2 Computing environmental design

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"[S]urvival of mankind as we know it" is at stake, and the "natural human ecology stands in jeopardy." Serge Chermayeff's 1960 plea for environmental conservation addressed the growing use of cars, as he thought everyone's access to them resulted in a noisy "auto-anarchy" with roads depredating the natural environment (Chermayeff 1960a: 190, 193, 1962a: 4–13). "Personally, I observe these probabilities with profoundest melancholy" in Cape Cod, he noted. The things affected by this predicament ranged from the privacy of his cottage to the ecology of the neighborhood, the social order of the Wellfleet community, and even the planning of the entire peninsula. Only a powerful computer could solve the complexity of the problem, Chermayeff thought.

Through the lens of social history of design, I argue that the early history of computing in design established a managerial view of the natural world benefiting the well-educated, liberal elite. Chermayeff was part of a group of modernist designers with vacation homes on Cape Cod who nurtured political ties to the Kennedy family. Their community was fashioned around using the Wellfleet environment as a place for leisure and vacation, a lifestyle threatened by various local housing and road developments. In response they began promoting a national park to protect the area, and began pondering on finding new tools for proper environmental design that could protect their interests. The computer became their unifying tool for a multilayered approach to environmental planning, which saw nature as rational in character. It offered managerial distance and an imagined socio-political objectivity. As a device the computer emerged out of Chermayeff's comprehensive "Environmental Design" courses at Harvard University, which sought to merge arts, science, and technology in the design process modeled on the Bauhaus legacy.

Environmental conservation at Cape Cod

Since the arrival of former Bauhaus faculty in the United States in the late 1930s the picturesque and beautiful town of Wellfleet, Cape Cod, had been their annual summer residence. Bauhauslers such as László Moholy-

Nagy, Walter Gropius, Herbert Bayer, and Marcel Breuer spent their vacations there on an annual basis, along with prominent modernists such as Eero Saarinen, Paul Weidlinger, and Jack Hall. Chermayeff was very much a part of this community, having bought his own property there in 1944. It was 1,500 square feet of playful avant-garde and the only place he would ever feel truly at home. Located at the Slough Pond, close to the beaches, it was in the midst of, what was then, and indeed still is today, beautiful natural scenery. The architectural history of this modernist community has been well documented by Peter McMahon and Christine Cipriani, who tell a story of a tight knit group of friends enjoying a laid-back culture of beaches, woods, art, architecture, and each other (Blum 1986; McMahon, Cipriani 2014).

Hard as it may be to imagine today, back then Wellfleet was a place with no restaurants and only a few tourists. And this was exactly what Chermayeff cherished the most. Though he previously had shown environmental concern, such as in a 1934 lecture about noise prevention in buildings, his turn to nature conservancy began in earnest at Cape Cod (Chermayeff 1934). What raised his concern were numerous new parcels of buildings that were put on the market in the late 1950s, with new developments built for vacationers as well as local residents (Kneedler-Schad, Lacy, Lowenthal 1995: 44–45). The town's modernist designers were less than pleased at seeing their beloved scenery being invaded by people and homes that did not belong to the community of the avant-garde. First among them to express concern about the loss of natural habitat was Gropius, who in his lectures at Harvard tried to convey an environmental ethic to his students that could halt such development:

> … the greatest responsibility of the planner and architect, I believe, is the protection and development of our habitat. Man has evolved a mutual relationship with nature on earth, but his power to change its surface has grown so tremendously that this may become a curse instead of a blessing. How can we afford to have one beautiful tract of open country after the other bulldozed out of existence, flattened and emptied for the sake of smooth building operations and then filled up by a developer with hundreds of insipid little house units, that will never grow into a community. […] *Until we love and respect the land almost religiously, its fatal deterioration will go on.*
>
> (Gropius 1955: 184)

Chermayeff was most definitely among those who loved and respected their land almost religiously. His property, his community of designer friends, and the nature scenery that surrounded him were most precious to him, and the arrival of new developments with cars, people, and noise were personally upsetting. As will be apparent, both his writings and teachings addressed this problem head-on, and the computer would surface as an objectifying tool in planning for a more cautious development.

