepared to observe and record perceptual sensations. I also believe that endeavoring to maintain this meditative state of mind throughout the tenure of data collection will help to null any tendency toward conceptual bias.

Therefore, this sub-study of preparation for the *epoche* through the practice of Anapana mediation becomes an integral component of this Dissertation, capable of producing additional knowledge for the research community. I would propose, then, in the context of this Research Design, that before setting out to perceive settlement morphologies I practice a half-hour of Anapana meditation beforehand. Once the desired state of mind is achieved, I will be prepared to perceive and record the qualitative experience of moving through these morphologies with the prospect of extracting the essence of the experience. This may be considered a more empirical approach to phenomenological study than simply willing the *epoche* into being.

I have one more important consideration to address in this Research Design: that of the technique for collecting phenomenological data. In my prior studies – moving through the settlement morphologies of Siena and downtown Seattle (Mare, 2012) – I experienced the phenomena first and then later recorded the perceptions as protocol. While writing the protocol, I had every intention of representing as accurately as possible the experiences, yet the possibility did exist for inter-collating sensations or interjecting value judgments or omitting prominent details based on the limitations of memory. I could have carried a notepad with me

and so accurately recorded the perceptions as they were occurring; yet this seems to me a bit cumbersome: managing the details of packing equipment and writing instead of single-mindedly attending to the perceptions as they are occurring. Besides, shifting into a linear writing frame of mind would mean losing the desired meditative state, a state more conducive to perceiving patterns and essences. Based upon these considerations, I would propose for this research study the following data collection technique: While moving through the morphologies, I will attach to my ear a microphone that will be fed into an MP3 device. I can then record the perceptual sensations – visual, textural, auditory, kinesthetic, spatial, whatever they might be – as I am experiencing them by vocalizing into the microphone. At a later time, I can then review the contents of the MP3 and begin the phenomenological evaluations.

Here then are the three proposed stages of this Research Design, abbreviated and placed next to one another to show their relationships:

1) Formulating a theoretical synthesis based on a thorough review of the existing literature pertaining to the phenomena of i) cognitive maps, ii) functional isomorphic topologies, and iii) synchronous distributed neural networks. The theoretical synthesis will be presented as an hypothesis to answer the first research question.
2) Collecting phenomenological data to answer the second research question. This phase will entail experiencing the perception of "moving through" the contrasting settlement morphologies of "grid" and "organic." The hypothesis formulated in the first phase of the study will then be used as the basis for evaluating this phenomenological data.
3) Anapana meditation will be practiced and presented as preparation for the *epoche*. A meditative state of mind will be preferred during the collection of perceptual data. Furthermore, the neural dynamics of meditation, as discussed in the literature, may inform the formulation of the theoretical synthesis of Phase 1.

This appears to me to be an interesting, well-integrated Dissertation Proposal with the potential of contributing substantive knowledge, on multiple levels, to the research community in the environmental design professions. I recognize the inherent self-containment of the proposed study, meaning that I potentially could navigate all three phases solo. I can defend this choice from a couple of directions:

First, Varela and Shear, in their compilation *The View from Within: First-person Approaches to the Study of Consciousness* (1999), claim that much more work needs to be done to formulate viable and credible first-person methodologies as "the basis for a science of consciousness which includes first-person, subjective experience as an explicit and active component" (p. 2). Additionally, Varela (1996), in the seminal paper in which he introduced neurophenomenology as a research program, called for a "*disciplined approach* to human

experience…We need to turn to a systematic exploration of the only link between mind and consciousness that seems both obvious and natural: *the structure of human experience itself* (p. 330, original emphases). In that sense, the first-person emphasis of my Dissertation Proposal may contribute to the goals of this research program.

Second, while adding co-researchers would contribute further depth to the study by providing phenomenological data from multiple sources to work with, there is a definite logistics issue. While there are plenty of grids to be found close by, North America is seriously lacking in organic settlement morphology. Therefore, for the study of organic morphologies I envisioned going back to Tuscany where can be found some of the most expressive morphologies available. I would not be able to finance co-researchers going to Tuscany so that leaves in incompleteness in the Research Design: ideally, co-researchers would be experiencing the same settlement morphologies as I do so that protocols neatly correspond.

With that in mind, a compromise could be made whereby a team of co-researchers is organized within North America for the sole purpose of perceiving grid morphologies. This could add the interesting prospect of comparing protocols from participants *without* settlement morphology education with the protocols that I will produce as an *authority* (root word 'author') of settlement morphology. Enlisting co-researchers in this fashion will provide the additional opportunity to test the effects of Anapana meditation as preparation for a 'phenomenology of perception' task, as I would want to coordinate this preliminary to the *epoche* with each co-researcher before embarking on their study. I would appreciate feedback from my Committee on the relative merits of organizing details like these within the standard scope of an HOD Dissertation. It could be possible to make this co-researcher aspect an Independent Study project for students of Fairhaven College or Antioch University.

And so now that I've gone through the whole effort of presenting my Research Design, I've been thinking about a slight modification to the research questions: I want to replace the word 'residing' with 'dwelling' – which was a preferred term of Heidegger (Heidegger, 1962; Norberg-Schulz, 1979; Norberg-Schulz, 1985, Pattison, 2000). This will afford me the opportunity to include a Heideggerian "existential phenomenology" perspective to my study. How does this revision look?

- Can a correlation be hypothesized between settlement morphology and the neural patterning of people dwelling therein?
- Can a correlation be demonstrated between settlement morphology and the conscious experience of people dwelling therein?

Literatures to Access

The following is not intended to be a formal Literature Review; that will be forthcoming as the second chapter of my Dissertation. Nevertheless, at this stage I wanted to present to my Committee the range of materials I will be working with and thus the research communities with which I will be engaging. A study like Neurophenomenology of Settlement Morphology is intrinsically and dynamically interdisciplinary; thus, it will be helpful for all concerned to regard the essential categories I am working with, along with associated resources contained within each category, as a coherent whole. As the study unfolds, the various disciplines involved will get weaved together into a whole systems design that will be my Dissertation. (Note: Many of the resources presented here are not duplicated in the References Cited during the writing of this Proposal. Other resources, however, are referenced in both sections).

