



SPATIAL COMPUTING

AN AI-DRIVEN BUSINESS

REVOLUTION

CATHY HACKL IRENA CRONIN

WILEY

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Cathy Hackl

I dedicate this book to my dad, Ambassador Luis Varela, the man who taught me to have a rebellious soul, a voracious appetite for learning, and the heart of an explorer. Te amo con todo mi alma papito bello!

I also dedicate this book to all the women working in Spatial Computing, AI, XR, and tech in general. We can change the future by making technology better!

Irena Cronin

For the memory of my husband, Danny, and his love of tech.

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FOREWORD

The Inception of Our New Spatial Reality: Immerse or Die!

Apple had its next iPhone moment with the launch of its Vision Pro in 2024. Like in 2007, Apple yet again shifted the trajectory of computing behaviors by developing an intelligent and immersive Spatial Computing platform. And like in 2007, the world will never be the same. An entirely new operating system unlocked entirely new dimensions. These infinite, layered canvases bestowed users with metahuman capabilities. Now, people in any context can interact with information, content, and each other in ways and in spaces that didn't exist in traditional physical and digital realms. We thus gain access to unprecedented worlds and experiences with unimagined worlds forming in virtual and augmented realms every day.

But wait, there's more. Eight or so months before the introduction of Apple's Vision Pro, OpenAI released ChatGPT, introducing generative AI to the masses. In fact, ChatGPT is widely regarded as the fastest-growing consumer internet app of all time, reaching an estimated 100 million monthly users in just two months.¹ Generative AI is also in its own way giving users superpowers by augmenting their efforts with Artificial Intelligence. In fact, most apps and platforms will automatically integrate generative AI as parts of its user interface (UI). It will just seamlessly blend in to digital experiences. Added to Spatial Computing, AI-powered experiences supercharge human potential by arming them with a cognitive exoskeleton, augmented and virtual vision, and the ability to interact with computers, robots, data, and one another in three-dimensional other-worldly spaces.

And that's where this story begins.

Humans are now entering into uncharted portals of hybrid realities that are not only intelligent and immersive, but also transcendent. They augment human capabilities to unlock exponential performance and previously unattainable outcomes in evolving hybrid dimensions that foster the intermundane relationship between physical and digital worlds.

Cathy Hackl and Irena Cronin are about to deliver a transformative inception by planting the idea of spatial innovation to spark your imagination to create new worlds, new ways of working, new ways of learning, new ways of communicating, new ways of exploring, and new ways of dreaming, remembering, inventing, solving, and evolving.

This frontier between the physical and digital world will be shaped by you and fellow readers. You are the architects of these unexplored worlds. You are the astronomers who discover them. You are the pioneers who explore these new territories. And it's your vision that defines the next chapter of spatial design, experiences, and human potential.

What a *virtual* world we now live in!

Immerse or die!

Brian Solis

*Digital Futurist, Anthropologist, 9x Best-Selling Author, Metahuman,
briansolis.com*

INTRODUCTION

The Converging Frontiers of AI and Spatial Computing

A pivotal moment is at the heart of this discussion; one that will reshape our world as we know it. This convergence embodies the union of two potent forces: Artificial Intelligence (AI) and Spatial Computing, epitomized by Augmented Reality (AR) and Virtual Reality (VR). This fusion represents an intricate dance between innovation and creativity, offering a novel lens through which we engage with both our digital and physical realities. Without AI, Spatial Computing would not have been possible. It is now with the emergence of Generative AI (Gen AI), that Spatial Computing will be even more augmented.

This juncture is not merely a coming together of technologies; it signifies the opening of a portal to a new era, a threshold to uncharted possibilities. It marries the exceptional data-processing capabilities of AI with the immersive prowess of AR and VR, creating a dynamic synergy. This partnership holds the promise of a transformative future where our interaction with digital information and the world around us is intuitive and seamless, transcending the traditional boundaries between the physical and digital realms.

