



RESPONSIVE
ARCHITECTURE /
PERFORMINGS
INSTRUMENTS

THE ARCHITECTURAL LEAGUE OF NEW YORK
SITUATED TECHNOLOGIES PAMPHLETS 4
PHILIP BEESLEY AND OMAR KHAN

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Situated Technologies Pamphlets 4:

Responsive Architecture/Performing Instruments

Philip Beesley and Omar Khan

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The Situated Technologies Pamphlet Series extends a discourse initiated in the summer of 2006 by a three-month-long discussion on the Institute for Distributed Creativity (iDC) mailing list that culminated in the Architecture and Situated Technologies symposium at the Urban Center and Eyebeam in New York, co-produced by the Center for Virtual Architecture (CVA), the Architectural League of New York and the iDC. The series explores the implications of ubiquitous computing for architecture and urbanism: how our experience of space and the choices we make within it are affected by a range of mobile, pervasive, embedded, or otherwise “situated” technologies. Published three times a year over three years, the series is structured as a succession of nine “conversations” between researchers, writers, and other practitioners from architecture, art, philosophy of technology, comparative media studies, performance studies, and engineering.

www.situatedtechnologies.net

This volume of the Situated Technologies Pamphlet Series discusses key qualities of “responsive” architecture, a framing that understands it to be a performing instrument. A new generation of architecture that responds to building occupants and environmental factors has embraced distributed technical systems as a means and end for developing more mutually enriching relationships between people, the space they inhabit, and the environment. In contrast to wide optimism about this new kinetic, interactive technology, this conversation examines responsiveness as mutable and contestable.

Recent publications such as Branko Kolarevic and Ali Malkawi’s *Performative Architecture: Beyond Instrumentality*, Michelle Addington and Daniel Schodek’s *Smart Materials and Technologies in Architecture: for the architecture and design professions*, Michael Hensel and Achim Menges’ *Morphologies*, and Neil Spiller’s *Digital Architecture Now* offer building performance as a key principle for design, adopting new paradigms for the design of buildings, landscapes and urban infrastructures. This way of thinking about architecture places “performance” above form making, and uses digital simulations and fabrication strategies in pursuit of comprehensive approaches to the built environment. The works they document employ distributed communication and control systems, lightweight actuators, and sensors integrated within component-based envelope systems. These are supported by new design methods including dynamic visualization and prototyping of complex systems. As a whole, this work is marked by a striking optimism about the expanded powers of performance-based architecture that aspire to be dynamic and open.

Yet while new generative and parametric design practices have increased the scope of architecture’s capacity to manipulate the environment, critical caution appears slight. It might be argued that such confidence in performance continues a preceding “modern” generation’s misplaced optimism in technology. In contrast, this pamphlet pursues an expanded view of architectural “performance” that attempts to move beyond instrumental systems oriented towards efficient service. It explores the conceptual landscape of humans’ fraught relationship with responsive technologies and proposes a renewed engagement with instruments that establish complex organic relationships between environment and occupant. With a focus on the potential of contemporary environments to “care,” the theoretical possibility of realizing spatial systems that are based on precise patterns of spatial cognition and occupation invites renewed consideration.

Omar Khan, Trebor Scholz and Mark Shepard

Philip Beesley (University of Waterloo) has degrees in fine art from Queens University, in architecture from the University of Toronto, and a diploma in technology from Humber College. His work combines active practice, experiment, research and publication in public architecture, stage and exhibition design, book design and sculpture. Distinctions for his work include the Prix de Rome in Architecture for Canada; first-prize VIDA; FEIDAD and Governor-Generals and Dora Mavor Moore awards. He is the Director of Waterloo Architecture's Integrated Group for Visualization, Design and Architecture; directs the publication program of the Canadian Design Research Network/ Design Research Canada; and serves on the executive steering committee of ACADIA. He leads core curriculum sections for Master's research and Undergraduate design streams at Waterloo. In 2008–9 his work has been exhibited in locations including Beijing, Linz, Los Angeles, Madrid, and New York. Recent publications include *Mobile Nation and Hylozoic Soil* (Riverside), *Ourtopias* (Design Exchange), *On Growth and Form: Organic Architecture and Beyond* (TUNS Press).

Omar Khan (University at Buffalo, Center for Architecture and Situated Technologies (CAST)) is an architect and educator whose work spans the disciplines of architecture, installation/performance art, and digital media. His research explores the role of pervasive media and computing in designing responsive architecture and environments. This has followed different strategies including augmenting environments with sensing and actuating technologies, rethinking material substrates and assemblies, and theorizing on ways to develop mutualist relationships with our built environment. He is a co-editor of the "Situated Technologies Pamphlet Series" and a co-director at the Center for Architecture and Situated Technologies at the University at Buffalo. He is also co-principal at the design firm Liminal Projects. His work has been exhibited at The Kitchen, NYC; The Whitney Annex, NYC; The Urban Center, NYC; The Storefront for Art and Architecture, NYC; The National Building Museum, Washington DC; and Atelier Farbergasse, Vienna, among others. He received his BArch from Cornell University and SMArch from MIT where he was a member of the Aesthetics and Computation Group (ACG) at the MIT Media Lab.

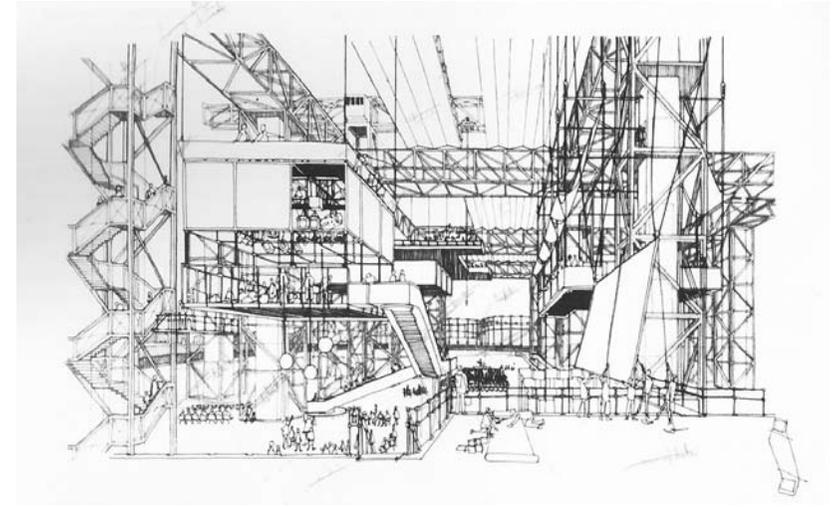
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OK **Omar Khan:** Let's reflect on architectural examples that can help define issues related to responsiveness. Why "responsive?" Does this speak to a need for gaining greater control over our increasingly unpredictable circumstances? Do we need our architecture to behave more like our information technologies? Let's start by looking at a project quite often discussed in relation to responsive architecture: architect Cedric Price's and theater director Joan Littlewood's unrealized 1964 Fun Palace was a hybrid that resided somewhere between a participatory theater and a perpetual construction site. Price and Littlewood conceived the Palace as a community-directed learning environment where working class people could go and learn new trades or whatever else they desired. The open nature of the learning program suggested a space that could be reconfigured and organized based upon people's changing needs. To accommodate this, Price provided a crane that allowed parts of the building to be moved and stacked in different ways and a gangway system for people to circulate between them. The building's visual incompleteness was a provocation to its inhabitants to change and adapt it. It was also a representation of an architecture that could never be finished.

