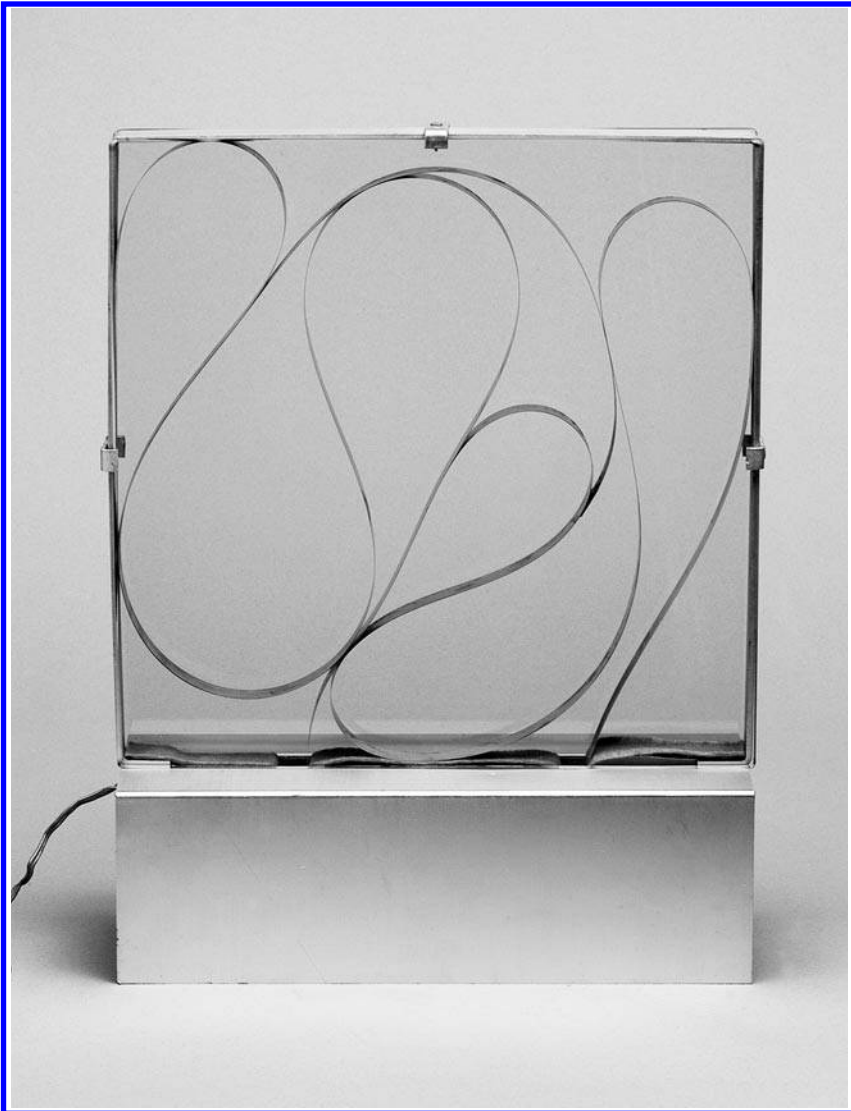


Gianni Colombo. *Strutturazione fluida* (Fluid structure), 1960.  
Courtesy Archivio Gianni Colombo, Milan, Italy.

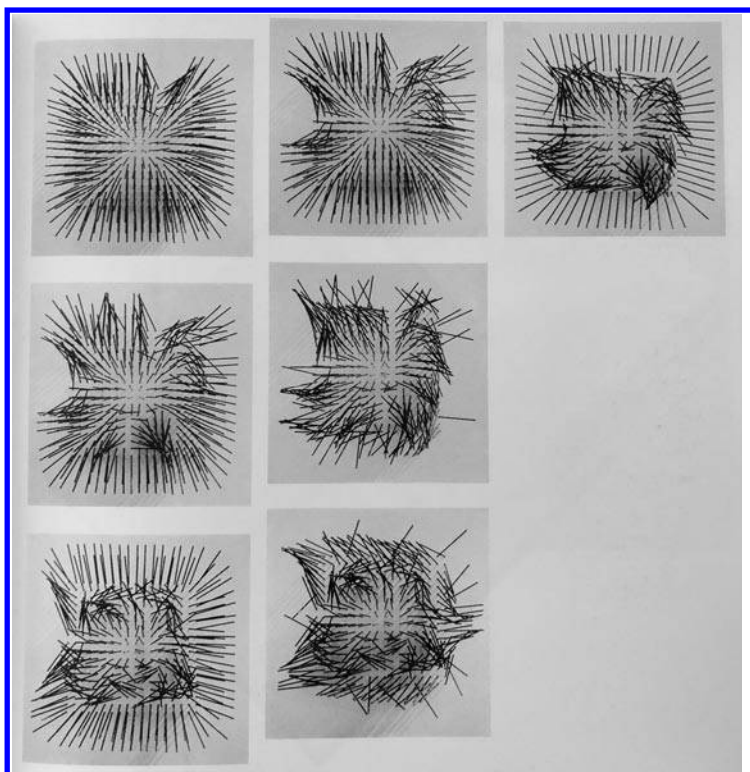


# From Collective Creation to Creating Collectives: *Arte programmata* and the Open Work, 1962

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When the 1962 exhibition *Arte programmata: Arte cinetica, opere moltiplicate, opera aperta* (Programmed art: Kinetic art, multiple works, open work) opened at the Olivetti Showroom in Milan, it might not have been immediately apparent what a room filled with mesmerizing kinetic sculptures and optically stimulating assemblages had to do with a company dedicated to electronics and communications technologies. None of the artworks used computers, typewriters, or calculators as a medium, nor did this dizzying array of plastic and metal abstract assemblages seem to offer practical design possibilities for future Olivetti products. Yet the structural and conceptual foundations of computers, Olivetti's most recent interest and investment, were everywhere. Key features of the computer—the delegation of creative tasks to automated mechanisms and the communication between human beings and machines—simultaneously constituted *how* the works were made and *what* spectators were asked to observe in action. Gruppo T member Gianni Colombo's *Strutturazione fluida* (Fluid structure, 1960), for example, was a transparent box containing a clear plastic ribbon that, thanks to a motorized pulley hidden in the base, appeared to snake itself in and around the frame. Gruppo N's *Rilievo ottico-dinamico* (Optico-dynamic relief, 1962) was a white square pierced with rotatable metal rods, organized into a grid that viewers were invited to twist into new configurations. And in the collective's *Interferenza geometrica* (Geometric interference, 1962), five sliding panels, adorned with a stack of either horizontal, vertical, or diagonally dashed lines, enabled the audience to create unique designs from the work's constituent parts. The idea of “programming” underlying *Arte programmata* therefore condensed complex and seemingly competing notions such as algorithmic functions, stochastic processes, and Kurt Gödel's incompleteness theorem into a single operating principle: A simple, logical structure can generate an unforeseeable number of possible forms.

For the contributing essayists to the *Arte programmata* catalogue, this notion of the program articulated a broader and interconnected set of cultural and epistemological transformations that these artworks interrogated and engaged. Organizer and participating artist Bruno Munari posited that programming was primarily an artistic method to generate formally innovative compositions, explaining that “in these works of programmed art, the fundamental elements . . . are arranged objectively in geometrically ordered systems so as to create the greatest number of combinations, often unpredictable in their mutations but all programmed in accordance with the system planned by the artist.”<sup>1</sup> The philosopher Umberto Eco claimed that the greatest contribution of *Arte programmata* was how it demonstrated that “following precise, predisposed formative



Top: Gruppo N. *Rilievo ottico-dinamico* (Optico-dynamic relief), 1962. As reproduced in the exhibition catalogue *Arte programmata* (1962). Courtesy Associazione Archivio Storico Olivetti, Ivrea, Italy.



Bottom: Gruppo N. *Rilievo ottico-dinamico* (Optico-dynamic relief), 1962. As displayed in the 1962 *Arte programmata* exhibition at the Olivetti Showroom in Milan. Frame enlargement from Enzo Monachesi, dir., *Arte programmata* (1963).

Opposite: Gruppo N. *Interferenza geometrica* (Geometric interference), 1962. As displayed in the 1962 *Arte programmata* exhibition at the Olivetti Showroom in Milan. Frame enlargement from Enzo Monachesi, dir., *Arte programmata* (1963).

patterns . . . do[es] not negate spontaneity, but rather enlarge[s] its boundaries and possible directions.”<sup>2</sup> He defined *programmed art* in terms of a “singular dialectic between chance and program”:

Contemporary art is generally recognised by two categories of artists: on the one hand those who devote themselves to the search for new forms, faithful to an almost Pythagorean ideal of mathematical harmony. . . . On the other hand those who have realized the richness of chance and disorder, certainly not unaware of the reevaluation—made by scientific disciplines—of random processes. . . . But is it really true that mathematical rule excludes chance? . . . Would it not be possible, therefore, to delineate, with the linear purity of a mathematical program, “fields of events” where random processes can happen?<sup>3</sup>

For Eco, the works in *Arte programmata* demonstrate that such a synthesis is possible. The forms are finite, logical, and clear, but their instantiation in space and time, as moving, phenomenological objects, renders them infinite, unpredictable, approaching (Eco contends) utter randomness. Both Eco and Munari assert this singular reading that *Arte programmata* illustrates the tensile oppositions constitutive of contemporary life: chaos and order, fragment and whole, planning and spontaneous action.