Intriguingly, the implications of this convergence extend far beyond the realm of technology. It touches various aspects of our daily lives, from how we educate and entertain ourselves to how we receive healthcare and make purchasing decisions. This transformative shift will not only alter the way we interact with technology, but will also redefine the landscape of business.

From a business perspective, the implications are profound. Companies that harness this technology will gain a competitive edge by delivering captivating, immersive experiences to their customers. Consider the medical field, where AR can revolutionize surgeries by providing real-time data to surgeons, or imagine the retail industry, where VR can offer customers the ability to try on clothing

virtually. Moreover, the analytical capabilities of AI will facilitate more informed decision-making, a coveted asset in today's dynamic business landscape.

This introduction provides a solid footing for our subsequent exploration of AI and Spatial Computing. Throughout this discussion, we will explore the key components, practical applications, and the far-reaching impact on various sectors. What follows is an in-depth investigation of the convergence that promises to reshape the boundaries between the digital and physical worlds, offering a glimpse into a rapidly evolving present and a promising future that's brimming with opportunities and innovation.

Setting the Stage

In our quest to truly comprehend the significance of this convergence, let's begin by drawing parallels with transformative inventions of the past. History is marked by moments when technological innovations have rewritten the very fabric of human experience. Think back to the groundbreaking invention of the first photograph, which immortalized moments in time and revolutionized the art of visual storytelling. Then came the advent of the first motion picture, which brought narratives to life on the silver screen, ushering in a new era of entertainment and artistic expression.

These pivotal milestones in our history led to tectonic shifts in how we perceive the world. Yet again, we find ourselves at a juncture with AI and Spatial Computing, technologies that stand on the brink of reshaping our lives in profound ways, akin to the revolutionary inventions of the past. Just as the first photograph changed how we document and cherish memories, AI and Spatial Computing are altering our perception of reality. Similar to how motion pictures transformed the entertainment landscape, AR and VR are introducing entirely new dimensions of immersive experiences.

Moreover, just as the introduction of the first television set forever altered the way we connect with the world, AI and Spatial Computing are breaking down the barriers between the physical and digital realms. These technologies enable us to engage with information and environments in previously unimaginable ways.

This convergence isn't merely about the evolution of technology; it signifies a profound shift in how we engage with the world. It has the power to redefine our reality, blurring the lines between the virtual and the physical. It paves the way for a future where our daily lives seamlessly intertwine with AI and Spatial Computing, opening up possibilities beyond our current understanding. As we embark on this exploration of the transformative potential of these technologies, we'll unveil how they are reshaping industries, redefining experiences, and propelling us into an era where innovation and imagination know no bounds.

An AI Moment Unlike Any Other

At this time in history, we find ourselves amid a convergence of two distinctive technological forces, each at a pivotal place in its development. On one hand, there's AI, a technology that has been on an extraordinary evolutionary journey for quite some time. AI's roots can be traced back to the inception of computer science and mathematics, and over the years, it has transformed from abstract concepts into practical applications, becoming an intrinsic part of our daily existence.

Throughout this book, we will explore AI's key components, practical applications, and its far-reaching impact on various sectors. It's imperative to note that Computer Vision (CV) is the driving force behind Spatial Computing. Spatial Computing seamlessly integrates CV, enabling the creation of immersive experiences by understanding and interacting with the physical world. These technologies extend beyond mere vision; they encompass scanning technologies that play a vital role in mapping and interpreting the environment.

Additionally, the influence of GenAI cannot be overstated in the context of Spatial Computing. This technology brings a whole new dimension of 3D creativity, thereby enabling the generation of immersive and interactive 3D content that enriches the Spatial Computing landscape. As we navigate through this book, we will further explore the profound interplay of these technologies and their transformative potential.

