Dimensions is the annual, student-produced journal of architecture at the A. Alfred Taubman College of Architecture and Urban Planning that seeks to contribute to the critical discourse of architectural education by documenting the most compelling work produced by its students, fellows, and visiting lecturers.

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Typeset in Akzidenz-Grotesque, the original sans serif since 1898.
Haematin... I am your father.

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This Time is Out of Joint

Computation, Politics and Participation

G. Britt Eversole

Fellowships in Architecture

Walter B. Sanders Fellow /
“Permutational art is inscribed in filigree on the technological era.”

“Indeed, from our point of view, only the personal and collective generation of form, including not only houses, cities, and surroundings, but also political choice and collective aims, in a perennial dynamic equilibrium with the ecological and ecosocial situation, represents true and complete self-consciousness; it is the indispensable premise for self-realization. . . We are fully aware that without the aid of cybernetic, logical and mathematical tools it is inconceivable that man might overcome present-day ecological and ecosocial complexities. Nevertheless, our first preoccupation concerns the ethical and political use of such tools.”
As streets burned and students occupied buildings, one of the critical projects of the 1960s reconsidered architectural pedagogy to address technological progress, crises of traditional knowledge forms, political radicalism, perceived social irrelevance of the discipline, and the State’s growing authoritarianism over education. It was an international phenomenon with revolutions and counterrevolutions, but a particular set of conducted experiments merit attention for the use of concepts and young technologies that today are our daily bread.

Even if primarily conceptual, the complex geometries, calculus-based mathematics, and kinetic assemblies circumscribing our age were already laced throughout discourse fifty years ago in Italy with a politico-philosophical frame. Designers questioned how one might encourage political autonomy and subjective emancipation by challenging the role of architecture and planning in granting concrete form to institutional and economic authorities; or, in that era’s parlance, planning for power. To threaten the capitalist instrumentalizing of form, whether symbolic or empty, architects sought to empower the citizenry through constructive processes using tactics of participation, play, and self-management, autogestione, realized and expressed through computation, permutational art, povera technique, and self-organizing systems.

Among the most interesting persons working in this vein were Turinese architects Leonardo Mosso and Laura Mosso Castagno. Their research in the Centro Studi di Cibernetica Ambientale ed Architettura Programmata at the Politecnico di Torino suggested a comprehensive reconsideration of the didactics of planning and design. Mosso and Castagno envisioned a new “ecosocial” model, filtered through the semiotic, anthropological, and ecological literature of the day, encouraging direct popular participation mediated by interactive technology in the management and production of spatial organization. Pursuing an approach to planning no longer based in power, they sought to create relations and potentialities, producing new common languages encouraging the collective alleviation of alienation through the self-management of form. Their research was published in five languages yet gained little traction in Italy as 1970s’ politics declined into terrorism and culture turned to fads. The historical significance of their work derives from its status as an early attempt to integrate indeterminacy and participation toward an agonistic architecture.

In pursuit of a material corollary to their political writings, Mosso revisited the archetypal project of the universal joint reconsidered with a twist. He imagined a “virtual joint” with its center of rotation as a void rather than matter. Fields and frameworks of dynamic joints yielded systems of potential form in a state of constant unfolding. His “proto-utopian” experiment foregrounds negotiation, conflict, and choice, not only regarding the transformation of form itself, but the initial choice to be politically engaged from the outset. The choice of the citizenry to participate was primary, one that can be offered, but not mandated by architecture.

Mosso and Castagno’s chiefly pedagogical project was premised on the disjunctedness between the practice and teaching of architecture and popular needs and problems during an intolerable present. New methods of research were required that would preclude the objectification of power relations in the built environment and avoid producing another generation of dispassionate students. Between the “destruction of the object” and the popular transformation of new tectonic languages, their project sought a political and linguistic re-origination of architecture beyond the designer’s role in perpetuating the power of the few over many.
Marxist theory was completely restructured during the 1960s because it was ill-equipped to address scientific advances that altered the communication of information, increased affective labor, and created new workers, such as the technician. New models incorporated consumer culture, new sociological analytic methods, the crisis of the European in divorcing himself from Soviet totalitarianism, and the failure of revolution due to reforms to capitalism during height of modernist culture. However, other left and militant movements emerged outside party apparatuses and intellectual canon. Anarchists, extra-parliamentary activists, and student organizers sought other approaches to freedom less burdened by theoretical anxieties and more open to visionary action using the tools of technological culture.