PB **Philip Beesley:** Price seemed to see the actual provision of enclosures as a rather secondary issue compared to the crucial question of where something can be at a certain time. Rather homely enclosures, akin to contemporary shipping containers, are hung and stacked in the Palace. Spreads like Quonset huts run along the ground below. An operating system of seventy-five tower-skeletons framing the vast enclosure and a giant gantry crane that runs overhead are lovingly detailed. Perhaps he would have liked the specter of a "logistics" operator in a typical port today, surrounded by gantries and keeping containers moving.

OK The Fun Palace has many shortcomings as a design, but there is an incredible optimism in its projections for collective action that still ring true 55 years later. Perhaps that was the point; its legend was more provocative than its reality and that may have had something to do with Price's conception of it as a building with an expiration date of ten years. He did realize a smaller version of it in 1977 called "Interaction," whose demolition in 1999 he supported. Perhaps the larger Palace would have found a similar fate as Nicholas Negroponte's notorious 1973 "SEEK" installation, a project inhabited by gerbils and aluminum cubes. SEEK's robotic arm stopped working during the exhibition and



Cedric Price, *Interior perspective of Fun Palace*, ca. 1960–1964 (Fonds Cedric Price Collection Centre Canadien d'Architecture/Canadian Centre for Architecture, Montréal)

the gerbils all escaped the glass box for the museum walls, which they no doubt preferred as habitation. I mention SEEK because the Palace has been criticized for the way its cybernetic systems forced the inhabitants into particular behaviors. I don't think that is a fair criticism, because unlike the gerbils, the Palace's inhabitants were free to come and go. And even in the oppressive case of Negroponte's project, the gerbils ultimately undermined that control. And so I envision the Fun Palace with perpetual technological crashes resulting in a similar fate of abandonment. For Price that may have been alright.

PB The Fun Palace was conceived more as a tool than a building.

OK So what kind of responsiveness does this kind of architecture as tool offer? At its most basic it could be asked to perform tasks of comfort and security. It can manage energy and environmental controls like light, air, and security for its inhabitants. I think we have little reservation in delegating control of such things to automated systems. However, what about behavior engineering? And what about when that is accompanied by massively controlled flows of information? If we agree that all good architecture modifies behavior in some fundamental ways, perhaps the lesson of the Fun Palace was that it offered this control as a feedback system. Not only did the building act on the

inhabitants, the inhabitants acted back. If the public wanted change, the architecture could be modified to suit. The building as tool conditions our behavior but it also serves our changing intentions.

Another quality that the Fun Palace demonstrated was that of architecture as process. Price's life work speaks to this. The Fun Palace's factory-construction site aesthetics suggests a project that is in the midst of construction. It keeps us in continual anticipation, creating architecture in suspended animation full of possibilities yet to be realized. While its industrial aesthetics may not be as provocative for contemporary practice, its representation of incompleteness seems potent.

PB Could we call the Fun Palace a kind of "spontaneous combustion" machine for producing urban life? By seeding the space with a fertile set of connections, Price and Littlewood hoped that intersecting occasions might arise, perhaps at first through friction and debate, but eventually in a kind of combustion of cascading interaction, event upon event. Perhaps it is accurate to relate contemporary theology to that kind of political transformation. The publication of theologian Teilhard de Chardin's book *Phenomenon of Man* emerged in 1956, just before the Fun Palace was designed, and it is tempting to link the two visions. Teilhard speaks in that book about surging energies and connections running around the world, building into vast networks. He saw, in that pre-internet global vision, the emergence of collective consciousness.

OK The collective consciousness that emerges in the Fun Palace is political in nature. I'm not sure if de Chardin saw it in this way.

PB It's an interesting point—de Chardin used terms like "finding prodigious affinity" and "the collective power of sympathy" in gauging how collective consciousness might behave. Surely this is politics at its core.

OK Yes, but it is reduced to an ideal. In the Fun Palace, collective consciousness is a work in progress continually being constructed by the project's occupants. The building offers no fixed score to follow, only some rules of engagement. What remains provocative about the Fun Palace is that its technologies are deliberately wild and dangerous, ripe with creative potential. This is very different from the

optimism that pervades contemporary smart technologies. The implicit claim is one of salvation from our excesses through better management and preservation of our environment. I am concerned with the limited imagination we tend to project within these technologies. They tend to be domestic and put to dutiful service.

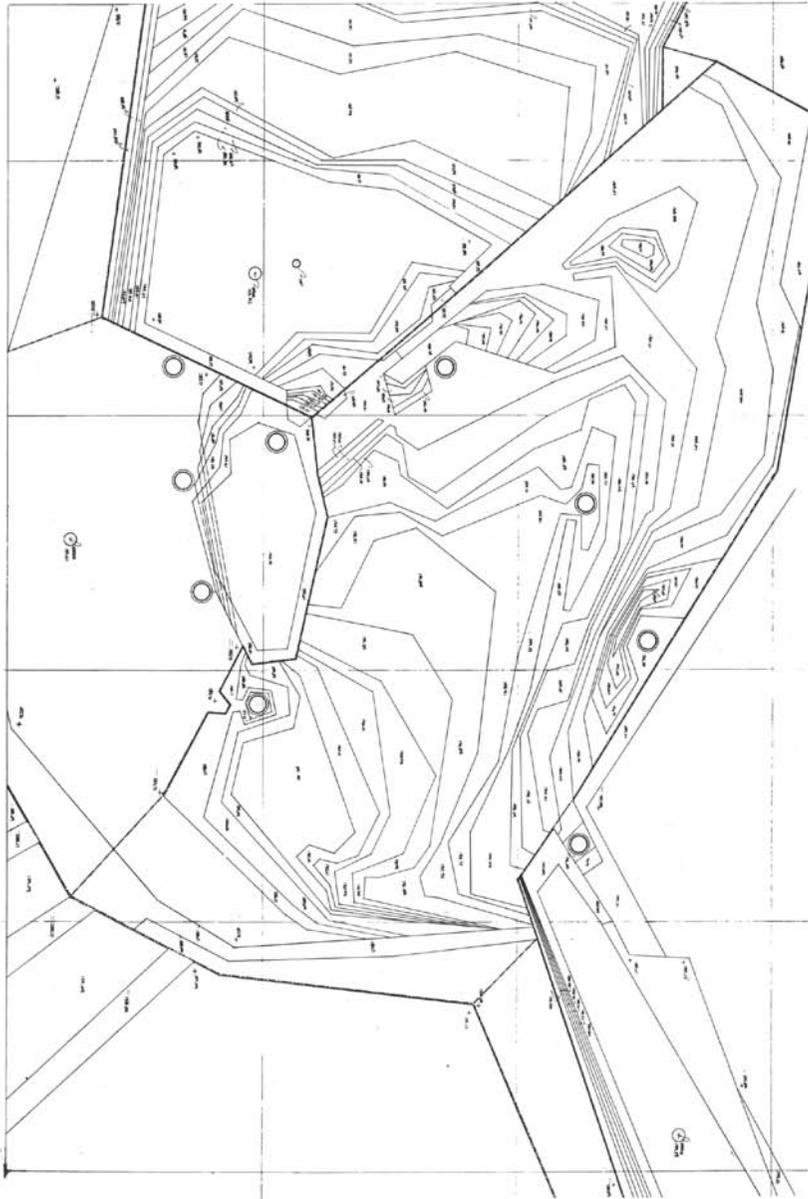
PB Just where that balance lies is fraught. Price seemed most concerned about opening possibilities, and gave scant attention to misuse. The fragility of the structure was, of course, part of the point—it didn't try to resist. Instead it seems to have been framed as lightly as possible, so that it could give way to action. Perhaps, in its fulfilled state, it would simply evaporate and be completely overtaken by crowds continually making their own formations.