It was the prospect of creating the Cape Cod National Seashore Park that sparked Chermayeff into action. In the fall of 1959 the Senator of Massachusetts, John F. Kennedy, reached out to Chermayeff and asked him his opinion about a possible park, as he was planning to sponsor a bill in support of it and wanted Chermayeff to testify in its favor. In his enthusiastic reply, Chermayeff said he would gladly testify, and that he could also provide a Harvard study in support of the park (Chermayeff 1959a, 1959b, 1959c; Holborn 1959; Kennedy 1959). He immediately formed the Wellfleet Study Group of Harvard undergraduates, and would, in subsequent months, lobby local and federal politicians about the importance of the park by focusing on the ecological vulnerability of the Cape (Chermayeff 1960b, 1960c; Landstrom 1960). In a show of authority, when contacting people for support, he used the official Harvard letterhead in his personal correspondence (Chermayeff 1960d). In the summer of 1960 Chermayeff invited Directors within the Department of Interior to be shown around the possible park area, which included his own property. And they loved visiting his "delightful summer home" after the tour (Lee 1960). In December the same year he would finally testify at the House of Representatives in favor of the park, arguing that it should be as large as possible. If the Senate voted in favor of a tiny park, he argued, "Conservation would then be just a word. It would not have any serious meaning because the ecology of wildlife cannot jump quarter mile gaps with residents, their pets and cars and so on" (Chermayeff 1961a: 102). What was needed was a larger plan for Cape Cod and Wellfleet that would make sure that neither the town nor the surrounding landscape would be shattered by suburban sprawl. Unless the Senate took action, "the cape as we know it will vanish forever within a decade and be replaced by an endless suburban sprawl, a dormitory for Route 128 industries within 45 minutes commuting time," he argued (Chermayeff 1961a: 105).

Not all his modernist neighbors were equally enthusiastic about the park. His friend and fellow designer, Breuer, for example, was annoyed as he had just subdivided and sold off two properties at Herring Pond and worried the value of his remaining land would dwindle with it being inside a park. Chermayeff tried to convince him about the value of having a cottage within a nature conservation area:

> I am fighting hard for the Park. There is no question that this unique area would be very quickly built over if the Park Service doesn't take over and reverse the process and conserve the natural resources in years to come. […] However, every house with its traffic and noise and erosion, squeezed into our small pond area, scars the landscape and scares away the wild life which will not be restored in our lifetime.
>
> (Chermayeff 1961b).

There was also plenty of local opposition to the park reflecting an ongoing tension between local and summer residents, with the visitors being inclined to support nature conservation. The visitors tended to be wealthier, better educated, or also having a wider social network (Corbett 1955: 214–222). The Kennedys considered themselves to be true Cape Codders, having spent more than forty summers at a place they considered their home. Yet this identification was not recognized by all. Hyannis Port, where their estates were located, was considered a part-time summer colony by most Cape Codders, and John F. Kennedy's self-identification was not taken entirely seriously by true locals. In addition, the average Cape Codders were obviously not up to par with the Kennedy's wealth and social influence. While serving as US Senator for Massachusetts between 1953 and 1960 Kennedy did his best to keep these tensions buried, so as to maintain the political cachet of having a local identity and support base, but despite his attempts, they surfaced in the debate about a possible Cape Cod National Seashore Park. Those living in Cape Cod year-round feared a tax increase with the loss of property tax revenue on the land that was turned into a park, and there was also a fear of a ban on developers in the areas. As a result there was much controversy surrounding Kennedy and his plans for the park in the summer of 1959, even leading to some demonstrations against the project. Francis P. Burling, then Managing Editor of *The Cape Codder* was on Kennedy's side, however, and very much in favor of the park, and he skewed the local newspaper accordingly (Damore 1967; Foster 1985). The managerial culture that later came with the computer planning would magnify the social distance with the machine serving as an objectifying tool controlling such local opposition.

Yet in light of his bid for Democratic nomination for Presidency, Kennedy decided to postpone support of the park so that the local opposition could not be used against him during the election year of 1960. Having been elected President, he finally established the Cape Cod National Seashore Park in August 1961 while he was enjoying his vacation at Hyannis Port. This was his first show of support of environmentalism, and it propelled him to think further about the issue, as he later did in his endorsement of the conclusions of Rachel Carson's *Silent Spring* (Carson 1962). A special edition of Henry David Thoreau's memoirs from Cape Cod was issued on the occasion, with the park being fashioned rhetorically as saving the beaches he had once described (Thoreau 1961; Mulloney 1998). A local historian correctly noted, "[i]t was as much to protect beaches of the lower Cape *for* the people as it was to save them *from* the people" that the park was established (Schneider 2000: 304). The beaches were to be as accessible as possible fostering tourism business, while the green mantle was to be protected. Only homes already built within the park could remain, and one of those belonged to Chermayeff, who was overjoyed about the prospect of "escape into a wilderness" knowing that there would be no new developments in his neighborhood (Chermayeff 1962b: 7).