The phrase *la sfida elettronica*, the electronic challenge, encapsulates the technological concerns of Italian artists and architects. Aware of British and American computation and cybernetic research, the new specter sweeping across the continent was the promise and peril of technological integration in the arts and planning. As Giuseppe Ciribini noted, late 1960s designers were forced to address a general reversal in emphasis from quantitative calculation to the flux or flow of information, along with the popular diffusion of computation and information decentralization. Integrating design and the computer suggested three areas of architectural research: the technology of human-machine relations and its ergonomic implications; programming technology (software), device, memory compatibility, and
inter-connectivity. Form and environment were understood through interaction, programming, and information exchange.

Design challenges were not only technological; rapid urban expansion and population increases during the 1950s threatened old city centers and accelerated the almost total human alteration of the landscape, rendering ineffective classic planning techniques. Even as the distinction became increasingly blurred under Carlo Aymonino’s rubric *La città territorio*, designers were encouraged to redefine their role as managing the city’s inherent dynamism and disequilibria between the city and territory. Calling for rigorous study of the potential for politically interrelating technology and planning to foreground dynamism rather than suppress it, Aymonino endorsed popular participation in planning the public sphere.

Philosophers, such as Umberto Eco, began studying new forms of logic, the implications of universal language, and the possibility of endless permutations that render every means of expression a logarithmic combinatorics. While writers such as Nanni Balestrini were generating algorithmic poetry, artists—who Eco called the “Bit Generation”—were producing mechanized, modulated, and “programmed” environments. From the Milanese Gruppo T to Gruppo N in Padova, ZERO in Germany and the Parisian G.R.A.V. (Groupe de recherche d’art visuelle), to the interdisciplinary group surrounding the Turinese Studio di informazione estetica (of which Mosso was a founding member), European artists tapped new media to experiment with visual communication through dynamic stimuli. Programmed art and kinetic art combined technological mediation and inter-activity with moving components and malleable materials articulated as machines of chance and immersive environments. Randomness, seriality, and interaction replaced the figural, “expressing reality in terms of its becoming.” Far from mere visual stimuli without signification, these environmental works drew on communications theory and semiotics to produce highly legible yet indeterminate and open-ended works—a “new objectivity”—that deferred semantic concerns and the artist’s subjective intuition.

Many architects were satisfied with the compositional potential of indeterminacy and seriality, but Mosso saw pedagogical possibility in the intersection of linguistics and computation. The planner, the architect, and their students were the form-givers to power hierarchies; as Vittorio Gregotti and Reyner Banham note, the rethinking of architecture and the city had to occur in universities, not in firms or governmental chambers. Recognizing the paradox of criticizing while critically instrumentalizing the very technologies that contributed to power inequities, Mosso and Castagno argued that tools of calculation and programming were already tools of exploitation; thus, the problem became not how to subvert them but how to harness them toward producing non-alienating, non-hierarchical environments. The times required new technological and formal models, and new forms of representation for teaching design and planning. Mosso and Castagno turned instead to an interactive model of *con ricerca* with students, rejecting the ironic and critical images, street theatrics, technological neo-primitivism, and aesthetic fetishes of the Florentine radicals, Mosso and Castagno turned instead to an interactive model with students of *con ricerca*, “through research.”

Mosso, “Self programming and elaborating universal three-dimensional serial structure with movable connections”
THREE JOINTS : THREE IDEAS

In theorizing a “programmed architecture,” Leonardo Mosso often refers to structures and systems, but his work always starts with the joint. The joint is the essential moment of translation within a structure; in linguistic terms, the connection, not the component, is the basis for the constitution of syntax. The joint is the beginning and the registration of any systemic transformation—it is both the moment where multiple components interact as well as the constantly shifting point of relation in an evolving system or topological deformation. However, the singular joint is significant only in relation to all others in the system, especially when structure is conceived as transformational rather than fixed.

Reading Jean Piaget’s Structuralism, Mosso found not only the linguistic basis for his ideas, but also a broad method for postulating the role of architecture as a mechanism of political transition:

“. . . [The] design of the future as structure (in the sense given to us by Piaget as a ‘system of transformation and possibility’) has as an essential condition that everyone designs and that not only the object of design is structural; this is to say that even the system of design activities is structural. In other words, this means that design understood as structure requires also a politics understood as structure. If everyone designs, the structure of designing in addition to the designed object has a different structuration than if it were designed by a few. Thus the structural-ness of the future is only partial if limited to the object and not extended to the process itself and thus to man. In other words, the structural-ness of the process requires the structural-ness of social-political attitudes.”

