Dissipative Models: Notes toward Design Method

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I want to describe a particular kind of form language rooted intimately within our bodies[1]. I will try to articulate traces of subtle phenomena seeking emplacement, measured by intense mutual relationships of exchange with surrounding environments. The qualities that I will describe are characterized by punctuated oscillation. They use the paradigm of dissipative structures and diffusion as a fundamental guide for their design and their forms. This form language will be used to describe architectural projects that I will claim have living qualities. This personal involvement results in shifting boundaries that fluctuate between hard facts and hopeful fictions for exploring the future.

For twenty-five hundred years, Western artists and designers have been speaking about emulating life[2]. The imagery and forms from this tradition show potent hope for inanimate forms of craft and art coming alive. Yet the speech and evocations of visual art and architecture have often treated 'life' as a kind of boundary, defined by separation and distance from human craft. The symbolism that evokes life has been maintained by distinguishing human artifice from the viable organisms of nature[3]. The discipline of architecture seems to have been especially emphatic in maintaining this divide. Architecture seems a counterform to nature[4], staying deliberately distinct from the living world, preferring instead the role of a stripped stage that supports the living world by means of clear restraint. Perhaps that kind of separation has a moral kind of imperative, avoiding trespass. Indeed, if we think about atrocities this past century, then there would be a very good reason to make a clean, empty place where we could be free, where a clear sanctuary could support nuanced interactions that rebuild humanity.

Yet the distinct progress of science and technology in recent decades invites a change to this strategy of restraint. The achievement of comprehensive information within the human genome project[6], the accomplishment of potent learning functions in computational controls[7], and the increasing fluency in programming physical materials and projecting complex-system ecological modeling can conspire to demonstrate that living systems no longer need be maintained as a sacrament separate from human intervention[8]. The ability to see our traces and to understand dimensions of the impact with which we thread forms an ethical key to this change. With that sensitivity it becomes possible to speak about full-blooded fertile involvement for designers. The shift offers a symmetrical opposite to the kind of deliberately empty, existentialist freedom that has defined generations of preceding architecture[9]. Emerging from the distancing functions of reverence into a new phase of highly involved stewardship, living systems can now occupy the space of architectural design.

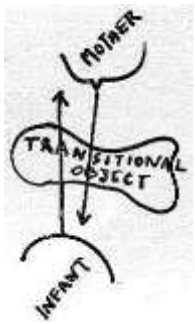
In this discussion I will make comments about emplacement in pursuit of a fundamental relationship with the environment rooted in diffusive form. I will describe subtle phenomena that evoke expanded physiologies, embodying the forms of diffusion and dissipative forms. Building from these qualities, projects will be described that approach living qualities. I argue for a particular kind of form language employing diffusive and dissipative forms. This morphology stands distinctly against the prevailing modern preference for stripped, minimal stages offering freedom. The language I argue for instead pursues culpable involvement. An undulating, quasiperiodic metabolism is evoked by this series of projects. Rather than a polarized working method that follows only a 'top-down' or 'bottom-up' method, the edges of this working method oscillate. The deliberate ambivalence of this approach can yield qualities where things convulse and stutter in emerging vitality.

The entire world is never stable. In poignant contrast to the architectural tradition framed by 'firmitas', today's environment seems distant from the stable hold of natural cycles. Instead of the eternity of nature, we are surrounded by turbulence. What kind of design methods might contribute to such instability? It would be tempting to follow optimums within natural form finding that they are exemplified by the space of a rain drop. If Plato were teaching today's designers he might say that the elegant reductions of primary geometry provide keys to architecture[10] by using the minimum possible envelope and the maximum possible territory enclosing interior territory. Yet the reductive form language that guides such efficiency is a kind of machine for resisting interaction as well. There can be

no less surface for interaction than that of a sphere. The reductive form-languages of spheres and crystals achieve maximum possible territory and maximum possible inertia by minimizing their exposure to their surroundings[11]. Such a form can be effective in a cold climate that requires retention of energy. It can also be effective if you want to destroy as much as possible with embodied energy of ballistics. However, cooling requires the opposite. The opposite of a spherical raindrop appears in the form of snowflakes. Snowflakes epitomize dissipation; the operation harvests the internal heat by optimizing release through an efflorescence of exchange. Such a form offers a strategy for a diffusive architecture in which surfaces are devoted to the maximum possible intensity and resonance with their surroundings[12].