OK In contrast, perhaps we should discuss an example that supports the idea of architectural resistance?

PB What about Lawrence Halprin's Lovejoy Plaza and Cascade of 1966? Like Price, Halprin conceived the fountain as a score for the movement of people, but he used a very different strategy by creating a permanent foundation for the space.

OK He took care in replicating natural effects that he learned from observing waterfalls in the High Sierras.

PB It's a remarkably simple and effective design: the dimensions of the stepping slopes that make up the fountain precinct are tuned so that they function both as bleachers for sitting and lounging and orthodox steps for walking and climbing. Clusters of steps are turned inward in a series of small pockets of space that in turn create larger valleys. You are right when you refer to the influence of natural topography, and it is striking how the cascading steps and shifting series of plinths so consistently get co-opted as stage and amphitheatre. Halprin seems to have captured a tipping point between nature and social iconography in those forms: valley, theatre. If nature implies loss of control, then perhaps Halprin wanted to hover at a brink, at the edge of solid urban ground, stepping toward wilderness. He wanted to create a dense, provocative catalyst for a kind of social theatre where audience and performer would constantly trade roles, fostering a deliberately unstable kind of interaction, rather than one that resolves itself into



Lawrence Halprin, *Lovejoy Cascade*, 1966 (Courtesy of Lawrence Halprin)

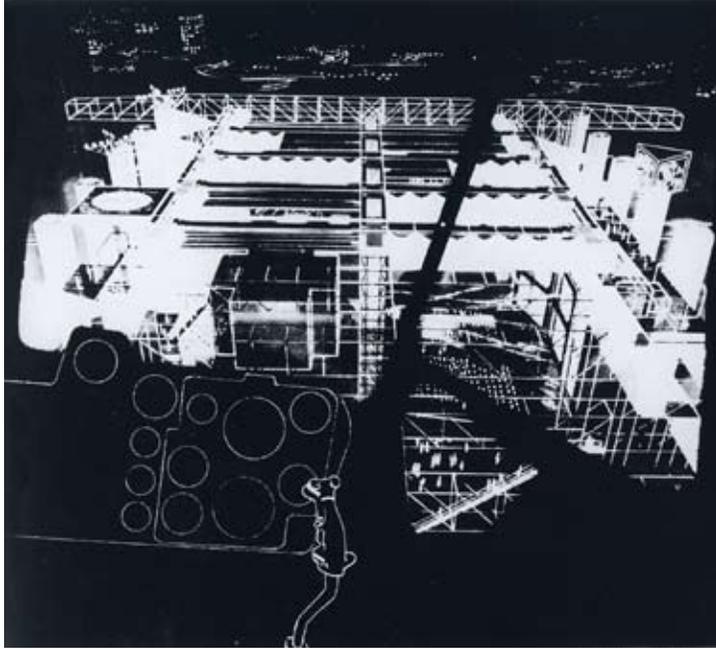
the pure geometries of stable tribal structures. There is a massive, almost “chthonian” core to the thing. You would have no hesitation of having a bonfire or playing as hard as you can in this space.

OK How do you think Halprin’s architecture differs from Price’s in the way it responds to its inhabitants?

PB They seem fundamentally different. Halprin’s stage speaks of almost eternal duration, the lasting quality of geology, rendering any event that happens around it ephemeral. While a huge crowd can gather in the space, it always breaks and folds—the fissures and ridges carved in the topography tend to imprint a heterogeneous, unruly form on the whole. And he then leaves it quite empty. The open space is al-



Lawrence Halprin, *Lovejoy Cascade*, 1966 (Courtesy of Lawrence Halprin)

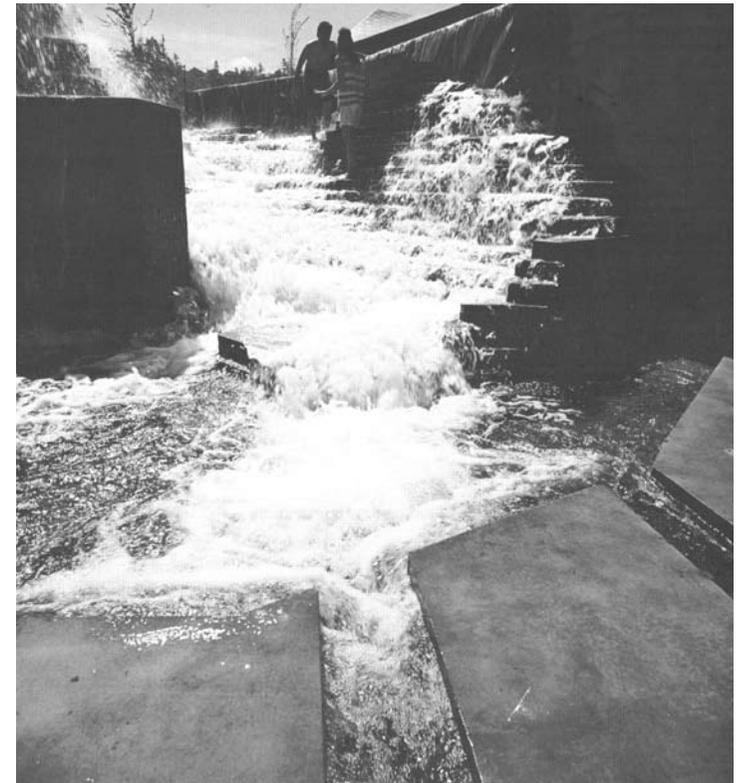


Cedric Price, *Arriving by helicopter at the Fun Palace*, ca. 1964 (Fonds Cedric Price Collection Centre Canadien d'Architecture/Canadian Centre for Architecture, Montréal)

most literally pregnant with possibilities. Time has, I think, been quite kind to this conception. By conceiving of an effective, rugged frame, the space is free to support innumerable generations of action. In contrast, Price and Littlewood seem to be orchestrating action itself, with scant concern for a permanent stage. Their building acts dynamically, acquiring a kind of “peer” relationship with the social action, acting alongside its human occupants and hopefully keeping pace with the shifting scene. The focus of the design seems to have shifted to political action, where the physical scaffold is strictly temporary; a dissolving prop that will give way as soon as enough crowd-energy gathers to hold its own form. As an analogue for cybernetics, I think the light-weight scaffolding and ephemeral physical framing of the Fun Palace works beautifully. On the other hand, I hesitate when I think of the popular success of the cybernetic analogy. Shopping centers around the world have effectively adopted open, ephemeral frameworks. In that light, the aura of the preceding Price/Littlewood scaffold seems rather fragile and vulnerable. I reveal my bias here: I think mortality inevitably rears its head when we speak of dynamic, performance-based architecture. I am drawn to Halprin’s strategy.

