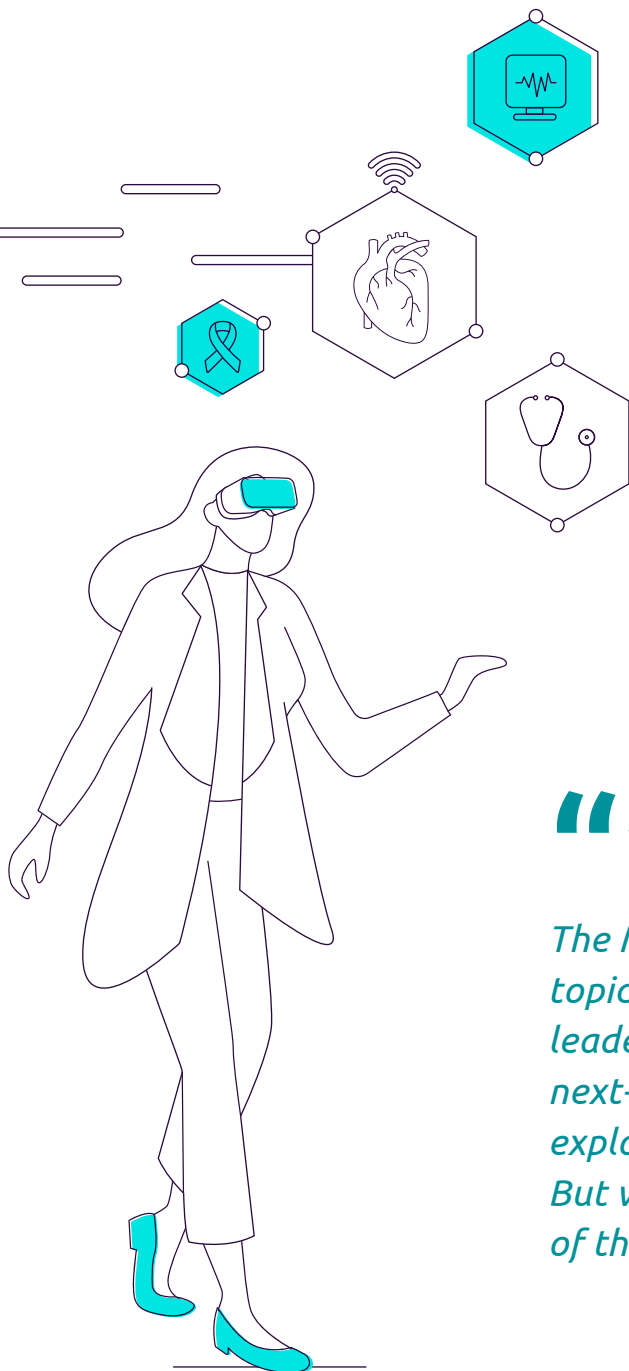Will the Metaverse be part of

THE FUTURE
OF HEALTHCARE?

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> *The Metaverse has been a very hot topic for the past year, with technology leaders positioning themselves to build next-generation offerings and industry actors exploring the potential use cases it offers. But what does it stand for and will it be part of the future of healthcare?*
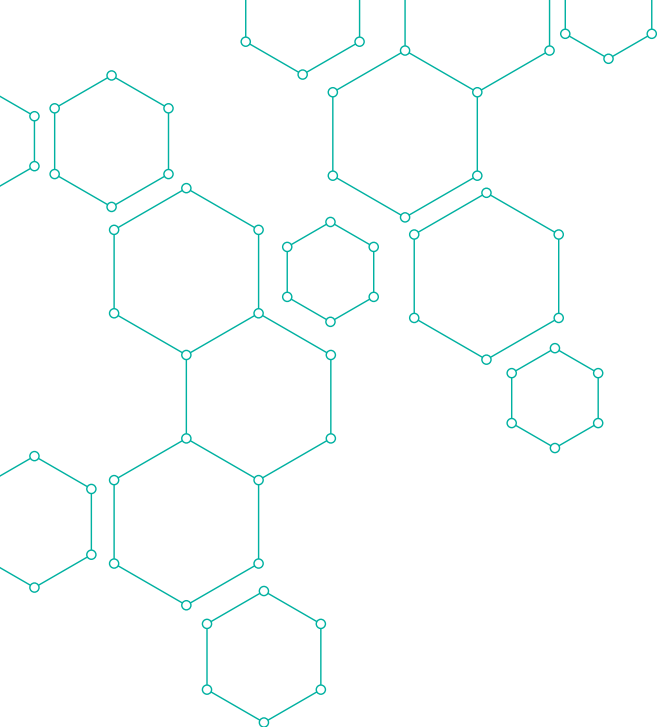>
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ENABLERS FOR IMMERSIVE METAVERSE EXPERIENCES