The story of AI is marked by significant milestones, from the early days of expert systems, which is software powered by AI that mimics the decision-making expertise of a human specialist in a specific domain to the current era of Machine Learning (ML), Deep Neural Networks, and GAI. Along the way, it has driven innovations like natural language processing, image recognition, and predictive analytics, fundamentally reshaping the way we live and work. The algorithms and models that power AI have grown increasingly sophisticated, empowering intricate decision-making, automation, and personalization across a wide array of industries.

On a parallel route, we encounter Spatial Computing, epitomized by AR and VR, teetering on the precipice of a transition from an evolutionary phase to a revolutionary one. While AR and VR have been evolving for some time, they are now poised to transcend their niche beginnings and achieve more widespread, mainstream adoption. This pivotal moment is significant as it signifies a shift from early enthusiasts to broader and more diverse user bases.

What sets this juncture apart is the profound involvement of AI with Spatial Computing. It's not merely the coexistence of these technologies, but their synergistic potential that holds the power to reshape our world. This convergence is unparalleled, surpassing even transformative events in history, such as the advent of electricity or the impact of the Industrial Revolution. While

these past milestones reshaped industries and accelerated progress, the current convergence extends beyond industry and infrastructure to redefine the very essence of human existence.

In addition to its use by CV, AI, with its capability for intricate data analysis, prediction, and decision-making, has already woven itself into the fabric of our lives. It subtly influences our choices, from the content we engage with to the products we select, often working behind the scenes to enhance our experiences. AI has become a silent but ever-present partner in our daily decision-making, consistently striving to enhance efficiency, personalization, and convenience.

In concert, Spatial Computing, with its ability to merge the digital and physical worlds seamlessly, elevates our interactions with technology. It's not just about offering a digital overlay on our physical reality; it's about enabling us to inhabit a context-aware, immersive digital environment. In this spatial dimension, the boundaries between the digital and physical dissolve, unlocking new avenues for interaction and engagement.

This moment signifies a transition from passive consumption of technology to active participation in the digital world. It's a shift from merely observing the digital realm to inhabiting it. The convergence of AI and Spatial Computing promises to redefine not only our daily experiences, but also the very essence of work, education, healthcare, and entertainment.

In essence, this convergence represents a fusion of AI, a technology in ongoing evolution, with the transformative potential of Spatial Computing. It's a bonding that paves the way for a future that is not only technologically advanced, but also profoundly human-centered. It's a moment that holds the promise of unprecedented innovation and transformation, a moment unlike any other in history, where the digital and physical realms unite to create a reality where human potential appears boundless. It's a moment that transcends time and space, defining an era where innovation and imagination combine to redefine the very essence of human interaction and experience.

The Unforgettable Past: 1st Photo, 1st Movie, 1st Television

In the annals of history, let's step back to an era when the very notion of capturing moments in time was revolutionary. The creation of the first photograph was nothing short of a seismic shift in visual representation. It gave humans the profound capability of capturing and immortalizing a profound capability, one to capture and immortalize moments that might otherwise vanish into the mists of history. Through the photograph, we discovered a

means to arrest the ephemeral beauty of life, preserving memories in a tangible form for generations to come.

Following this milestone, the emergence of the first motion picture marked an even greater leap in our ability to convey and preserve stories. This technological marvel was a catalyst for narratives, allowing us to experience stories in ways that were once confined to the realm of dreams. The motion picture became the epicenter of entertainment, a medium that bridged gaps and connected people through the universal language of storytelling. It transformed dimly lit theaters into gateways to new worlds, enabling audiences to travel to distant places and bygone eras, all from the comfort of their seats.

And then, the television, another milestone in human history, flickered to life as the first television set was switched on. It was a revelation that introduced the world directly into our living rooms, effectively creating a window to the outside world. Gone were the days when information and entertainment were limited to books and the confines of the radio. The television destroyed the barriers of communication, allowing events from across the globe to unfold visually before our very eyes. News, art, culture, and entertainment were no longer distant; they were now accessible to a wider audience, enriching lives and uniting people across vast distances.

