POLI.DESIGN

FUJITSU

Transformation by Design

Planning Design Strategies and Services for the Next Generation Digital Challenges

shaping tomorrow with you

MAGGIOLI
EDITORE

Foreword

In the past decade, digital technology has changed the way we connect, run businesses, and deliver public services. With new uncertainties such as climate change, global pandemics, and social problems such as the imbalance of information or the invasion of privacy, the world is in the midst of chaos. In such times, what is important is to not react recklessly to threats and change, but instead to tackle them swiftly and securely by creating a democratic future where the possibilities of people and society blossom.

Fujitsu is transforming itself from an IT company to a digital transformation company and operating as an organization that generates social value. Fujitsu is moving away from delivering solutions that solve problems that lie before us. Instead, the company is committed to delivering transformations, which will at times overwrite the rules in the market or in society, to dramatically change user experience using digital technologies.

Our experiences since COVID-19 forced us to overwrite many existing norms in our lives and work, and these experiences may have been a factor in prompting this transition. Every day before this calamity, we packed into trains, went to designated offices for designated hours, and went home on another overcrowded train. COVID-19 upended that lifestyle. Every employee is now connected online with internal and external stakeholders and communicates and delivers remotely. Such an autonomous workstyle has become the new normal. Many of us today have welcomed these new ways of working. Ironically, it wasn't existing technological solutions that sparked such transformations and changes in norms and routines. Rather, it was a terrible, unwanted guest disguised in the form of a prehistoric infectious agent—a virus.

Such changes in prerequisites and preconceived notions are the imminent transformations in our society that leave lasting effects. Yet we are capable of bringing about this change without relying on another outbreak. Instead, we can turn to the power of design. Design is the avenue to realizing a sustainable society using the power of technology available to us. Design pushes us to envision a hopeful future from an individual and societal perspective and widens possibilities for actualizations without being limited to how society is today. Fujitsu's Human Centric Experience Design (HXD) has been crystallized from all of our design experience. It intelligibly democratizes the power of design and navigates us to scalable digital transformations for our society. Moving forward, I commit that such a structured design approach along with agile approaches will continue to materialize the scalable software and business sense befitting next generation design.

I must emphasize that the purpose of design is not to superficially make over our products or services, nor is design a tool to produce eccentric ideas. Instead, design is a mindset that every individual should adopt to cultivate innovation and contemporary business literacy.

In the twenty-first century, there is an increasing demand for corporations to clearly define and articulate their purpose and role in society. People are interested in and paying attention to which organizations contribute to creating values for them. Corporate leaders also recognize that for companies to accomplish sustainable and long-lasting growth, it is extremely important for them to explicitly present the *why* of their companies and to fulfill their promises and obligations to people and society. We should no longer be trapped in customer needs of the past or old business concepts and routines. The transformational design mindset requires us to steer away from old constraints. It instead guides us to achieve important goals that people and society aspire to. Every organization should constantly foster and promote this design mindset, since it is the ultimate source of power and drive that shapes a better future.

This book was specially designed and edited to include materials that foster the growth of such a transformative design mindset and offer support and guidance for the process. These materials are based on the research outcomes and the philosophy of Fujitsu's strategic partner, Politecnico di Milano's design department, along with Fujitsu's know-how gained from our own practices. We believe this combination will provide you with tangible knowledge on how design has evolved across industries and various fields. My belief is that to bring about transformation at the required speed and scale, it would be vital for the act of design to become an organizational culture that rejects utter dependence on a handful of experts.

Mr. Takahito Tokita, Fujitsu's CEO and CDXO (Chief Digital Transformation Officer), proclaimed on the July 1 CEO bulletin that design is a crucial corporate management resource and must be applied to Fujitsu's strategies and philosophy in every aspect of the business process. We hope you, the reader of this book, will cultivate a design mindset and become a leader of design-driven transformation today, shoulder to shoulder with other transformation leaders who may not be part of the company, and we hope you share this path in realizing a more fulfilling society. By blending together the digital realm with the power of design, we look forward to creating a yet unfathomable but brilliant world.

Tetsuya UDA
Head of Design Center
Fujitsu Limited

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The Value of Design Today

Venanzio Arquilla
(Politecnico di Milano)

The meaning of the word *design* has greatly evolved over time, as have the object that design is concerned with and the level at which design operates within companies. Design has acquired a more strategic position and design thinking has attracted attention in the business context, becoming a core innovation asset. Today, design is very much connected to the idea of designing for people, and human-centered design (HCD) plays a central role. This chapter presents a brief historical overview of design, documenting a transformation of the meaning of the word itself, its growing importance as an attitude, and its implications on people's mindsets.

1. The Meaning of Design

1.1

Defining design

Design is increasingly at the center of debate in the business context and beyond. It is challenging to come up with an exhaustive definition of design because it is a complex phenomenon, or rather, a problematic word. In fact, its meaning and attributes largely depend on the context to which it is referred.

From a linguistic standpoint, design could be a verb, as in *to design, to carry out a project*. This concept derives from the Latin projectus, which means *throwing forward* in reference to the goals one intends to pursue in the future. As a verb, *to design* thus means to create something for our future, or more generally, for a better future. Likewise, *design* can be used as a noun when it refers to project-related activities or skills, while it has more recently found new applications as an adjective (e.g., designer clothes, designer shoes, etc.), thus acquiring interesting promotional value. In this context, *design* refers to the stylistic qualities of the object, its creation process, and eventually its cost.

In his book *Design: A Very Short Introduction*, British writer and lecturer John Heskett (2002) comes to the conclusion that the word design has so many meanings that it becomes almost impossible to disentangle its complexity: "Design… as a word is common enough, but it is full of incongruities, has innumerable manifestations, and lacks boundaries that give clarity and definition…. Design has so many levels of meaning that it is in itself a source of confusion."

With this in mind, this introduction will try to bring together a variety of perspectives on the topic to show some of the most recent and interesting contributions to the definition of this complex field.

In his definition of *design* for the *Treccani Encyclopedia*, Italian architect and designer Andrea Branzi (2006) talks about design as a mass phenomenon:

> Design has become a mass phenomenon. The use of the expression "mass" does not have a negative connotation, but points towards a new kind of social

1

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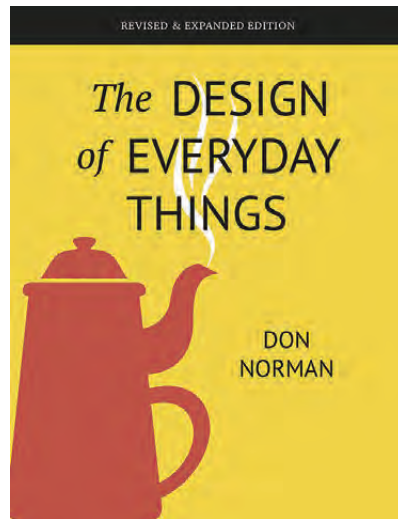
activity undertaken by an ever-increasing number of actors, who are committed to designing innovation strategies and future scenarios that go way beyond the product. We can thus affirm that the era of the design masters, whose production revolved around individual objects (often true masterpieces), has come to an end and a new era has begun, one in which design is one of the main levers of the social economy.