Gropius was also thrilled. To him, the new park was a vehicle for protecting both the environment and the community of avant-garde that were encroached upon by developments and conventionals' traditional architecture and style. It is telling that he advised the National Park Service that "only fresh and imaginative contemporary design" should be built within the newly established Cape Cod National Seashore Park (Gropius 1963a). Chermayeff agreed. In addition to requiring contemporary architecture, he thought the park authorities should also think using an environmental design aesthetic that included everything from road planning to graphic signage of its displays. True nature conservation, he argued, entailed "a total architecture which must be designed simultaneously with the landscape, the roads and the buildings" (Chermayeff 1963a).

Environmental design

Chermayeff's "total architecture" approach to environmental conservation reflected his adaptation of the Bauhaus legacy. At the Bauhaus school, it is worth recalling, students of the ground course were asked to study biology, along with color studies, history of art, materials, and tools (Moholy-Nagy 1938: 8–21). The curriculum was replicated by the school's former professor Moholy-Nagy at the School of Design in Chicago where students were encouraged to design everything from cities to tea-sets. When Moholy-Nagy learned he had terminal cancer in 1946, he asked Chermayeff to be its new Director, knowing that he endorsed the pedagogy of the Bauhaus program.

Being a Russian émigré from rural Grozny (currently in the Chechen Republic, Russia), Chermayeff had lived most of his life in London, after which he moved to the US in 1940. In London he was known as an architect of modernist buildings, and he, from the mid-1930s on, would hang out with Bauhauslers such as Moholy-Nagy, Gropius, and Breuer, along with scientific socialists and proponents of planning such as Julian Huxley, J.B.S Haldane and J. Desmond Bernal. Following in their footsteps, Chermayeff would, in his capacity as new Director in Chicago from 1946 to 1951, argue that the role of the designer was that of "social therapy" (Chermayeff 1950a: 142). Design should have a "social purpose" and designers should aspire to be like an "artist-scientist-technician" (Chermayeff 1950b: 68). When he used the term "environmental design" for the first time in 1949, it was to promote integration of science and art, but also by bringing together architecture, landscape design, and planning in pedagogy (Powers 2001: 177). Early on, Chermayeff had been skeptical of the word "architecture," a word he thought should be dropped in favor of the more comprehensive word "design," inspired by insights of the natural scientists. In Chicago he envisioned that his students would promote "good housing and schools, well-planned cities, and preserved natural resources" (Chermayeff 1950a: 142). Indeed, the "*social responsibility* and the ethics" of the designer, Chermayeff argued, included an aspiration to

protect "*man's physical environment*," a sentiment that was shared by Bauhauslers such as Moholy-Nagy, Herbert Bayer, and Gropius (Chermayeff 1951: 12). They all argued in favor of a comprehensive design that took care of both humans and nature.

In 1951 Chermayeff resigned as Director due to the financial difficulties of the institution and disagreements with the terms of its incorporation into the Illinois Institute of Technology. He subsequently moved to Cambridge where he set up his own office and began a lectureship at MIT, followed by a professorship at Harvard University's Graduate School of Design (GSD) in 1952. Gropius had just retired as Chair of the Department of Architecture, and Chermayeff was hired to reenergize GSD under its new Dean, Josep Lluís Sert.

Under the heading of "Environmental Design," Chermayeff taught Harvard's first year students the environmentally friendly, comprehensive, and interdisciplinary Bauhaus-inspired foundation course that he knew from Illinois, after which the students went on to focus on architecture, urban planning, landscape design, and so forth. He adopted the "total architecture" approach of Gropius, "embracing the entire visible environment from the simplest utensil to the complicated city" (Gropius 1956: 9). In the mid-1950s Chermayeff began advocating moving "Environmental Design" beyond just first year students, as he imagined an Advanced Studies Program with PhD students under the rubric, which, after some dispute, was approved by the school's faculty in 1958 (Chermayeff 1955b). The pushback addressed a real concern: how could a student carry out research and receive a PhD without appropriate specialization? As will be apparent, the computer became an important tool in providing a unifying mathematical language for the comprehensive environmental research design program. Yet the lack of appreciation for his pedagogical program made Chermayeff exclaim in frustration that "most architects have not yet joined the 20th century!" (Chermayeff 1959c: 18).

