Model, Metaphor, Analogy: The Computational Imaginary in Arte Programmata's Experimental Environments, 1964-68

LINDSAY CAPLAN

> Electronic brains, even if they are still far from producing all the functions of the human brain, are nonetheless capable of providing us with a convincing theoretical model for the most complex processes of our memory, our mental associations, our imagination, our conscience.
> (Calvino 1967)

When Italo Calvino spoke these words in 1967 to an audience in Turin, he captured one of the central ways that artists and writers had been engaging with new computational technologies for the last decade: as a robust model for conceptualizing the creative and cognitive capacities of human beings. The terms drawn from computers may be new—coding, patterns, programming, and information, to name some of the most prevalent at the time—but, Calvino claimed, they described operations as old as writing itself: «writers, as they have always been up to now, are already writing machines,» he asserted, elaborating that «the struggle of literature is in fact a struggle to escape the confines of language.» (Calvino, 1986, p. 13; 16) Individual expression constitutes a dynamic process of working within and beyond technological, linguistic, social, or material constraints. The advent of computers simply helped to make this clearer than ever before. Much has been written about *what* computers model for Calvino (a world of discrete instead of continuous structures and experiences; art as a combinatorial game, with radical implications for understanding the nature of authorship). However, less attention has been paid to *how* modeling worked to articulate the political agency of art—in mixed and often contradictory ways—and *why* it was so widely used to describe computer art, specifically, especially among artists working with these new technologies in Italy in the 1960s. *Model* was a key concept at the 1965 *New Tendency 3* exhibition in Zagreb, which assembled experimental new media

artists largely from Eastern and Western Europe and Latin America. The term structured the arguments of catalogue essays by Giulio Carlo Argan and Abraham Moles, and it was mobilized by artists such as Gruppo di ricerca cibernetica, who drew on Silvio Ceccato's research into machine learning to «develop models of mental activity» with their art. (Bek, 1965; Rosen, 2011) In these instances, the artwork, rather than the computer, serves as the model, but the term operates in the same way: to suggest that formal experiments are small-scale prototypes with the potential for wide and varied applicability in the world. Artworks, it was claimed, can model anything from a philosophical notion to a political organization, just as computers model perceptual processes, and computer *art* can do the same. Modeling was a central mechanism by which new media artists dispensed with both medium specificity and disciplinary bounds, to forge relationships between arenas of knowledge (eg. art and science, technology and psychology), and, most of all, art and life. And yet across the discourse of early computer art, the meaning of the term model shifted from definitive to provisional. This chapter argues that this shift indexed a struggle to deal with art's political agency and confront its circumscribed capacity to affect change in other fields. Ultimately, the very notion that promised to deliver art's interdisciplinarity and sprawling, wide-ranging relevance came to delineate its specificity and limits.

Even when the word itself was absent, the idea of the model infused conversations about the influence of computers on contemporary art in the 1960s, especially when the technology was not actually employed in the works. All the artworks exhibited at *New Tendency 3* were analog, and a majority were abstract sculptures and reliefs: Vjenceslav Richter's *Relief-Meter* confronted viewers with an ensemble of aluminum rods that could be manipulated; Gruppo MID's *Disk* (1965) comprised a plexiglass sphere patterned with black speckled concentric circles, backlit by a florescent light and propelled by motors to spin (to dizzying effect); and François Morellet's *Neon No. 3* (1965) was a grid lit sporadically with thin neon bars in a composition reminiscent of a Piet Mondrian painting. Kinetic works by Italian artists who, like Gruppo MID, were associated with Arte Programmata, such as Bruno Munari, Enzo Mari, and the collectives Gruppo T and Gruppo N, were also prominently featured in the 1965 exhibition. When Bruno Munari screened his film *The Colors of Light* and Gianni Colombo displayed his *Fluid Structure,* they assumed an analogical relation between the mutating works and the vicissitudes of perception; both were modeled on computer programs, which adhere to the logic of generative structures.

This led Lea Vergine (1973, p. 1) to characterize the work of Arte Programmata as «a typological sample (in the sense of a model),» one that creates «a plastic analogy» for processes of perception and the ways that sensing subject interact with the material world.

The use of the computer as a model therefore distinguishes the artists of Arte Programmata from other early computer artists at the time, for whom the new technology was principally a medium. Two of the earliest exhibitions of «computer art» also took place in 1965 and featured program-generated graphics, many of which imitated conventional artforms and styles: the «statistical graphics» by Georg Nees in Stüttgart and *Computer-Generated Pictures* at the Howard Wise Gallery in New York, featuring work by engineer A. Michael Noll and perceptual psychologist Bela Julesz (both employees of Bell Labs). For Nees and Noll, computers figured as a material with which to experiment making new compositions and raised questions about whether computers could «be» artists. (Taylor, 2014; Patterson, 2015) Noll based a large part of his practice on using computers to simulate well-known works by Pablo Picasso and Bridget Riley. Such practices, aimed at figuring out what computers could do, are far from the theoretical renegotiations of the nature of authorship, creativity, perception, and the social significance of art that constituted the more conceptual impact of computers on the work of the New Tendencies group. In the former, the computer is used to simulate operations presumed to be stable and given (creativity, quality, the category of art), while in the latter computers are used principally as conceptual inspiration to rethink these operations from the ground up.