Primary Sources – I begin with the collection of intellectual resources that have most inspired the particular course of study outlined in this Dissertation Proposal:

- Aurobindo, S. (1990). *The life divine.* Twin Lakes, WI: Lotus Press
- Eberhard, J.P. (2004). Architecture with the brain in mind. The Dana Foundation, www.dana.org, downloaded 9 March 2011
- Eberhard, J.P. (2007). *Architecture and the brain: A new knowledge base from neuroscience.* Atlanta: Greenway Communications, LLC
- Eberhard, J.P. (2009). *Brain landscape: The coexistence of neuroscience and architecture.* New York: Oxford University Press
- Mallgrave, H. (2011). *The architect's brain: Neuroscience, creativity, and architecture.* Chichester, West Sussex, UK: Blackwell Publishing
- Zeisel, J. (2006). *Inquiry by design: Environment/behavior/neuroscience in architecture, interiors, landscape, and planning.* New York: W.W. Norton & Company

Settlement Morphology – Here are the best sources available of human settlement studies that characterize them as I have in this Dissertation Proposal: as *morphologies* that evolve through time. A key contributor to this category is the journal *Urban Morphology: International Seminar on Urban Form*, and its precedents:

- Alexander, C., Ishikawa, S. & M. Silverstein (1977). *A pattern language: Towns, buildings, construction.* New York: Oxford University Press
- Bacon, E.N. (1967/1974). *Design of cities.* New York: Penguin Books
- Bhatt, R. (2010). Christopher Alexander's pattern language: An alternative exploration of space-making practices. *The Journal of Architecture,* 15: 6, 711-729

- Bourdier, J.-P. & N. Alsayyad, eds. (1989). *Dwellings, settlements and tradition.* Lanham, MD: University Press of America
- Carter, H. (1972). *An introduction to urban historical geography.* London: Arnold
- Cataldi, G., Iacono, P. & A. Merlo (2000). La geometria di Firenze il progetto matrice della citta a del territorio. *Firenze Architettura,* 1, 4-17
- Conzen, M.P. (1975). A transport interpretation of the growth of urban regions: An American example. *Journal of Historical Geography,* 1, 361-82
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- Conzen, M.R.G. (1960). *Alnwick, Northumberland: A study in town-plan analysis.* Institute of British Geographers, Publication 27. London: George Philip
- Conzen, M.R.G. (2004). *Thinking about urban form: Papers on urban morphology, 1932-1998.* Oxford: Lang
- Cooper, J. (2005). Assessing urban character: The use of fractal analysis of street edges. *Urban Morphology,* 9, 95-105
- Darin, M. (1998). The study of urban form in France. *Urban Morphology,* Vol. 2, No. 2, 63-76
- Eisner, S., Gallion, A. & S. Eisner (1993). *The urban pattern, sixth edition.* New York: John Wiley & Sons, Inc.
- Gauthiez, B. (2005). The history of urban morphology. *Sage Urban Studies Abstracts, 33,* No. 1, Sage Publications
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- Kostof, S. (1991). *The city shaped: Urban patterns and meanings through history.* New York: Bulfinch Press
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- Reps, J. (1965/1980). *Town planning in frontier America.* Columbia: University of Missouri Press
- Safdie, M. (1982). *Form and purpose.* Boston: Houghton Mifflin Company
- Schmiedeler, T. (2007). Transitions in the forms of Midwestern county seats on the American frontier. *Urban Morphology,* Vol. 11, No. 2, 126-141
- Siksna, A. (1997). The effects of block size and form in North American and Australian city centres. *Urban Morphology,* 1, 19-33
- Slater, T.R., ed. (1990). *The built form of Western cities.* Leicester: Leicester University Press
- Venturi, R., Brown, D.S. & S. Izenour (1977). *Learning from Las Vegas, revised edition.* Cambridge, MA: The MIT Press
- Whitehand, J.W.R. (1987). *The changing face of cities: A study of development cycles and urban form*. Institute of British Geographers, Special Publication 21. Oxford: Blackwell
- Whitehand, J.W.R. & P.J. Larkham, eds. (1992). *Urban landscapes: International perspectives.* London: Routledge

Phenomenology – I list prominent sources from Phenomenology, first, on their own, before Neurophenomenology, because Neurophenomenology is the synthesis of Phenomenology and Cognitive Neuroscience. The following sources will influence my approach to answering research question #2:

- Bentz, V.M. & J.J. Shapiro (1998). *Mindful inquiry in social research:* Thousand Oaks: Sage Publications
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- Gallagher, S. & J.B. Sorensen (2006). Experimenting with phenomenology. *Consciousness and Cognition,* 15, 119-134
- Gallagher, S. & D. Zahavi (2008). *The phenomenological mind, 2nd edition.* London: Routledge
- Gelven, M. (1970). *A commentary on Heidegger's "Being and Time."* New York: Harper Torchbooks
- Hammond, M., Howarth, J. & R. Keat (1994). *Understanding phenomenology.* Oxford, UK: Blackwell

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- Heidegger, M., trans. by Fritsch, M. & J.A. Gosetti-Ferencei (2010). *The phenomenology of religious life.* Bloomington and Indianapolis: Indiana University Press
- Husserl, E., trans. by D. Carr (1970). *The crisis of European sciences and transcendental phenomenology.* Evanston: Northwestern University Press
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- Schutz, A. & T. Luckmann (1973). *The structures of the life-world, volume 1.* Evanston: Northwestern University Press
- Sokolowski, R. (2008). *Phenomenology of the human person.* Cambridge: Cambridge University Press
- Smith, J.A., Flowers, P. & M. Larkin (2009). *Interpretative phenomenological analysis: Theory, method and research.* Los Angeles: Sage Publications
- Van Manen, M. (1990). *Researching lived experience: Human science for an action sensitive pedagogy.* Albany: State University of New York Press
- Wagner, H.R. (1983). *Phenomenology of consciousness and sociology of the life-world: An introductory study.* Edmonton, Canada: University of Alberta Press
- Webber, D. (2008). Zen and the art of surfboard design. *The Indo-Pacific Journal of Phenomenology,* Volume 8, Edition 1, 1-7

Phenomenology of Architecture – This is a special section including those publications in which authors have been trailblazing the use of phenomenology in architecture, and in a few rare instances, applied to settlement form. Lynch's *The Image of the City* stands out here as perhaps the most direct precedent to what I am proposing in my Dissertation (though with important distinctions).

