

Unraveling Design Principles from Buchanan's thinking¹

Desentrañando los principios de diseño del pensamiento de Buchanan

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Abstract

Producing new knowledge and training design professionals are constant concerns in Buchanan's discourse. The author seeks to provoke debate, motivate reflection, and identify gaps in both contexts. Therefore, he proposes to rethink the design disciplines and to reconstruct them. This article introduces Buchanan's ideas, first, around the development of new knowledge, followed by a review and discussion of his "four orders"; then, it proposes

¹ A previous version of this article was published in Spanish as a book chapter. This version has been revised and updated with Buchanan's most recent work.

to interpret these same orders as principles, given that, from the point of view of this research, it might be more nourishing for the construction of knowledge to rethink Buchanan's concepts as principles instead of orders: the symbolic, material, action, and systems principle. Moreover, instead of four, a fifth principle based on the author's concepts is conceived: the transition principle, which takes his ideas from a transitional perspective. In this article, I propose five principles to trigger reflection and thinking, develop new knowledge in design, and question the structures through which we train design professionals, intentions faithfully rooted in Buchanan's thinking.

Keywords: Design Principles, Buchanan's Thinking, philosophy, Four Orders.

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Resumen

Producir nuevos conocimientos y formar profesionales del diseño son preocupaciones constantes en el discurso de Buchanan. El autor siempre busca suscitar el debate, motivar la reflexión, e identificar lagunas en ambos contextos. Por ello, propone repensar las disciplinas del diseño y reconstruirlas. Este artículo introduce las ideas de Buchanan, primero, en torno al desarrollo de nuevos conocimientos, seguido de una revisión y discusión de sus "cuatro órdenes"; después, se propone interpretar estos mismos órdenes como principios, dado que, desde el punto de vista de esta investigación, podría ser más nutritivo para la construcción del conocimiento repensar los conceptos de Buchanan como principios en lugar de órdenes: el principio simbólico, material, de acción y de sistemas. Además, en lugar de cuatro, se propone un quinto principio basado en los conceptos del autor: el principio de transición, que contempla sus ideas desde una perspectiva transicional. En este artículo, propongo cinco principios para desencadenar la reflexión y el pensamiento, con el objetivo de contribuir al desarrollo de nuevos conocimientos en diseño y cuestionar las estructuras a través de las cuales formamos a los profesionales del diseño, intenciones fielmente arraigadas al pensamiento de Buchanan.

Keywords: Principios del Diseño, Pensamiento de Buchanan, Filosofía, Cuatro Órdenes.

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1. Introduction: Producing knowledge and teaching in design

This article aims to revisit The Four orders of Design by Richard Buchanan, which has influenced, among other works, our understanding of design practice extraordinarily. This article presents a proposal to interpret Buchanan's concepts as principles of design, given that as places of thought and discovery, they could give birth to principles instead of orders. Additionally, instead of four, a fifth principle is proposed based on the author's thinking, which would envision his concepts from a transitional perspective. The results highlight an alternative and fertile perspective to understanding every design practice and the possibilities for design education. The reflections in this paper emerge from two primary sources. The first source corresponds to a literature review of different contributions that Buchanan has published over time, highlighting three of them: "Education and Professional Practice in Design" (1998), in which the author declares the emergence of a new era in design, recognizing it as a field of knowledge. As such, part of his work consists of reflecting on the role that education should have, both in transforming the practice of design and in discovering and disseminating new knowledge. "Design Research and the New Learning" (2001), in which the author proposes the four orders of design as a response to the fragmentation of knowledge and the disjointed efforts in the field that present a challenge in identifying the value of design. "Surroundings and Environments in Fourth Order Design" (2019), in

which Buchanan expands on his reflections on the fourth order of design. The second source of information to unpack Buchanan's thinking was the review of keynotes and lectures accessible through video platforms. In this format stands the keynote "Dialectic and Inquiry in Design" (RSD6, 2017), in which the author expands the reflection on the four orders of design. The references in this article include only those sources that were cited directly, which are considered vital to understanding the arguments presented here. However, the study of other publications and talks that were not referenced was necessary to unravel Buchanan's thinking.

