The Humble Designer: logic and ethics for innovation

Charles Bezerra

Book cover text

Charles Bezerra holds a Ph.D in design from the Illinois Institute of Technology, known as "the New Bauhaus", a masters in Production Engineering from the Federal University of Santa Catarina, and did his undergraduate work at the Federal University of Pernambuco where he graduated in Industrial Design. He has experience as a strategic design consultant and has worked on projects for various multinational companies. He has given lectures on design and innovation in universities in Brazil, the U.S., and New Zealand, and has been published in respected international journals and magazines connected to user-centered design and innovation processes. He lives in São Paulo with his wife and son.

Book Summary

Charles Bezerra is a designer and professor who easily and elegantly circulates between the worlds of university research and the high-tech market. In this text he discusses several aspects of design: multidisciplinary issues, problem identification, professional postures, and questions about innovation in design and in life, always guided by the thoughts of Austrian philosopher Karl Popper. Charles Bezerra states that "to innovate with frequency one must often know a great deal about a great deal of things: at the same time you must be both a specialist and a generalist" and that is what is accomplished in this text, directed not only towards designers, but anyone interested or worried about living sustainably and in harmony with the world.
Claudio Ferlauto

#Pages 6 and 7

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Ariovaldo Capano
Rosa Maria Abad Capano

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Rua Apeninos 930 5º andar c/ 51
São Paulo SP Brasil 04104 020
Tel Fax 55 11 5571 7704 55 11 5575 7760
vendas@rosari.com.br
www.rosari.com.br

from my father to my son...

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Preface

The capacity to plan and produce the "new" could perhaps be the most exceptional and celebrated characteristic of our minds. Through our creations we change the world, the future, and ourselves. This creation process, both fundamental and complex, is what we call design.

Never before has this ability been so valued or this term so used. Knowledge about design processes has brought advantages to the individual, organizations, and even governments and they all recognize and use this subtle form of power. The majority of the time the creation act further increases our ego and because of this we become limited and undeserving of this fantastic tool. Like negligent parents, we have the tendency to see the positive side of our creations and very rarely do we take responsibility for the negative side.

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The irresponsible use of human creativity is bringing increasingly larger risks and demands reflection about how we should use our creative minds. This book is a philosophical conversation about creation and innovation, about design processes in a competitive, dynamic, and connected world, and about our duty as creators and our responsibility to the future. It is also an attempt to discuss our arrogance as designers and to help us reflect on the processes that we use to create the artificial world around us. Until now we have been discovering and improving upon this powerful process, now we must begin learning to use it according to a collective, long-term plan.

Our goal is to deal with the questions of design logic and ethics in a direct and deep way. Readers from any professional areas are invited to this reflection because no terminology or specific knowledge is necessary for its understanding. Despite being a book about design, creativity, and the innovation process, there won't be any diagrams or designs, but simply a text that demands analysis, done patiently, and which values the message more than its format.

As we are diving into tough issues, the book seeks to maintain ideas and examples at a high level, so that they can be general concepts and applicable to any design problem or situation.
The idea of the humble designer is an optimistic concept. It represents the idea of a creator who chooses not to follow selfish impulses, but rather recognizes his own limitations and dependency on others. It is a new type of creator that doesn't create for himself and who believes that humanity is his most important client.
This is the type of book that I would have liked to have read when I started becoming interested in creation processes. It is the result of many years of questioning and seeking. The reader will realize that its content is a collage of influences, phrases, readings, and conversations about design. The influence of the ideas of Austrian philosopher Karl Popper will also become clear throughout the presented concepts. The clarity and the depth of his texts have had, like no other, a great impact on my intellectual life.

Our capacity for design is connected to who we are and

who we will eventually become, individually and collectively. It is this which we urgently need to reflect and improve upon.

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Verbal problems and real problems

To begin our reflection, the first question to be tackled is, without a doubt, the question of vocabulary. For this reason, I would like to call the readers' attention not to the importance of the words used, but to the essence of the concept that they represent.

"Design" is a word that is used and abused in our time. However, as similar words such as "innovation", "creativity", and "strategy" are being used in the same ways, it is important that we don't become trapped in fads, as these terms are often fleeting. We should pay attention to what is really behind them in order to know if the concepts that they communicate are truly consistent or not. If the concept, the essence of the idea, is consistent, then the words may change, but the central idea will remain.

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Popper said that we shouldn't let ourselves get caught up in debates about the questions of words and their meanings. For him, what should be taken seriously are questions about facts (theories and hypotheses), and the problems raised and answered by them. Popper thought that we should avoid wasting time and energy on verbal or terminological problems; problems which he considered the direct path to intellectual perdition.