In October 2015, during its twenty-ninth General Assembly, the World Design Organization (WDO and former ICSID, International Council of Societies of Industrial Design) has introduced one of the most effective and contemporary definitions of *design*:

Industrial Design is a strategic problem-solving process that drives innovation, builds business success, and leads to a better quality of life through innovative products, systems, services, and experiences. Industrial Design bridges the gap between what is and what's possible. It is a trans-disciplinary profession that harnesses creativity to resolve problems and co-create solutions with the intent of making a product, system, service, experience or a business, better. At its heart, Industrial Design provides a more optimistic way of looking at the future by reframing problems as opportunities. It links innovation, technology, research, business, and customers to provide new value and competitive advantage across economic, social, and environmental spheres.

Design is a process with high strategic value, a problem-solving tool, and an enabler of innovation that often leads to successful business outcomes. First and foremost, this definition frames what the domain of design is. Today, design isn't just about products anymore, but it is also applied to systems, services, and experiences. Second, this definition highlights its distinctive qualities. When a product, process, service, or experience is well designed and works well, it generates a tangible positive outcome. This outcome is expressed in the form of improvements to people's lives and the creation of new economic value.

Up to the beginning of the twenty-first century, design had mostly been applied to industrial products (hence the definition of *industrial design*). Thanks to the advent of digital technologies and the technological revolution this brought about, an extremely fast transition occurred, making design a particularly important asset for the creation of systems, services, and experiences. In fact, user experience has lately become the most important part of every business model.

In an article for the NN/g group American researcher, author, and professor Don Norman, known as the father of user experience, puts forth a provocation in which he declares that experience is everything: "User experience encompasses all aspects of the end-user's interaction with the company, its services, and its products." In this respect, design plays a maieutic and visionary role because, as the WDO's definition of design highlights, it fills the gap between what is and what is feasible or desirable.

1.2
Strategic design

Design is concerned with the future; from a methodological standpoint, this is reflected in the use of ethnographic methods, observation, interviews, and more generally the involvement of users in the design process. In this meaningful detail sits the magic of design and its most important characteristic: the ability to read innovation and give it purpose and value. Italian professor and researcher Francesco Zurlo gives a definition of this strategic action. In his book *Le strategie del design, disegnare il valore oltre il prodotto* (*Design Strategies, Designing Value beyond the Product*), he explicitly presents the three fundamental characteristics of design and designers: foreseeing, seeing, and making other see.

Likewise, there are several other authors, including Italian professor and researcher Roberto Verganti, who refer to the idea of *meaning innovation*. This innovation is expressed through products and services that create radical breakthroughs and disrupt the schemes of incremental innovation. It proposes new approaches and generates new opportunities to solve complex problems.

It is evident that innovation isn't exclusively about technology and that it can fully be defined as such only when it enters the market and makes an impact on society. To achieve this, any innovative component of any solution must be deemed worthy by users, and so innovation, research, technology, and business should work together harmoniously to interpret or anticipate user needs in an appropriate way.

Example:
The Nintendo Wii, a success of meaning innovation (2006)

As Roberto Verganti (2009) highlights in his book *Design-Driven Innovation*, the Nintendo Wii case study demonstrates how technology can play a central role as the enabler of a radical breakthrough. This groundbreaking innovation not only transforms a product and its functionalities, but it can also redefine the meaning of the action the user performs with it. In fact, the Nintendo Wii relies on a specific type of electronic component—MEMS (microelectromechanical system) accelerometers to allow users to interact with the games in a new and more active way, through gestures and movements in the real world.

As Verganti says, the Wii transforms "the meaning of game consoles from a passive immersion in a virtual world into an active physical entertainment in the real world, through better socialization." In an approach quite different from those of their competitors, who were moving in the direction of more immersive experiences, Nintendo chose to simplify its games, interactions, and visual styles. As a result, the Nintendo Wii has quickly become popular across generations and has redefined the meaning of gaming, managing to appeal to new

1.
Nintendo Wii

2.
Nintendo Switch

1

2

and unexpected markets.

Children, parents, and grandparents gather around the console; technology has been the main driver in the console's development, but this has resulted in a new purpose for users. The same interesting approach can be seen in the more recent Nintendo Switch console, which has once again redefined the concept of videogames, detaching it from a specific context (the user plays alone or with somebody else, in front of the TV or anywhere else) and allowing for new interactions through the creative Nintendo Labo kit.

Example:
The Google Glass,
a failure meaning innovation (2014)

On the contrary, the Google Glass experiment and its commercial failure testify a very different kind of situation, one in which innovation has been primarily driven by technology and has given birth to a product that feels distant from real user needs. From an engineering perspective, the Glass is truly avant-garde, as it allows users to perform complex tasks through a head-mounted display and to voice commands, completely hands free.

However, while the Glass had a significant impact on specific B2B contexts (e.g., medical and maintenance), it failed to create value for individual customers (its intended target). It also failed to clarify what need the product was solving and why people would want to buy it and use

it. What this story illuminates is that when innovation is solely driven by technology, it rarely becomes a market success. If it does succeed, it's because it has been given a form that makes such technology approachable and human centric.

As design becomes more strategically relevant, the role that designers play is evolving as well. In particular, designers today must be able to infuse responsibility and cultural awareness into the creation of products and services. Technology offers us endless opportunities, while design gives us the tools to imagine new products and services and transformative business opportunities through a user-centered approach. Thus design must act responsibly. This means, for instance, adopting an ethical approach towards big data and AI, but also curating the aesthetics and form of products, services, interfaces, and interactive artifacts, in order to make them coherent and understandable. Also, acting responsibly concerns taking into account the cultural implications of every project and finding ways to contain the loss of distinctive and unique cultural traits, also known as deculturation. Altogether, the concepts listed here represent the most prominent ethical concerns that designers should pay attention to.

1.3

Human-centered design

Design is inherently interested in people as users of products and services or as actors who interact with such artifacts in various ways. The interest of scholars and practitioners towards codifying the theories and methods of a human-centric approach isn't new. Already in 1937, as Hungarian artist László Moholy-Nagy was establishing the design school New Bauhaus, he affirmed that observing users and their behaviors to come up with solutions was already a consolidated practice for designers.

Later on, human-centered design made its appearance as a methodology that could help designers to come up with more usable machines or interactive systems. Particularly important in this sense is the manual written by American industrial designer Henry Dreyfuss in 1955, *Designing for People*. This application in engineering-related fields has proven its value to support the creation of tools with a predefined set of goals and tasks. However, the approach falls short in the case of more complex design problems or more open-ended and exploratory interactions performed by users.

Thus, in more recent years, human-centered design has been redefined as a practice that looks at users in their contexts, to not only create usable solutions but also to identify areas of value and create relevant propositions. This has elevated the role of human-centered design

as a methodological approach that can help to inform strategic decisions.