The computer program, however, served as more than just the interpretive key behind the exhibition *Arte programmata*. It also operated as a working methodology, one that ran counter to programmed art having a set or single message. The participants (Munari, Enzo Mari, and the collectives Gruppo T and Gruppo N) hoped to avoid creating singular artworks and instead sought to provide their audience with a material platform that could include them as co-creators of the work. By automating the realization of their artworks and demanding concrete activity on the part of viewers—who would have to move their bodies to see all sides of a kinetic sculpture or continually refocus their eyes to keep up with rippling geometric patterns or motorized compositions—Munari, Mari, Gruppo T, and Gruppo N imagined they were alienating the authorial operation, objectifying



it in the program, and dispersing it equally across all elements of the work. From this perspective, the most radical ambition of an *arte programmata* was to generate a multiply authored, horizontally organized, and endlessly mutating composition—a leveling, even democratizing, of the creative process that included and activated the audience.<sup>4</sup>

How and why the program was seen by the artists of *Arte programmata* as a means for collectivizing authorship relied in large part on its relationship with another term in the Olivetti exhibition's title: the *open work*, a term Eco had defined in a series of essays compiled and published as *Opera aperta: Forma e indeterminazione nelle poetiche contemporanee* (The open work: Form and indeterminacy in contemporary poetics).<sup>5</sup> In *Opera aperta*, Eco draws on information theory, a field foundational to the development of computers, to describe open artworks as those that contain a multiplicity of possible interpretations. From kinetic “works-in-movement,” to musical compositions reconfigured for every performance, to novels with ambiguous signifiers, many understood the genre of *arte programmata* to espouse the same model of authorship as Eco's notion of the open work. While “programmed art” stresses the openness of forms and Eco's “open work” emphasizes the plurality of meaning, in both terms the author spawns a “field of possibilities” rather than a definitive work of art. Where the two coincide most comfortably is in their theory of artistic labor. Both terms describe a process for delegating authorship to the chance operations of the work, and both presume that the space of labor will encompass the sphere of reception; that, through the mediating term of the programmed open artwork, the creative agency renounced by the author will in turn be assumed by the audience, who will interact with and interpret the work with greater freedom than ever before.

However, another dimension of the program operating in the 1962 Olivetti exhibition is based not on authorship or labor (and its projected expansion) but in the distinct, delineated space of reception.<sup>6</sup> This element of *Arte programmata* exceeds, or at least deviates from, the contemporaneous theorizations typified by Eco's “open work.” From this other perspective, a “programmed art” does not create an indeterminate, infinitely mutating space, in and around which the viewer may meander and indefinitely explore. The stark, geometric simplicity of the artworks is striking, their “algorithmic” logic so reduced as to be almost infantilizing. Faced with the oscillation between finite and infinite in these metamorphosing, mutating works, one experiences expansiveness and enclosure simultaneously—not, as the artists and Eco posit, in progression as a gradual opening out. The experience is not one of unbounded liberation but of control, of restraint, of limits. These works demonstrate how our presumably free and

spontaneous actions—whether physical movement or the process of interpretation—rely on rather than defy our given, material constraints. Embedded in all the rhetorical assertions about openness and freedom and inclusion is therefore a more complex and historically provocative assertion: For any kind of social engagement—artistic or otherwise—to take place, one needs a commonly held platform, a set of protocols, a program. This assertion is obfuscated by the collapse of “programmed art” with the “open work,” a collapse that fulfills a fantasy that one can seamlessly reconcile total individual freedom and an operable social sphere. When we uncouple the two terms and tease out their differences, however, we see that the most compelling aspect of *Arte programmata* is how the works generate aesthetic experiences that resist individuation to produce a sense of collectivity grounded in the technological media we share.

### **Ideological “Impegno” and the Politics of Authorship in Postwar Italy**

In the late 1950s and early 1960s, young practitioners in the vibrant northern Italian art scene were rethinking the role of the artist and, with it, the location of creative agency, as defined in the work of art. Fatigued by the immediate postwar debates about the political efficacy of figuration versus abstraction, artists wanted to eschew the ideas about authorship these styles espoused: on the one hand, the artist of social realism, who is subservient to a predetermined ideology, political project, and party; on the other hand, that of *arte informale*, in which access to and expression of an authentic individuality is paramount. *Arte programmata* was staged at a time when both paradigms were in crisis, their underlying assumptions being challenged on multiple fronts.

The Italian Communist Party (PCI) thrived in Italy right after World War II as the party of the antifascist victors and became the party of a wide range of left-leaning artists and intellectuals. As the party of the Resistance and its ideals of democracy and freedom, the PCI initially tolerated a diversity of artistic styles to express the idea of *impegno*, or commitment to the revolutionary communist cause. But pressures from Moscow and the growing popularity of American art and values among Italians pushed the PCI to adhere more rigidly to an ideology and aesthetic, thereby dissolving the alliance between the PCI and more-moderate factions of the Italian Left. In November 1948, following the PCI’s disastrous defeat in the election, party leader Palmiro Togliatti publicly condemned abstract art and asserted figurative realism as the only real expression of *impegno*. From that point on, many artists, most notably Renato Guttuso, were championed for making art that was more straightforwardly an expression of political content. Others refused Togliatti’s mandate and continued to defend the importance of

stylistic experimentation as a part of any *arte impegnata*, including the artists of Forma 1, who staunchly defended their claim to be “both formalists and Marxists,” a position they had asserted since their founding manifesto in April 1947.<sup>7</sup> Similarly, the painter (and PCI member) Emilio Vedova understood his thickly scrawled abstract paintings from the late 1940s and early 1950s as no less politically committed than socialist realism, since they wrested the expression of the individual from the self-effacing political imperative of fascism.<sup>8</sup> Togliatti’s 1948 proclamation led to a bifurcation of artists along the lines of abstraction and figuration. Realist artists such as Guttuso contended that their position was the true representative of an international, revolutionary project, while abstract artists who held fast to formal experimentation heralded themselves as the progeny of the Italian Resistance with their antitotalitarian assertions of individual autonomy and uncensored expression.<sup>9</sup> However, the distinct styles and values to which figurative and abstract artists adhered obscure what the two sides held in common. So long as communism was a viable ideological position, committed artists could rely on their association with it to bring political relevance to their art. Therefore, whether deployed by PCI-affiliated realist artists or those defending abstraction against party policy, in both cases the notion of *impegno* carried with it a specific authorial operation. Artworks, whatever their form, were expressions of the artist’s commitment to an already-existing political program. As Guttuso explained, “if he is a man *impegnato* . . . it can be seen in all that he does,” and the artists of Forma 1 asserted their own identity as a means of claiming a politics for their art.<sup>10</sup> Each of these politically committed artists affixed himself to a stable political project, and it was this equation of the author with a political agenda that propelled the creation, form, and meaning of their work.

The communist project was thrown into crisis over the course of the 1950s in Italy. The Soviet invasion of Hungary in 1956 delivered a final devastating blow to the viability of official communist ideology and aesthetics. The invasion, seen by many as revealing the inadequacies of de-Stalinization, spurred widespread disenchantment with the PCI and tainted orthodox Marxism among most leftist artistic circles in Italy.<sup>11</sup> This launched a flurry of writing that sought to unsettle a notion of *impegno* based on official variants of communism or party affiliation. The disparate positions and opinions about this problem of where to locate the politics of art confronted one another in the pages of literary journals such as *Officina* (founded in 1955), *Il verri* (founded in 1956), and *Il Menabò* (founded in 1959).<sup>12</sup> The debates that unfolded reflected a crisis not only about the political content to be expressed by a work of art but about the very possibility of shared meaning. Among visual artists there was a drive to circumvent the question of