Structure is understood as a network of relational conditions unfolding diachronously. Design comes to be considered as establishing systems of relationships when the designer’s role is to project systems that encourage and empower a future community to design, program, and plan its spaces. The notion that the structure of language is dynamic was critical for Mosso’s paradigm. He understood the need to find material means for facilitating participatory actions, because language, rather than an elitist imposition, had to evolve from below. The invocation for everyone to plan, however, is not a renunciation of design. The invocation is the first choice as political will, to enfranchise the populace, even if only conceptually, in the process of programming and design. Design is a mode of resistance and survival for the architect and the citizenry, design or be designed.

Mosso, “Universal three-dimensional serial structure, self programming with movable and elastic connections”
Mosso knew and was influenced by Konrad Wachsmann, best known for his study of universal joints. As illustrated in his seminal book *The Turning Point of Building*, Wachsmann investigated the possibilities of prefabricated construction systems based on standardized connectors. His vision for rationalizing techniques went beyond the singular building: he envisioned adaptable systems facilitating massive and complex spatial structures. Exemplified in his raster diagrams, Wachsmann began with an X, Y, Z origin from which all constructive possibilities emanated; it was his “symbol for measure, movement and time, into which any imagined form can be fitted within the system of relationships assumed.” His diagrams depict possible material conditions that interrelate through interpenetration, ossifying the ineffable Cartesian origin.

If Wachsmann conceived of systems of possibility generating aggregative constructive scenarios, Mosso conceived of models of potentiality that had the constitution of dynamic communities as a broader philosophical agenda. He viewed his joints as post-Cartesian, both in the sense of placing the origin under erasure as well as dispersing the Cartesian subject, replacing his point of view with an understanding of space, structure, and constitution of material reality through interaction, transformation, and contest. A dynamic community forged through common language replaces the rational subject.

Mosso’s research produced at least three distinct types of modifiable connection systems. Whereas the design sophistication increased with each new experiment, each joint’s characteristics suggested its virtual limits. His initial study, “a three dimensional universal joint,” was a pin connector system: linear components, executed in wood, acrylic, or metal, were drilled through at 90 degree angles, and adjacent components were joined with bolts or dowels to create space defining structures and woven surfaces. This familiar joint is an appropriation of an existing, dumb technology, reusing it in an expressive, symbolic manner to emphasize the system’s reconfigurability. Mosso’s “mobile” and “demountable” system was cast as fruit of his pedagogical research at the Politecnico di Torino in which, “every element [is studied] with the iteration necessary for its complete mastery until it is rendered insensible, so to speak—in order to fully exploit unique possibilities and methodic, organic growth.” Mosso envisioned the system as a programmed matrix and, as a result, self-generating based on modification through users’ negotiation. However, it matters little whether the construction actually moves or is modified; rather, it is a system which reinscribes the joint within a logic of potentiality; the semiotic of the connection system produces the semantic of adaptable.

The political implications, however, arise from both because the constructive technology was familiar, its semantic was easily communicable and comprehensible. The poverty of the joint precludes before-the-fact technological fetishism or aesthetics of complexity, and encourages both through transformation and legibility; the constitution of a “social language” in which “the roles of transmitter and receiver. . . alternate.”

Later studies explored virtual, omnidirectional joints, where virtual is understood in its philosophical sense as expressing potential. Instead of rendering the origin materially concrete like Wachsmann, Mosso conceived the joint’s “turning point” as a void: a deformable connection rather than a fixed, plug-in receiver of components. Around this theme he developed two further joints. One, which he called the “elastic joint,” literally translated his conceptual diagram: structural components slide past one another, fastened with compression straps. The elastic connectors allow free rotation, producing a quasi-topology in which deformations are translated across the structure and absorbed by the components’ slippage.

His third study, the “virtual joint,” explored the construction of dynamic surfaces. The linear components were made of steel springs and the connections consisted of the steel coil folded back on itself. The result was a structural surface in which the components “twisted” along their axes and bent in the direction of applied forces. This constructive technique produced an extraordinary effect: an implied surface could be pulled through itself or another while maintaining the integrity of system’s components.
Representation no longer constrained geometric transformation: undermining the tectonic-stereometric dialectic (additive versus subtractive, volumetric versus composition / formation), constructive acts could be enacted in the material world in real time.