The Metaverse is a container of 2D or 3D virtual spaces, a persistent place parallel to the physical world, aiming to combine online digital and real-life experiences with the sense of presence. The immersive experiences and the blockchain are the main critical enabling components to Metaverse solutions.

Extended Reality (XR) can enable fully immersive experiences in the Metaverse: this technology includes all existing or new technologies that may be created in the future that modify reality, either by mixing the digital and physical worlds or by creating a fully virtual environment.

Today, we use XR as an umbrella term to cover Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (Mr). VR is a 3D virtual environment generated by technology that immerses users through dedicated headsets, haptic touch, and even environmental feedback. AR is the superposition of virtual elements, adjusted and displayed in real time in a physical environment. It can bring information or create enhanced experiences. And as for MR, it is the merging of real and virtual worlds to produce new environments that facilitate interaction between the physical and the digital.

A blockchain is a network of autonomously operating computers used to manage a distributed ledger. Due to the autonomy of blockchains, many parties can execute and register direct transactions without the intervention of a centralized authority (i.e. traditional centralized banking system). A blockchain is transparent and immutable, which means that once information is recorded, it cannot be changed. This decentralized nature facilitates independent acts and ensures anonymity, essentially enabling everyone to take part, connect, and contribute.

Metaverse initiatives should be developed as decentralized platforms to fit the web 3.0 framework (next-generation web hosting a decentralized ecosystem). Decentralization, enabled by blockchain technology, is a key concept to consider when designing metaverse applications. This is because it will allow for higher adoption and growth.

Ultimately, the fundamental purpose of the Metaverse and Web 3 is to provide a decentralized assistance for engaging experiences. This goal will foster new business prospects for the healthcare industry and elevate the way interactions are currently handled.

"

Web 3.0 represents the next iteration or phase of the evolution of the web and internet and potentially could be as disruptive and represent as big a paradigm shift as Web 2.0 did.