politics entirely. For this reason, the same unstructured, abstract styles that had invoked an antifascist freedom of the individual in the late 1940s and 1950s now appealed to those seeking an apolitical, immediate, personal, and antirepresentational art. Artists who came to be known as affiliated with *arte informale* rose to prominence in Italy due to this drive toward a nonideological art.<sup>13</sup> Epitomized by Alberto Burri's assemblages of frayed fabric swatches and tacky globs of paint, *arte informale* claimed to capture the uncensored authenticity of individual artists struggling to express themselves without relying on mediating terms such as *politics*, *narrative*, or *figuration*. As Burri wrote, his paintings are unmediated demonstrations of "freedom attained."<sup>14</sup> Many practitioners of *arte informale*, like its French counterpart *art informel*, presumed that a stable subject (the author) was capable of expressing a universal human condition but that it was a condition in and of crisis, something the historian and critic Giulio Carlo Argan noted in 1961: "Informale is universally considered a phenomenon of revolt. The objective of the revolt is not traditional or conservative art, but art that moves from a revolutionary ideology, which can be criticized for not having achieved its program and reached its end."<sup>15</sup> In an attempt to escape the debates about the politics of art, however, many artists believed *arte informale* replaced one universalism with another, positing the unmediated expression of individual anguish as the only viable aim for art. The genre suffered further criticism by leftist artists and intellectuals in Italy, as its perceived individualism increasingly appeared to work in favor of Western consumer capitalist values. This affinity had already been recognized in 1957, when a group of artists from across Europe (Enrico Baj, Piero Manzoni, and Yves Klein, among others) issued the statement "Against Style," which charged that emotive gestural painting had fallen prey to the capitalist market and claimed that "every new invention is now at risk of becoming the object of stereotyped repetitions of a purely mercantile character."<sup>16</sup> Just a year later, in 1958, the exhibition of Jackson Pollock's drip paintings throughout Italy further ingrained the association of gestural abstraction with the unbridled individualism being championed by the capitalist West.

The early work of the artists included in *Arte programmata* developed as a concerted reaction against the two dominant aesthetic paradigms, *arte informale* and socialist realism. Each of the participants in the 1962 exhibition sought to navigate toward an aesthetic and ideological alternative that converged in the perception-oriented and participation-inviting works on view at the Olivetti exhibition.<sup>17</sup> The eldest of the contributors, Munari, had started making work in the immediate postwar period that dismantled both trends through his involvement in Movimento Arte Concreta (MAC).<sup>18</sup> Founded by Munari with artists



Gianni Monnet, Atanasio Soldati, and the critic Gillo Dorfles in 1948, MAC objected to the way gestural abstraction remained subservient to referentiality (of the artist's subjectivity) and debased art and the artist as such.<sup>19</sup> MAC sought to distinguish these expressive *abstract* works from what they designated "concrete." The aim was to generate forms that were real—concrete—but not referential, insofar as referential works were insufficient shadows of a more robust reality. Munari's *Negative-Positives* from the early 1950s embody embodies this mandate. A series of small black-and-white paintings of interlocking rectangles and canvases of squares in primary colors, the *Negative-Positives* are stark compositions that assert there is nothing to be gleaned from these works outside the experience of viewing them.

Mari's early work from the 1950s was also driven by a search for a nonexpressive mode of production that could engender a clearly legible form. The artist took inspiration from Renaissance artists who used mathematical principles to design their compositions and experimented with semiautomated, logical procedures for producing simple geometric compositions. He spent days studying the Sistine Chapel, which he praised for representing an absolute (in this case, God) through so many variable means.<sup>20</sup> Two works of encaustic on wood, executed in 1952, are plays on one-point perspective, divided and disrupted according to a logic Mari derived from the golden ratio. The fact that a simple rule could generate an infinite number of forms was for Mari analogous to how each person's experience (of art as much as of the world) might vary but still be grounded in the same reality. Through a scientific, and presumptively transparent, method of creation, Mari posited, works of art could demonstrate this concrete, common reality to viewers.

The decision by both Gruppo T and Gruppo N to work collaboratively was their first and most overt act of opposition to the figure of the *informale* artist. Gruppo T formed in October 1959, when Giovanni Anceschi, Davide Boriani, Gianni Colombo, and Gabriele Devecchi met and signed a declaration of their commitment to making works that explored what they saw as the reality of perpetual change.<sup>21</sup> The artists asserted that works such as *Ossidazioni decorative* (Decorative oxidations, 1960), a copper plate that, when subjected to changes in temperature altered in color, materialized time itself because the works were in a state of continual flux. Like Mari, Gruppo T strove to create works that transcended the subjective, volatile expressions of an artist to express a material reality presumed to be objective.<sup>22</sup> Working as a collective further ensured that the meaning of Gruppo T's works could not be seen as expressing a singular, individual perspective. Gruppo N was also founded on an interest in making art with a

common basis. Based in the university town of Padua, Gruppo N formed among the artists Ennio Chiggio, Giovanni Antonio Costa, Alberto Biasi, Manfredo Massironi, and Edoardo Landi in 1960. (By the 1962 exhibition, Costa was no longer involved.) Gruppo N's earliest exhibitions were irreverent and nihilistic; for example, *A porta chiusa* (Closed door), spanned just three days, September 11–13, 1960, and comprised a locked gallery door and a sign declaring “NES-SUNO È INVITATO A INTERVENIRE” (No one is invited to participate).<sup>23</sup> In contrast to Klein's *Le vide* (The void, 1958), a clear precedent and influence on the group, which invited people into an empty gallery in order to sensitize them to the aesthetic possibilities of space itself, *A porta chiusa* was a defiant act of refusal, halting artistic production and denying the audience the aesthetic experience of space and sensation.<sup>24</sup> As Gruppo N explained in a 1961 statement, they wanted “to eliminate art as a category . . . [and] demystify art of all those idealistic and transcendental values, such as the unique and unrepeatable work, the inimitable masterpiece, the individual creator, superior and brilliant.”<sup>25</sup> But for the *Arte programmata* artists, to dismantle individual authorship with a negative or ironic gesture was not enough. They needed to put in its place a positive model for an anti-individualistic art and authorship. Gruppo N's statement captures these artists' shared desire for a mode of working that not only collectivizes creativity but uses distributed authorship as a means to create collectives, now that they could no longer be politically presumed. All the artists featured in *Arte programmata* found a solution in the same mechanism: the computer program.

#### **The Computer in Italy: Olivetti's ELEA 9003 (1959) and *The Bompiani Almanac on Computers and the Arts* (1962)**

“Also in Italy, the future has already begun,” the popular periodical *Epoca* proclaimed on October 15, 1959.<sup>26</sup> Illustrating this enthusiastic headline was a bright color photograph of an orange computer chip woven with blue, black, and yellow coated wires. The chip was an integrated circuit belonging to the first computer produced in Italy, the ELEA 9003 (Elaboratore Elettronico Aritmetico, or Arithmetical Electronic Computer). Able to process hundreds of thousands of bits of information per second, ELEA promised a new future for Italy with implications beyond a more efficient workplace. As the *Epoca* article anticipated, ELEA “effectively open[ed] a new epoch of fascinating problems and responsibilities in the field of labor relations, creating new responsibilities in those fields of social organization, education, and school.”<sup>27</sup> This rhetoric was continuous with Adriano Olivetti's socially conscious mission to make objects capable of engendering better lifestyles and practices with their use.<sup>28</sup> Olivetti considered

mechanization as a pathway not only for a more efficient but a more equitable world. The industrialist wrote prolifically about ideal forms of government, especially what he called “managerialism,” which applied scientific principles of management to politics, following utopian socialists like Charles Fourier more than Henry Ford. Olivetti’s vision included a highly integrated social system in which each of the parts also had a degree of autonomy. Technologies held out models for new forms of this kind of integrated, efficient social organization. Olivetti’s son, Roberto, ran the company according to this same ethos after his father’s death in 1960, and in 1962 he established a small research team to develop the company’s first personal computer, the Programma 101, which was unveiled at the 1964 World’s Fair to critical acclaim. Roberto Olivetti was also one of the first industrialists to integrate the cybernetic principle of feedback into the organization of factories. This made Olivetti a controversial case study for a group of activists and radical sociologists associated with the journal *Quaderni rossi*, and one, Romano Alquati, published a study of Olivetti in 1962 to make a case about how computers and information theory were changing the terms of working-class struggles within the factories.<sup>29</sup> Whereas Olivetti saw computers and cybernetics as models for more liberatory and participatory modes of organizing a factory, Alquati saw this same sort of participation as further entrenching workers’ bodies and subjectivities within the capitalist mode of production—more cooperation leads to more refined and even invisible exploitation (prefiguring today’s “cognitive capitalism,” in which minds, knowledge, and creativity are the primary sites for profit exploitation).<sup>30</sup> Whether capable of realizing utopian socialism or a cyborg-capitalist nightmare, for Italians early computers

pointed more to questions about social organization, liberation, and power than to technological efficiencies.