The human-centered design pyramid (see image on the next page) defines very well this contemporary approach and suggests that we should look at humans from a number of different perspectives: biological, cognitive, emotional, sociological, and metaphysical. Similarly, in a brief video lecture, Donald Norman reminds practitioners that human problems are often multifaceted and interconnected and that designers should focus on the underlying causes rather than just on the symptoms of a given problem.

Human-centered design is concerned with taking the perspective of the user into account throughout the design process and always making sure that the decisions being made reflect the user's needs and address them intentionally. While it is always the designer's responsibility to act as a filter and shape the solution, failing to acknowledge the user's point of view could result in bad decisions. The following are some of the ways in which human-centered design can contribute to the design process:

Empathy and taking perspective: listening to users, observing them, and interacting with them to fully understand their context and needs.

Need definition: leveraging the gathered insights to define areas of need and opportunity. It is important

1.
Moholy-Nagy

2.
Artwork by
Moholy-Nagy

to stay anchored to user needs at this stage and avoid jumping to solutions too quickly. One should say "we need to help people better manage their finances and be more educated and in control" rather than "we need automated budget recommendations."

Idea generation and prioritization: leveraging the gathered insights to come up with possible solutions, and prioritizing them by taking into account the value for the user amongst other factors, such as feasibility, strategic fit, business potential, etc.

Solution validation: testing possible solutions with users to verify their fit in terms of value, usage, and usability.

Over time, the principles of human-centered design have been translated into a variety of templates, methods, and codified activities, sometimes taking the form of toolkits. Particularly notable are design consultancy IDEO's toolkit and field guide, which provide actionable insights and practical guidance to professionals seeking to adopt this approach.

Designing for People

We bear in mind that the object being worked on is going to be ridden in, sat upon, looked at, talked into, activated, operated, or in some other way used by people individually or en masse.

When the point of contact between the product and the people becomes a point of friction, then the industrial designer has failed.

On the other hand, if people are made safer, more comfortable, more eager to purchase, more efficient—or just plain happier—by contact with the product, then the designer has succeeded.

H.D.

Designing for People

HENRY DREYFUSS

The HCD Pyramid

WHY
Meaning

HOW
Semiotics,
Communication and
Discourse

WHEN
Interactivity

WHAT
Activities, Tasks and Functions

WHO
Human Factors

2.   Design Evolution

2.1

The origin of design

The origin of design can be set between the end of the nineteenth century and the beginning of the twentieth, following the advent of the second Industrial Revolution. The purpose of design in this historical moment can be easily defined through the concept of *Die gute Form* (Max Bill, 1949) or *Good Design*. This is opposed to the idea of design as style, diffused by various masters and ambassadors of design, who first adhered to the German art school Bauhaus and then to the Ulm School of Design. In its first applications, design was thus concerned with the idea of giving the appropriate form and quality to industrial products.

Before the advent of industrial design, design was considered on a par with craftsmanship. Anyone who was capable of producing an object could be called a *designer*, whether dedicated to the creation of unique self-produced pieces or small productions that relied on craftsmen specialized in the use of a certain material. This is how objects were created prior to the Industrial Revolution. In *Capire il design* (that is, *Understanding Design*), Andrea Branzi claims that design was born million of years ago when hominids first started shaping stones and using them to slice meat or hunt.

Making stones sharp enough to be employed as hunting weapons required advanced skills. In particular, it required the ability to identify a need (getting food) and turn it into a solution (a tool) that, once tested, could be used by every member of the community. Several cave paintings testify the successful, widespread adoption of new hunting tools. This story highlights one of the most salient qualities of what we call design today: the ability to turn problems into opportunities through intelligence, which is a key prerogative of human beings.

The following paragraphs leverage a variety of case studies to present some key milestones in the history of design. A significant portion of these examples draws from the Italian history of design.

2.2

Design and mass production: new industrial processes and chair No. 14 by Thonet

As industrialization progressed and technology evolved, design began to be applied to mass production. An interesting example is the Thonet chair company's creation of chair No. 14, which is regarded as a watershed between classic artisanal and industrial production. Designed in 1859, prior to the Industrial Revolution, this chair embodies an archetype, the Viennese chair, and has sold over fifty million units over the course of forty years. This chair is tangible proof that, when design is well applied and discontinues a tradition by integrating new understandable and desirable elements, it can lead to significant positive business outcomes.

German-Austrian cabinet maker Michael Thonet patented his steam-bending process for wood, which was a very promising technique but posed major productive constraints as well: wood could only be bent in one direction and there were limitations to the length of the pieces that could be processed. By turning these constraints into opportunities, Thonet created the first assembled chair in history that then went on to become an entire family of products.

Before Thonet, chairs used to be unique pieces, and the finest productions featured decorations or inlays. Overall, they were bulky and heavy. Thonet managed to simplify the form of the chair, offering a functional and rather minimal solution that defined a new paradigm for that era. His design choices had a knock-on effect on the distribution of the product as well, since the chairs were delivered completely disassembled to customers. Years and years before IKEA, the concept of the flat-pack was born with Thonet.

Chair No. 14

2.3

Postwar conversion and new opportunities for industrial production: the Vespa scooter

After World War II, several companies were on the lookout for new opportunities and seeking a viable alternative to war production. Like other companies, Italian company Piaggio produced military aircraft before making Vespa, and right after the war, they initially weren't planning on entering the sector of motorbikes.

In 1946, Italian entrepreneur Enrico Piaggio gave engineer Corradino D'Ascanio the task of designing a lightweight and economic scooter. D'Ascanio hated motorbikes; he deemed them uncomfortable, noisy, and difficult to maneuver on streets that were often unpaved, and he disliked how easy it was to get dirty while riding.

D'Ascanio was able to quickly flip the problem on its head and get the most out of these issues by defining a new archetype for mobility on two wheels. By simply moving the engine and the tank under the seat, he freed the central *tunnel*. By employing a load-bearing frame that served both an aesthetic and a functional purpose, he eliminated the need for an additional frame. Thus, he managed to limit assembly costs and simplify the overall assembly process.

This was made possible because Piaggio owned large industrial presses that served in the production of aircraft. Not only did the solution have a great technical impact, but it also made it possible to guarantee a comfortable seat and driving position. The needs of the user (in this case, the designer himself) were the driving force in a quest for smart solutions that didn't require heavy investment. For example, the engine was designed based on the starter motor of a plane, and the suspensions took inspiration from plane trolleys. In fact, most of the components of the new scooter could be produced with technologies that the company already owned.

The most innovative aspect of the Vespa scooter lies in what today we would call its *user experience*: instead of having to ride it like a motorbike, the rider can simply sit on it and drive it effortlessly. The Vespa scooter has become an icon of Italian design, and just like Thonet's chair, it created a new archetype: everybody thinks of a Vespa when somebody says "scooter." Its long-lasting impact, however, goes beyond the iconicity of the product and its commercial success; it is related to the way the Vespa has been designed, looking at user needs and turning those insights into effective solutions.