Web 3.0 is still developing but under construction at a rapid speed. Web 3.0 could be considered a rethink of Web 2.0, with decentralization as its foundation. It will potentially help users take control of their data from centralized corporations, which currently dominate most of the web that we use and interact with. Web 3.0 is a way for users to avoid comprising their privacy to access the internet, unlike today's scenario. It is the next phase of the web, which is built on top of crypto-economic networks and other technologies. A few examples of technologies that will enable this web 3.0 are blockchains, cryptocurrency, Initial Coin Offerings (ICOs), Non-fungible Tokens (NFTs) Edge computing, Decentralized Autonomous Organizations. (DAOs)
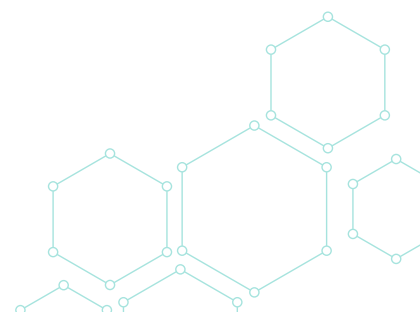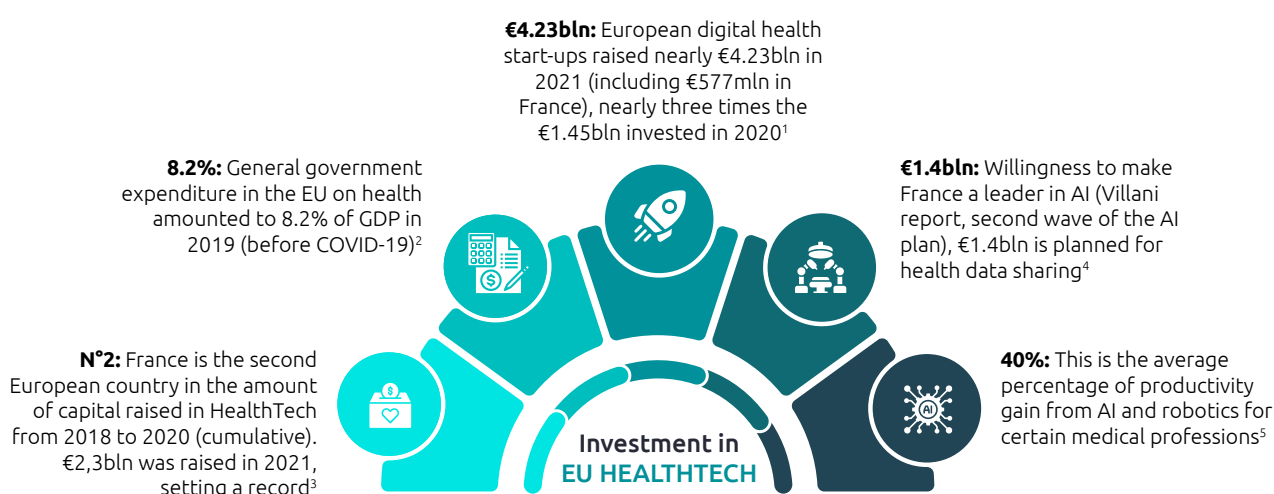
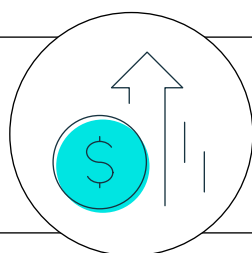*(source: Mater. Proc. 2022, 10(1), 8; https://doi.org/10.3390/materproc2022010008)*

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WHAT ARE THE LATEST TRENDS THE LIFE SCIENCES AND HEALTHCARE INDUSTRY IS FACING?

Investment in EU HEALTHTECH

€4.23bln: European digital health start-ups raised nearly €4.23bln in 2021 (including €577mln in France), nearly three times the €1.45bln invested in 2020[1]

8.2%: General government expenditure in the EU on health amounted to 8.2% of GDP in 2019 (before COVID-19)[2]

€1.4bln: Willingness to make France a leader in AI (Villani report, second wave of the AI plan), €1.4bln is planned for health data sharing[4]

N°2: France is the second European country in the amount of capital raised in HealthTech from 2018 to 2020 (cumulative). €2,3bln was raised in 2021, setting a record[3]

40%: This is the average percentage of productivity gain from AI and robotics for certain medical professions[5]

Investment in
EU HEALTHTECH

Investment in the METAVERSE (Global)

The metaverse in the **healthcare market** was valued at **USD 6.85 billion in 2021** and is projected to surpass around **USD 72.10 billion**