At the heart of these social questions were the various ways computers prompted a rethinking of human-machine relationships. While some believed computers would ensure a more efficient, easy, and even egalitarian future, for many the computer provoked anxiety about the extent to which human beings were like machines,



Illustration of an integrated circuit from the first computer produced in Italy, the Olivetti ELEA 9003. From *Epoca* (1959).

and vice versa. Tensions between these two perspectives roil throughout the publication that was the precursor for the *Arte programmata* show: the Bompiani almanac. Founded and funded by the Bompiani publishing company, the annual almanac compiled the news coverage about major historical events from the year. A large portion of the Bompiani almanac was dedicated to a particular theme that focused on arts and culture and speculated about their future. In the 1962 edition, this themed section was dedicated to current and potential uses of the computer in the human sciences and the arts. Cosponsored by Olivetti and IBM Italia, the articles, artworks, and illustrations that made up this section sought to develop a comprehensive discourse about the aesthetic and intellectual changes prompted by the advent of computers, grappling with the ways the computer would—or should—transform conceptions of human creativity.

All of the articles in the 1962 “Computers and the Arts” section touch on the idea of programming, or the translation of all activity and information into a standardized code. The problem for theorists and practitioners was to consider what such quantification did to creative expression. Did programming fatally restrict artistic expression, or did it open up entirely new forms of creation and thought? Many of the almanac’s authors celebrate the ability of computers to mechanize processes that were for the most part already mechanical, such as computation, data analysis, and even prediction (insofar as it is a statistical operation). Computer programs from this perspective liberated human beings from having to perform menial tasks. Others considered the computer’s application in fields such as linguistic analysis, archival research, and language translation.<sup>31</sup> For example, the information analyst and author Stanislaw Valsesia proposed a digital library, noting how much scholarship would benefit from a digitized, searchable collection.<sup>32</sup> And an illustrated section (with no listed author) traced the idea of automated art and autopoiesis historically, highlighting literature, art, and philosophy—from the Golem to Fritz Lang’s film *Metropolis* (1926)—that prefigured the concept of a programmable art.<sup>33</sup> The publication also includes some of the earliest examples of computer-generated art. Nanni Balestrini contributed *Tape Mark 1* (1961), which deploys an algorithm to assemble a poem composed entirely of fragments the artist selected from previously written texts by other authors.<sup>34</sup> Whether demonstrating that computers are accurate models for human beings or humanity’s antithesis, excellent artistic corollaries or evidence of art’s demise, the essays and artworks in the “Computer and the Arts” section of the 1962 almanac also indicate that alongside the development of computer technologies was an evolving discourse about the nature of individual agency and creativity.

### The Artist as Programmer: The *Arte programmata* Exhibition (1962)

The Bompiani almanac was the first occasion in which Eco, Munari, and the artists of Gruppo T collaborated. Reproductions of sketches and drawings by the artists were published alongside an essay by Eco titled “The Form of Disorder,” which establishes the terms that defined and developed the genre of programmed art: a multiplicity of points of view and a diverse array of perceptual experiences, all generated by a predetermined principle or operation.<sup>35</sup> Just after the almanac’s release in December 1961, Munari began to organize the exhibition that introduced the broader public to this idea of “un’arte programmata.” Working with Giorgio Soavi and Riccardo Musatti, the heads of Olivetti’s advertising department, Munari invited Gruppo T, Gruppo N, and Mari to participate. *Arte programmata: Arte cinetica, opere moltiplicate, opera aperta* opened on May 15 at



Top: Davide Boriani. *Superficie magnetica* (Magnetic surface), 1962. Courtesy the artist.



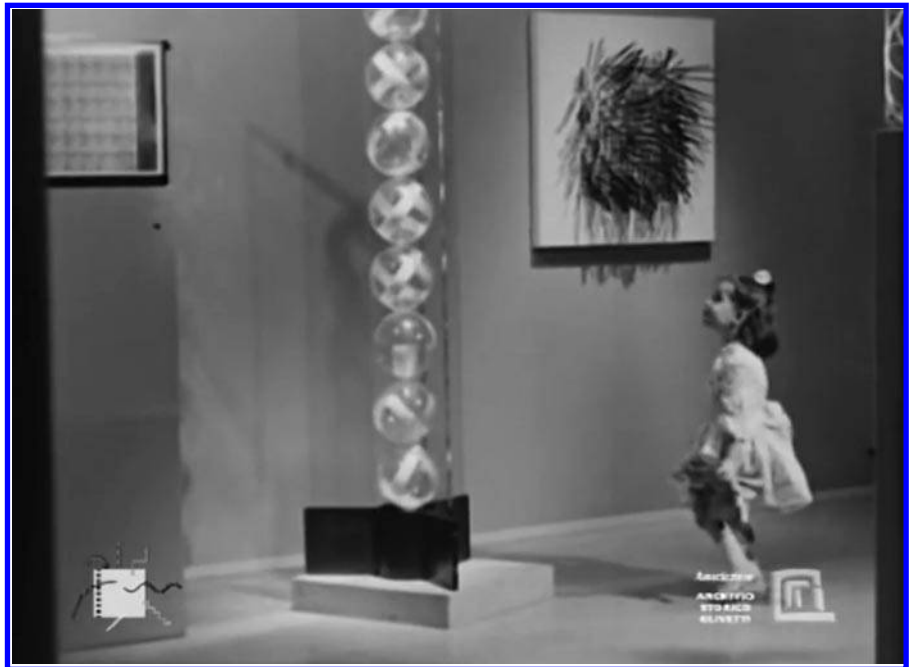
Bottom: Davide Boriani. *Superficie magnetica* (Magnetic surface), 1962. As displayed in the 1962 *Arte programmata* exhibition at the Olivetti Showroom in Milan. Frame enlargement from Enzo Monachesi, dir., *Arte programmata* (1963).

Opposite: Bruno Munari. *Nove sfere in colonna* (Nine spheres in a column), 1962. As displayed in the 1962 *Arte programmata* exhibition at the Olivetti Showroom in Milan. Frame enlargement from Enzo Monachesi, dir., *Arte programmata* (1963).

the Olivetti store in the Galleria Vittorio Emanuele, the main shopping mall in the center of Milan, presenting, for the first time in Italy, a vision of the computer program as an essential collaborator in the making of art.

Visitors to *Arte programmata* were confronted with eleven artwork-generating machines at work. A ten-minute film of the exhibition made by Enzo Monachesi with Munari and Soavi, accompanied by a high-pitch, staccato score by experimental composer Luciano Berio, captures the jerky, automated movements of the contraptions on display.<sup>36</sup> In one scene, the camera zooms in on viewers' mesmerized faces as they watch red, yellow, and orange liquid being pumped through thin plastic tubes in Gruppo T-member Giovanni Anceschi's *Percorsi fluidi orizzontali* (Horizontal fluid paths), creating colorful pulsating stripes across the black cubic frame. Another scene shows spectators gazing at the iron filings in Davide Boriani's *Superficie magnetica* (Magnetic surface) as the metal dust clumps together into little clusters that creep around the rotating plastic case. Mari's *Opera n. 649* flickers rainbow-colored cubes of light into the eyes of a sole viewer sitting in a darkened room. And in the final moments of the film, a little girl gazes up at Munari's *Nove sfere in colonna* (Nine spheres in a column) as transparent orbs with thick white stripes glisten as they perpetually turn.

On the one hand, the film highlights how the programmed mode of production effectively instigates the participation of the audience. The visitors interact with and marvel at these abstract assemblages and delight in their aleatory movements. On the other hand, the rigid choreography dictated by the works is readily apparent as the people appear to function like the works: their movements, too, are programmed, determined not only by the formal qualities of the work but by the organization of space and by societal conventions and pressure (at one point the film shows people patiently waiting in line to view Anceschi's *Percorsi fluidi orizzontali*). The encompassing nature of the program is amplified by the experimental score, whose arrhythmic bleeping aligns with the movements of both artworks and audience in such a way as to materialize the "field of possibilities" as a space of confinement and control. The audience is included according to carefully delimited terms.



The works in *Arte programmata* therefore aligned with the participants' investment in dismantling the fantasy of unmediated individual expression at the heart of *informale*. The program ensured that the artists' creative and expressive possibilities were firmly grounded in the material confines of the medium they chose—whether the magnetic possibilities of iron filings, the undulating effects of geometric abstraction, or the curvatures of an encased and motorized plastic ribbon. The Italian critic, curator, and historian Umbro Apollonio recognized this essential characteristic of these programmed works, writing in 1963 that with *arte programmata* “the interiority of the individual is gradually transforming into a communitarian field.”<sup>37</sup> But by expanding this field to encompass the audience, rather than just the artists and their creative methods, the film asserts the inexorability of participation and control.