These historic moments from our past serve as poignant reminders of the transformational power of technology. They illuminate how innovation consistently reshapes our world, redefining the ways in which we capture, experience, and communicate the essence of our existence. Similarly, the convergence of AI and Spatial Computing, epitomized by VR and AR, stands as a herald of profound change, poised to reshape how we perceive and interact with our digital and physical realities. This convergence is more than a technological evolution; it represents a paradigm shift, opening a gateway to a future where the boundaries between reality and the virtual realm become more like one. It invites us to participate in an era where innovation and imagination have no bounds, and where our existence intertwines seamlessly, almost magically, within the realm of AI and Spatial Computing.

The Dawn of VR and AR

Today, we stand on the precipice of a technological revolution, reminiscent of earlier paradigm shifts. In this case, it's the emergence of VR and AR that captures our collective imagination. These transformative technologies are redefining how we interact with and perceive the world.

VR, a pioneering innovation, offers the unique capability of transporting individuals into entirely digital environments. When one dons a VR headset, they step into a virtual realm, blurring the boundaries between the physical world and the digital landscape. This immersion enables users to explore synthetic,

yet captivatingly lifelike, settings from fantastical realms to lifelike training scenarios. The implications of VR extend far beyond mere entertainment, permeating sectors such as gaming, professional training, and even healthcare, where it replicates real-world situations for educational and skill development purposes.

In contrast, AR follows a different approach. Instead of submerging users in an entirely digital realm, AR superimposes digital elements onto our real-world surroundings. This augmentation enriches our perception and understanding of the physical environment by enhancing it with digital information. AR provides a personalized digital overlay on the real world, offering context and insights that enhance our experiences. Whether it's aiding in city navigation with real-time directions or providing healthcare professionals with crucial patient data during surgical procedures, AR is poised to redefine how we engage with our surroundings.

Both VR and AR transcend the confines of entertainment, making significant inroads into various sectors, including education, healthcare, engineering, and design. In the realm of education, VR provides the opportunity to transport students to historical events or into the inner workings of the human body, transforming learning into an immersive and unforgettable experience. In healthcare, AR empowers surgeons by offering instant access to vital patient data during medical procedures, thereby enhancing surgical precision and patient safety. In architecture and design, both VR and AR facilitate real-time modeling and visualization, enabling professionals to make informed decisions and collaborate more effectively.

The emergence of VR and AR is more than just a technological advancement; it heralds a fundamental shift in the way we learn, work, and enjoy entertainment. These technologies usher in a new era of improved experiential learning, enhanced healthcare practices, and revolutionary contributions to fields such as design and engineering. As we explore the potential of VR and AR, we'll discover how they are shaping the future, creating a reality where the digital and physical realms coexist seamlessly and enhance our lives in myriad ways.

The Promise of Spatial Computing

At the forefront of technology, we find the extraordinary development of Spatial Computing, seamlessly integrating AR and VR. This amalgamation promises to redefine our understanding of human-computer interaction.

The potential of Spatial Computing reaches far beyond mere technological advancement; it envisions a profound revolution in our perception and interaction with the digital and physical realms. In this immersive realm, digital and physical elements meld seamlessly, offering a fundamental shift in how we engage with data, information, and the world around us.

Imagine a future where digital information intricately fuses with your physical environment. In this spatial dimension, digital elements break free from the confines of screens, becoming integral components of your surroundings. Whether you're visualizing intricate data sets in a three-dimensional space, manipulating virtual objects as if they were tangible, or receiving contextually relevant information overlaid onto your physical environment, Spatial Computing not only enhances work, learning, and leisure, but also provides a new lens through which we perceive reality.