But this does not mean there was a consensus among the artists of the New Tendencies, and across the span of Arte Programmata's activity, about what it meant to invoke the computer as a model for creativity and human experience. Computers are unstable signifiers, making them volatile models. In the 1960s, computers engendered competing and paradoxical conceptions of what it means to be human, and their history is marked by theoretical meditations on what modeling can even mean. (Hesse, 1970, 2011; Haraway, 2004) Alan Turing's notion of the «universal engine,» which posited that computers can be programmed to imitate any other machine, led to their being deemed «electronic brains» because of their capacity to model other things. (Turing, 1950) With the Turing machine, then, the computer models the brain which models the computer, and so on—a circular logic that points to how models are less a way to define something than to displace definition altogether, a displacement productive

of the very relation the model claims to describe. Then there is the funda-
mentally analogical nature of cybernetics, an interdisciplinary field based
on the presumption that any system (biological, mechanical, artificial, nat-
ural, social, etc.) operates according to the same principles of control and
communication. (Wiener, 1989) But even within cybernetics, the epistemo-
logical and political implications of its analogical structure vary. To some,
cybernetics purports to explain everything, constituting an all-encompass-
ing grand theory. (Galison, 1994; Hayles, 1990; Halpern, 2015) But to oth-
ers, it foregrounds the limits of understanding, serving as a meta-critical
insight that enables researchers to grapple with how systems function
with imperfect knowledge, nevertheless. (Ashby, 1970; Pickering, 2011)

An important but underappreciated dimension of early computer art in
Italy was how it interrogated these intricacies and inconsistencies of com-
puter art-as-model. This is especially the case with Arte Programmata's
environments, which Gruppo T, Gruppo N, Gruppo MID, and Enzo Mari
constructed between 1964 and 1968. The *ambienti* enclose spectators in
metamorphosing light, sculptural elements, and sounds to insist on the
concrete, material basis of individual experience. At the same time, these
works force viewers to confront the uncertainty and unknowability of their
surroundings. The immersive environments function alternately as a
mode of visual communication and a phenomenological confrontation
with an impenetrable black box, a tension that indexes the contradictory
ambitions bound up in the concept of the model. The immersive, disori-
enting experiences produced by the *ambienti* demonstrate that comput-
ers were modeling new conceptions of the human, but these experi-
mental artworks also, crucially, require a critical reckoning with the politi-
cal implications and epistemological limits of *the model* as such.

Programmed Open Works: Model as Epistemological Metaphor

In its early years, Arte Programmata principally engaged the computer as
a model for authorship. The artists drew on programs, in particular—gen-
erative structures like algorithms—to enact a mode of delegated author-
ship in which creative agency is distributed to all elements of the works.
This strategy was clearly on display when the first exhibition of pro-
grammed art opened on May 15, 1962. *Arte Programmata: arte cinetica,
opera multiplicate, opera aperta* was sponsored by the Olivetti company,
which was at the forefront of computer design and had constructed its
first mainframe, the ELEA 9003 (Elaboratore Elettronico Aritmetico), in

1959. Yet none of the artists in *Arte programmata* used computers to design, print, or propel their compositions. Instead, *Arte programmata* featured an array of kinetic works by Gruppo T (Davide Boriani, Gianni Colombo, Giovanni Anceschi, Gabriele Devecchi, and Grazia Varisco), Gruppo N (Ennio Chiggio, Giovanni Antonio Costa, Alberto Biasi, Manfredo Massironi, and Edoardo Landi), Enzo Mari, and Bruno Munari. In Gruppo N's *Dynamic Optical Relief,* for example, a white-painted, square wooden plank was pierced with a gridded pattern of aluminum rods that the audience could grasp and move around. In Giovanni Anceschi's *Horizontal Fluid Paths,* colorful liquid pulsated through plastic tubes; while Gianni Colombo hid a motor in the base of his *Fluid Structure* so that a translucent ribbon would bend and twist around the work's metal frame. Although all the artists dispensed with outmoded mediums like «painting» and «sculpture,» the most advanced technologies in this new media art were motors, plastic, and florescent lights. Computers existed as inspiration for how the works were made: *like* algorithms, these programmed artworks were all simple structures that could spawn a multitude of possible forms.