As there are many opportunists taking advantage of the current wave of words such as innovation and design, (as never before has so much been written and spoken on this subject) this warning is important so that we always remain critical and don't waste our energy on verbal problems. To put the reflections and collocations of this

book into effect, we understand design as a process and innovation as a positive result of this process. We will talk about this more and I hope that the concepts become clearer to the reader.

The reasons that design and innovation are highlights in our communication seem obvious. The dynamism, competiveness, and connectivity that we are living out cause organizations and corporations to urgently seek out professionals capable of creating value with creativity and insight. The competence to solve design problems is an increasingly important characteristic in the global market.

It isn't easy to explain or define design. As with other concepts there are many perspectives and angles of understanding. We can understand them through their practical, operational, or professional aspects as illustrated in this quote by design methodologist Charles Owen "Design is a profession that is concerned with the creation of products, systems, communications and services that satisfy human needs, improve people's lives and do all of this with respect for the welfare of the natural environment."We can also view design as a translating activity, "values made visible" as the American consultant Peter Lawrence said, or even as type of configuration or ordination as defined by Design Theorist Victor Papanek in his quote "Design is the conscious effort to impose meaningful order." This is similar to designer Buckminster Fuller's idea that "Design is the opposite of chaos."

All of these understandings are real and consistent. Design seems to be a concept which incorporates many other ideas. Something similar was described by A.I. researcher Marvin Minksy when he tried to explain the concept of love in his book *The Emotional Machine*.

For him, love is a kind of a bag-word, a word that accepts many different notions, forms and levels. It's the same way with design; it incorporates itself into various concepts.

One thing I want to clarify is that our capacity to create, innovate, and resolve design problems is bigger than just a

word or definition. We need to focus less on verbal issues and concentrate on the innumerable real problems that are waiting for design improvements.

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Students of problems

Popper wrote "specialization is a deadly sin for philosophy." I believe that this is also true for creators. One premise of being an innovator is seeing things from different perspectives, looking for different angles and aspects. I don't want to go into the age-old debate between specialists and generalists, but merely show that it is both important and fundamental for the innovator to work in several dimensions of knowledge and to understand that innovative solutions find themselves at intellectual crossroads and in the connection of different types of knowledge.

Maybe the best macro-model that I've observed during my studies on design comes from one of the United States' most well-rounded innovators, Jay Doblin - a thinker, methodologist, professor, and consultant. To understand the model that Doblin proposed

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we must imagine one axis crossing another to form four quadrants. On the horizontal axis he places the relationship between analysis and synthesis with analysis representing the understanding of the problem and synthesis representing resolving the problem. On the vertical axis he places the famous subject-object relationship (debated by philosophers for centuries) with the object referring to what is outside, things that are concrete in the real world, and the subject referring to the abstract and things that reside in our minds. With these axes Doblin describes the activities that relate to design. The analysis-subject quadrant, which Doblin calls Humanics, represents areas of knowledge dealing with the understanding of human beings, physically and psychologically, and historically and socially. In this

quadrant we have Ergonomics, Psychology, Sociology, Economy, etc.

The synthesis-subject quadrant, which he calls Art, represents how the subject expresses itself and creates. It contains aspects of form, color, geometry, esthetics, and others. In the analysis-object quadrant, Doblin places science as a dimension that tries to understand the objective and concrete. Technology lies in the final quadrant, synthesis-object, as the expression and accomplishment of Science.
In this way, for Doblin, design activities "touch" the human dimensions of the Arts, Science, and Technology. It's worth pointing out that these activities can't be reduced to just one of the areas like many try to do when they define purely as art, science, or technology. But what interested me in this model were the four dimensions with design balanced in the middle of the knowledge dimensions.

Another concept that defined my intellectual design journey was a phrase from Popper's *Conjectures and Refutations*, "We aren't students of subjects but of problems." In this simple way he shows that the focus should be the problems, not the fields used to solve them. This becomes clearer in activities for conceiving new ideas. Innovative people generally unite concepts from several subjects to produce ideas as in the case of a doctor that creates a new cardiac surgical procedure using mechanical engineering concepts in medicine.

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To innovate with frequency you need to know a lot about a great deal of things; you must be both a specialist and a generalist.
We use design activities when we run into problems, when we aren't satisfied with the current situation, when we think that something can be different, and especially when we need to think first or if we don't want accidents to happen.
For this to happen we can't get caught up in knowledge of one subject or another but we have to have an awareness of all areas.

We saw that the notion of design can‘t be summarized in just one word and now we also realize that it can’t be summarized in just one subject. We‘re students of problems, problems without limits. American designer Charles Eames touched on this when he answered the question “What are the limits of design?” with another question: “What are the limits of problems?”