- Bachelard, G. (1958/1994). *The poetics of space.* Boston: Beacon Press
- Bloomer, K.C. & C.W. Moore (1977). *Body, memory, and architecture.* New Haven: Yale University Press
- Cullen, G. (1961/2003). *The concise townscape.* Amsterdam: Elsevier, The Architectural Press
- Geidion, S. (1941/1967). *Space, time and architecture.* Cambridge, MA: Harvard University Press
- Hiss, T. (1990). *The experience of place.* New York: Alfred A. Knopf
- Jackson, J.B. (1984). *Discovering the vernacular landscape.* New Haven: Yale University Press
- Lynch, K. (1960). *The image of the city.* Cambridge, MA: The MIT Press
- Norberg-Schulz, C. (1979). *Genius loci: Towards a phenomenology of architecture.* New York: Rizzoli International
- Norberg-Schulz, C. (1985). *The concept of dwelling: On the way to figurative architecture.* New York: Rizzoli International
- Rasmussen, S.E. (1959/2001). *Experiencing architecture.* Cambridge, MA: The MIT Press
- Relph, E. (1976). *Place and placelessness.* London: Pion Limited
- Seamon, D. (1979). *The geography of the lifeworld: Movement, rest, and encounter.* New York: St. Martin's Press
- Seamon, D. (1989). Foundations of the human sciences: Humanistic and phenomenological advances in environmental design. *The Humanistic Psychologist,* 17:3, 280-293
- Seamon, D., ed. (1993). *Dwelling, seeing, and designing: Toward a phenomenological ecology.* Albany: State University of New York Press
- Seamon, D. & R. Mugerauer, eds. (2000). *Dwelling, place & environment.* Malabar, FL: Krieger Publishing Company
- Zevi, B. (1957/1993). *Architecture as space.* New York: Da Capo Press, Inc.

Cognitive Neuroscience – I list first some general overview sources. I then cite more specific studies in the subcategories of i) cognitive maps, ii) functional isomorphic topologies, and iii) synchronous distributed neural networks:

- Carlson, N.R. (1977/2010). *Physiology of behavior, tenth edition.* Boston: Allyn & Bacon
- Changeux, J-.P. (1985). *Neuronal man: The biology of mind.* Princeton, NJ: Princeton University Press
- Chemero, A. (2009). *Radical embodied cognitive science.* Cambridge, MA: The MIT Press
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- Damasio, A. (1999). *The feeling of what happens: Body and emotion in the making of consciousness.* San Diego: A Harvest Book
- Damasio, A. (2003). *Looking for Spinoza: Joy, sorrow, and the feeling brain.* Orlando: Harcourt, Inc.
- Douglas, R.J. & K.A.C. Martin (2004). Neuronal circuits of the neocortex. *Annual Review of Neuroscience,* 27, 419-451
- Gazzaniga, M.S., Ivry, R.B. & G.R. Mangun (1998/2009). *Cognitive neuroscience: The biology of the mind, third edition.* New York: W.W. Norton & Company
- Goguen, J.A., ed. (1999). *Art and the brain.* Journal of Consciousness Studies, 6, No. 6-7. Bowling Green, OH: Imprint Academic
- Hurley, S.L. & A. Noe (2003). Neural plasticity and consciousness. *Biology and Philosophy,* 18, 131-168
- Ledoux, J. (2002). *Synaptic self: How our brains become who we are.* New York: Penguin Books
- Ming, G.-L. & H. Song (2005). Adult neurogenesis in the mammalian central nervous system. *Annual Review of Neuroscience,* 28, 223-250
- Oakley, D.A. & H.C. Plotkin, eds. (1979). *Brain, behavior, and evolution.* London: Methuen & Co., Ltd.
- Pascual-Leone, A., Amedi, A., Fregni, F. & L.B. Merabet (2005). The plastic human brain cortex. *Annual Review of Neuroscience,* 28, 377-401
- Shear, J., ed. (1998). *Explaining consciousness – the 'hard problem.'* Cambridge, MA: The MIT Press
- Wittrock, M.C., ed. (1977). *The human brain.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Cognitive Maps

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- Burgess, N. (2006). Spatial memory: How egocentric and allocentric combine. *Trends in Cognitive Sciences,* Vol. 10, No. 12,
- Chklovskii, D.B. & A.A. Koulakov (2004). Maps in the brain: What can we learn from them? *Annual Review of Neuroscience,* 27, 369-92
- Downs, R.M. & D. Stea (1973). *Image and environment: Cognitive mapping and spatial behavior.* Chicago: Aldine Publishing Company
- Epstein, R.A. (2008). Parahippocampal and retrosplenial contributions to human spatial navigation. *Trends in Cognitive Sciences,* Vol. 12, No. 10, 388-396
- Hafting, T., Fyhn, M., Molden, S., Moser, M.-B. & E.I. Moser (2005). Microstructure of a spatial map in the entorhinal cortex. *Nature,* Vol. 436/11, 801-806
- Hartley, T., Maguire, E.A., Spiers, H.J. & N. Burgess (2003). The well-worn route and the path less traveled: Distinct neural bases of route following and wayfinding in humans. *Neuron,* 37, 877-88
- Janzen, G. & M. van Turennout (2004). Selective neural representation of objects relevant for navigation. *Nature Neuroscience,* Volume 7, Number 6, 673-677

- Kim, Y.O. & A. Penn (2004). Linking the spatial syntax of cognitive maps to the spatial syntax of the environment. *Environment and Behavior,* Vol. 36, No. 4, 483-504
- Maguire, E.A., Frackowiak, R.S. & C.D. Frith (1997). Recalling routes around London: Activation of the right hippocampus in taxi drivers. *Journal of Neuroscience,* 17, 7103-10
- McNamara, T.P. & A.L. Shelton (2003). Cognitive maps and the hippocampus. *Trends in Cognitive Sciences,* Vol. 7, No. 8, 333-335
- O'Keefe, J. & L. Nadel (1978). *The Hippocampus as a Cognitive Map.* Oxford: Oxford University Press
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- Conforti, M. (1999). *Field, form, and fate: Patterns in mind, nature, and psyche.* Woodstock, CT: Spring Publications, Inc.
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- Renner, M.J. & M.R. Rosenzweig (1987). *Enriched and impoverished environments: Effects on brain and behavior.* New York: Springer-Verlag
- Shelton, A. & J.D.E. Gabrieli (2002). Neural correlates of encoding space from route and survey perspectives. *Journal of Neuroscience,* 22, 2711-17
- Thompson, E., Noe, A. & L. Pessoa (1999). Perceptual completion: A case study in phenomenology and cognitive science. In Petitot, J. *et al*., eds., *Naturalizing*

phenomenology: Issues in contemporary phenomenology and cognitive science. Stanford, CA: Stanford University Press, 161-95