One of the principal effects of the program as a model for dispersed, collective authorship was to enact a decisive break with the romanticized singular ideal that had come to be associated with the individualism of Abstract Expressionism and the existential angst of *art informel* in the 1950s. Gruppo N and Gruppo T were both founded on such repudiations, as indicated by their rejection of the moniker «artist» and embrace of the term «researchers.» In a 1961 statement, Gruppo N (1961, p. 286) claimed their collective was «a group of *experimental designers* united by the demand for collective research [. . .] the refutation of the individual as a determinate element of history, of experience.» They worked as collectives to mitigate the possibilities that their work would be interpreted as subjective expressions of their individual selves. This mode of production had implications for how the artists imagined the audience. The participants of *Arte programmata* wagered that their collective, dispersed authorship gave more freedom and creative agency to the audience than conventional, static works. In a letter from Gruppo N to Munari, the group expressed their satisfaction with the exhibition's title because it pointed to this leveling of production and reception, insisting on the equality of artist and audience as co-creators of the work. As they put it in a letter from 1962 to Munari in their correspondence leading up to the show:

we consider the title "arte programmata" to be the most appropriate to define our experiments, because the majority of our works will be to specify that the programmer [programmatore] of the work is the very same as the spectator, who chooses one view rather than another, or decides on one of an infinity of variations seizing the object in the movement of his vision. (Gruppo N, 2012)
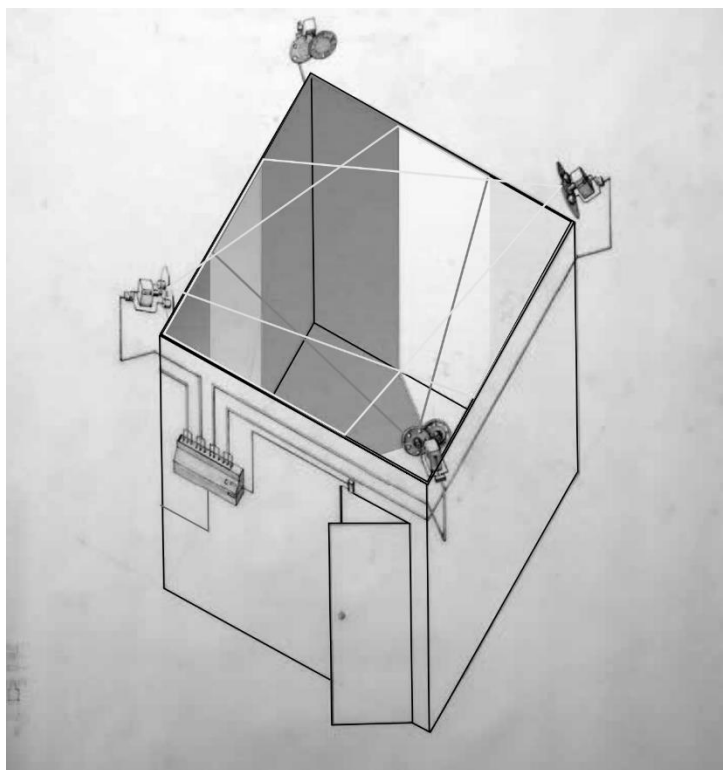

Fig. 1 – Giovanni Anceschi and Davide Boriani, diagram of *Ambiente sperimentale* (*Experimental Environment*), 1965. Courtesy of Davide Boriani

For Arte Programmata, initially the computer functioned as a model for a depersonalized and de-individualized conception of creativity in which the agency of both author and audience is enacted by navigating a delineated set of alternatives. Not everyone saw this as freedom. In her review of the New York version of *Arte programmata* in 1964, critic Dore Ashton (1964, p. 182) wrote that «each machine, even if "programmed" so that it does not repeat exactly the same image twice, creates an experience so limited and relatively monotonous that the viewer soon passes on.» And yet part

of the effect of an «arte programmata» was to contend with the proximate relationship between freedom and constraints.

Munari, who co-organized the 1962 exhibition, defined the dynamic interplay between structure and indeterminacy as programmed art's most salient feature: «Art should be programmed,» he wrote for the exhibition catalogue, «From an exact program is born a multitude of similar forms.» (Munari, 1962) In his essay for *Arte programmata,* the philosopher Umberto Eco described the work similarly, as embodying «a singular dialectic between chance and program, between mathematics and accident, between planned conceptions and free acceptance of what will occur.» (Eco, 1962a) This oscillation is the overt meaning of the works in *Arte programmata*—viewers are made to see, feel, and understand the coexistence of chaos and order. Less obvious are the ways that this oscillation evinces a series of equivalences that thematize how modeling works: the computer program models a mode of production, which models a way of composing an artwork, which models spectatorship, whose freedom should be understood as modeled on the work, which is determined by a model of programmed authorship, and so on: within each model, another model.