1.
Vespa Project
by D'Ascanio

2.
Vespa 50

1

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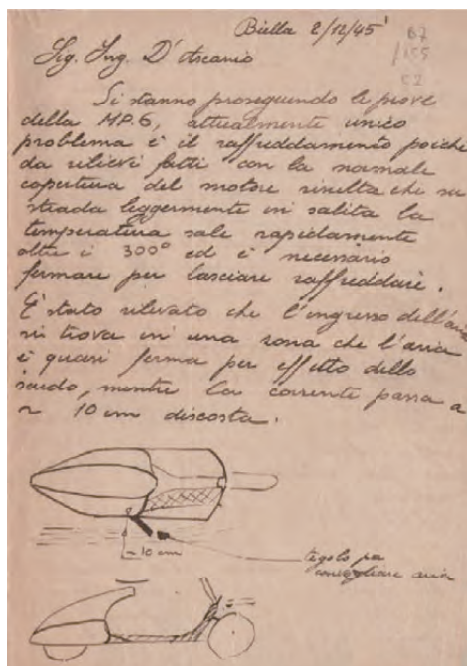
2.4

The advent of polymers and a new generation of products

Continuing our journey through the history of design and its evolution, we now move from mechanical to electrical and electronic products. The 1960s represented a key turning point in that respect. Televisions had made their first appearance in Italy in 1954. Both radios and TVs were commonplace in living rooms; they were encased in wood and, in a way, had become the center of the modern house. Later, plastic materials began to be employed in the production of appliances and electrical equipment. Italian engineer Giulio Natta, who would later be awarded the Nobel Prize in Chemistry, invented the Moplen (more commonly known as isotactic polypropylene) at Politecnico di Milano in the 1950s. This plastic is still one of the most widely used polymers today.

In this historical moment, industrial designers Marco Zanuso and Richard Sapper worked for Brionvega, a renowned Italian electronics company. They used plastic to give new life to the radio, turning a rather static object into a portable and colorful device, characterized by a minimalistic but sophisticated form. The project leveraged a set of technologies that were new and emerging at the time, with the plastic material on one side and electronic components on the other. These components made this project possible thanks to their miniaturized size.

Radio Cubo (TS522 radio) by Marco Zanuso is made of two hinges that allow the cables to go through (with the electronic boards) the controls and transistors on one side and the speaker on the other side. The radio features a clean, streamlined, and highly innovative design, accompanied by plastic elements, functional metallic components, an antenna, a comfortable handle, and a magnetic frame that made it easy to close the radio.

Radio Cubo embodies the perfect proposition for a generation of consumers that was changing its habits and had begun to wonder: "Why can't I listen to the radio when I'm not home?" The 1960s, with its many plastic products that transformed our domestic lives, constituted a radical style revolution. Similar examples of products that favored a radical transformation of simple daily experiences can be observed in other countries too, as the Walkman designed by Sony in Japan can very well testify.

Brionvega Radio Cubo

2.5

2007: The smartphone is born

Taking a quantum leap past the era of computers and human-computer interaction and its innovative contributions, we mark a new milestone in 2007. It feels relatively far away in the past, but 2007 is the year in which smartphones were born, with the release of the first iPhone. Once again, from a product design standpoint, the iPhone didn't rely on any new or ad-hoc technology. It was based on a proprietary ecosystem made of a dedicated OS and its service platform, iTunes. This platform had already proved its innovative potential with the iPod, both in terms of user experience and business model.

Other telephone companies were investing in incremental innovations for their products: Nokia was releasing its interchangeable covers, Motorola offered small pocket-size phones, RIM/Blackberry had developed a proprietary OS and was known for its QWERTY keyboard targeted to businesspeople. At the same time, Apple tried to imagine how the world of communication would evolve in the future, choosing to enter a business they didn't know. This was possible because Apple readily picked up weak signals and leveraged them to make strategic decisions. Network speed was increasing while costs for data usage were decreasing, content exchanged through mobile devices were becoming multimedia, and the latest technological developments had made it possible to unite several functionalities into one single object.

The output of this first innovation was a hybrid and slightly monolithic device: partly camera, partly music player, partly navigator, partly phone, and more. In fact, the most significant output has been turning the phone into a new service platform that, thanks to the advent of mobile applications, has seen an exponential and uncontrolled rise in offerings and has turned the smartphone into an indispensable object.

From a product design perspective, the iPhone relied on a number of existing components: an aluminum case with a touchscreen, produced by one of Apple's direct competitors, made suitable for the new purpose thanks to an extremely intuitive interface and haptic feedback. Steve Jobs' words in his famous 2007 keynote sound like a prophecy that Apple's numbers can very well prove. A piece of technology acquired from direct competitors and a company without a production line that decided to trust international manufacturers while claiming that their product was "designed by Apple in California": design is no longer just a trademark or a label, but it is instead the core strategic asset of a company.

2.6

A new generation of smart products: artificial intelligence (AI) and the Nest thermostat

Up until this point, design was concerned with objects which either addressed or anticipated certain user needs but had clear and recognizable functionalities, regulated by direct user input and interactions (e.g., the user presses a button and the radio turns on). However, today we are confronted with a new set of challenges posed by a generation of so-called thinking or smart objects. They derive their name from their incorporation of artificial intelligence. These objects no longer require the user to be an active subject all the time, and they rely on new forms of interaction and dialogue, presenting us with a whole new array of opportunities, including some dystopian ones.

Artificial intelligence isn't just about self-driving cars and extremely complex intelligent systems. Nest, which is now a property of Google, is a small domestic thermostat, equipped with artificial intelligence capabilities and developed by two former Apple employees, Tony Fadell and Matt Roger. Nest is a smart object: it isn't just an interface, but rather an intelligent device which learns from and adapts its behavior to the user's usage patterns. Users don't necessarily have to interact with it, since

The first iPhone

once activated, Nest is fully autonomous. First, the device is installed and the desired temperature for the room is set on the dial.

Then, after just seven days, thanks to a few environmental sensors and a Wi-Fi connection that makes it possible to detect any presence in the house, the device itself is capable of managing the temperature. It proposes an ideal program to the user, taking into account the user's comfort and wellbeing, but also helping to save money on heating. Compared to old thermostats that feature dozens of buttons, levers, and extremely technical user manuals, this sleek, round touchscreen device exceeds the expectations of users. As a matter of fact, it changes their relationship with the house. People don't need to worry about programming the thermostat; all they have to do is enjoy the experience of being in a house that, thanks to AI, can acknowledge their needs and adapt.

Nest's story is almost unsettling. It may easily draw our attention towards the ethical issues that may come with it, especially in relation to data security and the unwanted consequences of data misuse. However, if seen under a more positive light and with a pinch of trust in technology, a system like Nest offers a way to enjoy one's freedom more fully. It gives users more time for the things they truly love and potentially the benefit of a reduced impact on the environment. Future designers will need to face these challenges when designing smart objects and will need to ensure an appropriate amount of security, desirability, and ease of use.

2.7
Conclusions

If we look back at the diagram that opens section 2 of this chapter (see page 12), we can see how design evolves in relation to the context. In our journey through history, we moved from pure product design (Thonet's chair) to design for mass production (the Vespa scooter) and design of domestic and electronic objects, interfaces, and computers. We eventually reached an era that is dominated by attention to user experience and by technologies that enable objects to learn and think. If we look around, our lives are permeated by tools and services that embody new technologies to assist us in accomplishing tasks and make our daily experiences more exciting. Chapter 5 dives deeper into the design of services and experiences and offers several case studies from the digital era. In summary, designers today must acquire skills that allow them to deal with the various domains of design, but most importantly, they need to be able to evolve with the context.