OK Perhaps this is a shortcoming of the Palace—it is easily co-opted. But I would argue that this open quality is important to our discussion. I reveal my own bias here. Halprin’s fountain alludes to natural forms and processes to engage the inhabitant; there is something familiar in these forms, maybe even primordial. Perhaps that is the resistance that you find compelling. On the other hand, in Price’s case the Palace’s constructive aesthetic is awry, the weird neighbor that pulls you out of your familiar world to remind you that the “Other” exists. It is this aspect that I find compelling. Friction is effective for creating public debate and discussion.

PB So we have discussed two provocative approaches for creating responsive architecture. Halprin’s passive counterform uses very different technologies than Price’s focus on tools and process. However, the projects are devoted to the same open participatory purpose.



Lawrence Halprin, *Lovejoy Cascade*, 1966 (Courtesy of Lawrence Halprin)

OK The participatory purpose that you speak about stems from a desire to develop a greater mutual relationship between people and their environments. For both Price and Halprin architecture is a means to develop this engagement rather than separation, which is how we have traditionally understood architecture to perform; a boundary or controlled threshold separating the unruly outside from the domesticated inside. Are there some models that you have in mind as useful tropes for thinking about mutualism, or participatory purpose?

PB Let's take the model of a jungle or forest as a launch for the discussion. My own experience of the jungle has been quite polarized; a joyful encounter but also one of terror. Participation in that kind of system involves sweeping paths, chopping out and pushing things around, giving some modest pockets that offer personal control. However the pressure of the larger system prevails—there is no relief from violence. It is participation whose cost is palpable and present.

OK Yes, a survival cost. Perhaps what attracts you there is the potential for discovery. The wild offers that and its “precariousness” is a quality we yearn for in mutual relationships. However, the relationship with a wild animal is one of brief encounter where one is denied the projection of self so key to mutual relations.

PB If I hold out a walnut and a chipmunk comes and perches for a second before it flits off into the forest, you know that is a source of extraordinary satisfaction. It consents to my presence for a flash. So is that a different experience: Is it using me? Am I becoming its servant?

OK I would say that the wild is fundamentally indifferent to your desires and is simply being opportunistic. You infer from this exchange the emotional satisfaction of giving and connectedness. But it has none of those. The idea of nature being indifferent is horrifying to us. Either we must subjugate it or read into it some type of empathy. This is different from our relationship with pets with which we can develop mutual understanding.

PB Yes, you have to negotiate with them. They can reward you by obeying.

OK And what is the gratification of this negotiation?

PB A mixed picture. It would be tempting to say that a huge amount of my dog's behavior is a reflection back on me. It is a calculated response, finding what I like so that I will reward her. A sophisticated dance that through her body language reflects back my own patterns. But how extraordinarily satisfying that behavior is. When I have an “other” that is listening and saying yes, it gives an exquisite sense of companionship.

OK Yes, even though it is lopsided—with you the master and it the loyal servant—it provides tremendous satisfaction and benefits to both of you. In some instances, like walking an overanxious dog, the roles may seem to reverse but you are always the one holding the leash. There is a huge responsibility tied to sustaining an owner/pet relationship but the burden lies on you. How about a negotiated relationship that exists between equals, where there is mutual responsibility for maintaining it? Like the one we are having at the moment: a conversation? I have been very interested in the modalities of conversing and how they provide opportunities for learning and understanding to come about. More specifically I have been looking at Gordon Pask's formulation of it for human-machine interaction. What is provoking about Pask's conversation theory is that rather than understanding information as a thing to be passed between conversationalists, he sees it as an effect that results from conversing. So for example, in the conversation we are having right now, we affect each other mutually as we try to communicate and understand one another. Your responses are tempered not only by what you want to communicate but what you anticipate I can understand. And we jockey around in this way to develop mutual understanding. Between us information is not passed but mutually constructed. The gratification that comes out of this exchange is very different from that with the dog that listens and obeys. Isn't the understanding of the “other” less coerced and more nuanced through this?

PB Yes, but it comes with a cost. Let me seize the point of the mutual conversation as you described. Perhaps that could correspond to Piero della Francesca's *Flagellation of Christ*. If you could picture the image: a gridded stage-floor of tile work receding into the perspective; within a field of columns on the left a view of Christ being whipped.



Piero della Francesca, *Flagellation of Christ*, 1455-60

PB On the right there is a gathering of citizens in animated conversation. They stand firmly on the gridded floor, looking each other in the eye, one has his brow furled and another is gesturing thoughtfully. The nuance in their posture and exchange displays a sense of balance that exists between friends. Friends in this case that carry responsibility, agency, have authority for politics and money. If you look closely at that part of the painted theater, the mutual relationship of those conversing Florentines is utterly moving. What becomes troublesome for me in the gridded floor upon which they stand and the docile garden that stretches out after them and the walls that create their sanctuary. At what cost is the Florentine conversation occurring? I would identify the cost as being the vitality of nature and the forced relationship imposed on things outside the citizen's walled city. More debatable might be the nature of the stripped, inert floor within. But in any case, there is, to me, the troublesome sense that one is living on borrowed time, living at somebody's or something's expense.

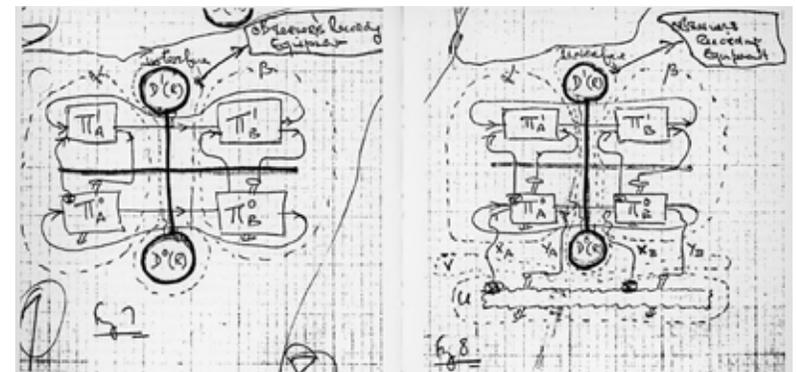
OK So your reservation with the conversation model stems from its potential closed nature and exclusivity. Your example suggests that since conversations only occur between equals they can lead to excluding difference. At the same time, it does bring up the limit of the

“conversation” metaphor in reference to our dialogue with non-human actors. Can we really “talk” with our architecture? Perhaps not. But I do think the constructionist nature of the conversation model is very compelling and provides an opportunity for developing more open interactive systems. Perhaps imagining conversations instead of information exchanges between inanimate things like architecture could be a more satisfying model for design.

PB So, along with conversation then I would turn to material that might foster rebalancing. And for that, with Pask and the proponents of second order cybernetics, I would like to raise Donald Winnicott and his concept of *transitional objects*. The idea of a transitional object is like that of the “lovey,” a diaper or best-loved toy that you hold when you are a baby, that lives with you and becomes a sodden stained mass that can't be washed and quite literally becomes part of an extended physiology. You are fused with it. My dog's stick that she carries around; my coffee cup...

OK My mobile phone?

PB And let's say personal devices and certainly clothing. The natural way to see these “threshold” objects is as a bridge towards the formation of the self-actualized person. They occur because I don't know myself. Humanist psychology devoted to achieving individual agency might say I mistakenly cling on to them, and that through nurturing and development I can learn who I am, can clean myself up, set



Drawings from the notebooks of Gordon Pask, included in *Soft Architecture Machines*, Nicholas Negroponte (The MIT Press, 1976)

boundaries and learn how to manipulate them as tools. And so the first reading of Winnicott might agree with that picture of self-actualization, as part of the ordained practice of acquiring integrity and autonomy.

