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Abstract
In this article we argue that the field of design evolved to include helping organizations address complex problems in the face of uncertainty, but it has yet to build knowledge in a way that formalizes the various activities embraced by the field. We use our relationship with the school of public health at Harvard to illustrate the advantages of formalizing design knowledge more explicitly. We introduce the Whole View model to provide the field of design with a tentative structure for its knowledge that could make it easier for design and other fields to work together. We situate the model in the context of different types of design education, and show examples of how the Whole View provides a structure for teaching, research, and practice. We conclude by introducing a new agenda for design centered on the well-being of people, organizations, and the natural environment, with health, happiness, and prosperity as the levers driving change.
About a year ago, I (Patrick Whitney; hereafter PW) joined the Harvard T.H. Chan School of Public Health as their first Professor in Residence. Schools at Harvard can activate this senior faculty position when they want to expand their field’s knowledge with frameworks and methods from another field. One of the central qualifications of the job is that the professor is from a different area of expertise.

The benefits of bringing together aspects of design and public health are not immediately apparent. Designers have been working for decades with healthcare professionals, creating products that were easier to use, making complex information easier to understand, and building environments that supported the work of medical staff and the healing of patients. This work is centered on a broader contribution not (only) to projects, but to the body of knowledge of both fields. The invitation was sufficiently adventurous that I gave up an endowed chair at the IIT Institute of Design and took the risk of being an oddity among scientists focused on public policy.

Together with André Nogueira, Ph.D., we have committed to five years of investigation, teaching graduate classes, supporting executive education, and leading and collaborating in faculty research. We work with colleagues in the school of public health and others from across the university who are interested in design and well-being. Several questions surfaced as we created this relationship:

• Why would a leading school of public health be interested in adding elements of design knowledge?
• How will the field of public health, based in science with its quest for certainty and the rigorous analysis of massive data sets, find relevance in design, which focuses on solving problems, on creative ideas and making decisions with information that is incomplete and ambiguous?
• What parts of design are relevant to public health?
• How should public health students, faculty, research groups, and other members of that community be introduced to design?
• What does it mean to formalize design?

While the pathways leading to answers to these questions are still unclear, greater emphasis has been on the enthusiasm of this journey than on its ambiguity. The general goal is to expand the field of public health towards the heuristic of design in the face of problems fraught with uncertainty due to cultural, social, and emotional factors. Examples include parents rejecting vaccines for their children, Type 2 diabetics eating the wrong food, and large numbers suffering depression or committing suicide in the USA. A second goal is to advance the field of design by identifying useful aspects of its informal knowledge that could be formalized. This effort is critical for the field if it is going to align the methods and culture of public health and other fields with complex challenges related to behavior.

Parallel Journeys

Over the last century, public health and design have each evolved in response to social, technical, and economic transformations. Both fields

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1 The main title of this article “Cutting Cube Out of Fog” comes from Jay Doblin in conversation with Patrick Whitney. For further information, see Jay Doblin, “A Short, Grandiose Theory of Design,” STA Design Journal, Analysis and Intuition (1987): 6–15, available at https://www.doblin.com/dist/images/uploads/A-Short-Grandiose-Theory-of-Design-J.-Doblin.pdf.
evolved in response to the rise of mass production and the seismic challenges it brought to organizations and society at large. The cotton mills built at the turn of the 19th century in Manchester, UK provide a good example of the variety and complexity of these changes: mass migration from the countryside to urban slum, children as young as 4 years old working long hours in factories, mass produced cotton replacing the hand-made fabrics made in the homes in the British countryside, and factory owners making low quality products. The response to these massive changes included a number of doctors turning their attention to the health of the public, artisans helping industrialist make better products, new public policies regarding child labor, and public infrastructure providing fresh water and sanitation.

The tremendous success of public health over the last century has been driven by science and the rigorous analysis of economic, demographic, environmental, and medical information (Figure 1). It has saved the lives of hundreds of millions of people by influencing policy and large-scale change. An early example is the work of Dr. John Snow, one of the founders of epidemiology—the field focused on the distribution and control of diseases. In 1854, he was tracking the cholera outbreak in Soho, London. By marking the locations of the disease on a street map, he noticed the higher density of deaths around the public wells. This data visualization technique led him to discover that cholera did not come from aqueous vapors, as it was believed at the time, but from polluted wells (see Figure 2).

2 John Snow, “The Cholera near Golden-Square, and at Deptford,” Medical Times and Gazette 9 (1854): 321–22, available at https://johnsnow.matrix.msu.edu/work.php?id=15-78-45.
Another example comes from Florence Nightingale, one of the mothers of modern nursing. Nightingale relied on what we now call participant observation and field observation methods to document the conditions and dynamics of the healthcare facilities receiving injured soldiers from the Crimean war battlefields. She combined insights from these methods with her outstanding abilities in statistical data analysis and persuasive techniques to create a new form of data visualization (see Figure 3). Her goal was to communicate to the British Parliament that the majority of deaths were not from battle wounds but preventable or mitigable zymotic diseases.

At about the same time that Snow and Nightingale were supporting public and private organizations, creating new policies and allocating resources to enact sanitation reforms, Henry Cole, a member of what is now the Royal Society of Arts, was influencing Prince Albert with the idea of artists and craftsmen helping industry leaders shape new consumption markets and lifestyles. The main focus of the industrialists was making standardized products at the lowest cost for the largest number of people. Cole and Albert thought industrial products should also be useful and attractive. Perhaps one of their most significant achievements was The Great Exhibition, which opened in Hyde Park on May 1, 1851. It was the first World’s Fair to show the intersection of industry and culture. During the following five months, about six million people paid to view 100,000 objects from 14,000 contributors. This effort represents an early example of designers providing specific solutions to organizations, and shaping how people live, work, learn, and play (see Figure 4).
Designers continued to influence organizations, helping them respond to shifting contexts in which their products would be made, distributed, sold, and used. Design became adaptable to almost any context. Its wide variety of applications has included restyling products to encourage sales that would help end the Great Depression, making camouflaging programs and new systems of visual aids for WWII, designing postwar farm machinery to suit the human form, and creating new identities for organizations going through the rampant mergers and acquisitions of the 1960s. It also included designing for manufacturing that addressed the quality challenges in factories during the 1970s and 1980s, creating interfaces in the 1990s that eased the use of products as they multiplied their functions and features, and designing services that helped organizations gain an advantage in competitive markets by providing a better user experience. Recently, the field has expanded its contributions via design for the Internet as a new medium, and for the Internet of Things, where the digital and physical collide.

Rather than delineating different types of design, this list indicates some of the application areas of the field. Indeed, each application or domain has its particular characteristics that require specialized knowledge. Depending on the socio-technical-economic context, design practitioners and faculty have dedicated substantial resources to the task of becoming experts in a given application area. Still, all of the different types of applications draw from different parts of the same pool of design knowledge.