This understanding of the model is best exemplified by Umberto Eco's notion of the open work, a phrase included in the exhibition subtitle. In 1962, Eco published *Opera aperta,* a collection of essays defining open works with the same terms he used to describe programmed art: as embodying indeterminacy in their form, thereby demonstrating that even chaos has a discernable logic. (Eco, 1962b) Eco, significantly, drew on computers, in particular the work of French cybernetician Abraham Moles and his ideas about aesthetic information, to explain how open works provide the conditions of possibility for meaning while also leaving meaning undefined: Open works are «*form as a field of possibilities*,» Eco (1989, p. 183) wrote, invoking Moles's phrasing, which insists that the meaning of artworks can be conceived in terms of statistical probabilities and the ratio between signal and noise. But Eco ascribes further meaning to the openness of open works: they are «epistemological metaphors:»

Contemporary art can be seen as an epistemological metaphor. The discontinuity of phenomena has called into question the possibility of a unified, definitive image of our universe; art suggests a way for us to see the world in which we live, and, by seeing it, to accept it and integrate it into our sensibility. The open work assumes the task of giving us an image of discontinuity. It does not narrate it; it *is* it. It takes on a mediating role between the abstract categories of science and the living matter of our sensibility. (Eco, 1989, p. 90)

For Eco, opens works are symptomatic of the end of universal narratives and the instability of truth that has defined modernism since the late nineteenth century, when poets like Stéphane Mallarmé first began to question the capacity of language and words to carry any meaning at all. Arguably, this instability reached a new intensity within the postwar and Cold War conditions of 1960s Italy, caught between competing ideologies, all of which seemed tainted or undesirable. Open works are epistemological metaphors insofar as they formalize and communicate historical phenomena at a scale that individuals can apprehend and better understand. They deliver insights into an underlying structure—in this case, open works clarify and allow viewers to confront the multiplicity of meaning that characterized their contemporary age. Decades later, Eco would assert that metaphor is a mode of knowledge production that is uniquely human. «No algorithm exists for metaphor, nor can a metaphor be produced by means of a computer's precise instructions.» (Eco, 1983) This is because for Eco, metaphors are messy, historically contingent, and unpredictable—they are not a kind of knowledge that computers can have or (contrary to contemporary theories of artificial intelligence) even enact. (Pasquinelli, 2017) But they could be metaphors and models *for* humans (and Eco continued to invoke them as such), by delivering revelatory insights and materializing—giving form to—distinctly human experiences ranging from thought to language to a historical worldview.

Eco's insistence that computers *are* metaphors but cannot *create* metaphors is further evidence that, for this generation of Italian intellectuals and artists, computers were a model and not a material—or, for that matter, an actual substitute for human beings. And this points to the specific quality of the computer as a model at this initial stage of Arte Programmata: they enabled the artists to emphasize similarities and continuities—not between humans and machines, notably, but among discrete human registers. As a model, the program equated processes of production and reception (both are creative yet need to navigate constraints), modeled operations that moved across scales (from artwork to perceptual apparatus to ways of being in the world), and traversed disciplines (art and science). Programs were uniquely suited for this reconciliatory work. The flexible yet functional structure of algorithms allowed artists to assert that meaning could be multiple yet collective, and to delegate authorship without letting go of some determinate (research-based, anti-expressive) aim, and to articulate a wide-reaching philosophical and political usefulness for

their art. Such notions and ways of working empowered the audience without emphasizing their individuality (thereby falling into subjectivism, which these artists wanted to avoid). Even the structure of the open work—in which meaning may be open, but openness is also to some extent *the* meaning of art—captured the competing ambitions of Arte Programmata, and how and why they saw in computers a model for synthesizing them, suggesting that the work of the model at this stage was synthesis.

Modeling Instability: Arte Programmata's Ambienti *at* New Tendencies 3*, 1965*

In the years following the 1962 *Arte programmata* exhibition, the tensions between these competing ambitions intensified, and the model could no longer foster such equivalences and relations. Mari, Gruppo T, and Gruppo N, especially, had a strong bias against expressionism and interiority that motivated their artistic practice and led them to problematize the modicum of individualism underlying the spectator experience of their open programmed works. In 1963, at the exhibition and conference Convegno di Verrucchio, the artists presented a jointly written statement entitled «Art and Freedom: Ideological Commitment (*impegno*) in contemporary artistic currents,» in which they declared their work to be all about the renunciation of the mythical individual artist, who works in «solipsistic isolation.» (Mari, Enzo, Gruppo T, and Gruppo N, 1963, p. 133) This statement marked a move away from prioritizing the openness of the field of reception and suggested ways that the artists were moving to rein this in. Gruppo N, Gruppo T, and Mari (1963, p. 134) defined all media (mass media *and* experimental art) as a «means of persuasion» and concluded with a provocative call for art to achieve «with maximum economy of means, the least ambiguity in individual interpretation.» This emphasis on clarity, instead of openness, suggests an emerging anxiety about the agency afforded to the spectator in the earlier open works—an anxiety that arguably motivated a shift in artistic strategy.
In the wake of the Verucchio conference and Arte Programmata's call for clarity, the artists constructed their first immersive environments for an exhibition held at the Musée des Arts Decoratifs in Paris, organized by Paris-based Groupe de Recherche d'Art Visuel (GRAV) and the Swiss artists Karl Gerstner on behalf of the New Tendencies group. A year later, Arte Programmata's *ambienti* held pride of place at the *New Tendency 3* exhibition in Zagreb, with its own special section organized by Enzo Mari with