However, a second reading could focus instead on intertwining identities, like when a baby is still part of the mother. One could see the transitional object as not just offering agency and bounded identity, but also a way of achieving mutual relationships. Couldn't that class of material be an effective bridge into mutual relationships as well as towards disarticulation: an opening of boundaries rather than a hardening of them?

OK I agree. A transitional object provides an in-between for self-actualization and mutualism. This seems to loosen the boundary of inclusion versus exclusion that I think you find problematic when we discussed conversation. The conversationalists in Pask's formulation don't give up their autonomy but Pask does recognize the conversation itself as a new hybrid, an intertwining that is separate from the individuals engaging in it. By making a conversation a thing as well as an exchange, I think he does something similar to the transitional object.

PB But it would be interesting to think about the extended physiology as a model that is rather different from the autonomous responsible exchanges that I am inferring from Pask. Because, in conversation, the kind of consciousness and realization that would occur is really of a higher-order thinking. You are "ascending," and you achieve in probably a moment of disinterest the kind of reflection where you can disengage yourself from the hurly burly of the scene. You reflect, and realize that here you are, and I respect you, and see what you mean. By setting aside one's agenda, one ascends to "higher" realization.

Thinking about an extended physiology, a first approach would be for extending power. That is a way to see the expansion of domain: our house as an extension of our body, the termite mound as an expanded physiology, or the tools that I surround myself with, memory aids and cognitive mechanisms or myriad of artificial processes that extend my reach. But in addition to this, a renewed relationship can develop that moves beyond of the agenda of expansion of one's power. Teilhard de Chardin, the geologist theologian talks about an expanded physiology in the concept of the noosphere. He speaks of a tangible, expanded

organism that could emerge from the interlinking of all of our inactive communication. And he wasn't very interested in power. He was interested in collective sympathy and collective responsibility. He imagined the ability to move outside self-oriented personal agendas into a collective sense of relations and responsibilities. Let's say we think of the expanded physiology in that way: a rethinking of the termite mound relative to the termite, clothes relative to the naked body, and the house relative to its inhabitant. Instead of these as a feathering of one's nest or a gorging of consumption, they can also be seen as constructing deeply entangled relationships with the world.

And maybe it turns back one more step, calling into question the model of the individual conscious citizen. By interrogating what one's experience is in practical terms, I hope to redeem the Paskian model: to what degree are we still pack animals? How much of this experience is individual and how much does it need to be individual in order to be viable and satisfying? If we insist on autonomy and individual agency as a condition for meaningful relationships, then are we going to see a football game, or a sing-along or election antics as grotesque? I wrestle with the question of common experience and shared origins, and on the other hand of individual agency as a qualifier for meaning. After all, communication involves cadence, repetition, and redundancy. I would hesitate to stand up and declare myself a pack animal before an individual. But I'd be hard pressed to say that isn't true as far as my behavior or the way in which my cognition works. This is a question of public identities.

OK Yes, but you are raising a dichotomy between the collective and the individual as if they are separate. I doubt the idea of creating a structure of the public or of the shared necessarily requires this separation. There are many bottom-up self-organizing structures, like the termite mound you mention, that don't make such distinctions—where individual behaviors fundamentally construct the collective. Communality need not come at the expense of individuality.

OK We have discussed different kinds of interaction between people and environments that offer mutual relations. Can we discuss ways in which architecture can bring this about?

PB Perhaps we could look at theater architecture to support the question. When we spoke earlier of Price and Halprin's projects, different kinds of performance activated their works. In a theater, architectural instruments devoted to shifts of perception seem explicit. We could look at the proscenium?

OK Let's say the proscenium separates audience from performer, providing a device through which the performers can deliver to the audience ideas and feelings. And perhaps because of this separation the audience can see the performers reflecting themselves, wherein the proscenium performs the task of a mirror. In this way a traditional proscenium formalizes and indexes a fixed performer/audience relationship. Laura Garófalo and I got involved with a group of performance and video artists in New York City in the late nineties, and we were confronted with the problem of rethinking the interface between audience and performers. In our work, the architecture abandoned the proscenium and instead became an instrument to explore open relationships between performers and audience. The artists we worked with were doing real-time mixing of captured and canned videos and asked us to create stage sets within which they would perform. The sets were located in galleries, lofts and lobbies where the audience was free to sit or move. We quickly learned that the set had to respond to different audience/performer relationships and that the static frame of the proscenium couldn't possibly handle those functions. All kinds of problems come from an itinerant audience; people getting in the way of the projection, noise from moving bodies and episodic engagements with the work. We wanted the set to give cues to the audience that provided multiple ways to engage the work. We tried to rethink the set as an instrument that could fold intrusions from informal audiences into the performance.

PB You've characterized a theatrical environment as an "interface," and a set as an "instrument." It seems like a large jump from proscenium to interface. Yes, the proscenium opens in the past hundred years—but in practical terms how do you maintain focus when that boundary is lost? I'll offer an example that might move toward the kind

of interface I think you are implying. It comes from the Performance Garage, which sought full-blooded involvement within street theater. Thirty years ago I was workshoping with the Wooster Group in Manhattan. The troupe had already established its canonical qualities: the extension of theatrical space out into the street, through their famous garage door that replaced the proscenium, and a visceral, immersive sense of the immediate present, borne from their prior lives in the "Living Theater." Your description encourages me to remember the function of that environment where objects populated our collective space: towels, sticks, a pair of chairs, swarmed over and handled as extensions to our bodies. The walls and floors too: I remember sustained contact, imprints of the floor boards, the rolling textures of wainscot and baseboards pressed in as we pushed along edges of the space. From familiar "head tone" and chest-based speech projection, we practiced extending sound into floor, wall and ceiling cavities, treating them as extended physiology; active, tangible resonators. The projections wound high in energy through intense repetition and focus. We tried to capture multiple octaves of projection and diffusion, a kind of practical alchemy where material qualities became a continuum. Effectively the frame of the preceding architecture was replaced by continuous, entangled immersion.

But the question of focus lingers in that. I recall arguments about whether we were lapsing into purely random tangles. We tried to handle it through our own perceptions, developing collective sensitivity. I remember using the word "resonance" in some conversations which seemed to offer a substantial, practical strategy for composing, at least as it applied to bodily limits. I would say, however, that still begged the question of the environment. Arguably, the environment hardly mattered, only our willingness to embrace whatever was there.

OK Your current installation work carries the same emphasis on suspension and bodily expansion but now you are developing resonances directly in an environment. I am thinking of Hylozoic Soil which presents a rather ominous geotextile. There is something precarious about the fields you have made; they are captivating and involved—ironically so, because they draw you in at your own peril. Could you talk about that work as an interface for "mutual" relationships?

PB I'll describe the system in general. Hylozoic Soil is a series of installations using evolving details of a specialized interactive



Beesley, *Hylozoic Soil*, 2007

“geotextile” mesh. Work in this series has the common behavior of “breathing” around its occupants. The relationship is, on the surface, gentle. Proximity sensors detect movement, and respond with caressing and swallowing motions. Hundreds of mechanisms—frond-like “breathing” pores, curling tongues, and groves of twitching whiskers are organized in spiralling rows that curl in and around the mesh surfaces. The whiskers stir the air in thickened areas of the matrix, propelling humidified air and stray organic material over fields of glands and traps.