The Evolution of Design Knowledge

The recent shift by leaders from governments, large companies, and large NGOs towards design is unprecedented. They recognize that reductiveist processes shaped by economics — for example, taking a lesser number of variables into consideration during analysis or use rigorous statistical mechanics and probability to define an efficient pathway forward. Whether running a hospital, auto manufacturer, publisher, or investment fund, leaders in organizations need the creativity, flexibility, responsiveness, and speed that design can provide when aiming at enabling individual and organizational behavior change.

The perspective of Michelle Williams, dean of Harvard T.H. Chan School of Public Health, represents the general sentiment of those adopting design to cope with the complexity of behavior change:

“Design gives us a fresh look at complex problems in public health. It allows us to solve problems in new ways, bringing a deeply human perspective to why these problems exist and what we can do to address them. Design as a field has the potential to transform public health. By paying close attention to the behaviors and complexities that underlie so many public health challenges, design allows us to solve problems and unlock human potential everywhere.”

Design has evolved from arts and crafts into a separate practice highly influenced by mass production and the rise of economies of scale. Initially, experts in the visual arts worked with manufacturers to improve product
Many were educated at specialized institutions — in art, artisanal craft, architecture — none of which paid any attention to mass production or mass markets. But a small group of political leaders in England and Germany realized there would not be enough qualified workers to help the industrialists make offerings to the tastes and needs of the emerging middle class. They needed to develop a new type of education that fit the age of mass production and mass markets instead of relying on historical styles as their inspiration, which was the conventional approach of the time. In Germany, Ernest Louis, Grand Duke of Hesse, supported the founding of an interprofessional association named the German Werkbund in 1907 to create a partnership between manufacturers and designers. The overall mission was to improve Germany’s competitiveness in global markets.

**Building Paradigms**

Twelve years later, Walter Gropius founded the Bauhaus in Weimar. The Bauhaus classes were more expansive and diverse than the discussions held at the Werkbund. Rather than aiding industry, the Bauhaus had a broader goal of shaping modernist culture and enlightening society. The curriculum for the preliminary Bauhaus course is particularly noteworthy. A significant goal of Gropius was to unify architecture, art, and craft. He asked Laszlo Moholy-Nagy to join the school and create a new first-year program, in which he structured design into elements that became a platform for all art and design. Students learned about color, 2-dimensional and 3-dimensional space, texture, light, and other fundamental components. In subsequent years, student’s mastery of these elements would be applied in various areas that might have been anything from architecture to weaving to photography.

Although teaching a standard set of elements might convey the impression of restraint placed on new ways of working or new application areas, it does precisely the opposite: core components form a platform that supports experimentation.

The Bauhaus represented a paradigm shift. Beyond training in craft and education in the beaux-arts, it would teach future designers to design in light of the social, technical, and economic disruptions that had begun 100 years earlier as new systems of mass production and consumption emerged. The success of this undertaking saw the Bauhaus eventually set the direction for modern design teaching, learning, and practice for decades to come, and influenced the creation of many other institutions, including the New Bauhaus in Chicago.

**Linking Design and Other Fields**

László Moholy-Nagy moved to Chicago in 1937 at the invitation of the Association of Arts and Industry, and with the recommendation of Walter Gropius, who had recently assumed the position of professor of architecture at Harvard. That move was yet another example of a group of industrialists working to demonstrate how design could be used to support manufacturing. This time, Moholy-Nagy’s interest in bringing social and natural aesthetics and usability in ways that would boost sales. They challenged conventional solutions and sought novel ways to create value. Many were educated at specialized institutions — in art, artisanal craft, architecture — none of which paid any attention to mass production or mass markets. But a small group of political leaders in England and Germany realized there would not be enough qualified workers to help the industrialists make offerings to the tastes and needs of the emerging middle class. They needed to develop a new type of education that fit the age of mass production and mass markets instead of relying on historical styles as their inspiration, which was the conventional approach of the time. In Germany, Ernest Louis, Grand Duke of Hesse, supported the founding of an interprofessional association named the German Werkbund in 1907 to create a partnership between manufacturers and designers. The overall mission was to improve Germany’s competitiveness in global markets.

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sciences into the program did not suit the American palate, and he lost the support of the people who had brought him over. Nevertheless, civic leaders Walter and Elizabeth Paepke, who led the revitalization of Aspen and the formation of the Aspen Institute, avidly supported his interest in teaching design as a catalyst for individual, organizational, and societal transformation. The school eventually achieved moderate stability, settled on a new name—the Institute of Design (ID)—and in 1949 joined the Illinois Institute of Technology.

ID continues to pioneer profound innovations to the form and content of design education. For example, over the last 40 years, computing and strategy are two areas that have influenced and been influenced by design. Embedding computer chips into everything from coffee makers to cars has multiplied the number of features and functions available, but also made using new products more difficult. Designers found themselves reading books by Don Norman (cognitive scientist), Lucy Suchman (anthropologist), and John Seely Brown (computer scientist). At the same time, producers realized they knew how to make anything but did not always know what to make for consumers who had become more discerning and less loyal. They had moved from the relatively predictable economy of scale to the volatile economy of choice.

Designers found themselves in programs with Paul Hawken (entrepreneur and environmentalist), Michael Porter (business strategist and economist), and Peter Gorb (business administration and management).

In this context, ID faculty began to envision a Ph.D. program that could develop new frameworks and methods for building a body of knowledge about design, while also connecting it to compelling developments in other fields. Professor Charles Owen, head of the product design program at ID, received support from the General Electric Foundation for himself and PW to visit leaders in many Asian and European Ph.D. programs in design. Some seemed to connect to humanities, while others seemed to be more in line with engineering. All of them were called design, but it was challenging to find common language and methods.

That difference sparked a lively debate among the ID faculty about whether they should change the names of its communication design and product design programs. Professor Greg Prygrocki reminded the group that three differentiators of ID’s work should stand out: (1) the large number of systems projects that made use of Owen’s strength in planning methods, (2) the extensive use of what we now call behavioral prototypes to better understand users, and (3) the growing interest in the design of organizational strategy. Prygrocki successfully made a case for names that referred to the differentiators of ID and what the faculty wanted to strengthen.

By 1989 the faculty had completed a plan for the first U.S. Ph.D. program in design, officially launched in 1991, and two new master’s programs called Design Planning and Human-Centered Design. The two programs shared core classes. But separating them into specialties enabled the students in planning program to delve more deeply into systems design and business strategy while the students in human-centered design were learning about cognition and anthropology.
It was probably the first use of human-centered design as the name of a program. It is amusing to note how rare the use of the term “human-centered” was then. The internal debate among faculty was whether the name of the program should be “user-centered” or “human-centered.” They both sounded weird, but faculty rejected the former because it appeared to be drug related. The group almost rekindled the debate when PW received a call from a member of the Christian Right on the week the programs were announced, emphasizing that their God, not humans, should be central. See the article by the current dean Denis Weil and colleagues for the current interests and nomenclature.