Synchronous Distributed Neural Networks

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- Edelman, G. (1992). *Bright air, brilliant fire: On the matter of the mind.* New York: Basic Books
- Edelman, G.M. & G. Tononi (2000). *A universe of consciousness: How matter becomes mind.* New York: Basic Books
- Fell, J. (2004). Identifying neural correlates of consciousness: The state space approach. *Consciousness and Cognition,* 13, 709-729
- Lutz, A. et al. (2002). Guiding the study of brain dynamics by using first-person data: Synchrony patterns correlate with ongoing conscious states during a simple visual task. *Proceedings of the National Academy of Sciences, USA,* 99, 1586-91
- Rodriguez, E., George, N., Lachaux, J.-P., Martinerie, J., Renault, B. & F.J. Varela (1999). Perception's shadow: Long-distance synchronization of human brain activity. *Nature,* Vol. 397, 430-33
- Schulkin, J. (2006). Cognitive functions, bodily sensibility and the brain. *Phenomenology and the Cognitive Sciences,* 5, 341-349
- Soon, C.S., Brass, M., Heinze, H.-J. & J.-D. Haynes (2008). Unconscious determinants of free decisions in the human brain. *Nature Neuroscience,* Volume 11, Number 5, 543-545
- Varela, F.J. (1995). Resonant cell assemblies: A new approach to cognitive functions and neuronal synchrony. *Biological Research,* **28**, 81-95
- Varela, F., Lachaux, J.-P., Rodriguez, E. & J. Martinerie (2001). The brainweb: Phase synchronization and large-scale integration. *Nature Reviews Neuroscience,* Volume 2, April, 229-239
- Vogels, T.P., Rajan, K. & L.F. Abbott (2005). Neural network dynamics. *Annual Review of Neuroscience,* 28, 357-376
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Neurophenomenology – This is the synthesis:

- Gallagher, S. (1997). Mutual enlightenment: Recent phenomenology in cognitive science. *Journal of Consciousness Studies,* 4, No. 3, 195-214
- Gallagher, S. & F. Varela (2001). Redrawing the map and resetting the time: Phenomenology and the cognitive sciences. In Crowell, S., Embree, L. & S.J. Julian, eds. *The reach of reflection: Issues for phenomenology's second century.* Center for Advanced Research in Phenomenology, Inc. Electronically published at www.electronpress.com

- Laughlin, C.D., McManus, J. & E.G. d'Aquili (1990). *Brain, symbol, and experience: Toward a neurophenomenology of human consciousness.* Boston & Shaftesbury: Shambhala
- Laughlin, C.D. & C.J. Throop (2009). Husserlian meditations and anthropological reflections: Toward a cultural neurophenomenology of experience and reality. *Anthropology of Consciousness,* Vol. 20, Issue 2, 130-170
- Lavazza, A. (2009). Art as a metaphor of the mind: A neo-Jamesian aesthetics embracing phenomenology, neuroscience, and evolution. *Phenomenology and the Cognitive Sciences,* 8, 159-182
- Lutz, A. (2002). Toward a neurophenomenology as an account of generative passages: A first empirical case study. *Phenomenology and the Cognitive Sciences,* **1**, 133-67
- Lutz, A. & E. Thompson (2003). Neurophenomenology: Integrating subjective experience and brain dynamics in the neuroscience of consciousness. *Journal of Consciousness Studies,* **10**, No. 9-10, 31-52
- Overgaard, M. (2004). On the naturalising of phenomenology. *Phenomenology and the Cognitive Sciences,* **3**, 365-379
- Petitot, J., Varela, F.J., Pachoud, B. & J.-M. Roy, eds. (1999). *Naturalizing phenomenology: Issues in contemporary phenomenology and cognitive science.* Stanford, CA: Stanford University Press
- Thompson, E. (2004). Life and mind: From autopoiesis to neurophenomenology. A tribute to Francisco Varela. *Phenomenology and the Cognitive Sciences,* **3**, 381-398
- Thompson, E. (2006). Neurophenomenology and contemplative experience. In Clayton, P., ed., *the Oxford handbook of science and religion.* New York: Oxford University Press, 226-36
- Thompson, E. (2007). *Mind in life: Biology, phenomenology, and the sciences of mind.* Cambridge, MA: Harvard University Press
- Van de Laar, T. (2008). Special section: Mind the methodology: Comparing heterophenomenology and neurophenomenology as methodologies for the scientific study of consciousness. *Theory and Psychology,* Vol. 18(3), 365-379
- Van de Laar, T. & H. de Regt (2008). Special section: Is cognitive science changing its mind?: Introduction to embodied embedded cognition and neurophenomenology. *Theory and Psychology,* Vol. 18(3), 291-296
- Varela, F.J. (1996). Neurophenomenology: A methodological remedy for the hard problem. *Journal of Consciousness Studies,* **3**, No. 4, 330-349
- Zahavi, D. (2004). Phenomenology and the project of naturalization. *Phenomenology and the Cognitive Sciences,* **3**, 331-347

<u>The Embodied Mind</u> – This is such an important aspect to my Dissertation because the embodied mind is what dwells in and moves through settlement morphologies: it is the wholistic/organic perceptual tool. In that sense, the disembodied mind, as a consequence of the negation of Cartesian dualism, could just as well exist in a vacuum – it doesn't matter, right? I also include some Yoga in the category of Embodied Mind because Yoga, meaning 'union with

the Divine,' is the ultimate potential of the embodied mind; it is also the ideal condition from which to initiate the phenomenology of perception: It could be possible to frame my research study as a yogic practice.