3. A New Role of Design

3.1

From design to design thinking and the evolution of the design discourse

Over time, design has significantly changed its role. Until 2002, innovation manuals regarded design as a technical activity in service of R&D departments. However, in 2005 *Oslo Manual* (published by the Organization for Economic Co-operation and Development [OECD] and Eurostat) acknowledged it as a specific type of innovation in itself, and in 2015 it was defined as a strategic activity. This is acknowledged in the definition provided by the International Council of Societies of Industrial Design (ICSID), which can be found at the beginning of this chapter.

In recent years, design thinking has gained significant attention in the business context and has become a central innovation asset for many firms. Thanks to the work of many authors and thinkers including Tim Brown (British designer and CEO of innovation consultancy IDEO), Tom Kelley (American author and partner at IDEO), and Roger Martin (American professor and author), design and design thinking in particular have permanently been recognized as business-oriented activities.

Politecnico di Milano is one of the contexts in which the design discourse has been deeply investigated and developed. In particular, some of the most relevant contributions include the following:

The design-driven innovation theory, formulated by Roberto Verganti, who was the first to codify a design-based innovation model by analyzing the history and evolution of several Italian firms that embody the *made in Italy* label (and some international companies, as well).

The strategic design approach, formulated by Francesco Zurlo, which introduces elements that bring value beyond the product, including the service and communication layer and the overall product system.

The design for social innovation approach, formulated by Ezio Manzini in his book *Design, When Everybody Designs*, which presents design as a democratic process that serves every individual but still requires professional design skills and culture to be actuated.

The meaning innovation theory, formulated by Roberto Verganti in his book *Overcrowded*, which reflects upon the value of design in a world overflowing with objects and ideas.

Design-Driven Innovation

1   2   3

3.2

John Maeda and three types of design

Within the contemporary debate on design, American executive and technologist John Maeda, author of the book *The Laws of Simplicity* and curator of the blog *Design in Tech Report*, is one of the most interesting voices. In *Design in Tech Report 2019*, he reflects upon how technology, business, and design are lately part of an overall ecosystem. More specifically, his report contains a schematic reflection that presents three different types of design.

John Maeda's three kinds of design
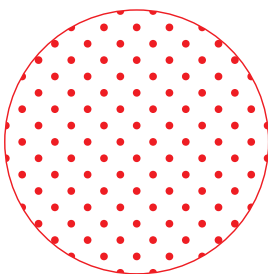
Classical Design

Driver / the Industrial Revolution, and prior to that at least a few millennia of ferment.
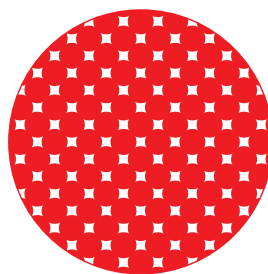
Design Thinking

Driver / the need to innovate in relation to individual customer needs requires empathy.
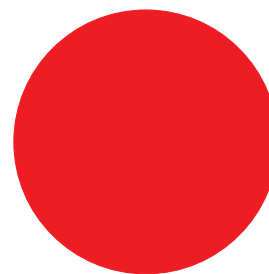
Computational Design

Driver / the impact of Moore's Law, mobile computing, and the latest tech paradigms.

From design
thinking to
circular design
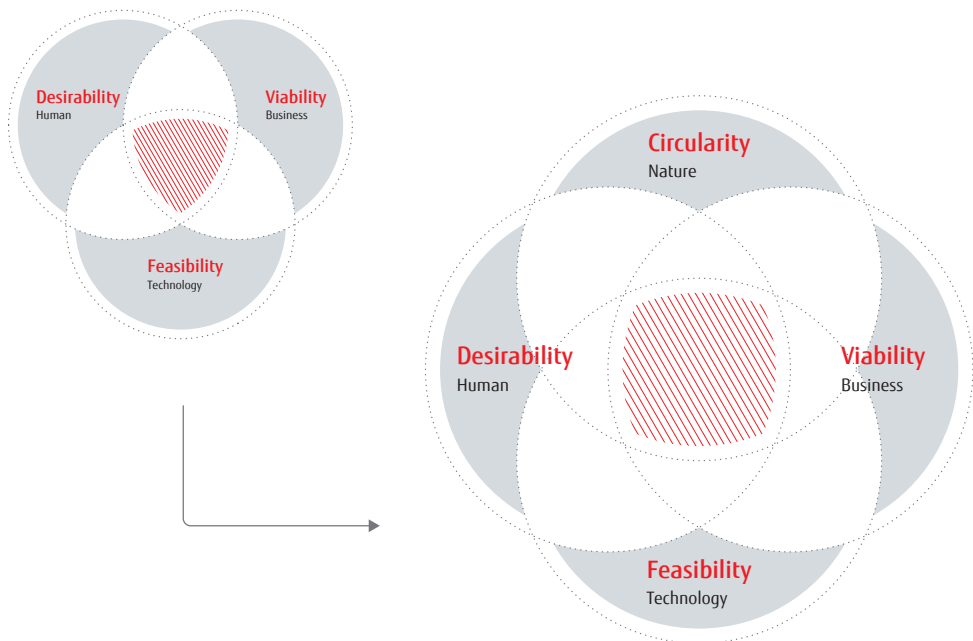
According to Maeda, design today means bringing different competencies together:

Classical design, the design that we inherited from the Industrial Revolution and is concerned with industrial products. This kind of design deals with finite objects, some of which have become milestones in the history of design and still have great value today. These are the objects that Dieter Rams would classify under the category "as little design as possible," to quote the title of the namesake book that he published in 2001. These objects are pure and archetypical tools in which design focuses on the details, the functional aspects, and the industrial processes that make their creation possible, thus giving birth to timeless products.

Design thinking, the more business-oriented vision of design that takes user needs into account and builds viable products and services, often leveraging new business models.

Computational design, a type of design that is being applied to a new generation of objects, which as previously discussed, have essentially become super-interfaces. These objects have a wide outreach and are adopted by millions of users and need frequent updates, both in terms of data and software. In fact, since they often exist across physical and digital dimensions, they suffer from a new kind of

obsolescence, which seems to progress much faster than the physical kind. In this context, the focus of the design activity isn't obtaining a finished product, as in the case of classical design, but rather the design process is continuous and more similar to what perpetual beta is for programming—that is, the continuous and ongoing implementation of new features blurs the line between the test and final version of a product.

What is interesting is that Maeda identifies four particularly important aspects of computational design, which attest to the need for design practitioners to evolve their mindset.

Understands computation. It is increasingly important for designers to know the fundamentals of programming in order to effectively define what can be easily implemented versus what has a higher degree of complexity. At the same time, designers aren't required to program directly, but should constantly interact with engineers and programmers, exchanging knowledge and expertise.