Today, the language and frameworks of human-centered design exist in almost all design offices and schools; after all, who does not want to put humans first? Still, the methods used vary significantly in their types and applications. Ethnography, user journey, and persona are terms used by most designers. But their meaning can range from significant in-home research for two months or more to designers using their own experience and memories to create journeys and generalizable identities in a couple of hours. The language and frameworks from design planning have travelled a different path into fields like innovation and design management.

**Breaking Paradigms**

Paradigm shifts are characterized as combining new knowledge with lessons garnered from old “mistakes” to create new ways of understanding and intervening in the changing world. In economics this process is sometimes called creative destruction. Because science and economics each have frameworks and methods that define their fields in general, as well as their specialties, both are able to quickly absorb new information and create advances that extend across their domains. For example, recent progress in the health sciences is partly related to the ever more explicit social determinants of health, and in economics, the realization that people frequently do not make rational choices has led to the new specialty of behavioral economics.

Design has seen paradigm shifts also, but because both the existing and the new paradigms are normally based on informal knowledge, changes to mindset and approach take more time to absorb and implement. Moreover, adoption in one area of design is no guarantee that the notion will extend more broadly across the field.

Two anecdotes from the late 1980s point out some of the challenges caused by the relatively loose structure of design knowledge.

**Core Knowledge Moves to the Edge; Edge Knowledge Moves to the Core**

In a conference room inside the museum of the Cranbrook Academy of Art, leaders of major graphic design programs in the U.S. met to discuss the dramatic changes in their field. Tom Ockerse, head of Rhode Island School of Design’s (RISD) graphic design program, recounted a recent meeting with a young woman who had just received a Bachelor of Fine Arts in graphic design from a well-respected university. As he approached the last few pages of her portfolio, he asked to see her graphic design. She replied that...
he had just seen it, leaving him to explain that, although her drawings were exquisite, they were not design. That conversation took place as Ockerse and his RISD colleagues were introducing semiotics—firmly grounded not in visual art, but in language—as a defining aspect of their program. What is interesting about this anecdote is that the faculty present at the Cranbrook meeting found it perfectly reasonable to say that a portfolio of drawings—demonstrating a fundamental capability of design—was not design. The approaches to knowledge being developed in an entirely different field (semiotics) ought to be core to one of the most distinguished graphic design programs in the world.

*Change: With or without Progress*

“Finding Order in Chaos” was a two-day education conference in Chicago, brought together about 200 professors and practitioners to discuss the confusing changes in design education and practice. Was there a way to weave Segal & Gale’s rigorous and resilient simplifications of complex financial and tax information with the paradigm-challenging work of experimenters like Katherine McCoy, Dan Friedman, Wolfgang Weingart, April Greiman, and others exploding the conventions of modern graphic design? How was the field to approach computing as a tool for data science and artificial intelligence exploration as well as a (tangible and intangible) medium for exchange that enables a considerable portion of our daily interactions with the world? What might the relationship be between the work of Murielle Cooper at MIT’s Visual Language Workshop and Aaron Marcus teaching introductory typography to thousands of engineers at SIGGraph and other computer science groups?

The intriguing cacophony of ideas at this event was of little help to teachers at undergraduate design schools. At the time, there was very little solid theoretical and practical ground for them to operate from. The two most common resources were relevant contemporary work by respected professionals and examples from history. No wonder the RISD applicant believed that drawing was design! With very little irony, PW proposed to the assembly that students attending undergraduate design programs should launch class action lawsuits against their schools. The charge: teaching them a language no one else understood and a value system no one else appreciated. Looking back, a more severe charge might have been levied against institutions: they were not teaching students how to understand design, how to talk about it, and how to create value from it.

*Structural Knowledge Gap in Design*

These anecdotes remind us that design education has advanced since the 1980s. Today, there exists a body of literature serving both researchers and professionals. Graduate students can find the right school because of the more apparent differentiation among graduate design programs. It is now generally agreed that there are many ways to practice design rather than believing there was one way for all. Also, there are now several Ph.D. programs.
Nevertheless, the overall problem of informality remains. Undergraduate programs are often unrelated to the profession. Professionals know their work demands skill and experience, yet there is no structured introduction to the field as there is for other public and private sector professions (internships) and medicine (residencies). The number of topics that need research is far higher than the number of research faculty. Design continues to produce novel solutions to specific problems but falls short in building knowledge that acts as a context for the various activities we call design. Table 1 shows key differences among various types of schools teaching some aspect of design. Although the variety of educational options is clearly much wider than it used to be, there is no clear structure to compare or differentiate their curriculum and programs.

| Type of School                          | Standard Business School (General Education) | Classic Design School | Human-Centered Design Program | Design Management Program |
|-----------------------------------------|---------------------------------------------|-----------------------|--------------------------------|----------------------------|
| Distinguishing Factors                  |                                             |                       |                                |                            |
| Purpose                                 | Students who want to work in well-established organizations. | Students who want to work in leading organizations. | Students who want to work in industries that need to be more user friendly, especially in areas with tech-people interaction. | Students who want to work towards aligning design to standard managerial practices in different sectors. |
| Core interests                          | How do large organizations work? How do marketing, strategy, op, relate? | How do projects appear to be personal and contemporary? | How are users interacting with the offerings provided? | How can design help organizations overcome challenges? |
| Student learning activities              | Readings, lectures, group discussions, case studies. | Studio projects, apprentice-mentor interactions. | Group projects, working demos. | Seminars, case studies. |
| Outcomes                                | Papers, case studies, and slideshow presentations to faculty and students in class. | Small exhibitions of objects and communication pieces open to all faculty and students. | Conceptual interfaces, user journeys, service blueprints, and other elements that shape user experiences. | Presentations of ideas showing benefits to key stakeholders. |
| Faculty exploration                     | Publish in credible magazines and in peer reviewed journals, create case studies, and consult. | Study contemporary design work. | Research in human-computer interactions considering physical, cognitive, social, and cultural human factors. | Research in design and organizational management, creating and expanding interprofessional networks and practices. |
| Knowledge base                          | Cases, best practices, theories and conceptual frameworks in businesses and management. | Historic and culturally relevant contributions, critical philosophical movements, leading practitioners, academic colleagues. | Small experiments, project reports, industry conferences and conventions, experience of colleagues. | Management and organizational theory, best practices in all sectors. |
A significant challenge for design is that its learning continues to be informal.\textsuperscript{24} Informality means that there is no agreed-upon structure that organizes the field’s core body of knowledge — although there are a few exceptions. Imagine trying to teach color application, for example, without the fundamental theories of Goethe, Munsell, Albers, and the many other artists and scientists that help us understand it.