three environments by Gruppo T (Boriani and Anceschi; Devecchi; and Colombo). The environments featured in *New Tendency 3* surrounded spectators in changing light, sounds, and color, with dizzying and disorienting effects. In Gabriele Devecchi's *Spazio in strutturazione plasticocromatica* (Space in Plastic-chromatic Structure), viewers were alternately subjected to sensory deprivation and overload as they stood in a dark room while a single light flashed red, then green. In his catalogue text, the artist referenced the idea from Gestalt psychology that the human mind innately organizes perceptual data, but then claimed that the after-image would «construct an initial hostility to comprehension.» (Devecchi, 1965) If Devecchi's earlier objects invoked viewers' inherent capacity for *strutturazione*, *Spazio in strutturazione plasticocromatica* deferred this process indefinitely. Gianni Colombo's environment achieved a similar effect by placing visitors within a metamorphosing three-dimensional grid. Beams of white light crisscrossed overhead, and the floors were built with deliberate unevenness, all to manipulate the viewer's sense of their surrounds and interfering with their ability to apprehend the environment as a whole. A version of the *ambienti* the artist created in 1964 in Paris, Colombo explained in the catalogue that the work is «designed to highlight differential relationships between optical and tactile perception and [the viewer's] self-orienting capacity.» (Colombo, 1965, p. 117) The light environment created by Davide Boriani and Giovanni Anceschi staged a cycle of twelve color-combinations, which had been algorithmically programmed and proceeded in patterns of increasing complexity. After entering the room one person at a time, visitors were given a survey with a series of adjectives with which to assess the work: modern, banal, serious, active, terrible, fascinating, poor—each scaled from zero to four. Boriani and Anceschi's survey drew on theories of aesthetic information articulated by Moles and Max Bense, as well as the method of semantic analysis developed by Dolf Zillmann, all three of whom lectured at the Ulm Bauhaus where Anceschi studied from 1962 to 1964, where he was exposed to cybernetics and information theory and their various influences in the arts. (Anceschi, 2016) These theories of information stressed the translatability between mathematical formulas and aesthetic experience (both can be conceived in terms of the ratio between signal and noise). (Bense, 1965; Moles, 1965, 1966) However, in Anceschi and Boriani's environment, the disconnect between the experience and the terms available for communicating and expressing them are held in suspension, making the

audience sense the insufficiencies of representation and at the same time the necessity of employing such tools, nevertheless.
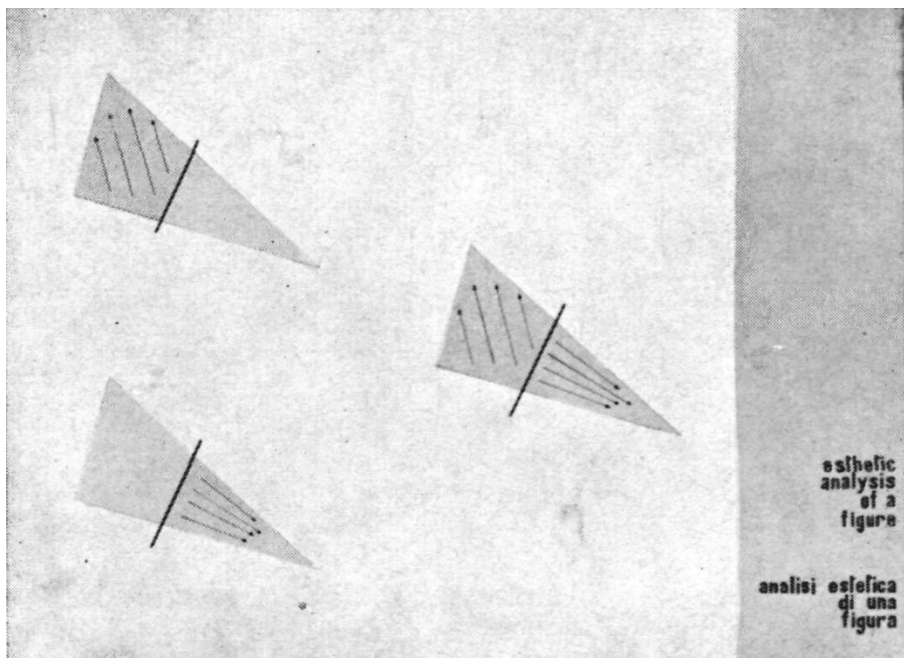

Fig. 2 – Gruppo di ricerca cibernetica, *Analysis of the Perceptive Process in Relation to a Triangle, from an aesthetic and neutral viewpoint,* 1965, distemper, wood, 1 or 14 plates (60 x 80 cm), as published in *Nove tendencije 3,* Muzej Suvremene Umjetnosti