According to the author, even though there are evident research efforts in different design fields, there is still a degree of uncertainty, which raises different questions. For example, what is the value of research for design? What is its field of belonging? That is, if design research belongs to the social sciences, business, or arts faculty (Buchanan, 2001). Even so, Buchanan still doubts "whether there is such a thing as design knowledge" (2001, p.3). Other authors who share the same concern have tried to discover whether design disciplines have a particular way of developing new knowledge (Cross, 1982). This concern is perhaps not new to the design field since even before Buchanan, researchers such as Donald Schön highlighted the particularity of the field of design, arguing that the practical orientation of design develops a particular way of thinking and developing new knowledge (Lopez-Leon, 2017). Thus, the practical orientation of design and its constant contact with different real contexts produces many experiences. These experiences may become the basis for reflection as case studies and the foundation to develop new knowledge from practice. However, Buchanan points out that designers have not yet made the leap to writing and using such case studies as an essential part of the design education process or as a platform for conducting research. Therefore, the "principles underlying the design process are not well documented, articulated, or agreed upon" (Breslin and Buchanan, 2008, p. 37). However, case studies still represent an opportunity to address design theory as a theory, not as a "practical application of wisdom and rules-of-thumb" (Breslin and Buchanan, 2008, p. 39). Embracing case studies is a route the author proposes to

achieve a theoretically-informed conversation that even succeeds in motivating a new generation of design teachers and researchers.

These concerns not only touch the DNA of the design fields but also impact the core of design education. If there is no solid knowledge and a clear conception of the discipline, then educational practices tend to focus on teaching technical knowledge since it is more tangible, precise, and sharp. The challenge, according to Buchanan, is to "prepare our students for a changing world" (Buchanan, 1998, p. 65). Technical knowledge will not be enough to prepare students to face the problems of today's societies, which have grown in complexity. In addition, the complex nature of such problems demands more than one way of approaching them (Buchanan, 1992). The author highlights that instead of maintaining current educational practices, which are also repetitions of previous practices, design teachers need to "anticipate new conditions of [professional] practice" (Buchanan, 1998, p. 65). Hence, we as teachers should develop methods and concepts that collaborate in preparing students for future design practices. According to the author, the development of design theory by teachers and researchers would help to provide context to understand the changes currently happening in design practice (Breslin and Buchanan, 2008). Although the author highlights that educational institutions have fallen behind in understanding what design is and how it should be taught, we must also consider that design is one of the disciplines that has changed the most in a very short time.

Unlike architecture, whose practice has evolved over centuries, design disciplines have been reinventing themselves and adapting to changes as rapidly as they can. Design has found ways to respond to the vertiginous technological advances that have led to new ways of collaborating, relating to one another, having fun, and entertainment, among many other fields. In less than a century, the design process has been influenced and transformed by different approaches, focusing at first on the paradigm that form follows function, then moving on to study process and design methods, to finally concern about integrating the end-user in the design process (Design Council, 2007), "it is the concept of form that has grown more supple and complex, embracing the social and environmental context of design"

(Buchanan, 2008, p.9). Thus, for simple cumulative reasons, (Buchanan, 2001c) the body of knowledge that design could have generated in all these years remains fragmented. In other words, the fact that design is a discipline in constant innovation, achieving consensus and establishing long-term theoretical bases becomes extremely difficult.

