

Eileen Gray, systems thinker

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ABSTRACT: I propose to show how Eileen Gray is an exemplar of Systems Thinking, and in so doing articulate how Systems Thinking can and should be integral to design on multiple levels from the conceptual/aesthetic to the pragmatic. After years of near-obscure, Eileen Gray (1878-1976) has secured her place as a thinker and designer who contributed significantly to Modernism at its inception. Scholars Peter Adam, Caroline Constant, Wilfried Wang and Jennifer Goff have detailed the depth of her knowledge and the sophistication of her working processes and innovation, both in the decorative arts/interiors and in her architecture—with the consensus that Eileen Gray had an unusually detailed and dynamic way of thinking about climate and site, functionality in daily life, and materiality and material processes—above and beyond many of her contemporaries. Systems Thinking—which emerged a half-century ago as a fundamental framework for environmental and economic sciences—enacts the notion that objects, forces, ideas, and especially people—interact and are mutually influenced in both somewhat predictable but startlingly dynamic ways. In architecture, we tend to attach the notion of systems to either the technical or the holistic/societal, but more clarity is needed about how it impacts the act of design itself, at the moment when multiple and competing interests are made manifest in matter and form. By outlining how Gray brought a kind of “operational thinking” to multiple aspects of her work, I will demonstrate through logical argumentation how she exemplifies Systems Thinking as enacted in design. A corollary motivation for this thesis is to take Eileen Gray out of relative—albeit admiring—isolation and place her in a framework that can further emphasize the nature of her contribution. Enriching the discourse on the design-specific implications of Systems Thinking also offers a potent bridge between theory and practice.

KEYWORDS: Eileen Gray, Systems Thinking, design, empathy, operational

INTRODUCTION

Systems thinking presents a lens to recognize and see how our built world exists within social, environmental and business realities, which are changing at a rate that traditional architecture can no longer support (Miller).

As a practicing architect and academic I am an advocate of Systems Thinking, which emerged a half-century ago as a fundamental underpinning of environmental and economic sciences. “Systems Thinking is the art and science of making reliable inferences about behavior by developing an increasingly deep understanding of the underlying structure,” (Richmond 1994, 6). While not without criticisms and caveats, Systems Thinking enacts the notion that objects, forces, ideas, and especially people—interact and are mutually influenced in both somewhat predictable but startlingly dynamic ways. While whole conferences have been devoted to Systems Thinking in architecture (i.e. ARCC 2017), the papers tend towards building science-type research—a creditable arena where increased understanding of flows and trade-offs is most pressing—but which leaves not only a gap in the discourse on the broader implications of Systems Thinking, but also the absence of a potent bridge between theory and practice.

I propose through logical argumentation to show how Eileen Gray is an exemplar of Systems Thinking, and in so doing articulate how Systems Thinking can and should be integral to design on multiple levels from the conceptual/aesthetic to the pragmatic. As part of book research on innovation and the home, I have done archival research on Eileen Gray to understand her working processes and thinking beyond what is available in other publications—highlighted by the occasion to examine the finally-nearly-restored E1027 in Cap Martin, France. Thinking about how Systems Thinking manifests in a designer’s work requires unpacking how and why

one makes thousands of decisions during the design-to-realization process while weighing considerations and trade-offs based on both sound and murky motivations. It also requires a more thoughtful analysis of what Systems Thinking actually means in the design arena.

1.0 BACKGROUND

1.1 Why Eileen Gray

After years of near-obscurity, Eileen Gray (1878-1976) has secured her place as a thinker and designer who contributed significantly to Modernism at its inception. Scholars Peter Gray, Caroline Constant, Wilfried Wang and Jennifer Goff have detailed the depth of her knowledge and the sophistication of her working processes and innovation, both in the decorative arts/interiors and architecture—as well as her often unacknowledged influence on others. While the specifics may vary, the consensus is that Eileen Gray had an unusually detailed and dynamic way of thinking about climate and site, functionality in daily life, and materiality and material processes—above and beyond many of her contemporaries. Her “outsider” status as a woman of independent wealth and tremendous drive, enabled her to enact ideas in unparalleled ways that inspire us to this day. Relative to the Modernist “canon” that centers around Le Corbusier, Walter Gropius, Mies Van der Rohe, et al., Eileen Gray nonetheless continues to be regarded in relative isolation, much like Carlo Scarpa, Hans Scharoun and even Alvar Aalto—the “Other Modernists” of Colin St. John Wilson (St. John Wilson 1995). While often revered, their contribution is seen as “unique” and thereby kept at the periphery of transmitted knowledge. A second motivation for this thesis, therefore, is to take Eileen Gray out of relative—albeit admiring—isolation and place her in a framework that can further emphasize the nature of her contribution.