The form-languages pursued in this discussion can contribute to a lexicon, a system for design. This search for fertile, generative language can be informed by theories of growth in the parallel discipline of human psychology. A traditional sequence of growing from infancy might follow the mid-20th century American psychologist Abraham Maslow's ladder of self-actualization[13]. Maslow's series of developmental stages follows a sequence of growth. As a very young person you lose things, get hurt and take responsibility. You move into agency and increasing freedom, able to handle separation and opposition. In such a sequence a goal is set up that moves distinctly from a diffuse, turbulent beginning into the destination of a clear, isolated and bounded whole. Artists might use similar terms to Maslow, I think, when they speak about relationships in their visual compositions, they often speak of 'figures' and 'grounds', and it seems to me that clear, bounded figures are almost always pursued as goals, emerging out of dark and uncertain grounds.

Donald W. Winnicott theorized the emergence of the infant psyche at the same time as Maslow, but his way of seeing our environment seems distinct from Maslow's prevailing views of growth and development. Similar to Maslow, Winnicott looked closely at the states that came before a person knows they are a person and before they know their name. He talks about objects and physical things as having a key relationship with living bodies and with emerging consciousness[14]. Winnicott describes Transitional Objects – blankets, stuffed animals, favourite objects that as a child you would carry as a constant. In those early times such things can be said to be coterminous with your body and with your mind. I do, dimly, remember my own 'blanky'.Perhaps I was almost fused with it when I was a tiny boy. Winnicott says some extraordinary things about trying to deliberately extend and delay the growth out of such an ambiguous state[15].