Indeed, much of the educational program at GSD was badly organized under Sert's leadership. This, at least, was the opinion expressed in a letter to him signed by all the students at GSD in May 1960. They claimed that their hard work only led to "dissatisfaction, confusion, anger, disappointment and finally apathy" (McCagg 1960a). Chermayeff's first year course was the exception, and Sert assumed he was the one firing up the students' anger. At GSD Chermayeff was known as "a tall, elegant, handsome man" and "one of the leading contenders for the title of world's best-dressed professor" (Atticus 1959: 3). Yet despite his striking impression, he was also known to be blunt and lacking in social skills. He kept largely to himself and it is understandable that Sert was suspicious, though the Students Council wrote Sert telling him that Chermayeff did not "instigate" the criticism (McCagg 1960b, 1961). Yet the students' anger refused to fade away, and Chermayeff somehow became associated with the unrest. This may explain why Sert withdrew the funding for Chermayeff's research

program in 1961, after only two years (Sert 1961a). The fallout was detrimental to Chermayeff's relationship to GSD, as he resigned in protest and accepted a professorship at Yale University where he was allowed to pursue his Environmental Design pedagogy when teaching graduate students (Sert 1961b).

Environmental privacy in a community

His most talented PhD student while at Harvard was Christopher Alexander. Alexander began in 1958 and would feed his adviser with what was worth knowing about computers, as using IBM 704 to model buildings was at the heart of his PhD proposal (Alexander 1958a). The computer could be instrumental, Alexander argued, as a tool for the mass production of house designs so that modernist architecture could be delivered to everyone. He envisioned a "[f]ormulation of mass-produced house design procedure as a cooperative game between architect and society" (Alexander 1958b). Given the urgent need for housing, the computer would enable the architect to be more socially responsible. The computer could also provide a clear mathematical language and thus replace the "abstract phraseology" of architectural theory (Alexander 1958b). In the following years Alexander and Chermayeff would collaborate and merge their thinking. Chermayeff came to embrace the computer while Alexander adapted to the comprehensive program of environmental design. Soon Alexander followed the advice of his mentor in making elaborate notes about the importance of climatic factors and "*bioclimatic discomfort*" in his computer modeling of housing units, while Chermayeff learned from Alexander the possibilities and limits of computers (Alexander 1960).

Addressing environmental problems was at the heart of what they tried to achieve. Chermayeff told his graduate students at Harvard to focus on noise and cars: "The car cuts the countryside to pieces, and it dissolves the city," he would say (Chermayeff 1961c: 50). The task of the environmental designer, as he saw it, was to create architecture of privacy with respect to noise and access to nature, while, at the same time, plan for a social community with minimal use of cars. These were the real issues he knew from Wellfleet which he began to conceptualize into a larger book. "Our humanity is at stake," he told his students. And designers, "in perhaps a dim way, [were] partially responsible for its survival" (Chermayeff 1963c: 8). He decided to bring his student Alexander along on the book project, as Alexander had access to an IBM 704 at the Computation Center at MIT and also intimate knowledge about how to use it. As the historian of architecture Margot Lystra has shown, Alexander was at the time working on innovative methods of computer-inspired highway designs with hand-drawn overlays that included untraditional factors such as noise, pollution, weather, and eyesores (Steinitz, Parker, Jordan 1976: 444–455; Lystra 2017: 157–174).

In the book, Chermayeff and Alexander envisioned to bring forth a novel environmental design approach. The first draft of their manuscript was finished in the summer of 1960 while the debate was raging about the possible Cape Cod National Seashore Park. Entitled *Community and Privacy: Toward a New Architecture of Humanism*, it argued for a humanism that placed environmental concerns at the forefront. They sent it to Athenaeum who rejected it based on a harsh peer-review (Friedlander 1960; Denney 1961), to Chermayeff's old friend Lewis Mumford who was unable to read it as he was away (Mumford 1962), and finally to Peter Blake, the editor of *Architectural Form*, who was "tremendously impressed" but thought it needed better graphic design (Blake 1961). What is remarkable in the first reaction to the manuscript is that none of the recipients noticed what the book became known for, namely the call to protect the environment with the help of computing methodology. In any case, Chermayeff and Alexander brushed up and finished the manuscript at Cape Cod in the summer of 1962. Chermayeff had just resigned his professorship at Harvard and moved to Yale to pursue environmental design there. When the book, which was dedicated to Gropius, appeared in the bookstores in the fall of 1963, it was his first public statement as a professor at Yale.

It was a timely book for designers. Rachel Carson had recently published her *Silent Spring* (1962), and its impact put environmental concerns very much on the public agenda. In his forward to *Community and Privacy*, the poet Kenneth Rexroth pointed to the environmental crisis of the planet caused by radical population growth, and the urgent need to use the science of ecology to inform landscape planning. "Man is so radically altering the ecological situation out of which he emerged as a species and altering it in such an irrational manner, that he is endangering his own future" (Rexroth 1963: 14).