1.2 Why systems thinking

For me, the choice of Systems Thinking as a framework emerges as much from professional practice as from the theoretical/academic. As projects face higher demands in cost, performance, and environmental impact, it is clear that design and construction need to be rethought through a much deeper operational and logistical lens. Most of us have expertise in things like structural systems, which at the most basic level consists of all the components that hold a building together and convey its vertical and lateral forces to the ground, including its foundations, walls, roofs, columns, and beams, as well as the mechanisms that join them. Considerations such as embodied energy or life-cycle analysis, however, move us beyond just physical systems into a realm where the role and interaction of factors like energy, human resources and psychology, waste, logistics, economics and equity must be integrally considered. Although some issues may ultimately be resolved through innovations such as smart materials or digitally-printed cities, getting there requires returning to first principles—to the biology, chemistry and physics of materials and forces in the environment, and to the reappraisal of core human—and non-human—needs. Increasingly, answers of substantive consequence can be divined only through Systems Thinking, because each decision is a result of many factors from the concrete to the ethereal—which in turn affect a web of consequences. Such real-world conditions are forcing designers to approach their profession with an experimental frame of mind, and with a willingness to re-assess and retool as needed.

1.3 Systems thinking, expanded—and simplified

The need to address issues like sustainability more deeply in architecture has pushed some theorists and practitioners to harness the language and concepts Systems Thinking. Kiel Moe, in his remarkable book *Convergence* argues that:

...buildings, and their architects, would be more powerful if they targeted complex, adaptive feedback loops that reinforce the ambitions and unconsidered capacities of buildings and their contingent system (Moe 2013, 7).

Moe urges us to imagine the systems potentials in many more aspects of buildings and materials than we do currently, with the potential of solving more problems with fewer means. For many, though, Kiel Moe is an expert in a language that remains elusive. It's not just Moe, either—looking through a variety of literatures it is clear that Systems Thinking is simple to understand as a generality, but slippery to communicate in how it manifests in actuality. It is

possible that Moe is that he's making his language more complicated than it needs to be—and maybe other Systems Thinkers do as well. On the subject of wood, for instance, one could boil his argument down to the point that it is a product of abundant free energy which simultaneously has structural, insulative and mass properties (as well as aesthetic and symbolic)—so why not use it for all of the above? In Systems Thinking-speak, it means that one gets many “alignments”, or mutually reinforcing benefits out of the one material that one can then “leverage” for a win-win or “positive feedback loop”, for the net result of an attractive, smaller-ecological-footprint building that relies on fewer fossil-fuel or mechanically-driven components. Moe is able to arrive at this thought because he is simultaneously able to pull “out”—to think about energy flows from a global or even extra-terrestrial perspective—and to pull “in” to think about its implications at the human interface. This kind of multi-scalar thinking is consistent with Barry Richmond's thought that:

...people embracing Systems Thinking position themselves such that they can see both the forest and the trees (one eye on each)...structurally...both the generic and the specific ... behaviorally...both the pattern and the event. (Richmond 1994, 7)

The idea is simultaneously revelatory and entirely commonsensical. In the same vein, Richmond goes on to highlight Operational Thinking—which he feels represents the “unique essence of Systems Thinking”—and which he defines simply as “getting down to the physics”—following what is actually going on in a particular condition,” and, “getting a fix on the underlying operational reality.” (Richmond 1994, 6) From this perspective, internalizing Systems Thinking starts to seem quite manageable.