These joints produced models of weak structures. The potentiality for form, material, and surface were coincident in Mosso’s conceptual designs: each was modifiable, limited only by the length and malleability of the members’ materiality, the complexity and depth of the form, the flexibility of the joint, and the entropy of the system’s originary coherence. This last point is key, because in his non-static system, Mosso’s constructions are non-specific yet they bear the trace of the initial grid. Yet the grid is never absolute, even when first erected: it is always impure, irregular, moderately yet not-inherently unstable. Though there is a vague trace of the originary condition, the initial weakness renders the capacity to re-originate a perfect form impossible.

Form results from forces producing deformations propagating through adjacent joints: one disturbance creates a field of disturbances. As the system breaks down, complex forms that both build on and erase former operations suggest that the undoing of any set of actions produces another condition rather than the retracing of one’s steps (thus it is non-indexical). And yet it is not fully entropic, for the system is still invariant because the number of joints and components are maintained and even if the originary weak order is lost, new relational conditions constantly emerge.

One must note the participatory nature of these frames. Students would assemble and then “play” with these weak structures; thus, the realization of form was not the virtuoso will of an elite mind (their initial weakness required collaboration just to erect them). Play trained students to explore form as relationships rather than objects. But this in no way was to be understood as an idealized scenario in which consensus might lead to a demonstrative form. Rather, the very openness of the system prohibited any definitive conclusion (other than the system’s collapse). The structure is a registration of human forces in perpetual conflict, and architecture becomes an inscription device for what we would now call agonistic relations.
The work of Leonardo Mosso and Laura Mosso Castagno is best described as research and experimentation instead of design. Through research with students in Turin and Berlin, countless spatial constructions at differing scales were built, documenting through photography the deformations and decompositions. The collective process of model construction and photo-documentation reveals the tension between the limitations of representation and systems' indeterminacy and immediacy. The material nature of the joints as well as the non-linearity of the systems made their drawn representation always insufficient. Experimental models replace architecture as a representational practice (in which design is the projecting of the present into the future through form); photographic images become visual artifacts of a specific moment in an unfolding system of potentiality with little concern for final causes.

These experimental constructions lay between two different definitions of the word "model." Like architectural models, they are "things" for thinking with: they are conceived by an architect, deployed in the academic studio, and exhibited and published as architecture. As Ludmilla Jordanova has noted, however, models used in scientific research do not just sit there:

"[A] model is what can be called an incomplete concept in implying the existence of something else, by virtue of which the model makes sense. This 'something else' might already be in existence or yet to come. It might be larger or smaller, more or less complete, or sophisticated or accessible. Models then, however verisimilitudinous, beautiful or satisfying, always refer onwards. As a result, there are interpretative gaps for viewers to fill in, the 'beholder's share' in Gombrich's words."

Mosso's models are not analogical of specific architectures, but they are devices for architectural process and systems—but to what do they refer onwards? Perhaps the question should be, to when do they refer onwards? For if we accept that Mosso's representations and constructions invite the viewer to continue the process and to make changes, then they are always out of joint with the temporality of their apperception. This provisional hypothesis allows us to speculate a response to the first question—to what do they refer? They primarily refer to conditions of alterity, in which the city becomes a technologically laden site of popular action. Cybernetics and computation would have to become popular tools.

Mosso and Castagno extended their participatory experiments to the territorial scale, proposing planning schemes based on predetermined variables and values. On a Sperry Rand UNIVAC 1108, they imagined the landscape as an organizational plane for organizational simulations. Computer algorithms aided in managing the use of the earth by establishing parameters such as constructed versus open space, number of housing units, allocated space versus "void" space, "laws of probability," and randomness as noise. The output was a field of 0s, *s, and gaps: the *s indicated built form, the 0s indicated future space for construction, and the gaps indicated voids where no construction was to be permitted. The result was the strategically randomized planning of the territory: strategic in that the system was set up in advance, but randomized to allow for constant modification and self-organization.

Rather than producing an ideal design, the intent was to transfer authority of devices of dynamic control to the citizenry toward a regime of autoprogrammazione, and to set up matrices precluding the concentration of wealth and territorial exploitation. The random was a means of planning dynamic decentralization.