The problem that *Community and Privacy* sought to address was how to find a balance between the town and the individual in the age of environmental destruction. Nature was vanishing and the town was vanishing, resulting in a pseudo-town, a pseudo-nature, and a loss of equilibrium between them. This reflected what they had observed in Cape Cod. What was needed was a new environmental order provided by the architect-planner. Soon "man will have invaded every corner of the earth," with their cars, they pointed out (Chermayeff 1962a: 4–13; Chermayeff, Alexander 1963a: 43). "A New Ecology" in which humans would adapt to the environment was necessary (Chermayeff, Alexander 1963a: 46).

The solution to these problems was to be found in reestablishing the lost equilibrium.

> Either he [the designer] must learn to preserve the existing equilibrium of life or he must introduce a new equilibrium of his own making. If he does neither, his present unplanned conduct may deform human nature beyond all cure, even if it manages to survive the more violent holocaust.
>
> (Chermayeff, Alexander 1963a: 46)

This trivialization of Jewish history may illustrate how serious the authors took the issue to be, but also their insensitivity towards the complexity of social processes. In any case, if equilibriums were to be achieved, the designers would have to address head-on the question of how to plan for a world with more people, but fewer cars and less noise.

The computer was to be the tool helping designers to achieve equilibrium by creating a new balanced system for both nature and society, and creative designers should not fear it:

> The problem of this kind cannot be solved without the help of electroniccomputers. […] The machine is distinctly complementary to and not a substitute for man's creative talent. […] The computer, while unable to invent, can explore relations very quickly and systematically, according to prescribed rules. It functions as a natural extension of man's analytical ability.
>
> (Chermayeff, Alexander 1963a: 160)

Chermayeff and Alexander used spaceships as their model as they saw the internal environment of these vehicles being in balance thanks to computer technology developed by NASA. The aim was to build a fully functioning framework for ecological equilibrium for the Earth modeled on the order of spaceships. Thus, the computer was to be understood as a useful tool that could enlarge the designer's rational power, but not necessarily their creative ability.

The task of the designer was to make "Art for Ecology's Sake" (Chermayeff, Alexander 1963a: 110). And the computer was to help the artist to design within the complexity of ecological relations, without having to engage too deeply with the social realm. The environmental issues were intricate with many layers of information, they argued: "Problems have outgrown a single individual's capacity to handle them. Society must invent ways and means that, in effect, magnify the designer's limited capacity and make it possible for him to apply himself more completely" (Chermayeff, Alexander 1963a: 109). Both Chermayeff and Alexander saw the computer as the key tool that could bring together the complexity of ecological problems by creating a hierarchy of number systems that would be manageable to the designer. "The IBM 704 computer" at MIT "found the major cleavages for our attachment problem in a few minutes" by framing the questions in terms of number hierarchies, they pointed out (Chermayeff, Alexander 1963a: 161).

Their hopes for computing reflected a deep optimism on behalf of technology and science in the Bauhaus tradition. The unification of art and science to improve culture was at the very heart of modernist architecture. "Designers need to come face to face with the facts of science and technology; their real hope for the restoration of humanism lies in their ability to exploit techniques to its limits," Chermayeff and Alexander argued (Chermayeff, Alexander

1963a: 111). The problem was the mass amount of different types of numerical data about the environment the designer had to think through. The computer could help in structuring and ordering this numerical data, thus turning unstructured problems into order by the means of mathematical representation of different aspects of the environment (see Figures 2.1 and 2.2).

"Congratulations on the book! It has been very difficult to obtain a copy in the Harvard Square area. The man in the Mandrake [bookstore]