Another commonsensical property of Systems Thinking is called “perspective” by some, “empathy” by others (Cabrera & Cabrera 2015)—which is to say that one has to be able to see from an “other's” point of view to understand what forces might be drivers from their vantage point as opposed to one's own. According to Human Interaction Designer, Seung Chan Lim:

Empathy is an explanatory principle for our potential to experience an event, where we feel as if we are embodying and/or understanding the experience of the other, and its related meanings from the context and vantage point of that other. (Lim 2013, 70)

Why this ultimately matters in Systems Thinking was unexpectedly clarified for me in an article about *Wealth of Nations* philosopher Adam Smith:

When two or more parties are in conflict, we must empathetically evaluate each of them. Only after having done so can we determine to what extent each has behaved properly toward the other. (Frazer 2010)

In other words, demands inherently compete, so navigating knowledgeably and adjudicating fairly amongst them is critical for achieving a “positive feedback loop” outcome. While applying this to interpersonal relationships may seem obvious, equally important in Systems Thinking is the idea that, “We are capable of realizing our empathy in relation to non-human beings, even inanimate objects.” (Lim 2013, 81) In a truly Systems Thinking mindset, we need with equanimity to be able to consider the point of view of a river, a factory, a healthcare regimen, and so on—what does each one need? What can each one give or take for the better of the whole?

2.0 EILEEN GRAY, SYSTEMS THINKER

2.1 Eileen Gray background

Operational Thinking and empathy as essential characteristics of Systems Thinking provide a useful entre into the consideration of Eileen Gray. I will discuss how these characteristics manifest in Gray's observations of, and design responses to what emerged from the following: material; daily living; climate and site; and fabrication and construction. While one could argue that other designers have used similar approaches and achieved comparable ends, several unusual elements of Gray's background reinforce this narrative aside from her tremendous native talent and intelligence. Her rigorous work and experimentation as an artist and artisan; her self-imposed isolation and the concomitant necessity of an inventive self-reliance; and her willingness to step across gender and class boundaries—were all factors in bringing about a more through-going Systems Thinking frame of mind. Most of my evidence relies on the

extensive scholarship of others, with some modest evidence about her work processes from my own ongoing research.

Eileen Gray's life story is quite extraordinary, and impossible to do justice to in a paper that is not even entirely about her. An Irishwoman born in 1878 to a noblewoman and bohemian artist father, Gray fled her likely lot in life in 1901 by landing herself in Paris—a buzzing milieu of new and often scandalous ideas, though the art education she received was staunchly classical, and corralled by her gender and class. A serious student but not entirely satisfied with just art, she pursued an extra-curricular discovery of lacquering that became a full-fledged apprenticeship and partnership with Sugawara, an ex-pat Japanese lacquer artisan. By the eve of WWI in 1914 at the age of 36, she had received considerable acclaim for an extraordinary series of lacquer screens and furniture pieces. After four years of war that included ambulance-driving, relief work, and finally retreating to London, Gray returned to a Paris markedly changed by both devastating losses of friends and places, but gains of new attitudes and freedoms. (Goff 2015)

The several years before 1926—when construction began on the iconic E1027 house—were remarkably productive for Gray. Featured at the 1923 Salon des Artistes Decorateurs, Gray gained notice not only from the public but from the likes of Pierre Chareau, Mallet-Stevens, members of De Stijl. Taking on lover and collaborator Jean Badovici, Gray found both a public venue for her ideas through his influential publication *L'Architecture Vivante* as well as a means to gain an architectural training of sorts, informally facilitated by Badovici's friendship with Le Corbusier. In the meantime, she had secured interior commissions in Paris and was variously maintaining workshops for producing her designs in lacquer, furniture and striking hand-made rugs, in addition to opening a retail Paris storefront called *Jean Desert*. By the time she started E1027 in Roquebrune, Cap Martin—where in ostensible collaboration with Badovici and for him, she could play out design ideas that harnessed all her training and capacity into an extraordinary result (Figure 1, 2).

The decade-plus following was wonderful and terrible in equal measure for Gray—travel to Mexico, Peru and the U.S.; closing *Jean Desert*; designing numerous unbuilt houses and public buildings; leaving Badovici—and with him E1027; building herself the possibly even more remarkable *Tempe e Paille* while unbeknownst to her Le Corbusier was covering E1027 with garish, erotic murals; forced to leave the coast as WWII closed in to later return to nearly destroyed houses; painstakingly restoring *Tempe e Paille* only to have to turn around and sell it. With all the disruption and increasingly distance from the design community, Gray essentially disappeared from the public view for twenty-five years, even as she continued to work and create. Suddenly “re-discovered” in the 70's with the record-breaking auction of one of her early lacquer screens, she was honored with six major shows worldwide in the last six years of her life, passing away in 1976 at the age of 98, while working on a celluloid screen. She destroyed many of her papers, but others were saved, and not long before she died Aram worked out licenses so that finally, her pieces could be mass-produced as she had always wanted (Goff 2015).