Most design students learn to practice design without explicitly understanding its underlying principles. For instance, there is no standard framework to help teach prototyping. While there are four or five common uses of prototypes and a consensus that prototyping is a core design capability, there are no commonly used names or descriptions, and no universally accepted way to categorize them. The same is true for observing users, evaluating solutions, and other ways of working that are core to the field.

Informal knowledge can be profound, but it takes much more time to teach, is much harder for people from other fields to understand, and takes much longer to adapt to a changing context.\textsuperscript{25}

We are not suggesting that design needs a process with a defined starting point — “discovering unexpressed user needs,” or “improved financial performance” — followed by a prescribed path through a set of methods. Precisely the opposite is the case. We believe that having a generally accepted set of frameworks and methods across the field can be a platform for more variety in design research, education, and practice. That structure would help faculty identify relevant research topics more efficiently, create knowledge that supports evidence of progress, help students learn faster, and make it easier for non-designers to understand how they could work with design.

\textbf{Whole View}

Whole View is a conceptual model showing relationships among the various forces that tend to influence design projects today. Unlike other design models that have a prescribed starting point and propose a series of steps to guide the design process toward a solution, the Whole View uses seven frameworks and related methods that help teams focus on content, expanding their set of questions when framing a project and defining its purpose, and making progress towards achieving its goals.

Having a set of general questions that can be used for any type of project and a structure for answering them is helpful for teams to break their domain-specific approaches to problem framing and solution finding. For example, a car designer that knows about what excites drivers and what touchpoints best convey quality would likely bring such lenses to any approach. In comparison, the same expert can use the Whole View to expand perceptions about the issues at hand, and incorporate considerations of user aspirations, strategy, and operations into the design of new offerings.

The value of Whole View is more obvious in schools, companies, and labs that explore projects multidimensionally. However, it can also be valuable to organizations that have people with deep, informal knowledge in single domains, varying from their wisest impresario to a conventional agent advocating for maintaining the status quo.
When used in complex projects, the Whole View brings a broader range of possibilities to the surface by helping teams answer one strategic question: “What do we need to know to make change?”

Once teams have an initial idea of the main purpose for making a change, they begin by selecting any of the frameworks, roughly sketching answers to its related questions, and then identifying key methods that can help them create relevant content (see Figure 5). Very few initiatives start off able to answer all of the questions posed by the seven frameworks. But asking them in early planning phases and throughout complex projects can help teams develop a wider understanding of the context and reveal more holistic alternative futures.

**Structure of the Whole View**

The Whole View evolved out of efforts to identify stronger economic drivers for human-centered design than merely uncovering unmet needs, and hopes that a client would pay for whatever novel idea emerged to satisfy them. Over time, it became clear that the solution was not to construct a convincing argument for one outcome or another, but rather to create a way for various individuals and organizations to come up with their own arguments within a holistic, coherent structure.
Currently, the Whole View model has three parts: purpose, frameworks, and methods. At its center, the model asks for a brief statement of a project’s purpose and level of ambition for making change, and a list of indicators that will serve as benchmarks measuring project success.

Some of the core Whole View frameworks are concerned with ascertaining project fitness in realms external to the organization (User Terrains, POEMS, Value Web, Organization Territory) and others are focused on identifying and creating fit within an organization (Levels of Innovation, Strategy Pyramid, Competency Flow).

The User Terrains framework identifies users’ aspirations and related problems. The POEMS framework name is an acronym for the types of offerings generated by design projects (People: Staff & training, Objects, Environments, Messages, Services). The Value Web framework reveals resources such as money, brands, technology, and market access that can support stakeholder participation. The Organization Territory framework fleshes out areas for value creation a company might decide to explore in response to insights into user terrains. The Levels of Innovation framework helps clarify the extent of change and risk a proposition represents. The Strategy Pyramid framework aligns strategy, operations, and offerings that meet users’ aspirations. The Competency Flow framework reveals the core and supporting competencies needed to achieve a purpose. When used in combination, the frameworks help teams generate broader, more flexible perspectives on existing situations, explore alternate futures, and visualize ideas born of differing, yet interconnected perspectives in more concrete ways.

The core methods (outlined in Table 2) provide data and information to the frameworks. The Whole View both benefits from and supports the application of various techniques that give shape to design education, research, and practice. These include, but are not limited to,

- using field observation and interviewing to understand people,
- making physical and virtual models to conceptualize new offerings,
- actively mapping and clustering networks to identify vectors for new value,
- storytelling and argument building to frame new opportunities, and
- backcasting, diagraming, and scenario planning to plan processes and realize change.

Whether in practice or as research, adopting the Whole View makes it easier for multidisciplinary teams to see and resolve their differences sooner because it allows people from many functions to “sketch” the whole project or organization together. Just like designers use quick visual sketches as a way to think about a product, the team can use Whole View frameworks to sketch operations, value creation, and other factors that need to fit each other in order for the project to ascertain the best path towards purposeful, lasting change. The structure facilitates information flow from framework to framework, supporting deeper investigation of each individual framework and wider exploration of the relationships between them. This same structure also relates to design research, design education, and design practice.
Whole View and Design Education

The Whole View model is not intended to replace any of the existing models that make up the diverse landscape of ways of practicing or teaching design. Instead, our intention is to provide a structure that relates the various models and points of view to each other. Figure 6 indicates how the Whole View reveals the similarities and the differences among classic design, design management, and human-centered design programs. The goal for this high-level representation is not to find the perfect description of the relationships, but to create a way for students to understand which schools fit their interests, and for faculty to decide in which ways they want their school to excel. Additionally, it can help point out opportunities for meaningful connections to other fields.

| Core Frameworks | User Terrain | POEMS | Value Web | Organization Territory | Levels of Innovation | Strategy Pyramid | Competency Flow |
|-----------------|--------------|-------|-----------|------------------------|---------------------|------------------|-----------------|
| Core Methods    |              |       |           |                        |                     |                  |                 |
| Prototyping Behavior | ●          |       |           |                        |                     |                  |                 |
| Pattern Finding  | ●            | ●     |           |                        |                     |                  |                 |
| Abstraction      | ●            |       |           |                        |                     |                  |                 |
| Open Interviews  | ●            |       |           |                        |                     |                  |                 |
| Remote Observation| ●           | ●     |           |                        |                     |                  |                 |
| Field Observation | ●            |       |           |                        |                     |                  |                 |
| Participant Observation | ●        | ●     |           |                        |                     |                  |                 |
| Co-designing     | ●            | ●     | ●         |                        | ●                   | ●                | ●               |
| Micro-piloting   | ●            | ●     |           |                        | ●                   | ●                | ●               |
| Prototyping Appearance | ●   |       |           |                        |                     |                  |                 |
| Prototyping Concepts | ●        | ●     |           |                        | ●                   | ●                | ●               |
| Silo Bridging    | ●            |       |           |                        |                     |                  |                 |
| Supporting Frameworks |              |       |           |                        |                     |                  |                 |
| Five stages of experiences | ●    | ●     |           |                        |                     |                  |                 |
| Six modes of experiences | ●  | ●     |           |                        |                     |                  |                 |
| Touchpoints      | ●            |       |           |                        |                     |                  |                 |
| Scenario Planning | ●            | ●     |           |                        |                     |                  |                 |
| Stakeholder Map  | ●            |       |           |                        |                     |                  |                 |
| Value Positioning Statement | ●         |       |           |                        |                     |                 |
A Networked Design Laboratory

We are creating a network of collaborators interested in advancing knowledge at the intersection of design and public health. Some members are from the school of public health, some are from various schools at Harvard, and some are from different parts of the world.