Thousands of primitive glands are clustered through the system, located at the base of each breathing pore and in suspended colonies of whiskers and trapping burrs. Latex bladders containing digestive liquids including brine, soy and synthetic sources are fitted with varying hypodermic and acupuncture needles for injecting and transferring materials within the system. Other glands are filled with salt, serving a “hygroscopic” function that pulls fluids out of the surrounding environment.

OK For me, *Hylozoic Soil* demonstrates a mutual environment that is at once indifferent like the jungle but also capable of registering collective resonance. It provides cues on how I can approach and engage it. The audience interfaces with the proximity sensors and kinetic parts while the architecture responds by sending vibrations throughout the whole structure. My individual interactions change the resonance of the larger collective surface. The physiological extension I caused is made palpable to others.

PB The physical elements use materials stretched near to the point of individual collapse, giving a quivering, vulnerable physical presence. Designing the components so that they operate quite near the point of collapse seems to be quite an effective strategy for this work. I like to think of these material exchanges as being the first stages of metabolic interactions where living functions might take root within the matrix. The interface provides amenity, but at a cost. The system extracts benefit for its own purposes and offers degrees of comfort back to you. Is there any common ground with your recent work in urethane meshwork?

OK The Open Columns environment that we have made using urethane elastomers presents a different set of objectives than *Hylozoic Soil*. For one thing it is explicitly purposeful; it has the task

of reorganizing people in space. In this utilitarian process its ulterior motive is to make inhabitants aware of their surroundings while at the same time achieving different forms of crowding in the space. The core consists of a system of nonstructural columns made from urethane composites. They operate by moving slowly to pattern the space below them through gradations of enclosure; in plan through their full deployment and in section through their partial unfurling or a combination of the two. In simple operation, the columns can be programmed to deploy themselves in prescribed configurations. This can be effective for re-proportioning a large space into smaller spaces or reorganizing the circulation of people through it. But the more complex program that they function on currently ties them to real time sensing so that they can respond in nuanced ways to inhabitants' perturbations in space. These have to do with breathing. In a reasonably enclosed space, carbon dioxide in the air can radically change with the inclusion of people. Working from a simple set of rules, the columns respond to data from carbon dioxide (CO₂) sensors. Columns are programmed to come down when CO₂ levels are going up resulting in people dispersing into smaller groups. If the levels are going down the columns respond by going up, effectively inviting people into the space. If however the value stays static the columns cycle through a random set of configurations until the CO₂ either goes up or down. These configurations are put into the system's memory and tested the next time a static CO₂ situation arises. If the stored configuration does not yield the necessary outcome, CO₂ going up or down, then it is lowered in rank and purged if on subsequent uses it does not perform. In this way the columns, over time, learn about their space based on their own actions within it. Their process of learning is unending because what worked the day before may not work the next day or on any subsequent day. This is clearly not an optimized machine learning method but that is purposely the point. By having little memory of past experiences the columns do not atrophy into predictive configurations. Using your term, they "resonate" the space by maintaining variety which in turn provides more possibilities of interaction between inhabitants. Perhaps inevitably, we are speaking of an artificial ecology.

PB But this also brings a certain fragility to architectural systems. Let me raise another example of recent work, to help capture that as a design quality. Endothelium is a field installation installed this past year at UCLA housing arrays of organic batteries housed within



Omar Khan, *Open Columns*, 2007



Philip Beesley, *Endothelium*, 2008

a lattice that might reinforce new growth. The sculpture works as an “earth surface machine” that burrows slowly into the ground and sends out extremely light space-filling material as a growth-supporting matrix. The system employs a dense series of very thin whiskers and vibrating burrowing leg mechanisms, and supports low-power miniature lights, pulsing and shifting in slight increments. Within this distributed matrix, microbial growth is fostered by enriched seed-patches housed within nest-like forms sheltered beneath main lattice units. The life of this hybrid organic system erodes during the exhibition.

OK The erosion is interesting because it reminds me of Price’s expiration date on the Palace. But it is different of course—the imposed date of 10 years is here replaced by ecological degradation. We could erode and disappear.

PB Speaking of weakness, when Ignasi de Sola-Morales spoke of “weak” architecture he evoked a stance of architecture hovering at the edge, deliberately holding back from trying to capture and anchor a situation. Instead, he invoked ornamental systems, and suggested that the ability to resonate and amplify situations was ultimately far more potent than strategies of control.

OK Yes, and he was speaking fundamentally of a kind of resistance in the face of overwhelming power. Rather than architecture acting as a cultural center, that vision suggested a withdrawal to a position of faint edges.

PB My hope is that the Endothelium construction extends some of de Sola-Morales’ ideas, by investing kinetic and “intelligent” interactive systems with vulnerability. In the field construction, repeating clusters of bladders stand within the field of tripods. The cell wiring is arranged in series, feeding into miniature electronic circuits that gather the weak currents and emit pulses of power when sufficient strength accumulates. Three main component types including main filter-packs, supporting whisker-anchor units, and bladder cells are arranged in a tripod field with clusters of specialized units making a repeating hexagonal array. Weak electrical charges are generated by copper and aluminum electrodes immersed in vinegar within latex bladders. The continuous support-skeleton is composed of minimal-mass bamboo compression struts arranged as a primitive space-truss, tied in

digitally fabricated triangular joints and stabilized by a web of thread and cable tension members.

OK I think that fragility provides a strategy for allowing an architectural structure to embrace multiple openings in the fact of its own demise. Because of fragility, the openings are inherently part of the system and they can be accessed and manipulated. Empathy arises, but also participation because not only is this architecture a body, but it is a body we can manipulate. A couple of terms—resonance as a value; interface as a function—prevail. Let’s call those key strategies for these performing instruments.

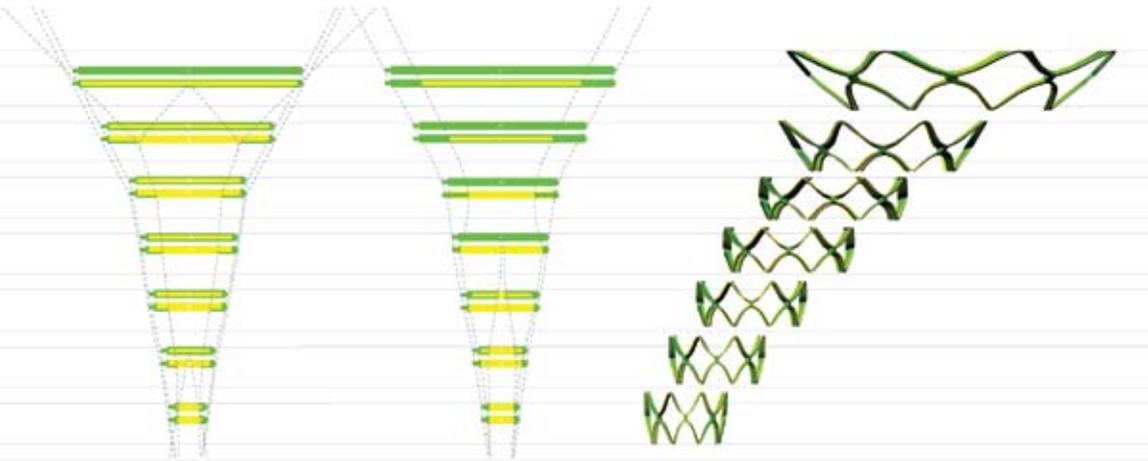
OK We’ve mentioned some key terms in the last projects: resistance and friction, such as we might see in Halprin’s foundations, and an involving, generative scaffold, like the underlying structure of Price’s Fun Palace. It’s clear that geometry plays a fundamental role in the series of projects we’ve just described. Let’s talk more about how they are organized. I think we could speak on one hand about geometry as means to control material behavior. This addresses techniques of shaping and structuring the architecture such that its mutable material assemblies can perform. On the other hand, geometry also provides a formal strategy for organizing how people interact with the object. In your work, geometry has not only been about the material behaviors but also iconography. Clearly the imagery of natural systems is just as important as the actual workings of your material assemblies?