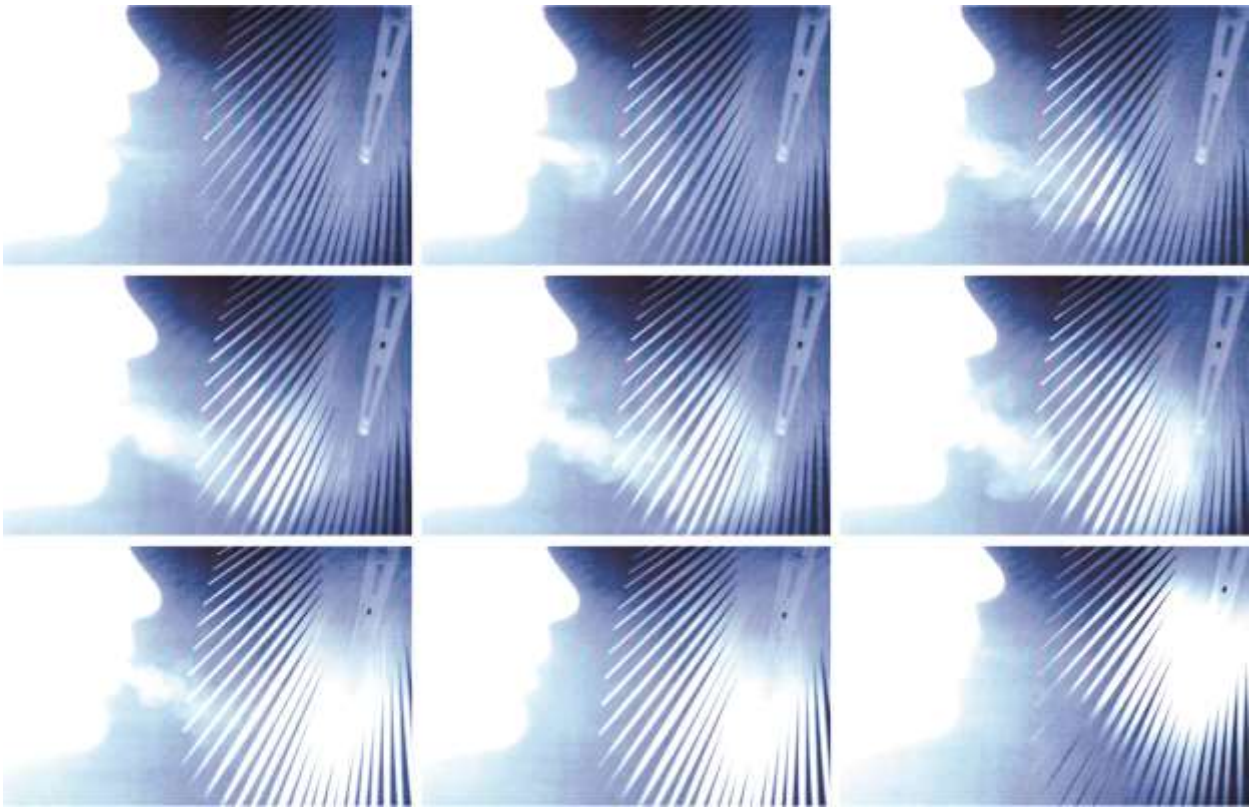


Rather than something being cut, pulled, and firmed up, the developing form language encourages quite slow and gentle condensation, allowing self-determined forms to crystallize out of a continuum. Far from responsible, wilful use of tools and manipulation of objects, he evokes a continuum that seems to offer delicious, delirious potential. In such a sensitive state there is a sense of being connected still.

From objects, Winnicott goes on to conceive of Transitional Fields[16], suggesting that cultural expressions could function in similar ways to objects handled by a pre-conscious infant, and implying in turn that public identity can emerge in ways that seem directly analogous to the emergence of individual consciousness. Winnicott says "The transitional objects and transitional phenomena belong to the realm of illusion which is at the basis of initiation of experience… the task of reality-acceptance is never completed, that no human being is free from the strain of relating inner and outer reality, and that relief from this strain is provided by an intermediate area of experience which is not challenged (arts, religion, etc.). This intermediate area is in direct continuity with the play area of the small child who is 'lost' in play." Illusions become prima materiae in such an exchange. To me, Winnicott gives confidence in the continuity of the world. He offers a potent response to the lingering question of how words and language might contribute to the generation of collective experience.

We can look carefully and see the traces that we make. In my own work, I have started examining thermodynamics to seek a tangible exchange for the reality of an expanded physiology. Layers of exchange wrap around each of us. You can see the translucency of the heat as it propagates out through the polymer tines of the digitally fabricated frond in the image presented here[17]. Asking as the subject being photographed in that image, I ask if I am pushing that heat-energy outward or whether the surrounding milieu of vapours is pulling energy out of me. Perhaps both of those states intermingle. If we look at the cycle, heat exchanges reveal themselves at first as obvious: I emit heat; the world receives my energy. The imagery presented here is aided by increased precision in which notch filters are tuned in order to reveal a flux of carbon dioxide in the air as it carries a thermal plume into this frond. We can see it propagate and then bleed into the mass and be pulled into the middle. However, certainty in a one-way flow fades when the later stages of this sequence of images appear[18]. In

the final images of the cycle, we can see that the temperature of the tines of the frond nearest my face recorded in dark tones show levels that are distinctly lower that when the cycle began. The ambient environment is not only receiving my action, but is also actively pulling heat from me. The surrounding air has pulled that energy outward, perhaps literally ingesting part of me.



I believe that the hardened boundaries exemplified by Plato's world of spheres and reductive forms might be replaced by form-languages that pursue intense involvement and exchange[19]. I make footprints in the world, but not as an individual figure leaving things about for them to dissolve into nothing. Rather, there's an active sense of the environment recoiling in multiple cycles. This implies a mutual kind of relationship. In turn, it suggests a craft of designing with materials conceived as filters that can expand our influence and expand the influence of the world on us, in an oscillating register: catching, harvesting, pulling and pushing. While personal boundaries can readily be found as functions of central systems--brain, and spine, and hearts define cores that we know well- parallel to those cores lie bundles of ganglia in our elbows or in our sternum and pineal[20]. Neural matter is riddled throughout our bodies, making a great shambling kind of network. Much of our consciousness is bound up in loops and reflexes, which happen at the outer edges of cognition. Such a model working internally could be expanded outward. In such a layered space, we could build up a deeply layered, deeply fissure set of relationships in which there are multiple sensitive boundaries. We might be able to build up in a sense of fertility reconstructing a kind of a soil and ground. We could measure values within that constructed ground by measuring resonance.

The projects that my collaborators and I have been making pursue the construction of a synthetic new kind of soil. The projects have moved through several stages. Structures tend to be lightweight and ephemeral. One stage has concentrated on geometry and on periodic structures, looking at the kind of resilience that comes from textile matrices, in turn moving toward quasiperiodic systems in which things shift and multiply and effloresce, producing resonance. A further stage of development has involved construction of diffusive metabolisms in which protocell chemistries can start to set up exchanges and material flux, raising the possibility of renewing skins of material. Weaving those together, active agents within this work lead to questions that ask what geometries define our own personal worlds.