All these environments at once disorient the audience and to insist that the work provides a solid basis for such disorientations. The effect is to create an experience in which spectators are made to feel the porosity of their bodies, the manipulability of their perception, and draw connections between these vicissitudes and the physical constraints of the work. The environments therefore shift the notion of the model from formally manifesting an epistemological condition (of uncertainty) to materializing—as if like a mirror—the perceptual process, allowing audiences to see, feel, and apprehend the structure of individual expression and aesthetic experience as it plays out in front of them in the work. Argan used the term «model» to describe this effect of mirroring and externalizing, in his essay «Art as Research» for the 1965 *New Tendency 3* catalogue. He writes that «the process of research as such qualifies as a model for thought, operation, or, in a word, behavior. A scientist proves that his methodology is

correct by verifying it or by demonstrating its operativeness. An artist is doing the same when he phenomenalizes or visualizes the mental process of research.» (Argan, 2011, p. 195) For Argan, art can be considered research because it materializes the interior processes of its audience, holding it up to be apprehended and assessed. For Argan, the generative structure of programmed art, in which a finite form contains within it the possibility of infinite mutations, is effectively an analogy for the human mind (drawing on Gestalt theories of visual perception that ascribe an active role to the human mind in apprehending form). (Argan, 1963) Elaborating this operation, Argan writes in a 1964 article that the artwork is a not «an absolute model of mental procedures,» but «the demonstration or verification of a method.» This, Argan continues, makes the artwork a «methodological unit that is proposed as a model for all human activities,» and thus delivers a formal procedure that is capable of describing processes across a range of fields and entities, thereby suggesting an interrelation among them. (Argan, 1964, p. 257)

This notion of the model as methodological puts the work of Arte Programmata in dialogue with developments in artificial intelligence, something illuminated by the work of the Rimini-based collective Gruppo di ricerca cibernetica, for whom the model was a key concept. The collective took their name from Silvio Ceccato's Centro di Cibernetica e di Attività Linguistiche at the Universtiy of Milan, devoted to researching linguistics and machine translation. One of the artists, Pino Parini, was invited by Ceccato in 1959 to assist with working on «machinery that observes and describes the events of its environment.» (Ceccato, 1962) Ceccato wanted to enlist artists to help him research image identification with the goal of making one of the first machine models of the process of perception and pattern recognition (an important precursor to today's artificial intelligence). As Ceccato (1966, p. 106) put it, «if one intends to copy the brain and its activity of thought, the first step to take is to obtain such a description of thought and its contents, of language, perception, representation and categories of the mind.» As elaborated in the 1965 film *L'occhio nuovo* by Massimo Mida, which documents the project, the group's research focused on the qualities of the form rather than the structure of the brain or a machine. Indeed, Ceccato (1966, p. 103) is aware that the work of mechanical modeling can succumb to «substantial confusions» instead of «substantial analogies,» which is why he ascribes such importance to the analytical, philosophical work of (human) researchers. Following Ceccato's aim to «model the mind» first and foremost, at the *New Tendency 3*

exhibition Gruppo di ricerca cibernetica displayed fourteen panels dia-gramming how one procedurally perceives a triangle by distinguishing the form from background, elaborating its shape and outline, and defining its essential characteristics. The assumption was that viewers could find within the structure of the triangle some sense of how perception of the triangle would logically proceed.

For many at the 1965 New Tendencies, like Gruppo di ricerca cibernetica, to consider the artwork-as-model continued to mean making work pre-sumed to externalize processes of creativity and perception. For other art-ists in the New Tendencies, like Karl Popper and GRAV, programming op-erated as a means for generating participatory art. If in their earlier ob-jects, the artists of Arte Programmata found in programming a model for synthesizing these ambitions, with the environments they are wrested apart and staged in succession. Audiences are subjected to an intensifica-tion of both control *and* uncertainty—the effect is to render even their own aesthetic experience a mystery, the source of their own agency indis-cernible and dispersed. What Arte Programmata's environments effec-tively come to model, then, is not a reconciliation but a disconnect be-tween the model and the world.

Destabilizing the Model: Inadequacy and/as Analogies in the Ambienti*, 1967-68*

This further destabilization of the model was evident at the 1967 exhibi-tion *Lo Spazio dell'Immagine*, where Gruppo T, Gruppo N, and Gruppo MID's environments were exhibited alongside other major figures of the postwar period in Italy, such as Lucio Fontana, Enrico Castellani, Pino Pas-cali, and Michaelangelo Pistoletto. In the town of Foligno, from July 2 through October 1, the participating artists tackled, in the words of the curator Germano Celant (1967, p. 21) «the problem of how to act in rela-tion to the environmental system.» For their *Ambiente struttura*, Gruppo N constructed a grid of wood polls that the audience had to circumnavigate amidst changing lighting. (Further insights into this largely undocumented environment can be gleaned from a model by Massironi for a 1965 work, *DO / OR*.) Both Gruppo MID and Boriani used stroboscopic lights: Gruppo MID flashed red, green, and blue lights at spectators, anticipating that the colors would mix in unexpected and disorienting ways, while Boriani di-vided the room with four mirror-lined walls and had nine strobe lights hung on the ceiling, to put spectators in «a condition of perceptive uncer-tainty.» (Boriani, 1967, p. 77) Devecchi and Colombo collaborated on a

series of rooms that all used flashing lights, patterned walls, and unstable floors to force visitors to navigate a hostile, ever-mutating space. Colombo explained that he wanted to use artificial light because he considered it «the most measurable and direct means to intervene in the observer's optical-perceptive process.» (Colombo, 1967, p. 104)