As mentioned earlier, our two goals are to bring the open discovery approach of design to public health and formalize design knowledge. Bringing design to public health will not generate a substitute for current public health practices; rather, it complements the ways the field works to solve seemingly intractable problems at the intersection of well-being and behavior.

We are pursuing a three-part agenda: research at the intersection of design and public health; education that focuses on public health professionals increasing their abilities to use selected design frameworks and methods; and translation that builds knowledge and capability to a diverse audience.
Research

A significant challenge is that behavioral factors often do not lend themselves to current research methods based on science and economics. Drives for better sanitation, reduced cigarette smoking, and wearing seat belts all had to overcome cultural and emotional barriers before becoming public health successes. We envision a research process that builds on the existing body of knowledge and practice from both fields: design can help identify solutions to seemingly intractable problems related to behavior, and public health researchers can conduct rigorous analysis to discover the principles behind successful experiments.

Design helps organizations address specific challenges in people’s lives. Public health research, which typically proceeds incrementally from an existing evidence base to test narrowly drawn hypotheses, can struggle to generate interventions that account for the complexities of human and organizational behavior. We are investigating whether the Whole View can provide a complementary approach to traditional public health research and education, by furnishing frameworks and methods for rigorous immersion in public health problems where data is incomplete and problems are complex. Fast, successful, and meaningful solutions can provide a basis for new research that builds upon existing knowledge and contributes to innovative and effective public policy (see Figure 7).

Although its process has not gone full cycle, Figure 8 illustrates how the Whole View can be used to frame the COVID-19 global pandemic. Remember Now is an ongoing research project whose structure is aligned with the process depicted in Figure 7.

Figure 7
How public health can use scientific analysis to develop general principles that provide the basis for policies, protocols, and further research. © 2020 by André Nogueira and Patrick Whitney.
3. Lack of preparation increases the cost of treatment and decreases economic productivity.

11. We invite faculty and field researchers from around the world to do remote field and user observation, and use self-documentary methods to capture the everyday activities of people who are coping with being quarantined. We will use insights from this work to create concepts and plan prototypes and pilots for new offerings that can improve people’s lives during and after being a victim of an epidemic.

How to make it real?
10. The intent is to leverage the existing body of knowledge in well-being and use discoveries from the field and user observation to support the health, happiness, and prosperity of people, organizations, and the natural environment by reducing the trauma related to all stages of a pandemic, including during future outbreaks.

Who is it for?
8. However, of all the possible changes we can design, how do we know which ones are worth pursuing?

9. With much of the world’s population under quarantine, we have an unusual opportunity to observe how people live, work, learn and play while they pay attention to COVID-9.

What are the offerings?
4. Services designed to save people from floods in Houston or earthquakes in California are memorable because their associated images are forceful, physical, visual, and noisy. They offer images that are more visceral and tangible than photos of empty streets and grounded aircraft.

6. Crowded wet markets can be designed to decrease the likelihood of viruses jumping from animals to people. Airport security can be designed so that agents’ gloves do not transfer pathogens to the documents of the thousands of people. Household cleaning products can be designed to indicate when surfaces have viruses or bacteria.

Why does it create value?
5. Our premise is that many offerings shaping the activities of daily life can be designed in ways that help decrease the frequency of epidemics, slow their transition into pandemics, and when they do occur, make the quarantine protocol more effective. Furthermore, the same innovations that help fight a contagion can help us raise the quality of life in normal times.

Education
We focus on enhancing our students’ ability to use design frameworks and methods to
- understand and plan solutions to challenges that are fraught with ambiguity;
- quickly integrate information related to strategy, operations, offerings, and user experience into a coherent description of a challenge;
- prescribe systemic solutions, at the appropriate level of ambition, which add long-term value for people, organizations, and the natural environment.

Through iterative exercises, we challenge students to sketch existing situations and new organizations quickly. We usually use socially-minded
organizations for project context because, compared to conventional businesses, they are more open to discussing finance, strategy, and operations. Recent examples are the World Health Organization, several organizations providing and influencing policy for developing fresh local food, and urban development companies with a robust social agenda.

We have created two types of courses: a two-week intensive workshop and a semester-long course with weekly classes.

An example of a two-week workshop was offered in Bangkok in January 2020 in collaboration with the Magnolia Quality Development Corporation Limited (MQDC), an international developer building new cities based on the themes of health and happiness (see Figure 9). The class comprised six design students from Chulalongkorn University and six from King Mongkut’s University of Technology Thonburi, plus 11 from Harvard University and two from Tufts University. We were joined by three professors, who helped

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**Figure 9**
One group’s application of the Whole View model. Participants in this group included Clair Roux, Harvard T.H. Chan School of Public Health; Aescilinn Donohu, Fletcher School of Law and Diplomacy at Tufts University; and Vanitsata Ngernyoo and Punyawee Kangvansaichol, Department of Industrial Design at Chulalongkorn University. © 2020 by André Nogueira and Patrick Whitney.
guide the students and teach the class: Chujit Treerattanaphan, Ph.D., from King Mongkut’s University of Technology Thonburi; Praima Israsena, Ph.D., from Chulalongkorn University; and Kevin Denny from Hong Kong Polytechnic University.

Students engaged in hands-on activities with the MQDC network of collaborators, local researchers, foundations, NGOs, corporations, and community organizations to better understand how everyday activities might inform alternative models for designing new cities. Students used the Whole View model to uncover patterns and find opportunities to improve life for residents, local organizations, and the surrounding natural environment.

The example of a semester-long course on social innovation depicted in Figure 10 comes from the IIT Institute of Design. Twenty graduate design students used the Whole View in the same as in Bangkok. Below we present a student’s work based on an organization focused on food waste reduction.

**Figure 10**
The work of Pooja Chaudhary, a graduate student from IIT Institute of Design, using the frameworks of the Whole View to understand Imperfect Produce. © 2020 by André Nogueira and Patrick Whitney.

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**Are we internally aligned?**
Strategically, IP helps farmers turn liabilities into assets. It buys produce that is cosmetically challenged from them, and then creates a system of offerings that makes access to rejected but quality produce easier, and 30% cheaper than in conventional grocery stores. The clear alignment between their strategy, operations, and offerings is one of their strengths for making progress towards their cause.