The artists avoided articulating this dimension of their art by stressing the similarities between artist and audience; notably, their shared creative labor. As Gruppo N explained in a letter to Munari dated January 12, 1962:

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.<sup>38</sup>

Gruppo T understood their work similarly, emphasizing the formal, physical freedom these works grant to the viewer. As Boriani explained, “the interaction between two dynamic processes, that of the work and that of the perception of the spectator, could augment the communicative potential of visual art; and in a manner more consonant to the concept of a reality that is not fixed and immutable but in continual mutation.”<sup>39</sup> In all instances, the artists of *Arte programmata* insisted that variations in the audience's experiences were, like the artist's expressive capabilities, derived from the common, objectified structure of the work. But for them, this was a method to achieve a distinctly different result: open-endedness and indeterminacy. They wanted to instigate a collective experience, not convey one based on a predetermined identity or ideology. In addition to dismantling the individualized and individuating ideal of *arte informale*, the program was also a way to circumvent the model of the *artista impegnato*, in which artists commit themselves to the expression of an already established political agenda or revolutionary plan. The *artista impegnato* wants to activate the audience, either to amplify the commitment they already have to the cause or to inspire them to join. For *arte programmata*, however, the program

was a way to invite the audience to participate without determining the end result. For the politically committed artist, the program is the end rather than the means of the work of art. For *arte programmata*, in contrast, the program is a logical, procedural platform on which artist and audience can meet and engage. Like the rules of a game, it sets the condition of possibility for interaction, while leaving the outcome indeterminate.

But once set in motion, asserting itself in real space, the works in *Arte programmata* betray how the program as a mode of production does not generate an entirely indeterminate artwork. Rather, as a process the program displaces the site of determination from ends to means. The audience chooses, participates, interacts, but always from a series of options designed for them. But this is not a prefiguration of Alquati's nightmare of cybernetically managed participation; the lesson of *Arte programmata* is not this unfortunate yet inevitable reversal, a dystopian disgrace of the artists' utopian dream. Such an analysis would maintain the very dichotomy—individual against system—that the work so productively, provocatively dismantles. Rather, *Arte programmata* demonstrates the programmed nature of all experience, insofar as our individual perceptions, actions, and interactions are (however apparently spontaneous) determined by our environment. This significance of *Arte programmata* and programmed art more generally is obscured by its association with another term in the exhibition's title: the "open work." The association allowed the artists and art historians to circumvent and even temper the more controlling aspects of the work, leaving the most challenging aspects of this exhibition unacknowledged. Examining the genesis of the "open work" before it was paired with "arte programmata" in 1962 will help to uncouple these terms and tease out their differences.

### **From Authorship to Interpretation: Eco and the Open Work**

Eco began writing on the concept of the open work in 1958. He published *Opera aperta*, a collection of essays about the concept, in 1962, just a few months before *Arte programmata* opened. Citing artists as diverse as Munari, James Joyce, Bertolt Brecht, Karlheinz Stockhausen, and Alexander Calder, Eco defines open works as having multiple interpretations and lacking any sort of conclusiveness. By virtue of their formal and conceptual open-endedness, Eco contends, open works are symptomatic of the end of universal narratives and the instability of truth that had defined modernism since the late nineteenth century, when poets such as Stéphane Mallarmé began to question the capacity of language and words to carry any stable or coherent meaning. Drawing on his research into the medieval period, when interpretations were limited to the literal, moral, allegor-



ical, and analogical, Eco explains that an open work, in contrast,

remains inexhaustible insofar as it is “open,” because in it an ordered world based on universally acknowledged laws is being replaced by a world based on ambiguity, both in the negative sense that directional centers are missing and in a positive sense, because values and dogma are constantly being placed into question.<sup>40</sup>

Eco is thinking as much of the laws of physics as of the state of contemporary politics when he claims the modern world is essentially unstable. At a microscopic level, matter disintegrates into energy and the effects of relativity become more severe. At the macro-level of geopolitics, ideologies and political theories are either tainted or undifferentiated. Open works convey this perpetual state of instability that defines the contemporary context, laying it bare for audiences to contend with and to try to understand. They are, Eco argues, epistemological metaphors, expressions of the world and how we come to know it: in a state of constant change and disarray. However, Eco’s notion of the open work is neither a dejected resignation that meaning and truth are impossible, nor a celebration of relativism.

The *possibilities* which the work’s openness make available always work within a given *field of relations*. . . . We may well deny that there is a single prescribed point of view. But this does not mean complete chaos in its internal relations. Therefore . . . the “work in movement” is the possibility of numerous different personal interventions, but it is not an amorphous invitation to indiscriminate participation.<sup>41</sup>

Open works represent a shared, material condition of indeterminacy; they do not succumb to it. However multiple, the meanings of open works are dependent on the mechanics of the work, how it positions the audience, and how it enables them to act and think within this discrete field. The work’s form allows for an openness that is circumscribed.<sup>42</sup>

To describe the limits of the open work, Eco utilizes insights gleaned from information theory, a field that was foundational to the development of computers. Information theory was launched as a field by the American engineer and mathematician Claude Shannon in “The Mathematical Theory of Communication,” published in 1948 in the *Bell System Technical Journal*.<sup>43</sup> Working as a cryptographer during World War II, Shannon wanted to mitigate two undesirable outcomes: that the wrong person (e.g., an enemy interceptor) could decode a message and that the right person might fail to do so correctly. Shannon’s crucial

innovation was to approach the problem quantitatively, defining information as what was unpredictable in a message and therefore the most likely to be missed or misunderstood. In Shannon's theory, information is defined as a statistical measure of the probability that a signal will be accurately reproduced after traversing a channel. Such a measure does not pertain to the precise meaning of the message but instead diagrams the outer limits of the types of signals that can be accurately received.<sup>44</sup>

Shannon's definition of information provided Eco with a concrete visualization for how open works produce what Eco calls "fields of possibilities" when it comes to meaning. Information theory tries to discern the outer limits of what is possible to communicate; open works, Eco argues, do the same. For Eco, open works are like information theory: both are metalinguistic commentaries on the conditions of possibility for meaning, not an interpretation of a work in and of itself. But there are important differences in emphasis. Shannon wanted to reduce the variability of meaning so as to ensure the accurate transmission of a message in wartime. Eco, writing about art, deploys information theory to explain how a work's meaning is tied to the composition of the work and not the whims of the spectator, however variable the meaning might be. Because of this disparity, Eco takes more inspiration from the French theorist Abraham Moles, who applies information theory to art in *Information Theory and Esthetic Perception* (1958). Moles stresses information theory's probability structure and the relatively open field of possible interpretations that artworks (uniquely) allow. "What is transmitted [by art] is *complexity*," Moles asserts.<sup>45</sup> Moles outlines how complexity is always relative, contingent not only on the form of other artworks (i.e., aesthetic conventions) but on the form of the audience—their expectations, predilections, and a slew of other unpredictable but material, social factors. The best artworks, Moles explains, occupy the outer edges of what is expected, pushing the boundaries of the audience while not straying so far afield as to be illegible or ugly. In *Opera aperta*, Eco echoes Moles when he writes,

even an art that upholds the values of vitality, action, movement, brute matter, and chance rests on the dialectics between the work itself and the "openness" of the "readings" it invites. A work of art can be open only insofar as it remains a work; beyond a certain boundary, it becomes mere noise.<sup>46</sup>

Moles allows Eco to emphasize novelty and innovation without relying on a mythical notion of creativity as generating forth, *ex nihilo*, from the individual artist. Moles's aesthetic information theory also supports Eco's claim that these experimental works are not absurd gestures proclaiming the impossibility of

meaning but statements about the simultaneously chaotic yet ordered state of the world. From Moles (arguably more than anywhere else) Eco derives his political theory of art.

One might say that rather than imposing a new system, contemporary art constantly oscillates between the rejection of the traditional linguistic system and its preservation—for if contemporary art imposed a totally new linguistic system, then its discourse would cease to be communicable. The dialectic between *form* and the *possibility* of multiple meanings, which constitutes the very essence of the “open work,” takes place in this oscillation.<sup>47</sup>

But the two differ in one important way. Moles reduces art’s purpose to its ability to communicate formal complexity, always seen (even calculable) in statistical relation to given conventions. Complexity, for Moles, is therefore narrowly defined. For Eco, complexity is analogical and expansive; it describes a societal condition, a creative methodology, and a property of artistic form. Most important, it places these registers (social, aesthetic, political) into direct relation—which allows art to comment on and even reshape the others.