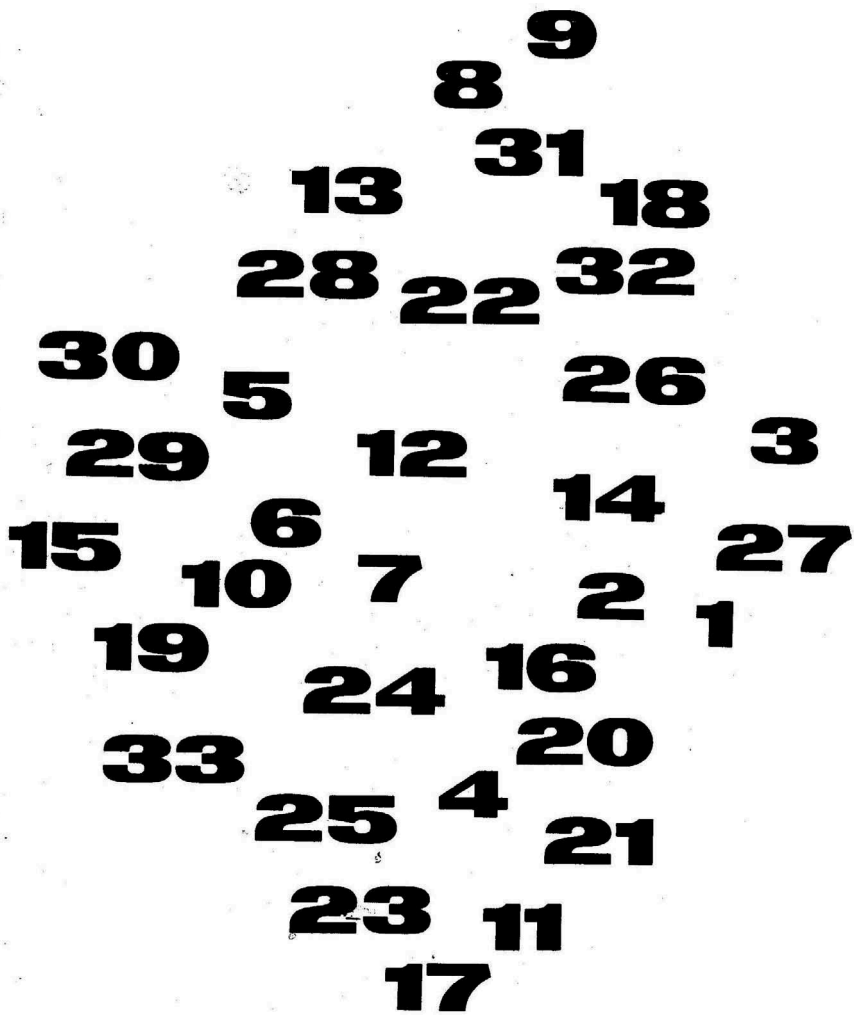

Figure 2.1 The problem unstructured. Chermayeff S. and C. Alexander, 1963. *Community and Privacy: Toward a New Architecture of Humanism*. Doubleday, p. 152

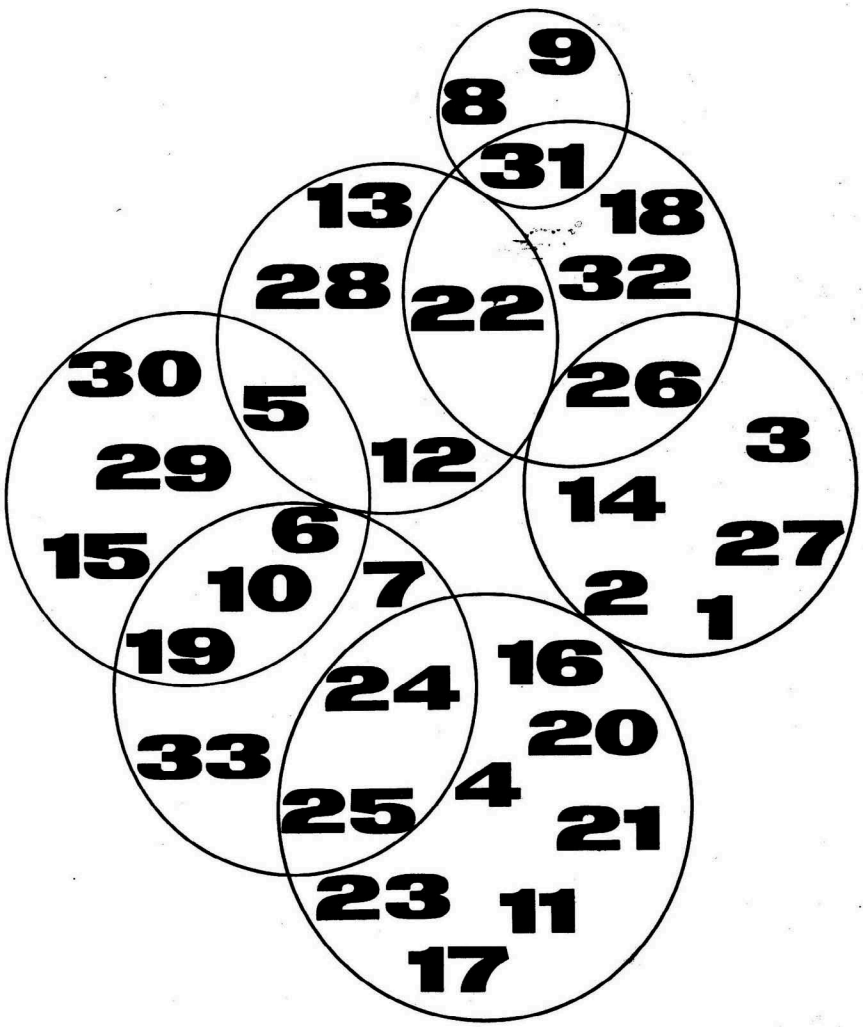

Figure 2.2 The problem structured. Chermayeff S. and C. Alexander, 1963. *Community and Privacy: Toward a New Architecture of Humanism*. Doubleday, p. 153