- Abrams, D. (1997). *The spell of the sensuous.* New York: Vintage Books
- Adams, F. (2010). Embodied cognition. *Phenomenology and the Cognitive Sciences,* 9, 619-628
- Bermudez, J.L., Marcel, A. & N. Eilan, eds. (1998). *The body and the self.* Cambridge, MA: The MIT Press
- Clark, A. (1997). *Being there: Putting brain, body, and world together again.* Cambridge, MA: The MIT Press
- Clark, A. (2011). *Supersizing the mind: Embodiment, action, and cognitive extension.* Oxford: Oxford University Press
- Deacon, T.W. (2012). *Incomplete nature: How mind emerged from matter.* New York: W.W. Norton & Company
- Dychtwald, K. (1977/1986). *Bodymind.* New York: Penguin
- Eliade, M. (1958/2009). *Yoga: Immortality and freedom.* Princeton, NJ: Princeton University Press
- Feuerstein, G. (1998/2008). *The yoga tradition: Its history, literature, philosophy and practice, third edition.* Prescott, AZ: Hohm Press
- Gallagher, S. (2005). *How the body shapes the mind.* Oxford: Oxford University Press
- Goldberg, E. (2005). Cognitive science and hatha yoga. *Zygon,* Vol. 40, No. 3, 613-629
- Hanna, T. (1988). *Somatics: Reawakening the mind's control of movement, flexibility, and health.* New York: Da Capo Press
- Haugeland, J. (1998). *Having thought: Essays in the metaphysics of mind.* Cambridge, MA: Harvard University Press
- Iyengar, B.K.S. (1988/2002). *The tree of yoga.* Boston: Shambhala
- Johnson, M. (1987). *The body in the mind: The bodily basis of meaning, imagination, and reason.* Chicago: University of Chicago Press
- Johnson, M. (2007). *The meaning of the body: Aesthetics of human understanding.* Chicago: University of Chicago Press
- Lackoff, G. & M. Johnson (1980). *Metaphors we live by.* Chicago: University of Chicago Press
- Lackoff, G. & M. Johnson (1999). *Philosophy in the flesh: The embodied mind and its challenge to Western thought.* New York: Basic Books
- Legrand, D., Grunbaum, T. & J. Krueger (2009). Dimensions of bodily subjectivity. *Phenomenology and the Cognitive Sciences,* 8, 279-283
- Morley, J. (2001). Inspiration and expiration: Yoga practice through Merleau-Ponty's phenomenology of the body. *Philosophy East and West,* Volume 51, Number 1, 73-82
- Morley, J. (2008). Embodied consciousness in Tantric yoga and the phenomenology of Merleau-Ponty. *Religion and the Arts,* 12, 144-163

- Nunez, R. & W.J. Freeman (1999). *Reclaiming cognition: The primacy of action, intention and emotion.* Journal of Consciousness Studies, 6, No. 11-12. Bowling Green, OH: Imprint Academic
- O'Neill, M.E. (2001). Corporeal experience: A haptic way of knowing. *Journal of Architectural Education,* 55/1, 3-12
- Roberts, T. (2010). Understanding 'sensorimotor understanding.' *Phenomenology and the Cognitive Sciences,* 9, 101-111
- Rowlands, M. (2010). *The new sciences of the mind: From extended mind to embodied phenomenology.* Cambridge, MA: The MIT Press
- Shapiro, L. (2011). *Embodied cognition.* London: Routledge
- Sheets-Johnstone, M. (2011). *The primacy of movement, expanded second edition.* Amsterdam: Johns Benjamins Publishing Company
- Shusterman, R. (2008). *Body consciousness: A philosophy of mindfulness and somaesthetics.* New York: Cambridge University Press
- Thelen, E. (2000). Grounded in the world: Developmental origins of the embodied mind. *Infancy,* 1(1), 3-28
- Thompson, E. (2005). Sensorimotor subjectivity and the enactive approach to experience. *Phenomenology and the Cognitive Sciences,* Vol. 4, No. 4, 407-27
- Thompson, E. & F.J. Varela (2001). Radical embodiment: Neural dynamics and consciousness. *Trends in Cognitive Sciences,* Vol. 5, No. 10, 418-25
- Torrance, S. (2006). In search of the enactive: Introduction to special issue on enactive experience. *Phenomenology and the Cognitive Sciences,* **4**, 357-368
- Varela, F.J., Thompson, E. & E. Rosch (1991). *The embodied mind: Cognitive science and human experience.* Cambridge, MA: The MIT Press
- Vivekananda (1953/1996). *The yogas and other works.* New York: Ramakrishna-Vivekananda Center
- Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin and Review,* 9(4), 625-636

Living Systems Theory – An understanding of this theory is critical for my analysis and evaluation of settlement morphologies; therefore, I anticipate my Dissertation will contain much language of Living Systems Theory, as expounded in the following sources. I include also in this category a selection of works more specific to the geometry of living systems.

- Capra, F. (1996). *The web of life: A new scientific understanding of living systems.* New York: Anchor Books
- Capra, F. (2002). *The hidden connections: A science for sustainable living.* New York: Anchor Books
- Cook, T.A. (1979). *The curves of life.* New York: Dover Publications, Inc.
- Doczi, G. (1994). *The power of limits: Proportional harmonies in nature, art, and architecture.* Boston & London: Shambhala

- Dube, R.L. (1997). *Natural pattern forms: A practical sourcebook for landscape design.* New York: Van Nostrand Reinhold
- Ghyka, M. (1977). *The geometry of art and life.* New York: Dover Publications, Inc.
- Goldfield, E.C. (1995). *Emergent forms: Origins and early development of human action and perception.* New York: Oxford University Press
- Huntley, H.E. (1970). *The divine proportion: A study in mathematical beauty.* Toronto, Canada: Dover Publications, Inc.
- Ivins, W.M., Jr. (1946). *Art & geometry: A study in space intuitions.* New York: Dover Publications, Inc.
- Jacob, F. (1970). *The logic of living systems.* London: Allen Lane
- Jantsch. E. (1975). *Design for evolution: Self-organization and planning in the life of human systems.* New York: George Braziller
- Kelso, J.A.S. (1995). *Dynamic patterns: The self-organization of brain and behavior.* Cambridge, MA: The MIT Press
- Laszlo, E. (1987). *Evolution: The grand synthesis.* Boston & London: Shambhala
- Lawlor, R. (1982). *Sacred geometry: Philosophy and practice.* London: Thames & Hudson
- Mandelbrot, B.B. (1977/1983). *The fractal geometry of nature.* New York: W.H. Freeman and Company
- Margulis, L. & D. Sagan (1995). *What is life?* New York: Simon & Schuster
- Maturana, H.R. & F.J. Varela (1987/1998). *The tree of knowledge: The biological roots of human understanding.* Boston & London: Shambhala
- Meadows, D.H. (2008). *Thinking in systems: A primer.* White River Junction, VT: Chelsea Green Publishing Company
- Skinner, S. (2006). *Sacred geometry: Deciphering the code.* New York: Sterling Publishing Co., Inc.