Thinks critically about technology. A computational designer should also be a *humanist technologist* who, while being enthusiastic about technology, can correctly interpret its value and the meaning of each

design decision and can distinguish between what can be done and what makes sense.

Uses all three kinds of designs. This type of designer should be able to apply all the three types of design presented in the previous paragraph, having an open-minded and multi-disciplinary approach.

Actively learning AI and the new. Finally, this professional should be curious and interested in learning about AI and other new technologies. They should also be visionaries capable of bringing value and an interesting cultural approach to the creation of new scenarios.

A successful designer today must possess a mix of competencies as well as a solid design foundation, a strong grasp of managerial and design thinking culture, and a well-rounded understanding of technology.

Tim Brown himself, one of the main contributors if not the creator of design thinking, speaks about circular design. This kind of design doesn't just concern the user, technology, and market; it also holds the potential to achieve more systemic impact by fostering sustainability and a system based on the principles of the circular economy.

There is one core idea reinforced by all of these different perspectives: the idea that design is never done, which is increasingly true in the world we live in.

3.3

The many faces of design: how different companies leverage design to innovate

If it is true that design has acquired strategic value and more often permeates a company's culture, it is also true that different companies have approached design in different ways, often developing tailored proprietary methodological frameworks that inform their innovation processes. Although the approaches presented here all stem from technology companies and share an intention to codify a design methodology, they do not always look at the design problem from the same perspective. In fact, it is interesting to note their unique viewpoint and set of principles.

Design thinking – SAP

SAP is an example of how a large technology corporation went from a more traditional approach to one inspired by design thinking and building empathy for customers to solve their problems.

SAP first took an interest in design thinking in 2004, when Hasso Plattner, one of SAP's founders, contributed to the creation of the first Stanford d.school with David Kelley, founder of IDEO. Over time, design thinking began to spread within SAP and gained strategic relevance. By 2012, it had become core to their way of helping customers innovate their businesses.

SAP Fiori

SAP combines design thinking practices (specifically, observing users and learning about their needs to design meaningful solutions) with business thinking and more traditional business research in order to deliver truly innovative output. In more recent years, they have developed SAP Fiori, a language system focused on the needs of enterprise users and thought to speed up, guide, and streamline the design of meaningful experiences.

IBM Enterprise Design Thinking approach
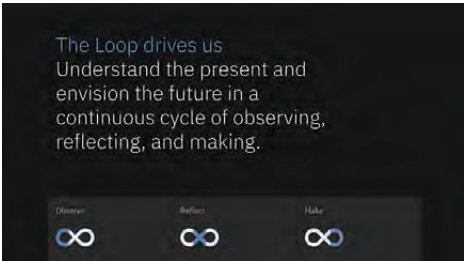
IBM Enterprise Design Thinking – IBM

IBM's Enterprise Design Thinking has been one of the first design thinking approaches in the technology world to become a standard and a major reference for the industry. IBM's approach focuses on achieving a customer-centric company culture and aims in particular at building an effective model for large corporations, one enabled to move fast and scale quickly.

The proposed methodology is modeled on a classic user-centric design thinking framework. It is described as a loop, composed of three main phases: observe, reflect, and make. Moreover, IBM's framework focuses on providing guidance around team collaboration and increasing effectiveness to achieve impact at scale. Some of the most important aspects of the approach include the following:

Fostering diversity within teams to create fertile ground for more radical breakthroughs that can emerge from the integration of different viewpoints.

Composing teams in such a way that they can be fully autonomous in making all of the most important decisions, thus streamlining innovation.

Providing guidance on team processes—in particular, IBM teams rely on three core activities: formalizing intent (hills), involving stakeholders into the process (playbacks) and making users a regular part of the design process (sponsor users).

Material Design – Google

Material Design was created by Google in 2014 with the codename Quantum Paper. It is a cross-platform visual language and design system, envisioned with the objective to create easy-to-use and universally clear digital experiences.
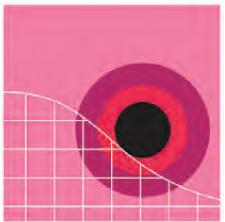
In fact, Material Design takes inspiration from the laws of the physical world to design the hierarchy and the relationships between interface components. Google's vice president Matías Duarte explains that Material Design uses visual cues such as edges and shadow to provide meaning and affordances while leveraging the endless possibilities of the digital world. This helps to provide a consistent experience, removing culture-bound elements and symbols. The bold and linear graphics help to create visual hierarchy, and motion always conveys meaning and follows nature's laws (e.g., gravity).

Material Design is used by Google consistently across their applications, but it has also been made available to the broader community of designers and developers and provides flexibility for brand customization. This is where the real strength of its approach lies: not only are the elements of the design language systems made

Bold, graphic, intentional

Material Design is guided by print design methods — typography, grids, space, scale, color, and imagery — to create hierarchy, meaning, and focus that immerse viewers in the experience.

Motion provides meaning

Motion focuses attention and maintains continuity, through subtle feedback and coherent transitions. As elements appear on screen, they transform and reorganize the environment, with interactions generating new transformations.

Flexible foundation

The Material Design system is designed to enable brand expression. It's integrated with a custom code base that allows the seamless implementation of components, plug-ins, and design elements.

Cross-platform

Material Design maintains the same UI across platforms, using shared components across Android, iOS, Flutter, and the web.

Material Design language system
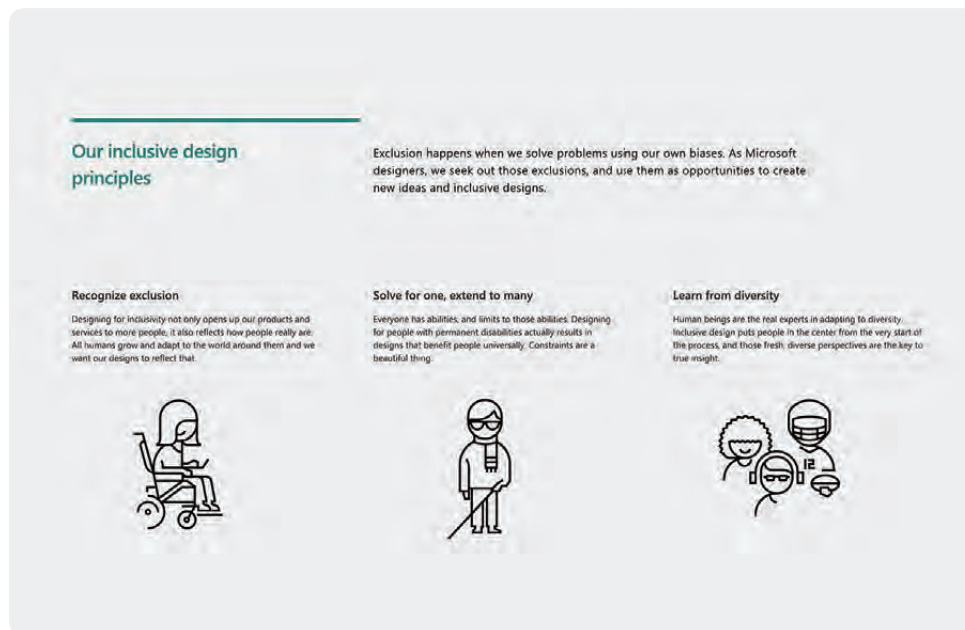
available, but they are accompanied by clear principles and thorough explanations and usage guidelines that can enable every practitioner to craft truly, universally usable systems.