The challenge is clear for young designers because they need to "have more knowledge and a broader humanistic point of view in order to deal with the complex problems that they must face in their professional careers" (Buchanan, 2001, p.6). In this way, although the design disciplines have had some success in contributing to the field of knowledge, at the same time, more solid and thicker borders have emerged between them, producing valuable but fragmented knowledge. Additionally, many specializations have emerged from design practice complicating, even more, to find "connections and integrations that serve human beings" (Buchanan, 2001, p.7). Years before Buchanan, Ortega y Gasset (2010) warned about specialization, referring to it as a barbarity. Ortega y Gasset emphasizes that the new ways of teaching and conducting research produce professionals who are specialists with a minimal scope in the fields of knowledge, unable to integrate and apply their findings to other disciplines or other types of problems. For Buchanan, design is the activity that "integrates knowledge from many fields for impact on how we live our lives" (Buchanan, 2001, p.7), regardless of the materialization of its practices, that is, the construction of artifacts, whether they are images, objects, activities, services, public policies, and even systems. Therefore, the author invites to provide new learning focused on connecting and integrating "knowledge from different specialties into productive results for individual and social life" (Buchanan, 2001, p.7). It is worth noting that the author's invitation is now more than 20 years old and is still as valid as when he wrote it.

The integrative capacity referred to by the author is visible from several approaches. From the multidisciplinary approach, design can be one of the kaleidoscopic approaches that integrate to address a singular object of study; from

the interdisciplinary approach, design integrates knowledge and methods generated in other disciplines to develop new forms of design practice and teaching; from the transdisciplinary approach, design builds bridges with those perspectives that allow it to address the complex problems that afflict societies today. This integrating capacity and its coexistence with other disciplines have led design to a state of constant uncertainty since numerous design definitions contrast and sometimes even contradict each other. However, for Buchanan, this is one of design's strengths. That is, the fact design as a discipline has not solidified, in Bauman's terms (Bauman, 2003), in a particular definition allows it to continue evolving. Furthermore, the author highlights that the disciplines that have agreed on a definition tend to enter a lethargic state or become fields that usually disappear or die (Buchanan, 2001, p.8). Likewise, he also recognizes that the same definitions can serve as a basis for research development, motivating inquiries, and, therefore, producing new knowledge. In other words, it can be understood, from Buchanan's perspective, that a definition could be seen as a question. Without being a determining statement, a question is an invitation to researchers, academics, students, practitioners, users, and all those involved with design practices, to discuss it, debate it, and respond to it, either through dialogue, texts, conferences or through the same practice. With this framework, the author proposes the following definition: "Design is the human power of conceiving, planning, and making products that serve human beings in the accomplishment of their individual and collective purposes" (Buchanan, 2001, p.9). It is worth mentioning that Buchanan's idea of a product is broader and inclusive since it does not refer only to commercial products or objects but to the result of the design process. The author's conception of this "product" is what gives birth to his ideas about the "design orders," as he calls them, which will be discussed in depth in this article.

2. The four orders of design

Intending to address problems related to design practice, design education, and design research, Buchanan proposes to observe the disciplines from four orders of design in the 21st century (Buchanan, 2001). The author clarifies that these orders are places to rethink and reconstruct the nature of design, that is, places for discovery, so they should not be seen as categories that have a fixed meaning. Next, we will review each of the four orders of design to discover, investigate, question, and rethink the concept of design, taking the proposed orders as places of thought, hence, maintaining Buchanan's original objective. In addition, among the main aspects to consider during this reflection is that the reach and differences between each of the orders have not been clearly described by the author, making it difficult to understand each one. Therefore, one of the objectives of this article is to collaborate in their differentiation and contribute to their understanding and reflection.

The first order of design refers to the manufacture of symbols. According to the author, the practices in this first order gave birth to what we know today as graphic design, a profession concerned with developing visual images linked to communication, print media, and even the new digital media. All of these share communication as the main objective of the practice, regardless of the chosen means of dissemination, which occurs through symbols. In short, the first-order design process is oriented toward symbol development.