Eco expands on these sociopolitical implications of the open work (and further departs from Moles) in his essay “Del modo di formare come impegno sulla realtà” (Form as social commitment), written just a few months after the publication of *Opera aperta*.<sup>48</sup> By using the term *impegno* in his title, Eco means to directly address the official Left (the PCI and party-affiliated artists and writers) and its critique of experimental art as elitist and out of touch.<sup>49</sup> In “Del modo,” which was published in *Il Menabò*, Eco argues that open works are instances of formal protest, more politically effective and truthful than, most notably, neorealism.<sup>50</sup> He explains that, by refusing meaning, contemporary artists are rejecting a social model, one in which the world is ordered and coherent. Formal protest is, for Eco, the most effective way to enact a political protest because forms are the means by which we understand the world and communicate this understanding to one another. At the time, Eco was writing not only against realism but against a more proactive, pedagogical method whereby art advances a predetermined revolutionary project. Eco could not have been clearer: with open works, “the artist does not provide a solution. . . . [Art’s] task is not to provide remedies.”<sup>51</sup> “When [art’s] discourse is unclear, it is because things themselves, and our relationship to them, are still very unclear,” Eco concludes, defending the apparent “noncommunication” of avant-garde art as the most truthful communication that could be.<sup>52</sup>

Open-endedness operates on many levels in Eco's notion of the open work: as a formal characteristic (movement), a message about reality, a metaphor for epistemology, and a model for the political function of art. It is also a quality of aesthetic experience, which Eco ties to the structural composition of the work. This is most apparent in the chapter on the open work and visual arts, where Eco surprisingly discusses *arte informale* as his central example. He argues that *arte informale* is open because it rejects a formal system: "the sign becomes imprecise, ambiguous. . . . Informal art calls into question the principle of causality, bivalent logics, univocal relationships, and the principle of contradiction."<sup>53</sup> *Arte informale* becomes for him a primary example of how a lack of clarity is the most precise way to represent the state of the world. To then explain how this effects the audience, Eco turns to the example of Jackson Pollock's drip paintings: "[T]he disorder of the signs, the disintegration of the outlines, the explosion of the figures incite the viewer to create his own network of connections."<sup>54</sup> This pleasurable, even empowering, experience of infinite possibility is the open work's *raison d'être*. "The 'reader' is excited by the new freedom of the work, by its infinite potential for proliferation, by its inner wealth and the unconscious projections that it inspires."<sup>55</sup> "Openness," he concludes, "is the guarantee of a particularly rich kind of pleasure that our civilization pursues as one of its most precious values, since every aspect of our culture invites us to conceive, feel, and thus see the world as possibility."<sup>56</sup>

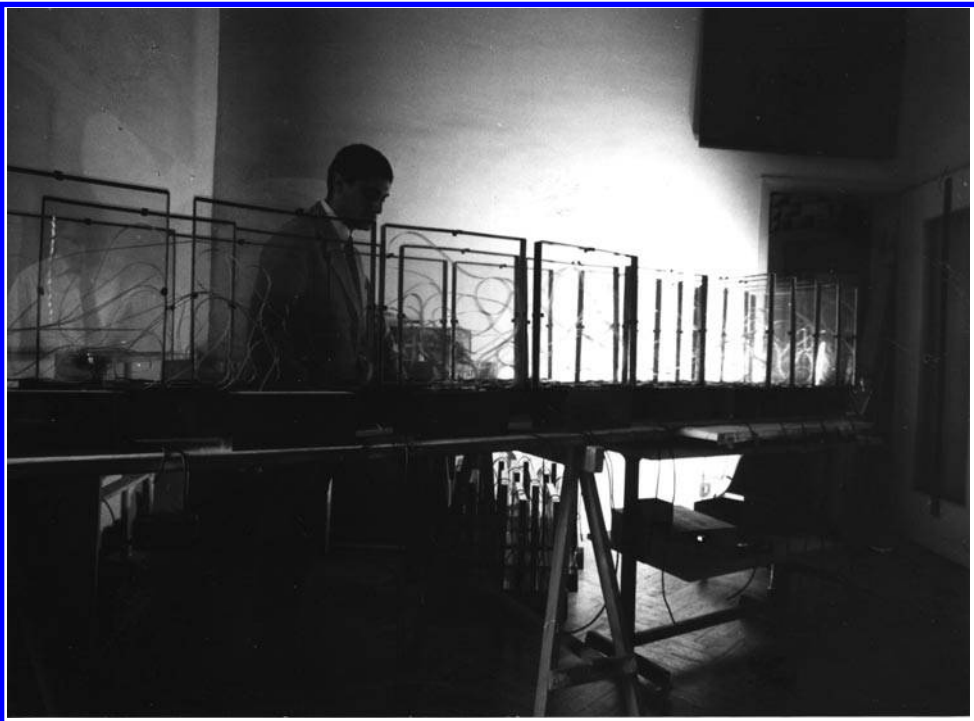
For Eco, then, production is quite separate from reception. While both the artistic process and the resulting form are best understood as a discrete field, open yet contained, the type of aesthetic experience triggered by open works is wholly individuating—albeit an individuation deliberately designed by the artist, rather than something inherent to the audience (and thus to all forms of art). As Eco contends, "we still live in a culture in which our desire to abandon ourselves to the free pursuit of visual and imaginative associations must be artificially induced by means of an intentionally suggestive construct."<sup>57</sup> The programmatic model, for Eco, is one such means of advancing individuation, of inspiring freedom in the viewers of art. The expressive gesture of *arte informale* is another. That Eco could posit *arte informale* and *arte programmata* as analogous in their open-endedness, working as similar metaphors for the same epistemology, protesting the same formal conventions and artistic styles, points to the disparity between *arte programmata* and Eco's ideas about the social function of art. *Arte programmata* is not a material articulation of chaos or a meditation on noncommunication in everyday life. Its geometric, algorithmic operations are an active intervention into this condition, an attempt to reconstitute a collective signal,

to reject noise and its alienating effects. If, as Eco claims, the complex web of Pollock's paint splatters invites the viewer to "create his own network" each and every time the work is viewed, then the motorized plastic Möbius strip snaking its way around the black square frame in Colombo's *Strutturazione fluida* achieves the opposite: it delineates its own network and entices viewers on its own mechanistic, albeit mutable, terms. The fact that the artists of *Arte programmata* did not recognize this crucial disparity suggests a critical fallacy in what they imagined their programmed artworks were designed to do. This distinction ultimately continued to crumble in observations of real audience responses, forcing the artists to rethink the program of *Arte programmata*.

### From Collective Creation to Creating Collectives

In one important way, information theory appealed to Eco as a theory of interpretation for the same reason programming appealed to the artists of *Arte programmata* as a mode of production: each offered a way to conceive the activity of individuals (artists or audience members) as stemming from shared material, social conditions rather than a uniquely subjective or metaphysical state. The artists of *Arte programmata* were excited by Eco's theory of the open work precisely because of how it presumed an active, engaged spectator who, although acting with unprecedented freedom, is nevertheless bounded by the form of the work and the shape of the channel or context.

But in their understanding of "participation," Mari, Gruppo T, and Gruppo N diverged from Eco. Although Eco argues that open works stem from a collectively held reality, he does not posit that even the most programmatic open works are a means for creating a sense of collectivity. To the contrary, Eco celebrates the amplified sense of freedom that open works impart to their viewers. Rather than collectivizing authorship, and far from creating collectivities, Eco's notion of the open work is more precisely understood as a type of delegated authorship: artists make works in which their audience (or performers) can enjoy the freedom



romantically understood to be the freedom (from determination, from instrumentality, etc.) of the artist too. Within an open work's field of possible interpretations, each spectator stands alone. In contrast, the artists of *Arte programmata* understood the program as a means for probing the possibilities of common, communal experience and action at a time when such a thing seemed all but impossible. The programming of their art was therefore an answer to a historically specific problem: how to engender a collective subject without a preexisting ideology or identity. This attempt to have it both ways—to generate a collective aesthetic experience that also affirmed the spectator's individual creative capacity—also led them to posit the inevitable element of control for any collective, however provisional, temporary, or inoperative, to exist.<sup>58</sup>

Some contemporaries took issue with what they perceived to be this controlling element, or hyperrationalism, in the art of *arte programmata*. In 1963, Italo Calvino referred to their intense mechanization of art production when he wrote of a “rationalist” trend in contemporary art that might successfully integrate art with industry, except that it had “paid with a weakening of creative and combative forces.”<sup>59</sup> The critic and historian Enrico Crispolti issued a similar critique of *arte programmata* in an essay also penned in 1963. Crispolti was largely sympathetic to *arte programmata*, especially to the young collectives Gruppo T and Gruppo N (Crispolti had curated an early exhibition of the Gruppo T artists in 1958). But in taking stock of the political effects of the artists' work, Crispolti concluded that *arte programmata* ultimately failed to transcend the negative effects of mechanization: automated art in turn automated (and stultified) its audiences. If the artists attempted to avoid this devastating effect, the resultant works, for Crispolti, did so not by creating a sense of collectivity but by embracing “a sort of playful visual design (*progettazione*)”—which, he continued, was far from a sociological or political interrogation of collective production or experience.<sup>60</sup> Central to Crispolti's and Calvino's criticisms of *arte programmata*, then, is the presumption that the contemporary condition demands that art protect and even advance the individual viewer's self-possession, autonomy, and agency.