Figure 1: Restored exterior of E1027 (author)



Figure 2: Restored interior of E1027 (author)

2.2 Gray's operational thinking and empathy via material

While designers may at times build their own work, for the most part it is the expectation of their training that they provide the ideas and instructions that others use to execute the actual work. Artists, on the other hand, typically execute their own work with the expectation that it is largely by their hand, and unique. As an artist/artisan, and in particular working in lacquer which is an arduous and exacting process, Gray became deeply familiar with the separate rigors of the repetitive as well as the unique. Lacquer can require as many as 40 layers applied and worked under exacting conditions, with the possibility of failure at any step. While virtually every lacquer piece Gray fabricated could be considered a tour-de-force, she regarded herself as often bumbling and having to start over. Nonetheless, “Eventually she mastered the medium to a perfection that assures her a place as one of the great lacquer artists in history,” (Adam 1987, 50). Both the repetitive nature of application as well as the arduous process of realizing unique colors and effects required the following of detailed steps and precise measurement, requiring a high level of Operational Thinking: “Her craftsman-like approach to everything she undertook speaks from every line she wrote down.” (Adam 1987, 53) This could equally be called empathy with the medium, as embodied in her willingness to accommodate to its rigors, though one might be tempted to shift the discussion to the lustrous, sensuous sense of the deeply layered materiality that she drew out of the material—empathically allowing the material its highest expression (Figure 3).

Gray also was deeply involved during the early part of her career in the design and fabrication of hand-knotted rugs. She went so far as travelling to North Africa to learn weaving and natural wool-dyeing techniques from Arab women,” (Goff 2015, 163) and “Gray (and collaborator Wyld) were probably the first to experiment with natural undyed wools used alongside dyed wools, uneven pile lengths, and juxtaposed plied and unplied yarns in the pile.” (Goff 2015, 164) She created a workshop in Paris to hire and train women, and again, “Gray was exceedingly precise in her instructions regarding the wool and the cost of wool to be used,” (Goff 2015, 164) and “Gray wrote....about the process of weaving, the workings of the loom and how to achieve a certain texture which illustrate an in-depth knowledge of technique.” (Goff 2015, 165) While this kind of Operational Thinking might be normal for any solid business undertaking, it was also about empathy, in seeking to elicit the most out the wool's natural materiality (Figure 4). As one reviewer glowingly described “The tangled wools recall the mane of some captive beast. It is the complementary effect the artist wanted for the shimmering wood and sharp edges of her furniture.” (Goff 2015, 164)



Figure 3: Laquer work (author)



Figure 4: Hand-knotted rug (author)

2.3 Gray's operational thinking and empathy in daily living

"A house is not a machine to live in. It is the shell of man, his extension, his release, his spiritual emanation. Not only its visual harmony but its entire organization, all the terms of the work, combine to render it human in the most profound sense." (Goff 2015, 263)

Gray is probably the most known not only for E1027 and its extraordinary siting, sophisticated organization and built-in cabinetry systems, but for the free-standing furniture that she designed as an integral aspect of the house. The adjustable steel tube bedside table and gateleg tea table (Figure 5) continue to be considered icons of Modern design. In each of such pieces, her Operational Thinking as well as multi-faceted problem-solving is evident. Like Marcel Breuer, Gray was intrigued by the design potential of steel tubing, but creating a static The tea table, for instance, slides together and folds compactly to store; it is light enough to move easily from indoors to out; has swiveling disk-shaped trays to support desserts that can be swung to arms-reach; the table end elongates so cups can be set down. Its surfaces are cork to prevent clinking noises that might disturb a sleeper or damage the cup itself. Inherent in her design was a critique of what she saw as the shortcomings of the approaches of architects such as Le Corbusier, who liked to claim thoughtfulness about storage but tended towards generic or standardized solutions. "she refused the modernist's trust in the power of machine to transform man and his environment, instead believing in the need for emotion in all creation." (Wang 2017, 15) The thinking-through—or Operational Thinking—of what needed to swing or move where and how to accommodate needs is one thing, but the transformational characteristics themselves elicits an interaction between human and object, creating an empathic relationship. As Caroline Constant articulates: "Gray derived her sense of design from the enabling powers of architecture vis-a-vis the human body. Gray rendered the subject an active agent in her environment..." (Constant 1994, 275)