At *Lo Spazio dell'Immagine*, the Arte Programmata environments dramatize the discrepancies between «space» and «the image.» This is a way of understanding the abstraction of their works, which significantly contrasted with the figuration of others in the exhibition (like Pistoletto's «mirror paintings,» with cut-out figures) and the Dada-esque absurdity and playfulness of Pascali's work. Abstraction in Arte Programmata's environments becomes abstraction *of* the environment. Their works resist modeling and undermine the sense that the environment can be adequately represented, anticipated, or completely known. This further explains the significance of Arte Programmata's change from object to *ambienti*. If the objects synthesized a transparency of structure with the experience of flux, the environments instead insisted on the world as a «black box,» a term central to cybernetic discourse at the time. Elaborated by British cybernetician Ross Ashby (1956), the «the black box» abandons the ambition to understand the intricacies of the world in its entirety—or rather, it takes for granted the fact that the world is always changing, that the past cannot be the premise for decisive insights into the future, espousing, instead, a statistical model of probability, in which anything remains possible and nothing can be decisively known. Assuming the world is a «black box» enables researchers to circumscribe knowledge and focus on what things *do*, avoiding (for the most part) attempts to chart their inner workings. (Ashby, 1956, pp. 112-117) Cybernetics assumes, then, that the partiality of knowledge is an integral part of how a system *works*. (Pickering, 2011) Critics have seized on this dimension of cybernetics as its greatest failure. In *Computers and Common Sense: The Myth of Thinking Machines*, the American philosopher Mortimer Taube laments the confusion between the «simulation of *structure* and simulation of *function*.» (Taube, 1962, p. 72) Computers can be made to mimic the results of thinking (computation, for example, gauging probabilities, or weighing statistical possibilities), Taube wagers, but they reveal little about the underlying structure of thought, the brain, or human communication. Cybernetics, Taube argues, is a failed model.

Fig. 3 – Davide Boriani, *Camera Stroboscopica Multidimensionale*, 1967. Courtesy of the artist

For many, however, the insistence on the insufficiency of knowledge made cybernetics an effective model, precisely because of how it dynamized and thematized *modeling* as such. Cybernetics is, in many ways, an extremely ambitious model. It is a theory of systems that claims to model *all systems* by reducing them to what can be articulated in terms of the communication of information. What is significant is how cybernetics imagines information as always partial in terms of what it describes and how long it may be applicable, inherent in a process called feedback. Norbert Wiener (1954, p. 24) defined feedback as the «control of a machine on the basis of its *actual* performance rather than its *expected* performance.» Feedback is essentially what Wiener is referring to when he describes processes of «control and communication,» and it is therefore the defining process of cybernetics. Feedback explains how systems can function without total knowledge, replacing such «world pictures» with the ability to learn and adapt. Feedback is therefore antithetical to the idea of the model as final explanation and accounts for the black box; it models another kind of

model, one that is conditional rather absolute. Modeling is not the goal, but an interim step in the continual process of being and acting in the world.
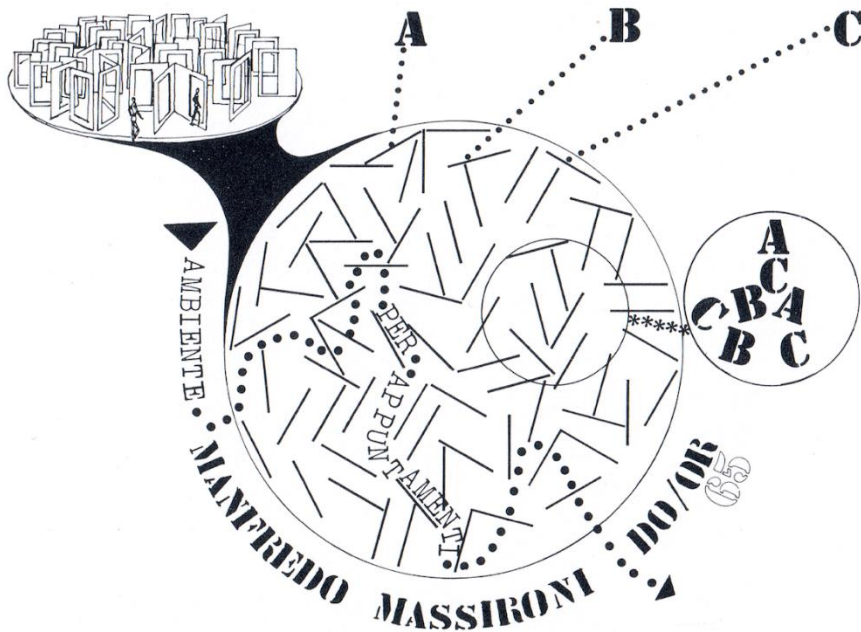
Fig. 4 – Manfredo Massironi, *Ambiente DO / OR*, 1965 (model never realized), in Mussa, *Il Gruppo Enne*, 1976. Courtesy of Michele Massironi