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We are all designers

Now that we’ve discussed some points about the nature of design, we see that many different perspectives exist for understanding design and that the term is quite difficult to define. We have also highlighted that, when we design, it’s because we’ve either identified a problem, the need to think ahead and plan to avoid problems, or the desire to express or communicate something. We will continue talking about these fundamental points, however, I would like to introduce two others: who designs and where does design happen?

Herbert Simon, the 1978 Economy Nobel Prize winner, was the man who explored these topics in great depth in *The Sciences of the Artificial*. In his opinion “anyone who alters the course off things to change existing situations for preferred situations is designing.” This basically means that we are all designers.

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We are capable of proposing new concepts which themselves are capable of bringing us to preferred situations and it is through concepts (meaning mental representations) that we use to connect our past and future experiences. The act of creation can be understood as the complex cognitive ability to reach new concepts. This ability is so fantastic that we often confuse it with actual intelligence. Generally we assess other species according to their capacity for solutions to difficult problems. When we see a chimpanzee cleaning a tree branch to use as a tool to reach ants deep in a hole we are witnessing an

example of design. It is the creation or adaption of something to solve a problem, something that leads to a better situation; in this case, access to ants. There are many examples of design, the production of new concepts, in nature. However, our larger capacity to design is what differentiates us from other species. Design is a competitive advantage in all contexts, as much in evolutionary biology as in market economics.

From the statements above we can discover where design really happens - in our minds.
Jay Doblin wrote that "a product is condensed information." Many times we fool ourselves into thinking that design happens when we come to a solution, but before we put the ideas on paper, we make innumerable design decisions in our minds, using information from past experiences, speculating about future scenarios, thinking up and refuting data and decisions until we find a solution.

Design activities involve several cognitive processes:
searching process – finding solutions in a space of alternative proposals;
visualization – mapping out and representing concepts to understand and communicate them better;
deconstruction – looking at all aspects of a problem;
categorizing – grouping similar concepts to reduce complexity;
pattern recognition – identifying similarities;

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decision making – evaluating and choosing between concepts that are often conflicting;
scenario construction – speculating about the future;
optimization – looking for the best option, even while knowing that more than one solution can exist.

Many attempts at understanding and simulating design processes fall into the trap of reducing design to just one cognitive process.

In the same way that we can't reduce design to a single word, definition, or subject, we also can't reduce it to a single cognitive process. Everyone's *hardware,* where design happens, is basically the same, and all of us are capable of producing ideas that lead to better situations. In other words, we are all designers.

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The two schools of design

When we talk about the act of creation, we almost always think of a division: the difference between Natural design and Artificial design. This division was heavily developed by Herbet Simon in *The Sciences of the Artificial*. He defines the Artificial as anything conceived and produced by human beings, results of human actions, and the Natural as products of nature. While it is true that we are also products of nature, this shouldn't invalidate the rationale and so it is worth it to explore this division. Simon goes further and states that design is a science of the Artificial – which, in a way, changes the way we understand design in a modern context.

Another book that deals with this subject is *Cats' Paws and Catapults* by biologist Steven Vogel. In the second chapter he introduces the concept of two design schools and focuses on the differences between design processes used by nature and those used by humans.

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A clear difference between the two ways of designing highlighted by Vogel is the question of time. The human process is much faster than that used by nature, which works for billions, millions, or thousands of years on one project. The human projects don't have such a long-term vision. In general, the design projects that we work with are finalized by external factors such as deadlines, client demands, lack of resources, etc.
Rarely do design projects finish because the designer wants them to. Design processes are dynamic activities, which in ideal conditions would never end but instead stay open to improvements wanted by nature or by human society. Vogel points out other differences: while nature uses humid and flexible structural components, we use dry and rigid components. While natural design uses curves, artificial shapes have lines and straight angles. In nature products grow without losing functionality; a small elephant becomes a large elephant but always remains an elephant. Artificial products don't have this capacity.

Another interesting difference between the two processes is that when we conceive a new "product" we can copy solutions used in other products; we can combine elements of a boat and a plane to create a seaplane that lands in the water. In nature this isn't possible; the solutions are exclusive. A natural product that walks on land, like a horse, can't look at another flying product, like a bird, to copy its wings and take off flying. Vogel argues that technological transference only exists in the design of the Artificial. It is worth noting that artificial creation processes can copy Natural design solutions, something that frequently happens in many areas of Science and Technology.

However, there are two important differences between the two schools. The first is that the basic mechanisms or design methods used in Natural design have already been identified. In 1859, the British naturalist Charles Darwin proposed a design theory that changed the way we view the world. In *The Origin of Species* he described the process called "natural selection."