Inclusive design – Microsoft

In recent years, thanks to the strong vision of CEO Satya Nadella, Microsoft has increased its focus on inclusivity, with the intention of maximizing the accessibility of all their products and services for people with all kinds of abilities. Microsoft's inclusive design approach focuses on diversity and overcoming the problems that arise when we are unaware of our biases and let them lead our design decisions. Starting from the assumption that constraints can help creativity and that designing for diversity can actually benefit any user, Microsoft has created and made available a comprehensive guide and set of tools and principles for practitioners to read, use, and integrate in their processes.

An important distinction they highlight in the introduction to the methodology is the one between *accessibility* and *inclusive design*: while the former is mostly concerned with meeting industry standards and regulations, the latter is concerned with taking user needs into account and designing for people. As Microsoft states in its Inclusive 101 Toolkit.

An important distinction is that accessibility is an attribute, while inclusive design is a method. And while practicing inclusive design should make your products more accessible, it's not a process for meeting all accessibility standards. Ideally, accessibility and inclusive design work together to make experiences that are not only compliant with standards, but truly usable and open to all.

Human Centric Experience Design (HXD) – Fujitsu

Fujitsu has long sought to create solutions that truly cater to user needs and put them at the center of the design process. Their approach has evolved alongside major technological developments since the 1980s. Over time, the value delivered by design became greater than the creation of effective software and hardware design, as designers aimed to make an impact at the intersection of user, business, and societal needs. Today, Fujitsu applies a methodology called Human Centric Experience Design (HXD), which brings together user experience design and design thinking. Fujitsu's unique approach is presented in detail in section 4 at the end of chapter 2, Design Thinking and Its Evolution, after a thorough overview of the evolution of design thinking in general.

4. The Value of Design

Value of $10,000 investment
$ thousand
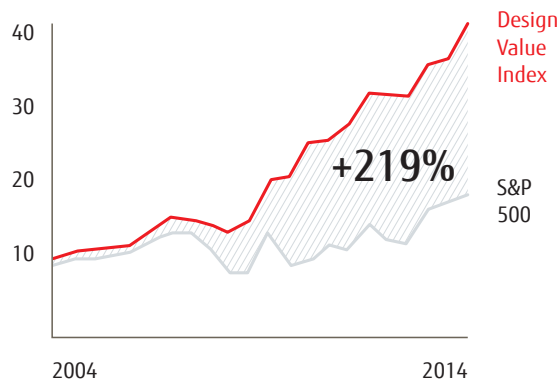
4.1
Design generates tangible returns

It has become evident that, when design is applied in an intelligent way and leveraged as a core company asset, firms can greatly benefit from it. Research studies have confirmed this hypothesis and have contributed to the definition of the intrinsic economic value of design.

The Design Management Institute has compared the economic value of the Standard and Poor (S&P) 500 companies with design-oriented companies to extract the so-called Design Value Index, which measures the value of publicly traded companies. Data shows the margin of the latter group is 219% of the former cluster in relation to the same volume of investments.

These findings help to make the value of design more tangible and underline how investing in design is relatively cheaper than investing in technology alone and more profitable by comparison. These numbers also show that design can be measured: what was originally limited to the analysis of intangible elements connected to the brand or the style can now be linked to explicit metrics that allow companies to measure the efficacy of design and innovation efforts. This practice empowers leaders and the management level in general, and it equips them with solid arguments for their choices. Design is a cross-functional talent: companies should stop thinking about design as an isolated and siloed activity if they want to

achieve tangible results. This is particularly true for high-tech companies, in which design should permeate all the different organizational layers.

4.2
Design as a strategic asset: role and evolution of design functions within organizations

In 1997, American researchers Julie H. Hertenstein and Marjorie B. Platt wrote a paper called "Developing a Strategic Design Culture," in which they analyzed several US firms. They focused on the role that industrial design played within the company and observed the company's design processes, hierarchical structure, and measurement frameworks for the performance of design.

The authors emphasize the importance of nurturing a strategic design culture. Design can offer insights to help the company shape its strategic direction when design and strategy work side by side. In this two-way relationship, the company's strategy provides input to inform design activities. This elevation of the role of design, compared to more traditional paradigms, often goes hand in hand with organizational changes and a new position acquired by design within the company's structure. In fact, the paper documents a trend that sees industrial design functions often shifting from engineering to marketing departments and design

directors actively contributing to the definition of the company's strategic direction.

This is increasingly true in modern product and service companies. Furthermore, design is currently important in every single phase of product or service creation and development. Design isn't just connected with the product but also with the user experience, and the product brings value only if it shares the same logic and overall purpose of the experience. The way design has been presented in this chapter shows that it isn't simply an activity or phase of the creative process but rather a continuous iteration.

In their paper "Design for Management: New Ways for Decision Making," professors and researchers Cabirio Cautela and Francesco Zurlo take these reflections on the role of design one step further. In fact, they analyze design-driven decision-making processes in relation to more traditional managerial processes and reflect on how the former can complement, strengthen, and even influence the latter.

Design typically receives input from management through project briefs. Over time, the design practice creates and codifies a set of qualitative methods that play a central role in helping teams define boundaries for intervention and reframe problems. Such methods include trend analysis, context inquiry, scenario building, rapid ethnography, blue-sky research, and character portraits. Design brings a new kind of output to the table, often based on visual stimuli and capable of picking up weak signals and emerging trends. Thus, design offers new perspectives that can help management go beyond known schemes and avoid an undifferentiated output.

These insights demonstrate that embracing design does not mean assigning design tasks to only some parts of the organization. Instead, it implies a true mindset shift and the creation of new collaboration models.
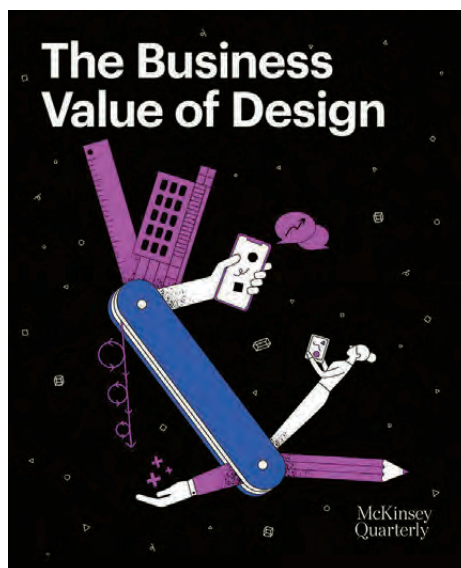
The Business Value of Design

It's analytical leadership

Measure and drive design performance with the same rigor as revenues and costs.

It's cross-functional talent

Make user-centric design everyone's responsibility, not a siloed function.