E1027 gets some of its unique characteristics from the fact that it was small but not about providing just the minimum, such as in the social housing units that also preoccupied designers at the time—it was a compact house meant to support joyful living for an exuberant man, Badovici. Even in the kitchen, which was not so much Badovici's realm but that of Louise, Gray's lifelong housekeeper, Gray made a conscious decision to integrate what she learned of the Frankfurt Kitchen and Taylorism, but also to go further or otherwise ignore some of its decisions in favor of a more exuberant notion of living. "The kitchen, more than any other room in the house, demonstrates Gray's rejection of the functional dogma of the avant-garde movement" (Goff 2015, 272) Without being much larger or lavish, the E1027 kitchen celebrates a strong connection to sunlight and the outdoors by working in retractable windows, and outdoor work space nearby, cistern overhead, easy but concealed access from the front entrance, drying racks placed in a sunny window niche, and varied storage components at useful heights and sizes (Figure 6). In effect, the kitchen is an exuberant negotiation between the outdoors sunlight and water, storage, preparation and serving needs, and the animated movements of the occupants. Though it is said that the kitchen didn't really work as well as Gray had hoped, it is a clear if imperfect example of both empathetic and operational modes of thought, where multiple alignments are sought, negotiated and harnessed. (Goff 2015) On a side note, E1027 has been almost fully restored, but the kitchen remains incomplete—one looks forward to the day when it can be explored in its original form.

While any of the dozens of elegant built-in storage units with folding or swing-out tables or drawers, mirrors and lights could be used as case studies, one less-seen example that caught my eye was the hat "niche" near the entrance, which Gray has described: "Built into the wall of the stair to the left is the niche for hats, a half cylinder in transparent celluloid, with its shelves made of loose-knit twine nets so the dust cannot settle." (Goff 2015, 270) One can imagine her puzzling through, where might hats go that might be wet or dusty, conveniently go to be ready at hand yet slightly hidden—and not create a clean-up nightmare, while being enchantingly being held by light twine...(Figure 7).



Figures 5, 6, 7: Gateleg tea table, Covered outdoor kitchen, Hat niche (author)

2.4 Gray's operational thinking and empathy towards climate

Gray's diagrammed plan of E1027 is well-known. In addition to noting the house's orientation relative to the town, the mountain upslope, the views to the sea, Gray carefully marks out the sun's path as well as the movement and stasis patterns of the inhabitants, both owner(s) and housekeeper throughout the day. Shading and sunning were of equal concern given the hot weather on the one hand and difficulty of obtaining fuel for heating on the other. In contrast to Le Corbusier's infamous failures to block the sun from overheating in some of his earlier buildings, which were later compensated by his famous but static *brise soleil*, Gray demonstrated a much more nuanced response to climate in its multiple modes and relationships to occupants.

Gray's window shutter system on the north side of E1027 is also said to reflect a much more multi-faceted and operationally-aware response to the climate as well as other factors. It was also a response to an off-site debate between Le Corbusier's dictum of horizontal "ribbon" windows for uninterrupted view, and Auguste Perret's assertion that contrary to the anthropomorphism of vertical window, horizontal windows were "a transgression of the values deeply rooted in the culture and life of the interior." (Constant, 274) Gray herself said that "a window without shutters is like an eye without eyelids" (Goff 2015, 256) Gray's solution of a sliding shutter and folding window system supported a variety of configurations from closed window and closed shutter to open window, closed shutter, open window and shutter, and so on, such that one could freely mediate between amount of sunlight, amount of breeze and degree of privacy. While Baldovici held the patent, the drawings and working out were clearly by Gray, (Goff 2015) further exemplifying her operational and empathic thinking (Figures 8, 9).