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Darwin explained that Natural project solutions happen through mechanisms of mutation, cross-breeding, and selection. It is an evolutionary process of incremental changes which is capable of generating a fantastic variety of solutions, basically operated through trial and error and lots of patience. Unlike nature, the artificial school of design doesn't have one clear theory. As we still don't know exactly how our minds work, we can't understand how we create our projected solutions. Numerous models try to explain the processes and mechanisms that we use when designing, however there is nothing comparable to Darwin's theory. The last difference between the two schools that I would like to comment on is very important and can perhaps help us to understand the essence of these two ways of designing. It is about the fact that the design of the Artificial has mechanisms of planning and anticipation. In nature this is impossible. There is no planning, the species simply fight for survival in a game where the only rules are to survive and reproduce. A Natural design solution, let's say a shark, wasn't planned; it happened. However, good solutions of the Artificial don't happen by accident, they are created with focus and

planning to solve an identified problem. We will come back to elaborate on this point later. This book is about the school of design of the Artificial. More than finding correct explanations or proposing an all-explaining theory, its objective is to arrange the disorder that this subject finds itself and, through a logical sequence, organize a line of rationale that brings us to a result that is more positive and more in balance with the Natural world, which is where, after all, we came from and where we will return.

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The design of the simple and the complex

Chess is often given as an example of a complex system. With finite pieces and a few rules, a new world emerges and creates an enormous quantity of possibilities. However, after careful analysis, it is apparent that design processes are more complex than chess because of its openness and quantity of variables.

The values and data that we use to make creative decisions are objective, with passive and quantifiable variables; but they are also subjective and difficult to measure. That's why it is important that we discuss the issue of simplicity and complexity.

The concept of complexity is strongly associated with systems formed by several extremely interconnected and interactive parts that are capable of functions such as self-organization, learning, replication, and adaption. Ant colonies and beehives, the internet, the central nervous system, and the global economy are all examples of this type of system

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where the behavior of the whole can't be explained solely through the behavior of the parts. In the book *The Quark and the Jaguar* physicist and Nobel Prize winner Gell-Mann makes an interesting and useful point. For him, the difference between simple and complex depends on the degree of description. For example, we can describe something like a chair simply: four feet, a support surface to sit on, and a back to lean upon; or in a complex way by considering the resistances or chemical structure of the materials. Because of this, simplicity or complexity depends on how and to whom we are describing the object.

When knowledge is used correctly, it helps us to

comprehend and understand complexities in a comfortable way, however, when it isn't used correctly it can lead to confusion, clouding focus, and increasing complexity. Considering this, I always remember to avoid the cognitive flaws pointed out by A.I. thinker Marvin Minsky in *Symbolic vs Connectionist*. Minksy stated the following as some examples of errors or defects in our minds:

•Obsessive preoccupation with inappropriate goals.
•Inattention and inability to concentrate.
•Bad representations.
•Excessively broad or narrow generalizations.
•Excessive accumulation of useless information.
•Superstition; defective credit assignment schema.
•Unrealistic cost/benefit analyses.
•Unbalanced, fanatical search strategies.
•Formation of defective categorizations.
•Inability to deal with exceptions to rules.
•Improper staging of development, or living in the past.
•Unwillingness to acknowledge loss.
•Depression or maniacal optimism.
•Excessive confusion from cross-coupling.

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The recent breakthroughs in the studies of complexity have affected many areas and dimensions of human knowledge and it's no different with design. Our vision of design has changed a lot as we learn to better understand the principles and mechanisms involved with complex systems. For example, until recently, design was seen as linear by moving from the problem to the solution. Now, it is seen as a process, where the understanding of the problem evolves parallel to the solution. What we previously thought to be a process to get to one solution is now seen as dependent on the context and able to simultaneously produce multiple solutions. What we understood as technical problems are now seen as ethical, environmental and even political problems. The process that relied on one agent (most of the time its' creator or designer), now focuses on a complex system of adaptable agents, such as the users, the environment, the culture, the technology, the markets, and others. Our interest in the creation process is nothing new. According to methodologist Charles Owen, design and architecture theories have appeared in literature since Roman times. The new thing now is the recognition of the complexity behind this amazing process, since the design which we call simple (direct solutions) is the most difficult to be

achieved. Creating the simple is actually complex; it requires reductions in understanding the problem and in the adopted solution. Our mind is a complex adapting system that uses a design process to create systems and which in turn generates unpredictable problems that demand new responses from our creative minds. This is the cycle of the complexity of design: by solving these problems we create others. For example, we created vehicles for transportation but they have, in turn, caused enormous environmental problems. We are used to creating without thinking about the consequences to the environment, to other species, and to other people. However, now this is changing, we have begun to suffer the consequences for exploiting natural resources to the breaking point and for our extreme level of consumerism and competition in society.