<u>Ecological Psychology</u> – Ecological Psychology is more descriptive of this work than is Environmental Psychology. 'Ecology' explicitly defines relationship whereas 'environment' can be regarded as 'out there,' thus perpetuating dualism. The following is an important collection of works exploring the perceptual interface between organism and its supporting ecology – and it is just this interface that I will be exploring in my Dissertation. Because so much of this work is about perception, I include some titles investigating 'aesthetics,' a word which comes from the Greek *aesthetikos*, 'to perceive.'

- Ackerman, D. (1990). *A natural history of the senses.* New York: Vintage Books
- Adorno, T.W. (1970/1997). *Aesthetic theory.* Minneapolis: University of Minnesota Press
- Arnheim, R. (1969/1997). *Visual thinking.* Berkeley & Los Angeles: University of California Press
- Barab, S.A. & W.-M. Roth (2006). Curriculum-based ecosystems: Supporting knowing from an ecological perspective. *Educational Researcher,* Vol. 35, No. 5, 3-13

- Barker, R.G. (1968). *Ecological psychology: Concepts and methods for studying the environment of human behavior.* Stanford, CA: Stanford University Press
- Bateson, G. (1972). *Steps to an ecology of mind.* New York: Ballantine Books
- Bourassa, S.C. (1990). A paradigm for landscape aesthetics. *Environment and Behavior,* Vol. 22, No. 6, 787-812
- Braund, M.J. (2008). The structures of perception: An ecological perspective. *Kritike,* Volume 2, Number 1, 123-144
- Cupchik, G.C., Vartanian, O., Crawley, A. & D.J. Mikulis (2009). Viewing artworks: Contributions of cognitive control and perceptual facilitation to aesthetic experience. *Brain and Cognition,* 70, 84-91
- Deutsch, J.A. & D. Deutsch (1973). *Physiological psychology.* Homewood, Illinois: The Dorsey Press
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Fig. 18 – What of Bremen? – such a distinction between movement in the old town and later additions of industrial housing! This would be a good place to study the neurophenomenology of settlement morphology.

Epilogue

I want to mention, rather sentimentally, that I began my disciplined, interdisciplinary, self-designed education back in 1994. That means that – including a couple-year intermission during which I lost funding yet nevertheless continued to read and write in more of a professional stance – I have been a full-time student for the past 18 years. This has been a substantial portion of my adult life! In that sense, this Dissertation represents the culmination of an era, not merely the capstone of another degree. The Taoists say once Yang culminates Yin is born; therefore, I anticipate this Dissertation to be a threshold into an entirely new phase of Being (Heidegger, 1962): What will it be like to be a mature, educated, contemplative scholar-practitioner and not be going to school?

Through all these years of disciplined study I seem to have been focusing on the same issue – albeit from multiple angles: What is the relationship between human potential and the qualities and characteristics of the environments wherein people live? It seems obvious to me that some places facilitate human potential more than others – and if that's accepted, then it's just a step further to speculate whether it is possible to *design* places that *optimize* human potential. Elsewhere, I've called this "Design for Consciousness" (Mare, 2009): the idea that we can organize the built environment, down to the most intricate decorative details, in such a way as to optimally stimulate the nervous system, to delight the emotions, and so to enliven the spirit; and that would make everybody happy. If this is possible – to design for consciousness – then it ought to be at the top of every agenda of organized human activity, at whatever scale.

Instead, we get a strictly functional built environment that is thrown together randomly and haphazardly according to the dictates of "the market." It's worth taking a look at one particularly eloquent critique of this American landscape, because my Dissertation is attempting to address, from one perspective, the dilemma to which it bespeaks:

> Eighty percent of everything ever built in America has been built in the last fifty years, and most of it is depressing, brutal, ugly, unhealthy, and spiritually degrading – the jive-plastic commuter tract home wastelands, the Potemkin village shopping plazas with their vast parking lagoons, the Lego-block hotel complexes, the "gourmet mansardic" junk-food joints, the Orwellian office "parks" featuring buildings sheathed in the same reflective glass as the sunglasses worn by chain-gang guards, the particle-board garden apartments rising up in every meadow and cornfield, the freeway loops around every big and little city with their clusters of discount merchandise marts, the whole destructive, wasteful, toxic, agoraphobia-inducing spectacle that politicians proudly call "growth" (Kunstler, 1993, p. 10).

My Dissertation is proposing that much of this predicament can be explained by examining the substructure, the foundation, the *settlement morphology* upon which the whole theatre set is constructed.

I used to be concerned about 'sustainability' as a worthwhile goal; now I think this goal 'sustainability' – with everybody suddenly wanting to go "green" – is essentially about trying to make the spectacle work, with less and less cheap energy available, when that may very well be a futile effort, simply because the gridded substructure, like every mechanical system, is prone to entropy. These days I think more about *beyond* sustainability, *beyond* mere steady-state material maintenance to conditions where human beings may *thrive* in personal and planetary plenitude. If it can be demonstrated, through this Dissertation, that settlement morphology influences neural patterning, and by extension consciousness, then the path to *beyond* sustainability may begin with taking a closer look at the organization of the substructure upon which we play our lives – it is *not* incidental.