Figure 8: Shutter system for E1027 from outside upper level (author)



Figures 9: Shutter system for E1027 from inside lower level (author)

2.5 Gray's operational thinking and empathy in fabrication and construction

A common point made about Gray is how she generally got on with the workmen, while her partner/collaborator Badovici—who was inclined to show up sporadically and start ordering them about—was not. This seems remarkable given that Gray was still operating in an extremely sexist world where female architects were virtually unheard of, much less one that was trying extremely novel and risky ideas. It helped that “from early childhood on, Eileen hated the complacency and arrogance of her class” and that she apparently had “an inborn feeling of compassion and social justice” (Adam 1987, 14). At E1027, Gray worked side-by-side on a daily basis with the workmen for nearly three years, such that “having lived on the site in daily contact with the builder, she had gained a tremendous amount of practical experience about building.” (Adam 1987, 267) She also spoke to the fact that there was reciprocity: “The close collaboration with workmen trained her eye and helped her to eliminate superficial decorations, of which the period was fond.” (Adam, 1987) It seems clear that Gray's experience as an artisan as well as a start-to-finish participant in building construction process gave her not only a deeper understanding of materiality, but also of the experience of the makers and builders themselves. She could not only have a much stronger dialogue about how something might be constructed, but also have an operational sense of the logistics and the effort required to get it done. This would immediately distinguish her from most other architects of the time, who might believe that they understood a detail or material, but would rarely have the experience or even the inclination to extend their understanding to considerations of or feedback from the people involved, particularly given the class attitudes of the time.

By the time she embarked on *Tempe e Paille*, she had enough experience to relish the challenge of the even-harder site perched on a hilltop on existing cisterns—helped by the fact that she had a loyal team of artisans to work with her. (Adam 1987) Again, one could argue that she was able—through the circumstances in which she existed—to observe with a deeper operational lens more empathetically and therefore, more successfully. In contemporary construction, gaps in this kind of operational understanding continue to be frequent sources of friction and litigation.

In other arenas, such as her furniture, she was quite conscientious to develop details that were not only logical and simple to operate from a user point of view, but also logical from the perspective of the fabricator as well as the materials involved. In part was likely a reaction to, or “lesson learned” from the extreme arduousness of her early lacquer pieces. In the case of the *Transat Chair* which Gray envisioned for inexpensive mass production, the bent-plate sliding connectors are particularly clever in their simplicity (Adam 1987) (Figure 10). This

differentiates her furniture, for instance, from the likes of Mies Van der Rohe's Barcelona chairs, whose crossing steel bars are reputed to take 7 days to weld together.

It should also be noted that as a business owner as much as an artisan or architect—in a metier where ambitions were high and business sense and profits were low—Gray could also see both sides of being paid for and having to pay for work. In my archival research, where I was looking for evidence of how she worked out technical details and questions of structure—in part to dispel notions that she relied on help from people like Badovici on such aspects—I was struck by how much time she clearly had to spend adding up columns of numbers, making detailed lists of materials and chemicals, discussing back and forth the fine points of a chroming process or threading of a screw, and haggling over bills. While having to take care of virtually all aspects of both her daily life and her work yielded a tremendous body of operational knowledge and creative output, she was still constantly forced to expend her energies swimming upstream—but perhaps she was OK with that.



Figures 10,11, 12: Details of Transat chair, light switch and wiring, mosquito netting cupboard (author)

CONCLUSION

Much of Eileen Gray's process work was destroyed by circumstance or as a matter of course, but enough remains to create a sense of an accomplished multi-faced thinker and maker. In her surviving (restored or newly manufactured) works, the narratives of her thought process feel as if they are embodied in the product—a testament to the quality of thought that went into them. So far, among many sets of sketches, I have only found one set of a seriously rough early-stage drawings that hint at how hard she worked to evolve some of her projects from start to finish—typically more resolved stages of work were preserved. As an experienced architect, I can bring a deeper level of interpretation to such process work, but more archival work lies ahead. So far I have also relied primarily on other scholars to understand the working processes of her contemporaries, so more archival work is also required there. While this attempt to conjoin Eileen Gray and Systems Thinking cannot do full justice to either, perhaps a useful dialogue can be opened about how an empathetic and dynamic thought process can not only result in successful, beautiful design—but suggest a systematic and integrated approach to design challenges that lie ahead.

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