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The way out can be learned from the great chess masters, who think ahead 18 moves during a game, to change the logic that we use to create the Artificial and in so doing enter into a more positive and sustainable cycle.

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The logic of design processes
We have talked about some issues related to the flow of information that happens during creative processes, but here I would like to go into detail about the knowledge, inferences, and methods that, consciously or unconsciously, we use when we create the Artificial.

The first point to be explored is the intentionality of the creation act. At its very essence, designing is an act of anticipation, always creating for the future and never for the past. We anticipate in order to communicate something new or to solve and avoid problems and accidents. What about creation? Could it be accidental, can design happen by chance? The answer seems clear because we often find solutions in unexpected ways. However, I would like to show that design processes happen as much in the moment that we connect the solution to the problem as when we connect the problem to the solution. This recognition of a solution as an answer to a question or problem (or vice-versa) is, in a way, always intentional. But how is it done? How do we find the answers to design problems? What is the logic of

design? Generally, design processes begin in a phase of contextual understanding. It is necessary to identify the real problem, the true question at stake. The most efficient way that we have found to do this is through research. Consciously or not, when we have a problem, we research the aspects related to the issue. The more information gathered the better. There are innumerous means and methods to collect information: we can look for what has already been written on the subject, we can talk to people, we can observe reality, etc. Everything depends on the nature of the question. Often information that is fundamental to understanding and solving a design problem is not easily found and so it is very important to enter into an absorption state by using all of our senses and allowing ourselves to be guided by curiosity. It is also important to have multiple perspectives on the issue, to look all around, to the past, the future, and above all, to be critical in selecting what is relevant and useful.

As design processes involve many factors, it is very common for a large quantity of information to be collected in a small research period. So, we go into the second phase, information analysis. The data and fragments that we collected during research are analysis' raw materials. When we plan/design, we change this data into knowledge. We use the information to bring us to a solution, to help us understand, and consequently, to solve the problem. Analysis is, fundamentally, coming to useful connections, insights or concepts that are the foundation of what we call ideas. This is a phase that naturally leads to new questions (which must be investigated) and which will bring us into a new cycle of research.
Of course, our minds do this interactively and the cycle continues until the insights are strong enough to be developed into ideas, and later into solutions or answers. From what we understanding of how our minds work, design is basically this process. It is a path, not a destination. Innovation is when this process reaches a level of such excellence that the result breaks away from what is known and introduces something new.
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In the current competitive context, organizations constantly need to differentiate themselves from the competition and because of this innovation has become one of the things that are desired most by the market.

However, too much attention is being given to results and few companies invest in the processes needed to reach them; few are really investing in the improvement of their design processes.

All the phases of the creation process are important. It is noteworthy that what we identify as relevant information during the research phase, or the connections we make during the analysis phase, or how we develop ideas in the synthesis phase, will depend on the information that we already have in our minds.
That's why experience in a specific design problem can be a differential in finding a solution. However, there are no guarantees in design, and it isn't possible to handle the creation process with a formula, but instead to transform data into information, information into knowledge, knowledge into advantages, and advantages into solutions.
Thinking strategically is also a crucial aspect of the creation process. It is difficult to explain what strategy really means for creation, but we have to be able to see the big picture. More precisely, we have to look closely at what is far away, and to step back from what is near. It also involves thinking in terms of goals, objectives, and the resources we have to reach these goals. Thinking about design strategically is planning the creation process and after, defining the logic and the methods to acquire and transform information.
Good designers aren't specialists in any specific products, but end up turning themselves into specialists in creation processes. It is common to find creators that start by solving a certain design problem and end up efficiently dealing with several types of problems. It's as if the experience of creating were more important that what is being created.

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Several attributes are fundamental to help us to become better designers, such as curiosity, persistence, and imagination. However, the capacity to learn from one's mistakes is perhaps the most important ability because it helps to evolve our design logic. We are all capable of trial and error. What differentiates us is how much we learn from the mistakes we make, and in order to learn from our mistakes another attribute is necessary, humility. It's about this which we are going to continue to reflect.

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Superman creators and Batman creators

Sometimes I think of the capacity to conceive the new as a type of superpower, and the act of creation a great and unique moment in our minds. I usually also think of creators as being divided into two types: Superman and Batman. It is a useful analogy to understand a fundamental difference in the attitude that we use to face design processes. The choice of the two super heroes is merely illustrative, and, of course, they can be substituted for Wonder Woman and Batgirl in the case of female creators.

The Superman designers would be those that believe that they have more creative power than others, or that they are capable of resolving design problems better than others. The confidence that this type of creator has during design processes comes from confidence that he has in himself. These creators are naturally more arrogant. They

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may need help, but they tend to take all possible credit for themselves. In the current context, where the superficial media holds a large influence on society, it is natural for Superman creators to stand out. They are easy to identify. They have a large need to be the subject of conversations and excessively use the word “I.” It is a creator that is more interested in the fame that design can bring him than in a real solution to the problem.