Since this Dissertation Proposal was so much assisted with the information contained in images, allow me now to close with one more set of images, a set that might be considered a Case Study. The first image is of the very center of the Aztec capital Tenochtitlan:

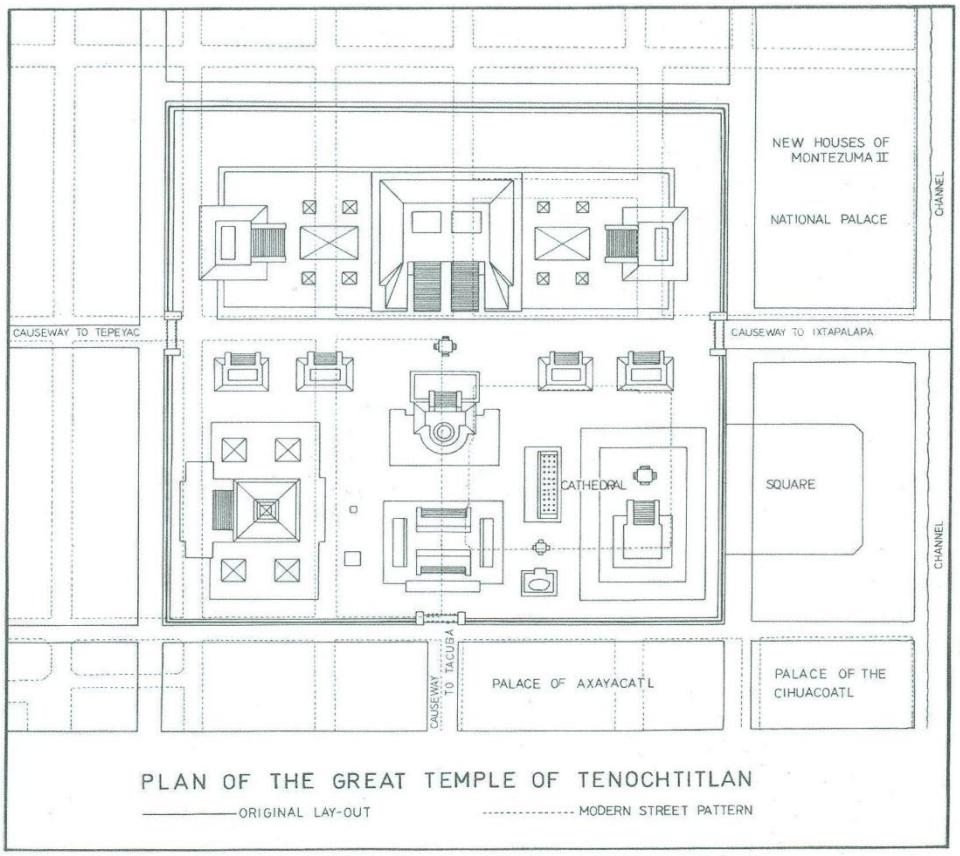

Fig. 19 – Central temple complex of Tenochtitlan: A rigid square grid. From Hardoy, 1968, Plate 36

The Aztec were notorious for their militaristic imperialism. Prisoners of war were systematically brought back to this temple complex to be sacrificed, their chests gouged open by a priest and then their hearts ripped out – a rather gory spectacle by any standard.

Another indigenous Mesoamerican civilization, the Classic Maya, embodied a very different form of settlement morphology. There are numerous examples to choose from; what they all have in common is an artful way of working with existing topography to create aesthetic visual effects. Here is the central zone of Tikal, a major center in the Peten:

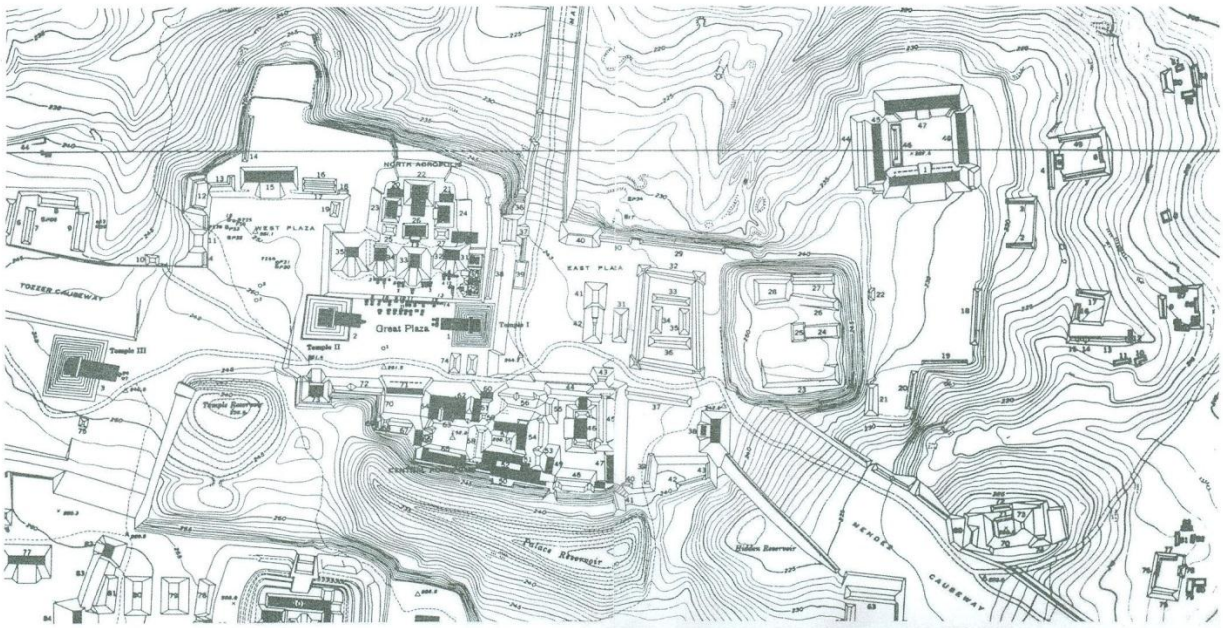

Fig. 20 – Plan of the central zone of Tikal. From Hardoy, 1968, Plate 11

Hardoy (p. 28) analyzes this settlement morphology:

> The central group of Tikal is one of the most original complexes in urban history. All the great elements of urban design are concentrated there in a partially occupied area of 75 hectares. The Great Square is the climax, where the most significant religious and civil functions of Tikal were carried out. The approach to it was provided by three causeways which allowed changing perspectives of the most important buildings of Tikal; their breadth contrasts with the sense of spatial confinement invoked by the spectacular group of constructions that formed the city's framework. Vertical force was provided by the two temples facing one another [slightly left of center in above plan] and constructed almost simultaneously about 700 A.D. Of all the large constructions of Tikal these two temples, resting on the elevated platforms, are perhaps the best proportioned, their airiness enhanced by elaborate painted crests. Although Temples I and II face each other and at first sight give the impression that their single stairways are aligned along the same east-west axis, a slight deviation exists nevertheless.