**How to make it real?**
To sell the cause, IP must be able to source produce that would otherwise go to waste and deliver it to people’s doorstep, grocery stores, and restaurants. In order to do so, it must not only identify organizations inclined towards reducing waste, but also make the experience of being part of this movement a desirable and affordable one.

**Who is it for?**
Rather than defining an age, ethnic, or socio-economic market segment, IP focuses on urban dwellers who want to support and be part of sustainability movements, but don’t have convenient and affordable options to be associated with a cause.

**What are the offerings?**
In addition to transportation logistic services, IP customizes produce boxes for individuals, and provides recipes to help people use the produce in creative ways. It also uses multi-channel messages to help its users to see who else is associated with the cause, including celebrity chefs, restaurants, and other organizations, forming a network around consuming “imperfect” produce.

**Why does it create value?**
Instead of being a conventional supplier in existing food ecosystems, IP created a unique web of agents, adding value not only to people and organizations, but also to the environment. To make this viable, IP connects farmers with grocery stores and restaurants who use larger amounts than individuals. This allows for every interaction to be associated with the cause.
Translation
Visiting Fellows
There are two programs for visitors with extensive experience and want to work at the intersection of design and public health. The Builders program is for accomplished professionals who want to bring an early-stage project related to design and well-being for a year of focused work. The Game-Changers program is for early and mid-career professionals who already have expertise in public health, public policy, or design and want to come to Harvard to explore the confluence of the three fields.

Advising Programs
We develop coaching programs for leaders of organizations to explore how to use design in public health and well-being. They can include audits that show how an organization currently uses design, and sprints that provide short intensive use of design to accelerate a project.

Progress and Design Knowledge
When peoples’ lives were simpler, slower, and offered fewer choices, leaders of organizations making new things and services could be certain about what to make. In the 20th century, it made sense to analyze markets and competitors, assess core competencies, specify measurable goals, and optimize toward a solution. Today, the continuous change in users’ lives, producers’ technology, and world events make those traditional steps less reliable. The principles of human-centered design that emerged in the 1980s helped companies and other organizations succeed by serving users who were becoming more discerning and had more choices. One can make the case that we would not have had the technology boom had designers not turned aggravating technology into user friendly offerings. And therein lies the problem.

The focus on use, cognitive experiences, and ethnography may have created a tightly defined specialty that it is not broad enough to meet the new challenges that are expansive and fraught with uncertainty. What are the consequences for the environment when one of innovation’s mantras is make your own product obsolete before a competitor does? Are we happier having more things in our lives that chime, beep, and vibrate with updates about what should get our attention now? Do we believe our children are healthier and happier with more screens in their lives?

Human-centered design, at the level of a product offering or organizational strategy, is not up to answering these questions. Its standard approach starting with discovering user needs and ending with prototypes that demonstrate better user experiences has several limitations. For example, human-centered design seldom makes economic arguments about why it is worth anyone paying for the solutions it creates. And, the more innovative they are, the more difficult it becomes to see how one should invest resources to make it real, including time, attention, or money. Without a clear understanding of why they create value, many ideas are not implemented, which, of course, is not good for the user.
Another critical challenge is human-centered design has devolved into a specialty that helps individuals and organizations make things easier to use—but not necessarily make people’s lives better. Of course, being useful and useable are still important; but they are no longer differentiators. They have become industry standards that, like design for manufacturing, branding, and product styling, are price of entry that every organization has to meet to even be considered by discerning users. Imagine that design included broader dimensions of what makes us human, such as happiness and health, in its frameworks and methods. Done properly, this would surely offer new opportunities for designers that move beyond fixing the cognitive human factors of new things.

Lastly, human-centered design ignores the looming environmental challenges the world faces. Nature does not appear in its models or language, unless it is a rare green project. By its essential role in “humanizing” high tech products during the incessant drive for innovation over the last three decades, it is actually complicit in creating the mountains made of remnants of cell phones and other products.

**Design for Well-Being**

We are exploring these challenges with a new initiative named Design for Well-Being. There are three constituencies: people, organizations, and the natural environment, and three interrelated areas to enact change: health, happiness, and prosperity (see Figure 11).

Upon reflecting on this new agenda, one might ask: don’t social innovation practices address this? Often they do, but at a much smaller scale than that of most design projects. Social innovation projects have the same challenge as sustainable design—the fact that they are needed is evidence that the majority of design projects are neither social nor sustainable. Shouldn’t the norm be projects that add to the well-being of society and the natural environment?

We believe the answer will not emerge organically from current human-centered design practices, nor will it be discovered in a university think tank or invented by a single individual or a company engaged in sustainability-minded projects. Instead, it will require new specializations that reframe how public and private organizations strategize and operate.

Following are three examples of the seismic challenges that are related to public health and can be helped by design.

**Pay Our Real Cost, Not Steal from the Future**

One of the most significant seismic challenge is addressing the interdependency between human activities and the ecological systems within which they exist. As manufactures continue to use the environment as a cheap source of new material and empty space to discard waste, the real financial and health costs continue to be pushed onto the shoulders of future generations. In the long run, it will be cheaper to redesign existing production-consumption systems to incorporate expenses related to health and resource extraction and use into organizational practices and offerings, than the cost to our well-being we will pay by not doing so.
If critical interventions are carried out effectively, new industries and organizational models will likely emerge. So will new design specialists. Examples might include extracting carbon from polluted air, redesigning wet markets, regenerating dysfunctional brownfields, or new ways to reduce household waste during production rather than relying on users’ behavior change or on their ability to navigate the complexities of material sorting.

**Designing for People, Not Markets**

A second seismic challenge is creating ways to provide choice to consumers through means other than the over production of goods. This is likely to include platform solutions that change the way products and services are created, sold, specified, and delivered.

The current system has these general steps: research desires of consumer segments, design and specify new products, make the products, distribute, promote and sell them. This system relies on the producers predicting what existing markets will buy, making significant investments, and hoping sales will occur. An alternative system might work with organizations understanding the diversity of people’s aspirations and presenting offerings that enable users to tailor product specifications to suit their needs and desires and finally making and delivering the final product for the individual to use. They might even collect valuable materials that would otherwise be disposed of.

This alternative does not rely on overproduction, it reduces the use of resources and waste, and enables individuals to achieve their own aspirations, including those related to their health, happiness, and prosperity. It is not apparent what a final specification system should be like and will need designers with specialized abilities to make this possible.

**Building Trust, Not Information Pollution**

A third seismic challenge relates to the need to curb the glut of information available to us. Until the mid-1990s, most people felt they needed more information to make decisions in their personal and work life. Before then, information was relatively expensive to produce. Publishers, writers, editors, fact-checkers, and many other professionals were part of a costly system that, in general, produced middle-of-the-road content for mass audiences. A key question for audiences was, “How do I get more information?”