The second order of design is concerned with the manufacture of things. Thus, similarly to the first symbolic order giving birth to graphic design, the second order gave birth to industrial design. According to the author, this discipline also includes the practice of "product design," referring to the practice related to the creation of mass-produced consumer goods. At this point, two questions emerge. First, can the first-order participate in consumer goods? Or everything regarding consumer goods is limited to the second-order practice? As we know, consumer goods also need symbols recognizable by users, communicating functions and attractive meanings to the consumer. Therefore, it is unclear why only the second order

refers to mass-produced consumer goods. Likewise, the design process that produces symbols in the first order occurs not only for consumer goods but also for services. The second aspect is that the artifacts resulting from the design process of the second order can also contain meaning. In other words, a watch, a ring, or a car are artifacts that carry meaning that can project commitment and status, among others, so the author does not delve into how the design process of the second order can include the first. Likewise, the characteristics of the second order are not exposed in-depth, nor are the relationships between the two first orders with each other, except that one refers to symbols and the other to material things. Hence, the first would be the field of action of graphic design, and the second of industrial design. Buchanan gives a hint of this glitch when discussing where to place interior design. He becomes aware there are practices in interior design involving elements for communication, construction, and interaction (Buchanan, 2019).

The third order corresponds to manufacturing actions. The author declares that thanks to a reordering of the disciplines, design is now concerned with becoming part of human beings' experiences. Therefore, the author invites us to consider that human communication and its material constructions, being part of the human experience, are also a form of action. This practice gives birth to what is now known as interaction design, focused on how human beings relate to each other through the mediating capacity of artifacts, meaning experiences, activities, or services. In other words, the design process in the third order is oriented to the manufacture of actions, intrinsically linked to planning, services, and experiences.

The fourth and final order focuses on environments and systems. According to the author, the very concept of system has changed and no longer refers to systems of things, but to human systems that integrate information, physical artifacts, and interactions in environments for living, working, learning, and playing. More recently, Buchanan envisions Interior Design as a discipline born within the fourth order (Buchanan, 2019). Hence, he depicts it as a more holistic practice that can face complex problems. From this point of view, several questions emerge about the delimitations of each order. For instance, why only the fourth order can

include practices from the previous three orders as if they represented a hierarchical structure? Why do they represent a one-way relationship? In other words, why can the fourth order imply symbols, construction, and interaction but not vice versa? Could a car, a product-result of the second-order industrial design, represent a "place" that interior designers can transform as fourth-order practice? Could a street sign, as symbolic communication from the first order, be considered an interactive artifact from the third order? The four orders as places of thought provoke that route of questioning that inspired the proposal about principles in this article.

3. Rethinking the orders: the principles of design

The orders proposed by the author are linked to a particular product and directly related to specific disciplinary practices. Therefore, to embrace them as places of thought and rediscovery, as the author proposes, it is necessary to envision them with greater scope than production lines of symbols, objects, and systems, as they were projected.

Rethinking design practices is necessary to produce new knowledge that aids in understanding them better. Furthermore, it is essential to detach them from the disciplinary division to regain the original notion of places of thought, as the author proposed. Otherwise, their ability to conceive differently design theory, education, and professional practice would be limited as they are anchored to a product, as they have always been. The challenge of rethinking practices would imply tearing down disciplinary borders and understanding that all the resultant products of design practices include aspects of different orders, such as the development of symbols. An object or thing can also include the construction of meaning in its development process. The design of environments, without a doubt, also requires a symbolic system that allows the user to understand and interact with an interface. The difference dwells in thinking that there is no design process mainly oriented to producing symbols but that every design process considers the construction of meaning in itself. Otherwise, it is hard to comprehend that

designing a mountain bike, a second-order product, does not involve constructing meaning in its process. Weighting options of forms and materials not only impact the engineering and function of the product, but they will influence how that product is perceived. Forms and materials are elements that can also carry meaning, such as endurance, speed, performance, adrenaline, and extreme sports, among others, that is, symbols that belong to the first order. The goal of these examples is to highlight that the construction of meaning is not exclusively a practice of graphic design, as well as the manipulation of different materials solely of industrial design. In other words, the characteristics of the four orders proposed by Buchanan can be found in all disciplines, depending on the standpoint.