(when I grabbed the last of his third order) told me that each batch has sold out almost immediately," a friend of Chermayeff reported (Floyd 1963). Soon they received letters of praise calling the book "a real contribution to environmental literature" (Temko 1963a; Gropius 1963b, 1963c) and "a smashing success!" (Maass 1963). Indeed, *Community and Privacy* would do well, selling over 2,000 copies in fall of 1963 alone, and

over 50,000 copies by 1976 (Riehl 1976). It thus set the agenda for architectural environmental debates for at least a decade.

Yet the immediate response in the form of book reviews was mixed. To one reviewer, it was "a most irritating book" filled with "pompous pseudophilosophy," (Von Eckardt 1964: 620) while another pointed to "a danger in the currently fashionable preoccupation with computer machinery" among designers (Anonymous 1965: 101). The idea that "we should be thinking in terms of the village to which technology has shrunk the globe, our earth," was troubling to one reviewer (Rowntree 1964), while another was excited about the book as "a painstaking demonstration of the computer's role in planning" (Gutheim 1964: 54; Rowntree 1966: 12). For the most part the book was praised for its timely environmental agenda (Rexroth 1964). Typically, *The New York Times* placed it among the growing genre of "environmental literature," arguing for planning with the help of "an electronic computer," and the newspaper placed it on the important "Christmas Guide for Readers" (Temko 1963a: 343; Anonymous 1963b: 86; O'Brian 1964: 116). The most euphoric review came in *The Cape Codder* editorial, which noted that Chermayeff was a "familiar figure" in Wellfleet as one of the backers of the Cape Cod National Seashore and that the book's argument about protecting the environment to secure both privacy and the community was "what Cape Cod is all about" (Anonymous 1964a: 12).

These readers and reviewers saw the computer as central to the book. Apparently, some even thought the authors made a case for replacing human reasoning and imagination with that of a computer, as Chermayeff and Alexander in the preface to the 1964 edition thought it was necessary to answer this concern by emphasizing that "this book does not advocate the substitution of computer techniques for human thought. It simply recognizes the usefulness of this new tool" (Chermayeff, Alexander 1963b: 58–63). Instead, they restated the purpose of the book was to advocate and develop a new "Science of Environmental Design." In a series of articles from the period, Chermayeff would argue that the architectural profession was "obsolete" as it had failed to recognize that humans were responsible for their own environment and that a comprehensive design that included both the natural and social realm was the way forward (Chermayeff 1963d: 301–305, 1964a: 26, 1964b: 880–883, 1964d: 17–23).

The architecture and computer conference

In December 1964 the Boston Architectural Center organized what may have been the first conference on the role of computers in architecture. It became a major event with more than 500 attendees from all parts of the country, including students. This took the organizers by surprise, as they were hoping for 200 (Jaffe 1964: 69). The question at stake was what the relationship should be between designers and machines, and *Community*

and Privacy would set the agenda for the conference with Chermayeff as the keynote or "luncheon speaker."

At the podium, in front of people enjoying their white-cloth lunch, Chermayeff embraced the computer as an important tool. It could help the architect in the comprehensive analysis of "Environmental Design" problems. The environmental designer had to deal with "Planning, Construction, Control and Conservation," which meant dealing with "extraordinary quantities, complexity and newness" of environmental information. Only the mastery of sophisticated computers could help the designer in sorting it out, and the design community should consequently embrace the new tool. Indeed, "our survival depends upon our recognition of the pressures upon us and our ability to master new complexities" with the help of the computer, he claimed (Chermayeff 1964e: 22).

There were mixed reactions to this sentiment among these enjoying their lunch. Gropius was enthusiastic and thought computers "might help us to free our creative power" (Gropius 1964: 41). Perhaps computers could bring together the complexity and different fields of environmental design? The computer would, perhaps, make the specialist obsolete while it could empower the comprehensive generalist addressing complex environmental issues, such as planning "a conservation area" for "a nature-starved" city. Yet this approach to nature conservation was not an easy sell to computer geeks and urban planners, as Chermayeff ended his Q&A with the blunt "nobody gives a damn. Thank you" (Millon 1964: 44).