These cybernetic experiments were precisely that—experiments: models of the potential of computation to produce meaningful planning strategies. Their limitations were of course, obvious, and they were never intended as "realistic" proposals with infrastructure, transportation, circulation, and so forth. Rather, they were demonstrations that another approach to planning was possible—a strategy of refusal to plan for power did not mean refusing to plan at all. That they intended the output to be read as persuasive information is confirmed by printing and exhibiting the results as 20 meter square drawings (resembling artwork by Dieter Rot or the original diagrams for Archizoom's No Stop City). Mosso and Castagno projected a condition of alterity using cybernetic means—a condition of alterity based only in language and information.
Though they wrote manifestos, Mosso’s call for popular action is clearly detectable in an essay entitled “Tutti che decidono è scienza” (Participation is Science).8 As the chief tool and weapon of mankind, science facilitated the rape and destruction of the landscape and the domination of one economic class over another. Yet science was the newest word in architecture culture. For Mosso, only by restoring a true objectivity to science by transferring its power to the citizenry could science recover its humanist imperative. When he wrote that science is literally “when everyone decides,” he meant that the legitimation of science had to be the result of and the fuel for popular contest (agonism), something wholly absent from other cybernetic models, such as those of Christopher Alexander. This is not to be confused with science as popular consensus, but scientific research must arise from and support contest, even conflict. Science for Mosso had to lead to the linguistic and constructive empowerment of the citizenry to plan for a different future—otherwise, it was nothing more than a mechanism of exploitation for the maintenance of the present.

Thus, architectural research as science must be understood as an act of criticism and resistance, one that by definition, in order to be efficacious, is set in contra-distinction to the present. Architectural research that merely produces new forms is not research, it is design, be it classic or cool, traditional or trendy. An architectural science must be a political practice that does not generate ideal solutions, but facilitates alternative solutions to the present state of affairs. As regards to architecture, research produces alterity; not alterity in a formal sense, but alterity to existing organizational, epistemological, and political authorities. This was the new ecology envisioned by Leonardo Mosso and Laura Castagno Mosso.

**0.5 KILOMETER CLOUD**

Polystyrene, monofilament, rubber, stainless steel fasteners, pulleys and cable 588 cubes 2,940 components at 18.4 cm 540 meters of material


This research included a revisiting of the virtual joint. For the installation in the Taubman College Gallery, students constructed a roughly 24’ x 15’ suspended, dynamic framework.9 The construction consisted of 1/4” x 7” polystyrene components and elastic connectors. Two types of components were laser cut from polystyrene sheets. Horizontal components had parallel 1/16” deep grooves cut into the member to receive the connectors. Vertical components had identical grooves as well as notches cut into the ends to receive the suspension wires; the notches were deeper to ensure the suspension wires did not slip and to encourage tautness in the line. We used 2,940 components—laid end to end they would stretch half a kilometer.10
The joint assembly was a lashed connection. Elastic material was applied in alignment with the grooves, which were made wider than the rubber to increase contact between the connector and the component. The elastic material allowed a degree of sliding between components without permitting them to completely slip away when subjected to forces, and rubber, used for the joints, allowed for a wide degree of flexibility—the components could separate without the failure of the joint. Styrene was also selected for its inherent flexibility. Working together, the elastic and deformable joint with the malleable quality of the styrene leant to the system a more fluid flexure.

For the assembly, horizontal components overlapped such that two elastic connections were used for each joint. Vertical components were similarly attached with two additional elastic connectors. The structure was built in sections that were then hoisted into the air and tied together. The cloud was then lifted into place using monofilament attached to pulleys mounted to cables attached to the structural steel above.¹¹

The structure was intentionally conceived as a weak structure. Because flexibility in terms of both the joint and the material was an interest, rigidity was viewed not as an absolute, but as a variable. Though the process involved relatively contemporary fabrication technologies and materials (laser cutters and industrial plastics), the assembly was fundamentally of a *povera* nature. Such a method was chosen as a rejection of the techno-fetish for industrial joinery that aestheticizes the joint as a means of suggesting contemporaneity through material complexity. This is not to suggest that the *povera* joint is more moral or authentic, but rather to re-emphasize that the intention is the clear communication (understood in the sense of communication theory and not as the simplification of meaning such as in neo-realism or post-criticality) of the how rather than the what. The what is the territory of innovation without intent or theory, of which I have little interest. Innovation that fails to even suggest alterity is no innovation at all.
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5Mosso, “Politica come struttura, struttura del progetto e scienza come linguaggio,” Parametro, Number 11 (1972) 8-11.

*Construction Notes:* Given that each component took 2.25 minutes to laser cut, this is roughly equivalent to 105 hours of laser cutting. Given the desire to maintain the numerical constraint of half a kilometer, the pre-deformation shape of the cloud was not perfectly square.


Dimensions Twenty Three Fellows in Architecture