PB For me the geometric series that can be found through twists and buckles and turbulence and exponential shifts suggests an instinctual body language that is full of empathetic exchanges. Why does it mean so much when something buckles? Why do we become concerned when we see that thing stretched? It is tempting to see an operation of empathy in such geometries which to my mind inevitably promotes engagement and interest from observers

OK How do you contrast that with the grid, which is such a pervasive organizational geometry in architecture?

PB Let’s acknowledge the ambivalence about it: we can say the grid of an American city is an inclusive thing, and we can also say it divides. The block structure allows you to build freely within your bounded quarter, regardless of what your neighbor does. But that kind of freedom also renders relationships mute. The grid offers freedom by disjunction. In contrast, it is tempting to look at prime numbers that don’t repeat so readily, and aperiodic geometric systems that allow drift. Or space-filling systems that allow for thickening and working accretively, moving beyond simple multiples. When I think of your flexing columns as a resilient system I wonder whether you have handled a similar question by using a different strategy. You’ve used radiant geometries but you have rendered them in flexible materials. They don’t seem dominated by the ordering system.

OK Rubber is unruly. With the Open Columns project, we had to set tight geometrical constraints purposely in the design because



Khan, *Open Columns*' parts indicating different Shore hardnesses, 2007

we knew that the material's elasticity would naturally undermine it. If you break the columns into their parts, you can see that they are made of very simple self similar parts. These are fabricated from a single reconfigurable mold using two different Shore hardnesses of rubber. In spite of all these strict geometric controls, the parts exhibit wonderful cadences of twisting and stretching. But by connecting the parts at multiple nodes, the twisting can become controlled and elegant.

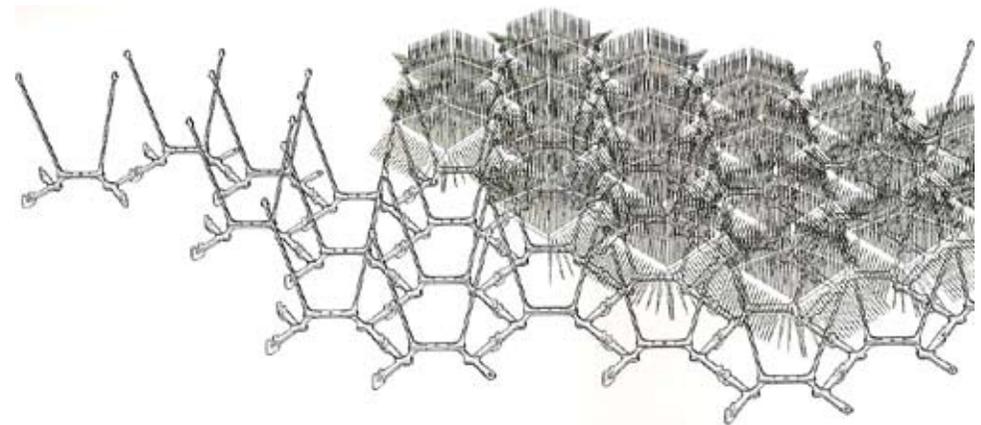
PB Perhaps another strategy for achieving variety and control would be developing an economy of junctions. If you join everything all at once, you get slightly monstrous joints. Fuller's geodesic system was prone to that—the struts were fine, but the geodesic joint was clumsy. If a twelve-way joint achieves a polyhedron, six two-way joints for the figure might be more effective. The “elegance” of unified, converging multiples can be deceiving.

OK Combining simple multiples can also be an effective strategy for material and spatial responsiveness. A strategy that has become useful for me is thinking of geometry not as an ordering system but a program to grow an assembly. I teach a course called Relational Geometries based on this premise. In it we take precedents from nature, like plants and their ability to create self similarity at different scales as well as develop aperiodic growth patterns. These patterns guide the way plants respond to light, air, and water in their environments. Such an approach to geometry allows us to imagine how we can make our synthetic materials more sensi-

tive to the contingencies of their context. I like the term accretion to describe this type of geometry. Accretion doesn't develop from a given formula but from the compounded effects of environmental forces on a material.

PB Accretion is a difficult term, because it could speak to mere accumulation, a silent mechanism functionally no different than the platonic grid. But if embedded in each transaction which accretes is some kind of existential consequence, a hunger or attraction, something potent can emerge. If there are exchanges or losses, waves and cycles of turbulence tend to make different kinds of cadence emerge. In contrast to a silent display of already resolved order, that kind of accretion is bound up with emotion and consequence. It is tempting to say that the same relationships that make satisfying materiality, like the resilient, shifting and variable densities of “Shore hardness” that go in your urethane constructions for example, do so by giving a body language that signals emotion in the way we relate.

OK The instincts of composition that guide my work are ambivalent. There is one side which sees a buckle or a collapse as something diseased. And characteristically we want to clean it up into a pure Platonic figure. But if one adopts the stance of a hunter-gatherer, the same qualities that imply failure might be life-giving. In my work there is an effective paranoia that is used in judging these kinds of geometries that are transitional, shifting, and accumulating. Instead of seeking smooth gradients, turbulence and friction speak volumes about catalytic potential. They carry their own history. Are we speaking of ornament?



Beesley, *Orpheus Filter*, 2007

PB If it is an ornamental series then it is a charged kind of ornament, with its own sense of consequence and sympathy. By working with this practice we're approaching a coherent language embedded quite precisely with feeling. The "Other" can start to push back and start to act in exchanges with our own cycles. Now that kind of language can speak of a new romanticism, in the best sense of that tradition. We are projecting presence of the other. In practical terms, we might capture this by speaking of resonance.

OK A foundation can be resonant if it is tuned to support action. An active, kinetic construction can be resonant if it is sensitive to its environment.

PB That term seems to release us from the figure-ground oppositions where the ground is exclusively passive and figures are predictably active. You spoke of Halprin's foundations and Price's scaffolds. Do they work that way? We seem to be pointing toward an involving, generative scaffold, an underlying structure.

OK So we've evoked some models for creating mutual relations and considered architectural approaches for conditioning and facilitating individual and collective experience. We have also discussed geometric and material strategies for making architecture more responsive to its inhabitants and its environment. What I'd like to suggest is that we expand on our precedents for responsive architecture. We have already discussed Price and Halprin at some length but can we build on that?

PB I'm tempted to turn to Fernandez-Galiano's wonderful *Fire and Memory* for a lineage. In that book, the author is proposing a reading of architecture distinct from the humanist or Vitruvian paradigm of permanent "counterforms." He offers the hearth, and active mechanisms, as basic to architecture. In an ambitious and compelling reading, he points to "vitalist" strains within ancient thought that reveal remarkably different dimensions seemingly excluded by Platonic and Vitruvian approaches to building. This would invite looking at the elaborate mechanized ceiling from the dining room at Nero's Domus Aurea, and perhaps the elaborate narratives implied in Tiberius's grotto constructions at Sperlonga, and seeing them as precedents alongside heroic industrial-revolution works. If we follow that interpretation, the rotating ceiling in the Domus Aurea offers much more than just enrichment of a decorated space. The movement acts out a cosmology, eternal dynamic life. This is a far cry from a reductive "mechanism."