Hardoy (p. 29) goes on to describe what he interprets to be the inherent intentionality behind the creation of this settlement morphology:

> But in their treatment of urban spaces, the Mayas did reach one of the peaks we know of in the history of urban design. The ceremonial centers of Tikal, of Copan, Palenque, Piedras Negras, Yaxchilan, or Uaxactun were true works of art. Despite the destruction of some of them it is nevertheless still possible to appreciate the skill in taking advantage of topography, the incredible subtlety displayed in the modeling of sequences, the deliberate handling of the element of surprise, and a clear intention to avoid monumental axes.

Thus it was *by design* these effects were created. A Neurophenomenology of Settlement Morphology would want to explore the effects upon the nervous system of moving through such exquisitely designed places, and then, in the interest of structural coupling, to wonder at the sort of consciousness that would be reflected – the quality of consciousness that both *produces* these works of art and, in turn, is shaped *by* them through the process of dwelling.

The most significant indication I can recall providing insight to the consciousness of the Classic Maya was something I read (and I wish I had referenced the source; it was years ago) to the effect that early excavations of archeological sites failed to uncover any implements of war. The Maya were fairly isolated in the thick jungles of their home region, and in this isolation they appear to have developed a peaceful agrarian culture of dispersed, holarchically clustered residential settlement punctuated by elaborate ceremonial centers like that of Tikal. Ashmore (1981) edits a fascinating volume in which contributors analyze the details of this settlement patterning and its consequences on political, economic, and cultural life. The elaborate centers were *ceremonial*: the elite appear to not have been interested in yoking the population, and this was reflected in the dispersed residential patterns. The people appear to have supported willingly the intellectual pursuits of the elite because they had autonomy in their dispersed, clustered residential groupings whose organization was based on the socio-economic functions of clans. There is a wealth of knowledge to be gained by the study of settlement morphology – and in all cases, quality of consciousness is implied.

Bell (1956, p. 441) provides a parting appraisal of the quality of consciousness embodied by these Classic Maya, when she explains:

> The esthetic refinements of Maya art and architecture, the accuracy of their astronomical system, the intricacy of their calendrics, and the skill and elaboration of their mathematics and writing, are unsurpassed by any other New World civilization and equaled by few in the Old World.

Indeed, as I am writing this in the Summer of 2012, it's become well known that the Mayan calendar suddenly ends on December 21st of this year. Whole books have been written

speculating on what this might mean (e.g. Arguelles, 1987; Jenkins, 1998): Why would the Maya choose this specific point in time to terminate their precise calendrics? Whatever the answer may be – and whatever phenomena may or may not transpire as December 21st nears – one thing is for sure: the Classic Maya continue to impress a profound influence well beyond their years. If I may interject a personal preference, what I hope will happen after 21 December 2012 is that people will begin to appreciate more the qualities and characteristics of the built environments in which they dwell, the stage upon which they conduct the play of Life, and so invest more effort into designing places – even whole settlements – that may contribute to the evolution of consciousness. This is what the Maya did; and this is what the Aurovilleans are proposing. Think about the poor people in Los Angeles…

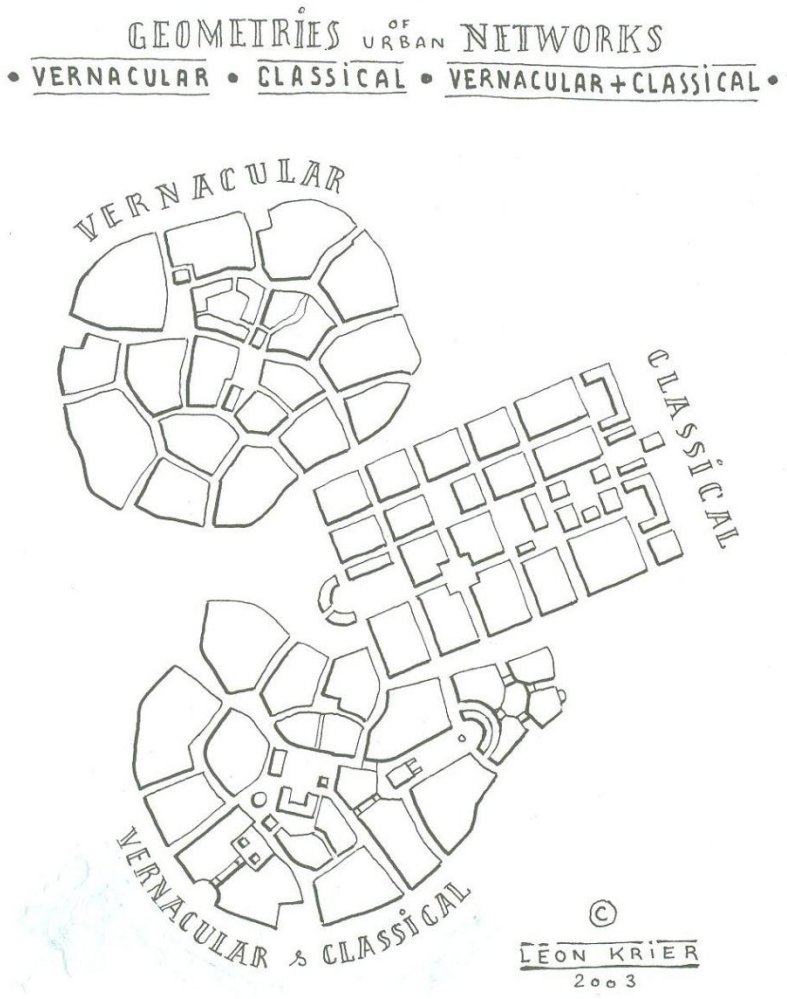

Fig. 21 – Leon Krier, architect for the Prince of Wales, argues that axial-orthogonal geometry does have a place in thoughtful settlement design. The axial-orthogonal is reserved to highlight approaches to prominent civic and spiritual complexes, thus enhancing their distinctive character. Any axial-orthogonal geometry, however, is best overlaid selectively on top of an existing vernacular (i.e. organic) morphology. From Krier, 2008, p. 16

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