Email, web browsers, video channels, social media, and almost everyone having a pocket publishing tool changed all of this. Now, a single individual can perform all of the roles previously carried out by a team of professionals. While we see an explosion in sources and production of content, the capacity of our attention has remained constant. A key question today is, “How do I find information that is true?” How much information on the web is lies, exaggeration, mistaken, and out of date? Probably a large portion.

Overcoming information pollution will require us to make significant changes to current systems — can we protect privacy while providing open access to data? Can we avoid censorship and still certify legitimate content? From an economic standpoint, how might design provide alternatives for people to control their personal data and get paid for letting others use it?
The three challenges described above seem daunting, but they are no more difficult than challenges faced by the pioneers of mass production. At that time, without knowing that department stores would be invented, industrialists must have wondered how they would distribute millions of products. And without knowing that television would be invented, they must have thought it impossible to get the attention of millions of people.

Organizations such as dealer networks, new techniques like budget planning, and principles of demographics that helped explain mass markets all had informal precursors. The speed and scale of modern life required that these and many other business models, frameworks, and methods become more formal. Although these processes did not result from an orchestrated transformation, they were critical for the changes that occurred between 1850 and 1950.
Paradigm Shift

It seems increasingly difficult to use design approaches created for 20th century problems to address 21st century challenges. The process models of design clearly define their steps but have very little guidance regarding content. As a result, the needs of users and clients have been defining content for each project. Of course, designers have to address the needs specific to a project. However, there is a pattern to the type of information sought in different projects. Common topics include potential sources of value, likely stakeholders, missing competencies, and aspirations of users.

Whole View is a model of content defined by its core frameworks, each representing a type of content in which one could become an expert. By formalizing the knowledge about the types of content, it is easier to include people from different fields and remove confusion amongst designers about the meaning of value, or the required competencies, or the users’ aspirations, and other important but abstract ideas.

Any content model has to be bounded to the activities of making and using. Making and using are compliments to each other. The things we use in daily life are made in an unfathomable number of ways ranging from home hobbyist equipment to the most sophisticated flexible production platforms in Shenzhen. While all these ways of making exist today, throughout history, particular approaches to making were prevalent and often defined an era.

A content model presents a new paradigm. To be understood and relevant to research, education, and practice it needs a point of view or definition where people can see how it is similar and different with others approaches to design. The following definition and description of terms serves this purpose for whole view.

Defining Design within the Whole View Paradigm

Design is the field concerned with making pragmatic changes in the physical and symbolic world that create tangible and intangible value for people, organizations, and the natural environment. It does this by applying frameworks and methods that lead to novel solutions that can be used in many ways.

Making

The act of making, as pointed out by John Heskett,29 is fundamental to being human. When making things for oneself or hand-crafting things for a familiar user there no need for user research. Making things for markets gave rise to professional design, and the increase in choice and complexity gave rise to user-research. New flexible platforms may reconnect users to making. Of course, design goes beyond making tangible things creating yields communications, environments, services, systems, organizations and other elements in people’s lives.

Pragmatic Change

Pragmatic changes are the practical consequences of a project’s outcomes. The notion of pragmatic change is informed by the philosophies of Charles

29 John Heskett, “Product Integrity,” in A John Heskett Reader: Design, History, Economics, ed. Clive Dilnot (London: Bloomsbury Academic, 2017), 287–92.
Peirce, 30 William James, 31 and John Dewey. 32 While the degree of change can range from incremental steps to ambitious leaps, the type of change identifies what to make, how to make it, why to make it, and who is the intended user. In general, the user experience is created by the user’s choice of where and when to use it, along with other specific details of use.

Tangible and Intangible Value
Design outcomes benefit more than an organization’s bottom line — it creates new ways creating and exchanging many outcomes including knowledge, data, access to an ecosystem or market, natural resources, and expertise in a new industry.

Natural Environment
In the context of the Whole View, the natural environment is considered a particular type of stakeholder in the value web. Unlike other actors who generally give their feedback immediately, a much longer time frame is needed to determine whether nature has been involved in a balanced exchange where its resources are replenished at the same rate as they are expended. The natural environment may take years or even decades to show a response. For most mid to large size industrial companies, nature’s response time might as well be forever given their schedule of quarterly financial reports. For internet companies the expected response time for evaluating whether a new offering is successful is often instantaneous.

Thinking of the natural environment a key stakeholder in every project argues against special “sustainable design” projects. Instead, it sets a new standard of conduct, asking organizations to build the cost of maintaining environmental integrity into their project strategies and budgets.

Frameworks & Methods
Designers have used most of the frameworks, methods and related techniques of the Whole View for a long time. They provide structure, enable expansion, and foster interconnectivity between the various moving parts of the model.

Novel Solutions
When the context of a problem is well understood, step changes can be made with certainty. But when there are too many parts to understand, or the parts are influenced by the ambiguities of human behavior, or the situation changes too quickly, it will require a leap-change from current knowledge and what needs to be known to succeed. The results are almost by definition “new.”

Use
In the context of the Whole View, user experience is not created by designers. Rather, it is created by the users who adopt the products of design to help create their own experiences. The concept of use is viewed broadly and is related the “user terrains” framework that focuses on user aspirations, ranging from high level life-defining goals to those tied to daily life.
Reframe

Even before the COVID-19 pandemic altered our daily life it was apparent that we, as a species, as citizens of a country, and as neighbors in towns and cities were not doing very well. Using the USA as an example, we are having difficulties educating our kids, delivering health care to our families, feeding and housing our fellow residents, and renewing the natural environment. We race forward with new technologies while seeking models by looking backwards at institutions designed 60 years ago. Most of our organizations emerged in a world of fixed infrastructure, top down planning, and slower timetable for change as the outcome lasted longer than its planning time.

Today, we praise mobile apps as signs that we are innovative, forgetting to compare them to innovations that are more than a century old, including, for example, those that brought water and electricity to homes and schools for our kids. The lack of preparation for a virus attack that we knew would happen but did not know when, amplified what we had already realized: contemporary institutions, organizations, and ways of working need to be reframed to fit the new, more flexible, networked world we have entered.

As it has done in the past, design can contribute a great deal to reframing these and other challenges. However, it needs to work as fast as the world is changing, linking its frameworks and methods to other fields needed to make the reframing a reality.

The role of higher education is pivotal to this. The normal location for building new knowledge and making progress in any field is graduate schools, with faculty leading research that can be shared within the field and connected to other fields. Of particular interest are the progresses made in the fields of public administration and public policy. The field of public administration, training mid-level managers for civic roles, had long been steeped in case studies and other forms of informal knowledge. A small number of schools became interested in formalizing knowledge to address the complex challenges of the state department and other complex and demanding organizations. These schools left the field of public administration and formed the much smaller but significantly more influential field of public policy.