The concept of order, as a place of thought, can be fertile for the development and understanding of design since order refers directly to a system. In this sense, even though the orders of design aid in understanding the origin of the disciplines, the author's depiction is, to a certain extent, limited since it does not describe a state of things, that is, a system as a state of relationships between different elements. Thus, to understand the first order that gave birth to graphic design, it would help to identify a series of elements of practice and reflect upon how those elements relate to each other at a certain point. Hence, a first order, or a first state of things, emerges. When said relations or that state changes, then a second order could appear. For instance, technology is an element that has transformed design practice. Throughout history, design has involved different states of things in its practice depending on the available technology. Hence, we could reflect upon different orders of design before and after the computer. The state of relations between different elements of design practice changes before and after incorporating new technologies. For this reason, the concept of order can be fertile for rethinking design practices. Therefore, the author's proposal should be taken as a starting point, as a question, or even as a provocation, leaving the task of developing new knowledge and deepening that perspective to design researchers.

About the concept of principle, Buchanan has pointed out that it is necessary for the production of new knowledge in design. "By investigating the generative principles of design thinking and design discourse, we may hope to reach a better understanding of the fundamental causes that have shaped design in the past and present, and that will continue to shape it in the future" (Buchanan, 2001c, p. 74) The author identifies four generative principles that have shaped design overtime and ill probably remain in years to come. In that sense, the author recognizes that design is shaped by actions, agents, necessities and contingencies, and ideas and ideals.

Hence, we can observe that these principles refer to external elements in the design process. This distinction is important because Buchanan emphasized the products of the orders, as in symbols, things, or interactions, hence, the orders of design are linked to design processes. However, by taking the ideas of the four orders of design as principles, it will be clear how they can nurture, particularly in understanding the design process, as internal elements. Visibly, generative principles address external aspects of the design process, looking at design as an action in an environment carried out by an agent bearing a specific thinking tradition and trying to cope with and transform material reality. In contrast, the reconception of design orders as principles addresses intrinsic aspects of the design process. This clarification is to highlight that Buchanan had already worked with the concept of principle but took a different route than the one intended in this document.

A principle can be understood as "an extremely general assumption or rule" (Bunge, 2005, p.170), or as "a fundamental truth or proposition that serves as the foundation for a system of beliefs, behavior, or for a chain of reasoning" (Lexico, 2020). In this way, if we observe the orders as principles, they can be taken as foundations or bases to rethink the design belief system or the way we understand it. Therefore, instead of the symbolic order that gives birth to graphic design, we could establish the symbolic, material, action, and systemic principles of design. These will not depend on the design disciplines but will act transversally in the

design process regardless of the product-result. Each of the orders is detailed below, re-understood from the principles' perspective. This different perspective could represent another way of conceiving the structure of design education, which is discussed in more detail in the last section of this document.

3.1 The symbolic principle

This principle refers to the fact that every design process, regardless of the product-result, implies the construction of meaning. In other words, even if the designer is unaware, the result he/she produces will have meaning for someone in particular. Buchanan highlights the production of symbols as the beginning of design disciplines. If the symbolic practice was the starting point, it is logical to think that the new practices would maintain it as an original aspect, similar to a design DNA. Symbolism as a principle of design implies that any practice, whether it produces images, objects, spaces, actions, or systems, will intrinsically carry a construction of meaning in its process.