OK I am reminded of Reyner Banham's *Architecture of the Well-tempered Environment* that also cites the campfire in reference to an alternate tradition of architecture. He discusses it relative to nomadic cultures and their attitude towards the architectural boundary which is "vague, adjustable according to functional need and rarely regular." The campfire is seen as a permeable boundary around which people can organize in adaptable ways. The heat and light form concentric gradients that people negotiate depending on their needs. It would be important to include it and the architecture of nomadic cultures as precedents. Within these I am imagining a whole host of collapsible structures like tents and their progeny as well as cyclical inhabitations like igloos. These offer compelling examples of adaptable and temporal architecture. Another trajectory that can also be extracted from Banham is the purely utilitarian architecture devoted to controlling flows of energy. This includes mechanisms like elevators, chimneys, flues, plumbing and construction machines.

PB Catherine Beecher and Harriet Beecher Stowe's 1869 *The American Woman's Home* offers another example of pure utility. But the laundry chute and modern plumbing in that dream-house didn't just offer to save labor; it also offered freedom, carrying all of the liberation and subversion of the suffrage movement.

OK Yes that is very important to recognize how pure utility is not void of provocations for social action and change. Banham's book elucidates the imagination and novelty that has resulted from the utilitarian task of controlling energy within architecture. The rub is that "well-temperedness" as an outcome is an elusive quality that can't be achieved through purely technical means. It is performed and negotiated between inhabitants and their architecture. This is where I think information technologies provide a way into the problem but only if we understand them as a means for addressing and not solving the problem.



PB When I think about a humanist such as Buckminster Fuller, I think of his extraordinary confidence and optimism in controlling the world for the good of humanity. I want to pause before I call him an arrogant son-of-a-bitch. And yet it does seem essential to go beyond that confidence, facing some fundamental questions of who is included and what is excluded. What belongs, and what does that system engender?

OK Fuller's confidence is interesting because on one level he is willing to address the big problems and pose solutions on a big scale. His project is clearly humane but in order to deal with the magnitude and complexity of the task it must control all the parameters. The assumption here is that if I could have all the information then I can act wisely and humanely on it.

PB Yes, that is Fuller's Geoscope project. You sit at the center, rows of buttons and switches stretch out before you, surrounded by layers and layers of information, organized and rendered in immersive displays that surround you—the perfect panopticon.

OK But isn't that an incredibly disturbing image of somebody at the center of all this disembodied information . . . making decisions.

PB Well if you have a wise and ethical leader, supported by deep information sets and with dynamic nested simulations, then it is a pretty effective model. I don't think that we can escape a deep ambivalence about this. Is the agenda of the Enlightenment safely past? We could argue that in time of unspeakable risk, like what is happening in the environment, that kind of transcendental order seems necessary. It might well be irresponsible not to seek the highest possible levels of unified, coordinated power today. In our past generation, I think we had the luxury of assuming that our institutions were well established, and that permitted us to concentrate on unmasking power. That confidence—the confidence of unbridled critique—seems unjustified today.

OK So perhaps we can fold Fuller and the legacy of cybernetics into our precedents. I think with the demise of unbridled critique there is greater comfort with mechanisms—especially those that offer a means to address the growing uncertainty around climate, security, and globalization. There is a resurgent interest in cybernetics, partly as a historical project but also as a cogent theory of mechanisms, whose scope included the mechanical, biological, and ecological. Cybernetics did a convincing job of linking mechanization to biological and cognitive processes but made the error of arguing that messy things like emotions and behaviors could be reduced to simple information feedback systems. N. Katherine Hayles has made a convincing critique of this legacy in *How We became Post-Human: Virtual Bodies in Cybernetics, Literature and Informatics*. In addition to Fuller's Geoscope we can

add Stafford Beer's 1970–73 *Cybersyn* project that provided a cybernetic system for a controlled economy in Allende's Chile or Jay Forrester's ongoing Systems Dynamics. And so while mechanisms are not the bogeymen, they must be approached with caution especially when they devolve into totalizing visions.

PB Another tangent of this conversation seems to be moving towards a full-blooded behaviorism. Instead of being horrified at the specter of humans as mechanisms to be engineered, a generation seems prepared to engineer behavior anew. Perhaps we've tweaked the model by relaxing about individual agency and seeing collective construction and expanded physiologies operate. Perhaps an ethical model of viability has emerged that relieves this picture, a sense of being interconnected in an inclusive way. Might it be possible to open the door again to the construction of feelings? This past generation abhorred the manipulation of emotions in BF Skinner's notorious boxes, however misunderstood those were. The Skinner box was a construction for rats,¹ but the popular perception was that it was for his daughter and that he considered all of us as mechanisms.² Skinner seemed to offer to make us happy by feeding us the right ingredients. Is it possible to approach that vision again, extending it to construct empathy as well?

OK I am tempted then to include in our precedents medical and entertainment instruments that deal with manipulations of psychology and physiology. This would include perception instruments, biometric data collecting instruments, and a host of spaces within which perception and physiology is altered, like anechoic and reverberation chambers, hyperbaric and other pressure chambers, camera obscuras, Turkish baths and Finnish saunas. These mechanisms act directly on the human body and psyche and they provide insight into ways in which architecture can expand the way it interfaces with the human body.

PB Through instruments that reflect or cause resonance in our senses.

OK And which demonstrate that perception and emotions can be manipulated. For too long architecture has made the ocular the

exclusive interface. Not only do the other senses need to be reconsidered but also perceptions that are extrasensory—like of Hertzian spaces or massive information flows. And so I wonder about the kinds of responsive architectures that we will build, whether it makes any difference if they have empathy programmed into them or they are indifferent. Like the jungle or wild that we mentioned previously.

PB When I see Bellini's *St. Francis in Ecstasy*, which has him standing on the cliff surveying this great plain then the symphony of the world speaks back to him. It receives him. It has a tangible life-pulsing presence, and it would be an obscene distortion to say that this is a packaging of manipulations and mechanisms. But I have to agree, in spite of that beautiful scene, that there is a projection running throughout that picture. It would be very tempting to say that there would be a volatile threshold between the wild and the domestic. The act of rendering domestic without flattening into slavery is the kind of mutualism that we seek. We recognize that we want the chipmunk to remain free but we want to make it our friend. I think there is an impulse to construct artificial mechanisms, like things, with that kind of quality of response to the built world and us. It raises the idea that we cannot truly tell the difference between observation and projection. To St. Francis, things have presence and speak back. To Skinner, thoughts are practical projections imposed on the world. This speaks to a boundary of our neurology. A limit. Perhaps embedding certain empathetic mechanisms is viable and absolutely effective. Hideous qualities of the thought aside, it may be practical. Take away the terror of hallucination and the illness of paranoia and just look at the neurological limit of projection and exchange. We have a relationship with things emerging which is artificial and satisfying.

¹ Image link, Skinner Box: <http://www.life.com/image/53366540>

² Image link: Skinner's Baby Tender: <http://www.life.com/image/50695702>

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September 2009

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Philip Beesley and Omar Khan

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