However, in my opinion, the Batman designers are those that have a more discrete attitude when they work. They know that they aren’t fundamentally different from others, but that the difference is their utility belt. These creators know that their power doesn’t necessarily come from themselves, but from the tools and problem solving methods that they have and have developed. The confidence of the Batman creators comes from confidence in learned skills and methods. They are more humble and, because of this, they work better in a team.

Because they are more humble and focus on competence and problem solving methods, these creators are more capable of hearing criticism and developing new tools for new problems. They are more aware of their limitations,

and therefore more open to learning, which causes them to evolve intellectually and to innovate more consistently. They may not know about a specific problem but they do know that after applying their methods of understanding to the context of the problem they will come to innovative solutions.

To create new things with excellence and consistency, one must have intellectual skills and strength to explore new hypotheses, however, humility is equally necessary to expose these hypotheses to analysis and criticism. The speculation and testing processes are described in detail in Karl Popper's books *The Logic of Scientific Discovery* and *Conjectures and Refutations* and they are very applicable here. The more that the design process is focused on the designer, the more difficult it is to expose the ideas and concepts to criticism. The ego of the Superman designers becomes defensive of its' ideas and distances itself from criticism; criticism which is key to a true innovation process.

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As there are no guarantees during the design process, no mind can find itself superior or inferior to any other mind. The best we can do is humbly discover the best ways to solve the problems we come across.

The real truth is that we aren't super-heroes. Our creations have brought many problems, destruction, and sadness. To revert this we need not only intellect and logic, but also character and ethics. For the current problems that we are facing, we need Batman designers, not Superman, because they are capable of developing new systems for finding solutions.

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Ethical design and Popper's lessons
The current world, disturbed by human creations, requires changes. The human capacity to create the artificial seems to have transcended our ability to think about the purpose and consequences of what we create. There is misery coexisting with excess; activities which damage the environment coexisting with clean technologies, violence, selfishness, and authoritarianism side by side with huge advances in knowledge. We have many answers to our

problems, but we are limited in dealing with long term meta-actions. It's as if we have created without leadership, without direction. The philosopher Socrates said that those with the most virtue are the ones who should lead. When questioned about the meaning of virtue, he defined it as the combination of logic and ethics. We have made great advances in logic, but we have left the ethical issues behind.

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Our problems are growing in number, scale, and complexity. Many are caused by the population explosion, which doesn't mean that there isn't enough space for everyone on the planet: space exists, but not for these unsustainable ways in which we are living.

Despite the terrible things that we are witnessing in the world, it could still become the best of all possible worlds, as philosopher Leibniz concluded. The truth is that we can't do anything about the past, but we can certainly plan for the betterment of the future. And here is where ethics in our creation processes enters the scene. In this book we talked about Popper in order to warn the reader not to waste time with false verbal problems but to concern himself with real problems. In Popper's opinion there are real problems that need to be solved urgently, for example, the reduction of misery, violence, authoritarianism, and the increase of education and freedom. Popper is well known for his theories on the Philosophy of Science, the Theory of Knowledge and the theory of Politics, but his ideas in the ethics field are equally important, although not as famous. Popper is recognized as on of the main philosophers of the 20th century. Few have written about so many topics with such clarity. He was quite critical of the idea that our knowledge starts through observation. He believed that what we observe depends on what we expect to observe, that we learn without induction and that we build our theories through a process involving speculation and tests. He believed that all life is summarized into a process of trial and error to resolve problems. Brilliantly, he showed that despite some theories surviving many tests, they would forever remain conjectures and could never be proven as truths.

It is true that we cannot prove theories as true, but we can prove them to be false through a process which he called "falsifiability." We can use the following example to

better explain this rationale: No matter how many instances of white swans we may have observed, this does not justify the conclusion that *all* swans are white, but on the other hand, seeing just one black swan is enough to prove that the statement is false. Popper warned us of the importance of putting our ideas and theories to the test,

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because this is what refines them and brings them towards the truth.
Based off of this logic, Popper developed and applied his theory of knowledge to several political and social scientific problems, for example, the distinction between Science and Metaphysics, the logic of the scientific method, the way we use language, how we understand history, and the dangers of public opinion. He also became known for being a defender of debate, freedom, optimism, and democratic ideas.
Popper was born in 1902 and remained an active speaker and writer until his death in 1994. At the age of 90 he was working heavily with ideas of open futures, rallying people to recognize their responsibilities for a future that must be faced with optimism and intellectual humility.