3.2 The material principle

This principle considers that, in every design process, a reification event occurs through the materials, that is, a materialization of the result. The relationship of design to materials, while visibly evident, has been somewhat ignored. In other words, design practices have also contributed to the excessive use of resources. By not considering this impact, the designer disposes of them as if they were infinite, among other practices that have collaborated with environmental deterioration. The material principle highlights the materialness, hence, the environmental impact, of the design process. Thus, even though graphic design works with images, this does not exempt it from its materiality and impact. For a long time, the dissemination of images consumed large amounts of paper and ink. Although digital dissemination of them has become more popular, it also involves energy consumption. Mobile devices, computers, digital billboards, and many other

media need to be increasingly powerful to project images in high definition. Materiality as a principle implies that any practice, regardless of the final product, will intrinsically carry reification in its process.

3.3 The principle of action

This principle holds that every design process is a form of action. It is no coincidence that in recent decades the user has gained a spotlight in the design process since it is clear that user interaction is one of its main objectives. Also, the design process does not really seek to develop images, objects, or environments but to transmit a message, perform a task, or provoke an experience. In other words, these actions are the ultimate goal of design, and the product-results of its process are only the means to achieve them. From the point of view of 'to every action there is always an equal reaction' of Newton's laws, designers must consider this principle because the consequence of their actions as designers will not go unnoticed in the context in which they intervene, impacting the behavior of different users. For instance, placing a billboard on a busy avenue will cause drivers to look away from the road for a few seconds while driving. The principle of action, which the author proposed as the origin of interaction design, is the principle on which Norman (2013) bases his affordance perspective, which analyzes the capacity for interaction and actions that a user can perform with different artifacts based on what they communicate, i.e., the symbolic principle. Action as a principle implies that any practice, regardless of the final product, will intrinsically carry an interaction with the user in its process.

3.4 The systemic principle or systemic integration.

This principle embraces the fact that every design process operates within a system. Understanding the systemic nature of design can be challenging, but it extends the scope of design beyond the perspective of single-object development.

Perhaps it is easy to consider that the systemic principle refers to designing systems, but as in the previous principles, the approach proposed in this article is to unlink each order-concept from particular disciplines. Thus, even when the design goal is to develop an object such as a chair, the systemic principle would demand considering also available resources, production processes, distribution channels, and possibilities of use, reuse, and recycling, among others. In other words, the principle of systemic integration would aid in observing how the object converges with meaning, material, and action systems inside and outside of the object itself. The design process becomes a process of integrating and connecting nodes, thereby expanding both the designer's vision and the scope of design possibilities. The systemic principle of design implies that any practice is a point of convergence between interrelated and interdependent elements, so it will intrinsically carry an integration process.

Rethinking Buchanan's four orders of design from the perspective of principles enabled us to observe that regardless of the specific practice or the disciplinary border in which a designer takes action, these concepts can influence the design process as if they were design's DNA. In other words, a single product could be analyzed and studied from its symbolic, material, interactive, and systemic aspects. Likewise, the design process is founded on the same principles, that is, regardless of the practice and the result, every product developed through a design process will intrinsically undertake symbolic, material, interactive, and systemic aspects. These aspects overlap as if they were layers or dimensions. So, whether we are talking about a chair, or a skyscraper, each can be understood from its symbolic to its systemic dimension. In other words, the principles are inescapable. Whether for developing images, objects, spaces, and so on, by the very nature of design, the design process will address symbolic, material, interactive, and systemic aspects every time it is undertaken, either the designer is aware of it or not.

4. The fifth principle: the transition.

Years after the publication on the four orders of design, Buchanan gave a lecture in 2017 in which he revisited them and delved into the fourth order, including the concept of dialectical design. (RSD6, 2017). Bringing the dialectic concept into the discussion of the systemic aids in identifying some key design activities, describing more accurately, and comprehending more deeply what is proposed in this article as a transitional principle. For the author, dialectical means systemic, so dialectical design corresponds to the design of systems, which focuses on two principal activities.