The Spatial Computing applications of AR and VR are nothing short of awe-inspiring. They offer the potential to revolutionize a wide array of professions. Architects can seamlessly transition from sketches to immersive, three-dimensional models, allowing them to design and visualize structures in real time. Medical practitioners can utilize AR to provide crucial information during procedures, thereby enhancing precision and safety. In the realm of education, AR and VR offer a new era of experiential learning, allowing students to closely investigate historical events, scientific phenomena, or artistic creations within a spatial context, making education more engaging and unforgettable.

Furthermore, AR and VR have the capacity to redefine collaboration and communication. In this spatial realm, distance becomes irrelevant. Teams can effortlessly collaborate in shared virtual spaces, fostering a sense of togetherness regardless of physical distances. This collaborative potential extends across various fields, including design, where professionals can work together on projects in real time, irrespective of their physical locations. In the field of healthcare, AR and VR enable telemedicine to reach new heights as medical experts can guide procedures through AR overlays, transcending geographical boundaries.

The promise of AR and VR extends far beyond the boundaries of technology; it redefines our reality and unleashes boundless potential. As we stand on the threshold of this transformative era, we enter a world where the lines between the digital and physical realms dissolve, paving the way for a tapestry of opportunities. Innovation knows no bounds in this landscape, where AR and VR enhance every facet of our lives, promising a future where the realms of the real and the virtual seamlessly merge to create a richer, more immersive existence.

The Imperative for Leaders

In the dynamically shifting domain of technology, established leaders—and those aspiring to take the helm—are confronted not with a mere choice, but with a serious obligation to immerse themselves in the profound insights provided in this book. In an era where the pace of technological convergence is nothing short of breathtaking, the ability to remain skilled, informed, and competitive in this ever-shifting terrain has transcended the realm of importance to become a paramount necessity.

At the heart of this imperative lies a fundamental truth that resonates with crystalline clarity in the world of technology: "AI won't replace your job, but someone working with AI will." This succinct statement encapsulates the crux of our current reality. It recognizes the irreplaceable role of human expertise, while underscoring the symbiotic relationship between human intellect and the capabilities of AI. It's not a matter of humans versus machines; rather, it's about humans collaborating with AI to unlock unprecedented potential.

In the chapters that follow, we will embark on an extensive exploration of the multifaceted landscape of AI and Spatial Computing. This journey will take us through a comprehensive understanding of their significance, their far-reaching applications spanning across various domains, and the multifaceted skill set required to adeptly navigate this perpetually shifting terrain.

The integration of these frontiers, AI and Spatial Computing, is not merely a confluence of technologies; it represents a burst of possibilities and opportunities. These are not passing trends but transformative forces, reshaping industries, redefining business models, and revolutionizing the way we interact with technology and the world at large.

Leaders bear a significant responsibility in this evolving landscape. It is incumbent on them not only to comprehend the intricacies of AI and Spatial Computing, but also to lead the charge in harnessing their capabilities effectively. Embracing these frontiers is the key to remaining at the vanguard of innovation. It's about steering organizations into a future where adaptability, innovation, and technological fluency are the cornerstones of success.

As a leader, your role extends beyond steering the ship; it's about having the vision and the courage to set sail in uncharted waters. It's about guiding your teams with confidence, knowing that the convergence of AI and Spatial Computing is a journey that promises not just technological advancement, but profound human-centered transformation. It's about shaping an organizational culture that is not only prepared for the future, but also poised to thrive in it.

The future beckons with tantalizing prospects and exciting possibilities. In this era, leadership is not just about managing change; it's about embracing it, leading with a sense of curiosity and courage, and seizing the transformative power of these converging frontiers. The leaders of tomorrow are those who understand that innovation is boundless, and that by embracing change and harnessing the capabilities of AI and Spatial Computing, we can create a future that's not only technologically advanced, but also deeply human-centric. Let's embark on this journey of exploration and transformation with determination and foresight. The future beckons, and we must be prepared to embrace it.

In our next section, we reveal the essence of Spatial Computing within the business context, and begin by exploring its fundamental definition and the core technologies it entails.