Popper left us many lessons, especially in his last works, that can be used to help us put together the fundamentals of a new vision for design. I would like to highlight three of these thoughts. The first and most political is the idea that we should improve our institutions with mechanisms that prevent bad leaders from causing damage. For Popper, democracy didn't mean a government of the people, but the possibility for the ruler to be changed without blood being spilt. He saw advantages to gradual reforms instead of revolutions which would avoid the way that all the institutions were being destroyed only to be rebuilt later. We have to reconstruct the house while living in it and without knocking it over. Environmental, social, and economical problems will certainly not be resolved quickly and what we are lacking is a long-term, gradual plan.

Popper's second thought deals with the idea that freedom depends on responsibility. He stated that, in a society, the freedom of the individual must be compatible with the freedom of others. Even at an advanced age, Popper warned about the destructive power of television in society, especially its role in training children for violence.

From his point of view, television is corrupting society and, like all other threats to freedom, it needs to be restricted.

The final thought highlighted here is the answer to several other questions. It deals with the value of education and critical discussion.

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Popper believed that education has a direct connection to freedom. Education is what makes a person understand the limits of his own freedom and, consequently, what reduces the need for censorship and laws. He dreamed of schools where the children would learn without being bored; where they would study not only to pass their tests. He thought that education is a path to self-emancipation and that "the true Enlightenment thinker, the true rationalist, never wants to talk anyone into anything. No, he does not even want to convince; all the time he is aware that he may be wrong." Freedom to form opinions is something precious that the thinker must value. Our education isn't currently enough to turn us into responsible creators.
The game of our existence on this planet is changing the rules. We have to create with new strategies and new ethics. It is probable that the solutions that we need won't come from our famous creators but from the unknown creators, the rationalist thinkers, the humble designers.

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The humble designer
Never before have we, as societies or as people, been as connected as we are now.
On one hand, the *network-effect* that is ever-present in our communication and economy hinders people from thinking in critical and free ways; on the other hand, the power of these networks is creating social and cultural changes at a never-before-seen rate. The markets are also extremely competitive, completely transforming the way that we work and live. Competitive powers are now acting globally, causing the designers of the Artificial to create solutions to meet the growing demand for status and prestige, creating a superficial and materialist society.

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71 Technology, more mutable than ever, also has an increasing role in our lives, and it is very difficult to be completely up-to-date. Even doctors, who must make life or death decisions, aren't capable of being absolutely updated in their respective areas. This powerful and fast technological avalanche produces a high degree of anxiety and it is very difficult to distinguish and control the positive and negative aspects, and this is just the beginning. Design has become a fundamental subject for society and creators have started to reflect on moral issues. There are two fundamental ideas that are addressed in this book. The first refers to the fact that sustainability and quality of life intrinsically depend upon the way that we create or in which we design. The second is that only humble designers can fix the problems that we are experiencing.
Every creation act brings expectations of change. We always create towards our expectations and values as individuals and as a society. The idea of humble design is an attempt to warn about our duty as creators and our responsibility to the future. It is also the recognition that the way we create is beginning to change. We are, more and more, reflecting on how our creations will affect both the present and the future. We have already developed our creation processes, now we must work on our ethics and evolve our expectations.

But what are the characteristics of humble designers? They have no time to be proud of their creations because they are always putting their creations to the test and correcting any errors. Actually, their solutions work to reduce the damage caused by irresponsible creators; as active participants they try to integrate all the aspects of our planet.
Humble designers recognize the beauty and importance of minimalism. They know that, although they may be difficult, the most economic solutions are elegant and ethically consistent. We need to constantly reflect on Ludwig Mies van der Rohe's phrase that "less is more" and to constantly ask ourselves, throughout all creative processes, what is truly necessary.

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We are already experiencing a new minimalism that will

probably continue to grow stronger. Our interest in the principles of simplicity tends to grow, and this is a natural response to the growing complexity of the artificial. Humble designers know that resources should be used and reused in a balanced fashion because they are limited and can't be wasted. Minimalism is, to them, more than just an esthetic choice but is an ethical response; a rational and logical life style. To solve the serious social problems, we need to learn to live less materially and more humanely.

These new professionals seek out intellect and character as a process and not as an end. Because they are humble, they know what they don't know, they are curious, they are in constant intellectual movement. Bertrand Russell, a British philosopher, believed that the concept of intelligence shouldn't be associated to the knowledge that a person has but to his capacity to look for new and relevant knowledge. In the book *On Education* Russell states that the basis for intellectual evolution is curiosity and that science led by love is the best way to progress. In his opinion love without science is powerless and science without love is destructive.
Humble designers concern themselves with character, with the development of values connected to sensibility, integrity, and the courage to make decisions during creative processes.
To create with humility and generosity is a daily intellectual struggle. The reality will improve when humble designers take on their role of leadership, and with a humane vision, manage technology and the business world.
Another characteristic of humble designers is optimism, which Popper called "a moral duty." It takes great optimism and integrity to beat the opportunistic pessimism disseminated by those who can't deal with complexity.