The first activity refers to establishing a relationship with the opposite. This idea concurs with the first of the three principles of complexity by Morin and Le Moigne, which argue for uniting opposing forces (Morin, 2000). In this sense, the design process would waive the traditional and well-established dichotomies in design, such as form-function, process-result, user-society, general-particular, outside-inside, among many others. We can see the union of opposites already emerging as dissolved dichotomies within the discipline, for instance, the 'prosumer' as the producer-consumer merged. Co-design and participatory design are examples that dissolve the designer-user, individual-collective, process-product dichotomies, involving other actors in addition to the designers in the design process (Lee, 2008; Manzini and Rizzo, 2011).

The transition principle claims that the design process can join opposing forces, concepts, and ideas. For example, the designer can diagnose a problem within a system. This system has been operating with opposing forces, concepts, or ideas in a first state, or a state A of the system. Then, the designer would seek to transform it into a system in state B where the borders between concepts are erased, and what once was contradictory becomes interdependent (Findeli, 2001). Transforming a system, from state A to state B, will not happen immediately. Hence, the system would enter into a state of transition. Furthermore, once the system reaches a state B, new problems and challenges will surely appear. These new challenges will trigger a new cycle of the design process, submitting the

system in state B into a new state of transition. Thus, the transition principle emphasizes the iterative quality of the design process.

The second activity of dialectical design refers to transforming the surrounding into an environment. For Buchanan, the surroundings and the environment are different. The author claims to have borrowed this idea from John Dewey and refers to the fact that the relationship we establish with the surrounding is to understand and interpret it, and when we act on it, it is to transform and adapt it into an environment that benefits us (Buchanan, 2019, p.7). In other words, man transforms his surroundings into an environment to change the way he experiences it. The author insists that the current concern of design is to interpret systems to transform them into environments that can improve the human experience. He even recognizes that "all areas of design involve the transformation of surroundings into environments" (Buchanan 2019, p.8). Therefore, in said transformation, there is also a process of transition.

Thus, in this article, I propose the principle of systemic transition as fifth principle of design, which refers to the fact that every design process is capable of provoking a transitional state in a system, that, in addition, is iterative. This principle allows us to understand the dialectical capacity of the design process, which implies that opposing ideas and practices can be integrated to transform a system through transitional cycles. Thus, the complex problems of today's societies can be addressed through the design process involving different disciplines with symbolic and material systems that could be opposites. Like the others, this principle applies to every design discipline without being exclusive to a particular practice. In short, the transition principle implies that any design practice will intrinsically submit any system to a transition state.

The need to string together a fifth principle based on the author's reflections emerges because the problems that design practices now face are more "open, complex, dynamic and interconnected" (RSD6b, 2017). Therefore, these problems require practices that respond from complexity since disciplinary practices have continued proposing short-range solutions. Moreover, this principle reclaims the

notion that design is unfinished, open, and iterative, that is, always in transition. In addition, the fifth principle not only unveils the possibility of transforming systems but also of building bridges with other disciplines. This idea is identifiable in the author's work if we look between the lines in some of his publications. It becomes particularly visible when he refers to an interview conducted in 1969 with the designer George Nelson, who, according to Buchanan, already foresaw a change in design disciplines, leaving aside symbols and things to reach the systemic (Buchanan, 2001b).

Nelson declares that "designers must remain generalists in order to satisfy the deepest needs of industry" (Buchanan, 2001b, p.15) disagreeing with specialization tendencies in the disciplines. Again, let us keep in mind this is a statement from almost half a century ago. However, modern thinking influenced design education, consequently, specialization and separation of the design disciplines were inevitable. Therefore, Buchanan reminds us that "specialized knowledge must be connected and integrated in new ways if the designer is to perform his or her proper function in society and culture" (Buchanan, 2001b, p.15). In this sense, building interdisciplinary bridges and transforming systems are visible ideas in Buchanan's work. Hence the principle of transition emerges to aid in understanding how design can respond to the complex environment that we face today and that we will face in the future, a concern also addressed by Kaja Tooming Buchanan (2022).