Hylozoic Ground, installed within the Canadian pavilion at the 2010 Venice Biennale for Architecture, was organized by a hyperbolic waffle structure that could be pulled and pushed into continuous doubly-curved shell surfaces. The structural scaffold was clothed with layers of mechanisms. Kinetic components were grouped together, making tribal organizations of multiple clusters that would speak to each other

and listen. In turn, these clusters would be organized in larger familial groups that spoke in quasi localized ways. Ripples of reaction and counter-reaction flow in this exchange. The behaviour is only partially predictable, but it is by no means random. It is the result of a tissue like aggregation of multiple gestures.

The hyperbolic scaffold is a resilient network made of tetrahedral structures, clothed with hanging filters which pass gentle convective plumes of ear and filter the environment. Electro-acoustic 'cricket' fields of polymer are shown in an image accompanying this writing[22]. Each one of the elements is powered by a miniature shape memory alloy actuator. In concert, the mechanisms ripple out and resonate. They chirp as you come close, stimulated by touch. Protocell fields of glass flasks cycle water from the Venice canal and contribute cleaning and refreshment. These do not achieve high, efficient functions. Instead they offer a sketch of possibility.

Recent work expands into larger fields in which plumes of breathing vessels hover above and vibrations ripple through the entire field[22]. Multiple vibrations shiver through it, activated by direct-current miniature motors fitted with offset weights that create oscillating motion. Communications move out into rippling fields. Protocell environments start to work as a kind of a soil. Inside the flasks are slowly evolving reactions. Saturation is built up in layers using custom glass work that create suspended fluid reticulums. A copper compound blooms out under osmotic 'pumping' through an aqueous solution of potassium ferric cyanide, making walnut-like reticulated structures. Intensely multiplied small elements work together chained through vessels, imparting a blooming fertility. Humidity and scent are exuded. Small glands are wrapped around with traps. The elements with their humidity and with their scent gather, trap and start to harvest themselves. The sensation is on one hand, of being bathed but on the other of being eaten.

Our work pursues the beginnings for public emplacement. Large membranes made tangible rooms for gathering in a recent installation for Toronto's Luminato festival at Brookfield Place Galleria. The hanging layers of the Brookfield Place sculpture were programmed for slightly convulsive breathing motions, working to amplify the large flows of public movement that occurred each day. A whispering field of stories overhead were cued by arrays of proximity sensors. A breathing field employed approximately one hundred bladders, breathing and harvesting in response to people standing below. Such installations tend to be organized along two axes that work in parallel. Working laterally, the spaces are framed to support collective experience; the realm of the public common. Along with the mediation of who we are together, a vertical axes is used that frames personal physiology, encouraging perception of a fundament below and aerial dimensions reaching far above. This expanded emplacement reaches beyond social boundaries toward multiple dimensions.

Changing scale in recent work is a collaboration in fashion, starting to contribute to the sense of an expanded physiology in literal ways. Iris Van Herpen's studio offers a radical intimacy where the skin is only one boundary amongst many. Using simple fissured forms configured like leaky heart valves, hovering leaf-like layers very slightly push and pump in the gentlest of ways. They encouraging plumes of air to rise around you in a three dimensional lace made of silicon and impact resistant acrylic[23]. They make a live performance as they harvest your

own energy and ripple around you. Layers lying immediately outside human bodies are organized in octaves of potential exploration, moving into turbulence. Musculature could be considered a mask, and an active fire-like metabolism can be sensed radiating through human skin. A corollary can be seen in a building composed of multiple layers. Traces are pulling at you. You become aware of the impact of your own tread in the world.

In summary, this work has been guided by opposing Plato's idea of a sphere, of the kind of skin that might claim to be efficient, that might claim to be responsible by reducing consumption and yet, somehow, which speaks much more potently of mortality than of a kind of a fertility. Spheres can speak of a violence and of a claim. Instead of the optimal, reductive forms of raindrops, I've suggested that snowflakes offer potent form-language that could guide emerging architecture. New projects from my studio are deeply layered and are founded in intimacy and touch. These works invite practice where we can see our traces. We can start to design in a way that can pull and harvest and resonate. The diffusive, dissipative form-language described here offers a strategy for constructing fertile new architecture.

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17. Cyclical exchanges of heat between a human figure and a polymer frond are recorded through thermal imaging.

18. Revealing subtle dynamics within an ambient environment, an 'ingestion' of heat-energy occurs as temperatures within polymer tine details travel inward, implied by the darker tones of its outer edges.

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