It seems to us that this might be a productive model for design. Imagine the results if as few as ten or fifteen graduate design programs agreed to advance knowledge within a one or two categories of design, sharing with each other and connecting with relevant people in other fields. Imagine how this movement could help the field of design, the field of public health, and the other fields concerned with the well-being of people, our organizations, and our planet.

Declaration of Interests

There are no conflicts of interest involved in this article.
References

Bédarida, François. *A Social History of England, 1851–1990*. London: Psychology Press, 1991.

Cohen, I. Bernard. “Florence Nightingale.” *Scientific American* 250, no. 3 (1984): 128–37. DOI: https://doi.org/10.1038/scientificamerican0384-128.

Dewey, John. *Logic: The Theory of Inquiry*. New York: Holt, Rinehart, and Winston, 1938.

Dewey, John. *Democracy and Education*, The Middle Works, edited by Jo Ann Boydston, vol. 9, 1916. Carbondale: Southern Illinois University Press, 1985.

Doblin, Jay. “A Short, Grandiose Theory of Design.” *STA Design Journal, Analysis and Intuition* (1987): 6–15. https://www.doblin.com/dist/images/uploads/A-Short-Grandiose-Theory-of-Design-J.-Doblin.pdf.

Droste, Magdalena. *Bauhaus: 1919–1933*. Köln: Taschen, 2002.

Findeli, Alain. “Moholy-Nagy’s Design Pedagogy in Chicago (1937–46).” *Design Issues* 7, no. 1 (1990): 4–19. DOI: https://doi.org/10.2307/1511466.

Flinchum, Russell. *Henry Dreyfuss, Industrial Designer: The Man in the Brown Suit*. New York: Rizzoli International Publications, 1997.

Heskett, John, and Alessandro Giorgetta. *Industrial Design*. London: Thames and Hudson, 1980.

Heskett, John. “Some Lessons of Design History.” In *Designkompetanse. Utvikling, forskning og undervisning*, edited by Astrid Skjerven, 11–21. Oslo: Kunsthøgskolen i Oslo, 2005.

Heskett, John. “Creating Economic Value by Design.” *International Journal of Design* 3, no. 1 (2009): 71–84. http://www.ijdesign.org/index.php/IJDesign/article/view/477.

Heskett, John. “Product Integrity.” In *A John Heskett Reader: Design, History, Economics*, edited by Clive Dilnot, 287–92. London: Bloomsbury Academic, 2017.

James, William. *Pragmatism: A New Name for Some Old Ways of Thinking*. New York: Longmans, Green, and Company, 1907.

Kumar, Vijay, and Patrick Whitney. “Faster, Cheaper, Deeper User Research.” *Design Management Journal (Former Series)* 14, no. 2 (2003): 50–57. DOI: https://doi.org/10.1111/j.1948-7169.2003.tb00041.x.

Kumar, Vijay, and Patrick Whitney. “Daily Life, Not Markets: Customer-Centered Design.” *Journal of Business Strategy* 28, no. 4 (2007): 46–58. https://id.iit.edu/wp-content/uploads/2015/03/Daily-life-not-markets_JBS_071.pdf.

Malherek, Joseph. “The Industrialist and the Artist: László Moholy-Nagy, Walter Paepcke, and the New Bauhaus in Chicago, 1918–46.” *Journal of Austrian-American History* 2, no. 1 (2018): 51–76. DOI: https://doi.org/10.5325/jaustamerhist.2.1.0051.

Mavigliano, George J. “The Chicago Design Workshop: 1939–1943.” *The Journal of Decorative and Propaganda Arts* 6 (Autumn, 1987): 34–47. DOI: https://doi.org/10.2307/1503912.

Meyer, Michael W., and Donald A. Norman. “Changing Design Education for the 21st Century.” *She Ji: The Journal of Design, Economics, and Innovation* 6, no. 1 (2020): 13–49. DOI: https://doi.org/10.1016/j.sheji.2019.12.002.

Muratovski, Gjoko. “Paradigm Shift: Report on the New Role of Design in Business and Society.” *She Ji: The Journal of Design, Economics, and Innovation* 1, no. 2 (2015): 118–39. DOI: https://doi.org/10.1016/j.sheji.2015.11.002.

Nightingale, Florence. “Diagram of the Causes of Mortality in the Army in the East.” In *Notes on Matters Affecting the Health, Efficiency, and Hospital Administration of the British Army*. London: Harrison and Sons, 1858. https://commons.wikimedia.org/wiki/File:Nightingale-mortality.jpg.

Nogueira, André Martins. *Sustainable Solutions in Complex Spaces of Innovation* (Ph.D. dissertation, Illinois Institute of Technology, 2019), ProQuest AAT.
Nogueira, André, Weslynee Ashton, Carlos Teixeira, Elizabeth Lyon, and Jonathan Pereira. “Infrastructuring the Circular Economy.” Energies 13, no. 7 (2020): 1805. DOI: https://doi.org/10.3390/en13071805.

Norman, Donald A. “Design Principles for Human-Computer Interfaces.” in CHI ’83: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 1–10. New York: ACM, 1983. DOI: https://doi.org/10.1145/800045.801571.

Peirce, Charles S. “Illustrations of the Logic of Science (1878).” In Chance, Love and Logic, edited by Morris R. Cohen. Lincoln: University of Nebraska Press, 1998.

Royal Commission. Official Catalogue of the Great Exhibition of the Works of Industry of All Nations, 1851. London: Spicer Brothers, 1851.

Ruth, Greg. “Walter Paul Paepcke (1896–1960).” Immigrant Entrepreneurship (website), published June 08, 2001. http://www.immigrantentrepreneurship.org/entry.php?rec=67&e_x003E.

Schwartz, Frederick J. The Werkbund: Design Theory and Mass Culture before the First World War. New Haven: Yale University Press, 1996.

Snow, John. “The Cholera near Golden-Square, and at Deptford.” Medical Times and Gazette 9 (1854): 321–22. https://johnsnow.matrix.msu.edu/work.php?id=15-78-45.

Snow, John. On the Mode of Communication of Cholera, 2nd ed. London: John Churchill, 1855. https://www.ph.ucla.edu/epi/snow/snowbook2.html.

Weil, Denis, and Matt Mayfield. “Tomorrow’s Critical Design Competencies: Building a Course System for 21st Century Designers.” She Ji: The Journal of Design, Economics, and Innovation 6, no. 2 (2020): 157–69, DOI: https://doi.org/10.1016/j.sheji.2020.03.001.

Weisberg, Gabriel P. “Italy and France: The Cosmopolitanism of the New Art.” The Journal of Decorative and Propaganda Arts 13 (Summer, 1989): 110–27. DOI: https://doi.org/10.2307/1504050.

Whitney, Patrick. “Design and the Economy of Choice.” She Ji: The Journal of Design, Economics, and Innovation 1, no. 1 (2015): 58–80. DOI: https://doi.org/10.1016/j.sheji.2015.09.001.