By attacking the integrity of the individual and situating their sense of self within (rather than against) a programmatic system, the works of *Arte programmata* not only refuse to see programming as stultifying to creativity; they also displace the locus of freedom from the individual to the site of engagement with the system itself.<sup>61</sup> In so doing, the objects included in the *Arte programmata* exhibition gesture toward an understanding of programs as foundational to social relations rather than as inextricably linked to their prediction, domination, and control.<sup>62</sup> The program in this instance is a resolutely social mechanism, a way

Gianni Colombo. *Strutturazione fluida* (Fluid structure), 1960.  
Photograph of the artist in his studio by Ugo Mulas. © Archivio Ugo Mulas Heirs.

to render art a collective enterprise, as well as a metaphor for the possibility of a functional and democratic social life.

The freedom that *Arte programmata* inspired in its viewers was therefore not just circumscribed but secondary to participation in this common—that is, programmed—activity and experience. Historically, the artists developed the idea of programmed production as a means to dismantle the untethered ideal of individual freedom and locate the basis for subjectivity and society in the material, physical structures we share. That they refused to recognize their own subjectivity in this formula only further complicates the challenges the works raise. From today's standpoint of data-driven behavior prediction, the role of artist-as-programmer is an uncomfortable one to adopt with enthusiasm. The aim is not to laud this position, or argue that we adopt it as our own, but to trouble the bifurcated thinking that would posit an aesthetics against programs or romanticize collectivity as somehow being without form and therefore without constraint. By excavating *Arte programmata's* vision of individuals united by programs, we might develop a new understanding of control, collectivity, and, inexorably, their interdependence that is not only more appropriate but more empowering, given the technologically mediated world in which we live.

## Notes

1. *Arte programmata* traveled to the Smithsonian Museum in 1964 and an English-language catalogue was printed for the occasion, which included an expanded statement by Munari defining “programmed art.” Bruno Munari, “Arte Programmata,” in *Arte Programmata Kinetic Art*, exh. cat. (1964), n.p., in Archivio Storico Olivetti Biblioteca (ASOB), Solo F. Arte folder 6, 1; emphasis added.

2. Umberto Eco in *Arte programmata*, exh. cat., ed. Bruno Munari et al. (Milan: Olivetti, 1962), n.p., in ASOB, Ivrea, Solo F. Arte folder 6, 1. English in the original catalogue.

3. Eco, in *Arte programmata*, ed. Munari, n.p.

4. This authorial operation, and the use of computer technologies and terminology to achieve it, was shared by other artists at the time, including François Morellet (who penned an essay on “programmed art” in 1962). Morellet and Mari, Gruppo T, and Gruppo N were all part of the New Tendencies movement, which began in 1961 with the first *New Tendencies* exhibition in Zagreb. The literature dealing with *Arte programmata* almost exclusively does so in this international context. This article takes another tack by situating the exhibition and its motivating concerns within the specific Italian context, especially the ways in which this context determined the artists’ particular understanding of collectivity, the legacy of communism, and the appeal of control.

5. Umberto Eco, *Opera aperta: Forma e indeterminazione nelle poetiche contemporanee* (Milan: Bompiani, 1962); published in English as Umberto Eco, *The Open Work*, trans. Anna Cancogni (Cambridge, MA: Harvard University Press, 1989).

6. Recent literature on Italian art, some including analyses of artists included in *Arte programmata*, focuses exclusively on the notion of artistic labor. Labor is how both artists of this period and, more recently, art historians articulate the political intentions *and* effects of art. I contend that labor is absolutely a primary way that artists implement their intentions but that it cannot be confused with the effects or meanings of the work. In trying to distinguish between the intentions of the artists and the meanings of the works (both historically and today), I therefore stress this distinction between labor and reception. What and how a work communicates lies in its form and the context in which it is received. For excellent examples of the labor focus I am describing, see Jaleh Mansoor, *Marshall Plan Modernism: Italian Postwar Abstraction and the Beginnings of Autonomia* (Durham, NC: Duke University Press, 2016); and Jacopo Galimberti, *Individuals against Individualism: Art Collectives in Western Europe (1956–1969)* (Liverpool, UK: Liverpool University Press, 2017).

7. Forma 1, “Manifesto of the Forma Group” (1947), in *The Italian Metamorphosis*, ed. Germano Celant (New York: Guggenheim Museum, 1994), 712. Originally published in *Forma 1: Mensile di arti figurative* [Form 1: Monthly of figurative arts] (Rome), April 1947.

8. As works such as *Ciclo della protesta N. 3* (Cycle of protest no. 3; 1956) attest, Vedova considered his gestural abstraction to be illustrative of a commonly held struggle against alienation, oppression, and tyranny. *Ciclo della protesta* was painted after the artist, during a visit to Brazil, witnessed the exploitation taking place on coffee plantations.

9. For a detailed account of this bifurcation, as well as the intricacies of the political commitment of Vedova, see Adrian R. Duran, *Painting, Politics, and the New Front of Cold War Italy* (Burlington, VT: Ashgate, 2014).



10. Guttuso quoted in Duran, 111.
11. For more on the importance of 1956 for communism in Italy, see Paul Ginsborg, *A History of Contemporary Italy: Society and Politics, 1943–1988* (New York: Palgrave Macmillan, 2003), 204–9.
12. For a study of these debates in poetry, see John Picchione, *The New Avant-Garde in Italy: Theoretical Debate and Poetic Practices* (Toronto: University of Toronto Press, 2004).
13. For more on this development, see Marcia E. Vetrocq, “National Style and the Agenda for Abstract Painting in Post-war Italy,” *Art History* 12, no. 4 (December 1989): 448–71. On *arte informale* in general, see Enrico Crispolti, *Ricerche dopo l’informale* (Rome: Officina, 1968); and Renato Barilli and Franco Solmi, *L’informale in Italia* (Milan: Mazzotta, 1983).
14. Alberto Burri, “Words Are No Help,” *The New Decade: 22 European Painters and Sculptors*, ed. Andrew Carduff Ritchie (New York: Museum of Modern Art, 1955), 82.
15. Giulio Carlo Argan, *Salvezza e caduta nell’arte moderna* (Milan: Il Saggiatore, 1964), 56. All translations from Italian are my own unless otherwise noted.
16. Enrico Baj et al., “Against Style” (1957), in *The Italian Metamorphosis, 1943–1968*, ed. Germano Celant (New York: Guggenheim Museum, 1994), 719.
17. Mari was explicit about this. While studying at the Brera Art Academy in Milan, the artist went to see exhibitions of *arte informale* and realism and was “disturbed that the values of the left . . . were painted in such a poor manner”—a poverty Mari saw as stemming from any art based on the variable and inconsistent expression of individuals. Enzo Mari, *25 modi per piantare un chiodo: Sessant’anni di idee e progetti per difendere un sogno* (Milan: Mondadori, 2011), 25.
18. MAC was the Italian manifestation of a widespread, international movement of concrete art, first articulated by Theo van Doesberg in 1930. Munari and the other artists and theorists of MAC positioned themselves within this broader movement and continued to advance its legacy. To see how MAC relates to this broader context, see Max Bill and Ettore Sottsass, *Arte astratta e concreta* (Milan: Palazzo Exreale, 1947); and G.C. Argan, P. Bucarelli, and J. Jarema, eds., *Arte astratta e concreta in Italia* (Rome: Galleria Nazionale d’Arte Moderna, 1951).
19. Luciano Caramel, *MAC: Movimento arte concreta, 1948–1958* (Florence: Maschietto e Musolino, 1996).
20. Mari, *25 modi per piantare un chiodo*, 27. Mari seems nostalgic for a world in which signs are stable. The creators and viewers of Renaissance paintings would have all shared the same church dogma, which made such clear communication possible.
21. The declaration read: “We consider then reality as a constant becoming of phenomena which we perceive in variation. . . . [W]e recognize in the arts a tendency to express reality in its ways of becoming. Therefore considering the artwork as a reality made with the same elements which constitute that reality which surrounds us it is necessary that the artwork itself be in constant variation.” Gruppo T, “Miriorama I declaration” (1959), in *Gruppo T: Anceschi, Boriani, Colombo, De Vecchi, Varisco: Miriorama, Le Opere, I Documenti*, ed. Luca Cerizza (Bologna: P420 Arte Contemporanea, 2010), 27.
22. As Enrico Crispolti notes in his review of an early Gruppo T show, the group’s early works featured “expressive media, primarily in the technical sense.” Enrico Crispolti, “Mostra di Anceschi, Boriani, Colombo, De Vecchi,” *Il verri* 5 (1959): 98.
23. For more on Gruppo N’s early work, as well as the intricacies of their political commitments,

especially their Marxism, see Jacopo Galimberti, “The N Group and the *Operaisti*: Art and Class Struggle in the Italian Economic Boom,” *Grey Room* 49 (Fall 2012): 80–101.