It's continuous iteration

De-risk development by continually listening, testing, and iterating with end-users.

It's user experience

Break down internal walls between physical, digital, and service design.

The Business Value of Design, factors

More than a feeling
More than a department
More than a phase
More than a product

A recent report published by McKinsey & Company named *The Business Value of Design* tries to outline the fundamental elements that allow companies to integrate design in an effective way and reach a sufficient degree of maturity from this perspective. In particular, they identify four main elements:

Strong **analytical leadership** that includes a design perspective at the C-level and adopts metrics to evaluate the value of design

Presence of **cross-functional talent** and an infrastructure that can empower cross-functional collaboration

Favorable attitude towards **continuous iteration** and the integration of different methods and perspectives

Primary focus on **user experience**

Regarding this last point, we can reference British interaction designer Gillian Crampton Smith, who has long claimed that users are not seeking products, but experiences. She is a prominent figure in the international design landscape and has contributed to the creation of important educational programs in design. In particular, she founded the Interaction Design Institute Ivrea in Italy in 2001, the first Italian school entirely dedicated to interaction design and a particularly interesting educational experiment focused on enhancing the way people interact with technologies.

We can find further support for Gillian Crampton Smith's reflections on the importance of experiences by looking at one of the most common objects of our contemporary lives: the smartphone. With regard to the design of the physical products, the differences between smartphones are not necessarily great, and it is relatively common for different brands to share product components. On the other hand, what sets products apart is the user experience, differenciated through applications, gestures, interactions, shortcuts, wallpapers, ringtones, and so on.

These are the aspects that interest users the most, because they enable them to communicate with others and perform other actions in the most intuitive way possible. In summary, we can say that the concept of user experience isn't new, but it is a way to re-define and re-aggregate the competences that designers once applied to industrial products. Today, design expertise are applied to new digital products that have broader perspectives and a renewed cultural outlook.

Key Takeaways

1. The Meaning of Design

Design is a multifaceted word, inherently linked to the idea of **looking at the future**. It can be used to indicate the action of creating something for our future, as well as the plan, activities, and skills involved in this process.

In recent definitions, the word design has acquired increasingly **strategic connotations**, indicating an activity that is essential for companies to innovate and thrive. Likewise, **design's outreach goes well beyond the product and encompasses systems, services, and experiences.**

Design is a strategic action that requires a range of methodologies including **ethnographic methods, observations, interviews,** and more.

Human-centered design (HCD) is a consolidated methodological approach that puts users at the center of the design process.

HCD plays an important role at different stages of the design process and is based on a set of different activities and best practices: conducting research with users to build empathy and illuminate human problems, leveraging research insights to define the project challenge from a user perspective, envisioning meaningful solutions, and testing solutions with users to gather feedback and improve output.

2. Design Evolution

Design has been used to **transform problems into opportunities** and is seen as key prerogative of human beings. In an attempt to outline a brief history of design, some key milestones are drawn from history of design:

Thonet's chair No.14 (1859): Michael Thonet transformed a chair into a light-weight object that can be disassembled, marking the turning point between classic artisanal and industrial mass production.

The Vespa Scooter (1946): Corradino D'Ascanio designed a scooter that prioritized the user's comfort and made clever use of the available components and technologies, creating a highly-functional, new archetype for mobility on two wheels.

Radio Cubo (1964): The incorporation of plastic materials in products gave rise to a variety of new products found in households. One of them being a portable radio with a minimalistic and sleek design that appealed to a new generation of consumers that was beginning to perceive entertainment as a mobile experience that could take place anywhere.

The first iPhone (2007): Apple released their first iPhone that would over time turn mobile phones into an intelligence service platform. As evident from Apple, design is no longer just a trademark or a label, but it is instead the core strategic asset of a company.

Nest thermostat (2011): This smart thermostat is an example of how artificial intelligence (AI) can be embedded into products to relieve users of mundane tasks and empower them to achieve better results.

3. A New Role of Design

In "Design in Tech Report 2019," John Maeda outlines three kinds of design, emphasizing the importance that designers of today possess cross-disciplinary competences: Classical design, Design thinking, and Computational design.

There are many approaches to design, and some technological companies have codified their methods to present a unique viewpoint and set of principals: **Design thinking by SAP, IBM Enterprise Design Thinking by IBM, Material Design by Google, Inclusive design by Microsoft, and Human Centric Experience Design (HXD) by Fujitsu.**

4. The Value of Design

Data shows companies that apply design consistently and intentionally tend to have better financial results, with much higher returns on investments. Therefore, it is evident that design generates tangible returns.

Companies that embrace design successfully tend to have different internal processes and organizational structure. This can include aspects like **design functions being found at the C-level, value generated by design being measured through dedicated metrics, design contributing to strategic decisions, promoting a design culture throughout the organization, and favoring an attitude of continuous iteration.**

Glossary

Design

Design is a multifaceted word, inherently linked to the idea of looking at the future. It can be used to indicate the action of creating something, as well as the plan, activities, and skills involved in this process. As an adjective (e.g., designer clothes) it points out the stylistic qualities of an object. In recent years, it has acquired more strategic connotations, and it often indicates an attitude rather than a specific discipline.

Strategic design

Strategic design is the project activity co-opted in the formulation and development of an organization's strategy. Its objective is to give shape to the strategy, which is meant mainly as a system-product. A system-product is the organic and coherent set of various media (product, service, communication) with which an enterprise builds its identity, positions itself on the market, and defines its mission in society.

Design thinking

Design thinking is the more business-oriented vision of design that takes user needs into account and builds viable products and services, often leveraging new business models. It is a very broad term that has become particularly popular in the business context and has given rise to the creation of unique and proprietary design methodologies, including Fujitsu's HXD approach. From a theoretical and academic perspective, design thinking is a multi-layered concept that can be defined through four models: creative problem solving, sprint execution, creative confidence, and innovation of meaning.

Human-centered design (HCD)

Human-centered design (HCD) is a methodological approach that puts users at the center of the design process. HCD looks at people not just from the perspective of their biological characteristics and how they interact with products and services, but also the context they are immersed in, their preferences, goals, and life aspirations.

Futures studies

The discipline of futures studies is concerned with maintaining or improving the welfare of humankind and the life-sustaining capacities of Earth itself. It does this by systematically exploring alternative futures and using prospective thinking. It is a broad discipline that encompasses numerous different methodologies, including SCENARIO BUILDING, an approach that focuses on interpreting current and upcoming trends to generate plausible and internally consistent scenarios that are built on a clear rationale and retraceable logic. Scenario building leverages BACKCASTING: this describes the process of back-tracking the steps from a desired end-state to the present moment to define what actions and decisions are needed today to get to a desired future.

Service design

Service design is the orchestration of all the different layers of a service: its value proposition and offering, the customer-facing (frontstage) experiences and interactions, and the backstage processes. Service design must take place at the intersection of design, technology, and business to maximize its value.

User experience design (UX design)

User experience design is very much interlinked with the design of services or systems and is one of its core components. It focuses on the creation of meaningful experiences and on the way users (whether end-customers or company users) interact with solutions.