If the first four orders correspond to symbols, things, actions, and systems, the fifth order corresponds to transition and transformation. It is necessary to state that the principle of transition is not directly related to or based on transitional design, which aims to generate a change in the world toward a more sustainable future (Irwin, 2015). However, we could observe transitional design from the principle of transition's perspective, understanding that its primary purpose is to elicit a change in the state of a system. Although these ideas are present in more recent design discourses, it seems to be a tendency to reclaim design origins. Herbert Simon (1969) declared almost half a century ago that all those who develop

"courses of action aimed at changing existing situations into preferred ones" (Simon, 1969, p.130) are designers, which is still the most inclusive design definition, according to Huppatz (2015).

A design process guided by the principle of transition will seek to find ways to integrate action nodes, things, and symbols from a systemic perspective to transform complex environments. Therefore, submitting a system to a state of transition depends on the first four principles, since the transformation will require the intervention of symbols, materials, and actions, all in a systemic manner. In addition, since a state of transition is considered in a temporary space, this principle will mediate other aspects of the practice, such as the planning and rhythm of the system of actions, and instruments for measuring user responses, also determining feedback channels or feedback-loops (Capra, 1999).

The principles presented in this article are interdependent and are present in the core of design practices, somewhat of design's DNA. As principles, they are intertwined in the design process, regardless of whether the designer is aware of it or not while designing. On the other hand, if the designer keeps them in mind during the design process, he/she can take advantage of them. For instance, if he/she seeks to drive a system into a state of transition, i.e., the fifth principle of design, he/she could begin by recognizing the interdependent relationships of its elements. That is, the processes and means of interaction, the forms of materialization of the elements involved, and the construction of meanings in said processes, which are references to the fourth, third, second, and first principles, respectively.

5. The principles as an educational structure.

Studying and understanding design from its disciplinary practices has caused the fragmentation and dissociation of design knowledge. Consequently, design's impact on social, political, and environmental activities has yet to be well-known. Moreover, consciously or not, the professional practice of design has also

contributed to a deterioration in such areas. On the other hand, design's identity is still blurred because of its practice's integrative and multidisciplinary aspects, provoking that design as a discipline belongs to different faculties within institutions across the world. In some places, design's faculty pairs with technology or engineering, while others place it as part of the arts or even with informatics and communication. The confusion is clear, an oxymoron that denotes the nature of the discipline. As the principles state, design's field of knowledge integrates symbolic, material, interaction, systemic, and transition or transformation aspects. Within each discipline, the confusion and fragmentation grow since, in addition, each of the specializations has sought to defend its field and produce its own knowledge and identity. Hence, Buchanan's invitation to train general designers is somewhat far from being achieved, although some institutions have conceived programs that aim to do it. However, the principles presented in this article can be a starting point to promote discussion about common areas of knowledge for curricular programs, even maintaining the division of design specialties within institutions. What would happen if, regardless of the specialty, different areas were conceived for learning and work in symbolic, material, interaction, systemic, and transformation aspects? How can we train our professionals to construct meaning? Or to face the material reality of the design process? Can interactive and systemic aspects be translated into specific courses? Conversely, what if the principles proposed here were areas of specialization in the discipline? What would happen if institutions planned the terminal part of the training for students to choose from a symbolic, material, interactive, systemic, or transitional emphasis? Likewise, new postgraduate programs could be conceived from these same axes. Without a doubt, design programs would look a little different than they do today, and the communicational bridges between these specialties would be broader and often crossed. We still need to abandon certain educational traditions, such as the emphasis on form, fundamentals, and designer-gurus, among others, whose essentialness to higher education practices weakens when we realize that societies' challenges have become increasingly complex. Therefore, I wish to present this article as an invitation to discuss the responsibility of educators, or as a provocation to promote reflection within educational

institutions and perhaps an inspiration to submit current design education practices into a state of transition.

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