This was, importantly, how Moles characterized information theory in his essay for *New Tendencies 3*, «Cybernetics and the Work of Art.» The text is illustrated with numerous flow charts elaborating how machines can be used for making art. One visualizes the artwork as a process that funnels «the idea» through such structures as «signs and codes» and «the program machine.» (Moles, 1965, p. 99) Much of the argument continues Moles's theorization of information theory as a method that conceives creativity in terms of the mathematical ratio between signal and noise. Later in the essay, however, Moles posits the work of modeling as an interim step, rather than an end. «Information theory presents itself as a *point of intersection* between [...] the idea of the model [...] and the process of iteration that, after having created a model, consists in ceaseless struggling against its insufficiencies.» (Moles, 2011, p. 221) This statement not only dynamizes the model, but it also foregrounds its inadequacies rather than

insisting on its idealization. Moreover, this passage suggests that the the-
oretical foundation of computers like cybernetics and information theory
are means through which to confront the necessity and limits of the
model. Moles, as historian Claus Pias (2007) has shown, continued to ad-
vocate for a notion of the model as inspiration for new forms of creation
and modes of thought. «Cybernetics and Art» begins and ends with state-
ments about how cybernetic analysis allows us «to change our perspec-
tives and our scales of value» and to «reveal relations of order … one might
quality as subliminal.» (Moles, 2011, pp. 217; 225) But even as the author
maintains its centrality, Moles's essay also suggests that a particular idea
of the model (as definitive representation) was being continually sub-
verted, and the kind of knowledge such models alleged to produce in-
creasingly circumscribed.

Fig. 5 – Gruppo T, Enzo Mari, *Percorso cinetico ad ostacoli programmati* (Kinetic pathway and
programed obstacles), 1968, diagram courtesy of Davide Boriani

With their move into making environments, Arte Programmata joined an
entire generation of artists working in a variety of media and modalities
that embraced an ecological consciousness, drawing on cybernetics and
information theory (as well as social theory and political philosophy) to
make artworks that underscore the interconnection between individuals
and the world. And they, like many intellectuals, were inspired by the ways
that new technologies offered new models, metaphors, and analogies for
conceptualizing what it means to be human. Arte Programmata's *ambienti*
are distinct in how these works staged experiential encounters with mod-
eling as a process (rather than end unto itself). The fact that this instability

became precisely what the artworks did model—that destabilizing the model effectively allowed the artists to model instability—only demonstrates the recuperative logic inherent to the idea of «modeling» in art and speaks to its persistent appeal.

The last of Arte Programmata's environments is a kind of swan song to the work of modeling, an intricate articulation of the model as simultaneously operational and always provisional, eventually always failed. This was a collaborative environment created by Mari with Gruppo T for *Cinétisme, spectacle, environnement,* an exhibition organized by Frank Popper that opened in early May 1968, in Grenoble, France, only to close days later in solidarity with the flood of protests that consumed the streets of Paris. Entitled *Percorso cinetico ad ostacoli programmati* (Kinetic pathway and programed obstacles), Gruppo T and Mari's environment forced the audience to negotiate moving walls and jump through their (literal) hoops. It was comprised of a rotating circular platform, divided by large plywood walls featuring large cutout figures in various arrangements. In one panel, a pair of silhouettes faced one another in a standoff while in another, a tangled group of four cascaded to the ground. Visitors walked the circular path, ducking under and weaving through the figuratively shaped holes. *Percorso*, the artists explained, «must be followed. [...] The spectator's inertia as he is transported by the mobile ring, is thus overcome at every new passage-way, as he is obliged to make a choice and find a solution which allows him to overcome the obstacle that confronts him.» (Popper, 1975, pp. 20-21) *Percorso* confronts its audience with an unstable environment, but it thematizes modeling by making it into a game: the cut-outs are a comically rigid structure that you have to contort your body to work with, but then dispense with and move on.

Arte Programmata's environments take the problems that modeling ostensibly answered—about the relationship between art and life, the world and its representation—and they held them out for audiences to grapple with in new and potentially revelatory ways. Their work prompts us to ask: what makes a good model? Does it hinge on the model's representational capacity or what it enables, even empowers, its users to do? By 1969, Davide Boriani was publicly lamenting the insufficiencies of artistic interventions that remain at the «level of symbol or metaphor,» arguing that artistic and cultural operations are no longer sufficient models for reconceptualizing the constitution and transformation of social life. (Boriani, 1969, p. 464) By this point, almost all the artists of Arte Programmata had ceased making art, working instead as designers, researchers, teachers, and activists.

What unites these disparate practices is that they were always in search of «models of the real.» (Leonetti, et al, 1988) At a time when artists and engineers were claiming that both art and technology could serve as effective models for most everything humans could do, Arte Programmata inquired into the operation of modeling—asserting the model as a mode of relationality, with all the imperfections and abstractions that this entails.

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