Chermayeff had a point, as much of the conference was focusing on issues such as how computers could aid architects cataloging building products (Sargent 1964: 2–3), how they could help save costs associated with repetitive designs, and how they could solve complex structural analytical problems (LeMessurier 1964: 4–6). These were exciting improvements for the engineers but a bit humdrum for the architects. That computers could use structural thermal data to generate exact load estimations and perhaps cut energy costs of buildings was, of course, a good thing, though there is little evidence suggesting that these papers generated much excitement among designers (Russell 1964: 7–9). The highlight of the conference was, perhaps, a "live" closed-circuit TV installation demonstration of the STRESS software by MIT's new IBM 7094 computer. Could such software help architects in their creative process? Was the machine to be understood as a practical extension of the architect's creativity? There was no shortage of optimism and vision, though few details on the specifics of what this would actually mean. The new instrument was destined to "make a major penetration into our profession," but exactly how was still a bit unclear (Payne 1964: 1; Ceruzzi 1998: 71–74; Vardouli 2015: 137–161).

One paper that stuck out was Howard Fisher's presentation of the technique for processing complex statistical data into meaningful graphic form by using the SYMAP ("synagraphic mapping") program (Fisher 1964: 13–18, 1982; Chrisman 2004). Fisher was a recent professor of city planning at the

GSD who, in his study of Boston, used statistical data to generate computer maps visualizing housing density, income levels, and recreational land. What was exciting about his work was not the data, which was well known, but the ways in which his SYMAP program brought together the data through mapping. The SYMAP program was the cornerstone at the Harvard Laboratory for Computer Graphics and Spatial Analysis which Fisher would start the following year. It was exactly this possibility of computers helping designers to master complexities that Chermayeff found so appealing. Fisher argued that computers constituted a critical tool for analyzing and comprehending environmental complexity, allowing for the integration of the built environment into the natural environment.

In the subsequent years the Harvard Laboratory for Computer Graphics and Spatial Analysis would turn the innovative SYMAP program towards environmental issues, thanks to funding from the Conservation Foundation. They were largely responsible for developing what today is known as the Geographical Information System (GIS). The 1964 conference was the very beginning of this endeavor. The laboratory was initially more about urban planning than environmental conservation, though the SYMAP program would train an influential trio of environmental planners. First among them was the soil scientist G. Angus Hill, who designed the Canada Land Inventory in 1968, which was a very early GIS study of landscapes. Second, the landscape architect Philip Lewis, who became a powerful advocate for environmental corridors through his Wisconsin Recreation Study of 1964. And third, Ian McHarg, whose use of transparent overlays of maps in *Design with Nature* (1969) became perhaps the most influential approach to landscape architecture in the 20th century (McHarg 1969; Lewis 1964: 130–142; Hills 1974: 339–371). Their respective work and thinking harkens back not only to the SYMAP program, but also to *Community and Privacy* and Chermayeff's Environmental Design program.

As professor of architecture at UC Berkeley, Alexander would continue to advocate for the use of the computer in dealing with the complexity of environmental design. "Consider the task of designing a complete environment for a million people," he wrote in his PhD thesis (1964). "The ecological balance of human and animal and plant life must be correctly adjusted both internally and to the given exterior physical condition" (Alexander 1964: 2; Grabow 1983: 51–54). This reflected the sentiment that nature and society mirror each other, and that environmental solutions thus in the end would solve social issues. The computer was a useful tool for creating a pattern language "for the whole physical environment" including animals, plants, and humans, as well as their ecological and social lives (Alexander 1966: 1; Steenson 2009: 20–23). The same went for Chermayeff, who, for the rest of his life, continued to enjoy his cabin at Wellfleet, and wrote important books and articles on the value of using computers in environmental design, such as *Shape of Community* (Chermayeff 1964c: 45–50, 1970: 5–13, 1971: 630–637, 1982; Chermayeff, Tzonis 1971).

In summary, computers were first introduced into the fields of architecture and design in order to reduce the complexity of environmental problems to a manageable mathematical language. They were imagined as useful tools to coordinate the use of architecture, landscape design, and urban planning in comprehensive environmental design. This was a top-down approach to both nature and society, reflecting the liberal elitist culture of modernists. The optimism with respect to what computers and rationalism could do was shared among modernist designers, and it reflected the Bauhaus legacy of trying to unite science and the arts through technology. The computer became a unifying tool, bringing together a diversity of fields in an effort to protect the natural environment and thereby also our humanity. Computers could order both the human and natural environment by using the same mathematical language, thus bringing ecological sciences, landscape, and architectural design together.

Note

Unless otherwise stated, all archive references are to the Serge Ivan Chermayeff Architectural Records and Papers at the Avery Library, Columbia University, New York, USA. I am grateful to Olga Touloumi and Theodora Vardouli for valuable comments.

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