24. Clearly interested in the process of “framing”—how context and discourse produces the work of art—Klein and his contemporary Piero Manzoni, who like Klein also signed people (including Eco) as works of art, were huge influences on Gruppo N. But while Gruppo N at first adopted Manzoni’s absurdist strategies, it soon turned away from them as yet another manifestation of singular authorship. For more on Manzoni and his relationship to Gruppo N, see Jacopo Galimberti, “The Intellectual and the Fool: Piero Manzoni between the Milanese Art Scene and the Land of Cockaigne,” *Oxford Art Journal* 35, no. 1 (March 2012): 75–94.

25. Statement by Gruppo N reprinted in Italo Mussa, *Il Gruppo Enne: La situazione dei gruppi in Europa negli anni ’60* (Rome: Bulzoni Editore, 1976), 305.

26. *Epoca*, “Anche in Italia il futuro è già cominciato,” *Epoca*, 15 October 1959.

27. *Epoca*, 9.

28. Olivetti published on his social ideals in several books over the course of the 1950s. See Adriano Olivetti, *Society, State, Community* (Milan: Edizioni di Comunità, 1954); and Adriano Olivetti, *Community Ideals* (Ivrea, Italy: Movimento Comunità, 1956). For an insightful analysis of Olivetti’s notions of community, planning, and the role of the industrialist as they relate to American models, see Paolo Scrivano, *Building Transatlantic Italy: Architectural Dialogues with Postwar America* (Burlington, VT: Ashgate, 2013).

29. Romano Alquati, “Composizione organica del capitale e forza-lavoro alla Olivetti” (1962), in *Sulla FIAT e altri scritti* (Milan: Feltrinelli, 1975), 81–163. Originally published in *Quaderni rossi*, no. 2 (June 1962).

30. See especially the section “La cooperazione come ‘ruffianesimo,’” in Alquati, “Composizione organica,” 152. For a detailed analysis of Alquati, Olivetti, and cybernetics, as well as their implications for contemporary labor dynamics, see Matteo Pasquinelli, “To Anticipate and Accelerate: Italian Operaismo and Reading Marx’s Notion of the Organic Composition of Capital,” *Rethinking Marxism* 26, no. 2 (2014): 178–92.

31. Carlo Tagliavini, “L’automazione nelle ricerche fonetiche,” in *Almanacco letterario Bompiani 1962*, ed. Sergio Morando (Milan: Bompiani, 1962), 120–22.

32. Stanislao Valsesia, “Verso la ‘biblioteca elettronica’: L’information retrieval,” in *Almanacco letterario Bompiani 1962*, 117–20.

33. “Breve crestomazia dei più celebri automi e automatari,” in *Almanacco letterario Bompiani 1962*, 159–74.

34. A poet, writer, and activist, Balestrini was a member of Gruppo 63 and was very active in the debates about the politics of form. For primary documents from these debates, see Nanni Balestrini et al., *Gruppo 63* (Milan: Bompiani, 2013). For a translation, as well as the code used to produce *Tape Mark 1*, see Hannah B. Higgins and Douglas Kahn, eds., *Mainframe Experimentalism: Early Computing and the Foundations of the Digital Arts* (Berkeley and Los Angeles: University of California Press, 2012), 266–74.

35. Umberto Eco, “La forme del disordine,” in *Almanacco Bompiani 1962*, 175–88.

36. Enzo Monachesi, dir., *Arte programmata* (1963), available online at [https://www.youtube.com/watch?v=iji\\_cT9L6RQ](https://www.youtube.com/watch?v=iji_cT9L6RQ). The film is included in the Olivetti Archive’s Youtube channel: Archivio

Nazionale del Cinema d'Impresa, Associazione Archivio Storico Olivetti, Fondo filmico Olivetti (1949–1985), Youtube, <https://www.youtube.com/playlist?list=PL15B-32H5GIL2MaHAbSzq5-p802TPj46qI>.

37. Umbro Apollonio, "Ipotesi su nuove modalità creative," *Quadrum* 14 (1963), quoted in Enrico Crispolti, "Neoconcretismo, arte programmata, lavoro di gruppo," *Il verri* 12 (1963): 42.

38. Gruppo N to Munari, 19 January 1962, in Archivio Alberto Biasi, Padova, reprinted in Marco Meneguzzo, Enrico Morteo, and Alberto Saibene, eds., *Programmare l'arte: Olivetti e le neoavanguardie cinetiche* (Monza, Italy: Johan and Levi, 2012), 15.

39. "Intervista a Davide Boriani," in Lucilla Meloni, *Gli ambienti del Gruppo T: Le origini dell'arte interattiva* (Rome: La Galleria Nazionale d'Arte Moderna e Contemporanea di Roma, 2006), 23.

40. Eco, *The Open Work*, 9.

41. Eco, *The Open Work*, 19.

42. *Opera aperta* predates and clearly prefigures Eco's writing on semiotics. See, for the earliest example, Umberto Eco, *La struttura assente: Introduzione alla ricerca semiologica* (Milan: Bompiani, 1968).

43. The article was then published as a book with an introduction by Warren Weaver: Claude Shannon, *The Mathematical Theory of Communication* (1948; Chicago: University of Chicago Press, 1998).

44. Eco cites Shannon's definition of information in his essay "Openness, Information, Communication," in *The Open Work*, 46.

45. Abraham Moles, *Information Theory and Esthetic Perception*, trans. Joel E. Cohen (Chicago: University of Illinois Press, 1966), 196.

46. Eco, "The Open Work in the Visual Arts," in *The Open Work*, 100.

47. Eco, "Openness, Information, Communication," 60.

48. Umberto Eco, "Del modo di formare come impegno sulla realtà," *Il Menabò* 5 (1962): 198–237. This essay was included in the second edition (1967) and in all subsequent editions of *Opera aperta*.

49. The entire issue of *Il Menabò* was conceived as a defense of experimentalism, as Eco recounts in his introduction to *Opera aperta*. Eco, *Opera aperta*, vi–vii.

50. Eco, *Opera aperta*, vi–vii.

51. Eco, *Opera aperta*, 149. Calvino makes a similar defense of avant-garde art in "La sfida al labirinto," arguing that literature's greatest promise is in its ability to educate. Italo Calvino, "La sfida al labirinto," *Il Menabò* 5 (1992): 85–99.

52. Eco, "Form as Social Commitment," 157.

53. Eco, "The Open Work in the Visual Arts," 85, 87.

54. Eco, "The Open Work in the Visual Arts," 103.

55. Eco, "The Open Work in the Visual Arts," 91.

56. Eco, "The Open Work in the Visual Arts," 104.

57. Eco, "The Open Work in the Visual Arts," 100.

58. With their desire to generate collectives while remaining open-ended and to eschew a solid, determinate political program while still having a sociopolitical effect, the artists of *Arte programmata* preempted the focus on contingency that defines much political theory (especially of community art and organizing) today. Consider Jean-Luc Nancy's *Inoperative Community* (1991), which

plays a central role in Grant Kester's theorization of participatory art in *Conversation Pieces* (2004). Nancy (and Kester following Nancy) argue that the most politically and ethically viable "form" of community can and should not be defined and then enacted; rather communities are formed within political realities and cohere in strategic opposition. *Arte programmata* prefigured this provisional notion of community. The unique provocation of the artists' work is how it does this while also pointing out the necessary element of control and even ethical imperative for transparent structures and protocols. Jean-Luc Nancy, *Inoperative Community*, trans. Peter Connor et al. (Minneapolis: University of Minnesota Press, 1991); and Grant Kester, *Conversation Pieces: Community and Communication in Modern Art* (Berkeley and Los Angeles: University of California Press, 2004).

59. Calvino, 94.

60. Crispolti, "Neoconcretismo, arte programmata, lavoro di gruppo," 57.

61. Gilles Deleuze presents another model for understanding the inextricable relationship between individuals and systems in "Postscript on the Societies of Control." Both Deleuze and *Arte programmata* refuse negation and criticality and the dichotomization on which these rely. Unlike Deleuze, however, who models his conception of resistance in control societies on William Burroughs and advocates miscommunication and jamming signals with noise, the artists of *Arte programmata* considered noncommunication and noise to be problems, not solutions. Instead, they held fast to the need for a functional (albeit flexible) system of communication as a condition of possibility for new social relations to come into existence. Gilles Deleuze, "Postscript on the Societies of Control," *October*, no. 59 (Winter 1992): 3–7.

62. Ann Marie Brennan argues that the *Arte programmata* exhibition was complicit, even instrumental, in the emergence of new forms of domination and control inherent to the immaterial, communication-based labor enabled by the technologies and rhetoric of Olivetti. See Ann Marie Brennan, "Olivetti: A Work of Art in the Age of Immaterial Labour," *Journal of Design History* 28, no. 3 (April 2015): 235–53. Brennan's argument, however, depends on dichotomized thinking that pits the individual against the machine or system and inherently views participation as integration. This is what the present article seeks to move beyond.