Humble designers must join forces, collaborate and share solutions, to reverse the situation and create deeper and more egalitarian Artificial. Divided between the desire to confront the challenges pointed out by environmentalists, scientists, and economists, and at the same time survive financially in a society dominated by a capitalistic paradigm, the creators of the Artificial have to make difficult ethical decisions.

This sense of ethics first happens on an individual level. Our parents, family, teachers, religion, and beliefs all help to form our ethics and how we design. Psychology professor Howard Rachlin states that altruistic behaviors can be learned and maintained without any special mechanisms. He explains that altruistic acts that bring no benefit to the individual (and may even bring risks) can be beneficial when they are repeated: the habit of ethical behavior turns us into altruists, even in extreme situations. To explain this idea he uses the example of a person that enters into a burning building to save a child he has never seen before. They prefer to risk their life than to break a standard of ethical behavior, which makes no sense from a biological or evolutionary perspective.
A theme of creative responsibility should be in the curriculum of all schools so that these new ethical standards can be developed.

Human-centered design may be the most advanced logical and rhetorical approach that the area has produced so far. This approach takes the focus off of technology and the designer and instead places it on the user. But from an ethical perspective this is still a limited concept, and the reasons that it has seen a trend in use has more to do with economic benefits that it can bring to organizations than to these organizations' ethical values.
However, a more complete design model is beginning to emerge. It is design centered not only on the individual, but on humanity and on the planet and it is capable of influencing designers to think of the long term.
New approaches to face the issues of design responsibility are emerging. For example, the slow design movement, which is coordinated by Alastair Fuad-Luke and which seeks improvement in Humanity and the environments well-being through a slow process, without compromising economic progress. In a similar vein, architect William McDonough created the cradle to cradle model,

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which uses natural systems and cyclical and restorative processes as a starting point towards creating sustainable solutions for various problems.
When examining the larger questions of social responsibility and its connections with design, it is possible to see that we can find a new method of creation. There is a growing certainty that designers have the potential to be educators and agents of social reform that will lead us to a better future.

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Future designers

In an interview with American journalist Charlie Rose, A.I. scientist Daniel Hillis presented an interesting view of the future: for him, we are only halfway to becoming truly human; halfway between animal and that which we will eventually become. Hillis observes that technology will play a large role in this transformation and will be connected to taking control of our own evolution. He believes that in the same way that we look at the lives of cave men and think that they were not yet human, in 10 thousand years, people will look at us and think the same; that we were just starting to discover tools. This is the feeling of those who work with technology today; we are only beginning our discoveries.

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Computing is in its infancy, simulating activities that we used to do on paper. But, ideally, computers could be like real extensions of our minds and help us to solve much more complex problems and turn us into more intelligent beings. Computing already supports creative processes, for example, registering, organizing, and storing data to communicate our ideas with society. But it is still limited in designing. As we have seen, designing requires high intelligence and, so far, in relation to machines, the only intelligence has been us.

That's why so many initial configurations and adjustments are needed; our digital systems still can't adapt themselves. The artificial world is increasingly working in digital form. The brains of machines – chips – are becoming more powerful and more present in out lives. We are on the way to artificial intelligence, where digital systems behave like minds, and it will be possible to have machines which are able to design and which intrinsically collaborate in designing as extensions of our minds. This will certainly bring new opportunities and also responsibilities; responsibility not only for physical or environmental issues, but also cognitive issues. Also, we will have to be responsible with the relation between the digital systems and our minds.

It is of note that although our technology and modern computing may be concrete, they were born from abstract

concepts. The digital world came from philosophical ideas of how to organize knowledge into categories and how these categories interrelate through logical operations, which was later translated into the theory of computing by Alan Turing. The capacity to represent ideas and to create symbols to reduce complexity and ease the manipulation of concepts has been fundamental to our technological evolution.
In relation to the future, we must have long-term plans; plans which aren't limited by our own existence. We must use time in our favor, thinking of continuity, new generations, and our children, which are, as Popper stated "the most important things that we have."

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We are more than the Artificial, more than what we produce and more than what we create. Our Artificial shouldn't enslave us, but help us to become more free, capable, intelligent, and happy. Design is a tool that can lead us to different paths, and we must learn to choose the correct ones. Facing the future with humility and optimism isn't a choice, but a duty. It is only in this way that we, both individually and collectively, can evolve, even if only a little at a time.

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