[1]https://www.karista.vc/stories/2022-european-active-digital-health-funds-mapping-by-karista#:~:text=European%20digital%20health%20start%2Dups,in%20the%20last%205%20years
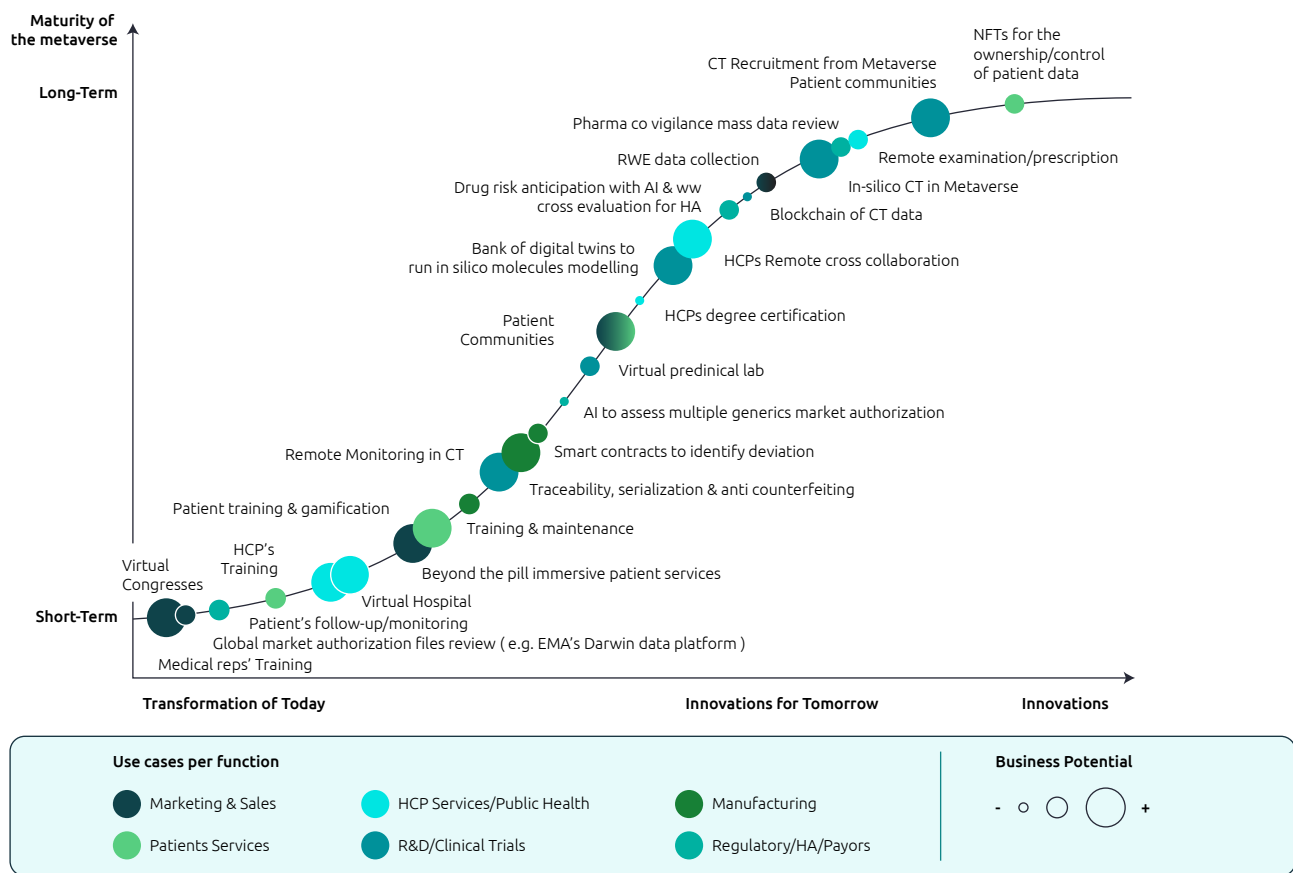
[2]https://www.oecd-ilibrary.org/sites/860615c9-en/index.html?itemId=/content/component/860615c9-en#:~:text=In%202019%2C%20it%20is%20estimated,line%20with%20overall%20economic%20growth

[3]https://solidarites-sante.gouv.fr/archives/archives-presse/archives-communiques-de-presse/article/lancement-operationnel-du-volet-numerique-du-segur-de-la-sante

[4]https://www.lequotidiendumedecin.fr/actus-medicales/esante/ce-que-propose-cedric-villani-sur-lintelligence-artificielle-en-sante

[5]https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7322190/

HOW CAN THE METAVERSE SUPPORT THE HEALTHCARE SECTOR TRANSFORMATION?

Figure 1: Healthcare potential use cases in the Metaverse (Source: interviews of experts at Capgemini Invent)

At Capgemini Invent, we can already observe numerous innovations supporting the transformation of the industry today, with some that possess great business potential. Notably, VR has already shown the tremendous potential it holds for the training of HCPs. This innovation could easily lead to an even bigger opportunity: remote cross collaboration within the Metaverse, allowing for international sharing of best-practices, enhancement of peer-to-peer collaboration, and groundbreaking discoveries. As the Metaverse will inevitably mature, we will witness advanced technical innovations that will tackle critical aspects the healthcare provision lacks. For instance, patient data would be safely collected thanks to NFTs and blockchain tech, as well as RWE CT data, which would streamline and emancipate the entire end-to-end pharma R&D unit. These are only a few examples of the plethora of opportunities the Metaverse promises to deliver, all soon to support the entire Healthcare value chain. This journey, underlined by a continuous and permanent progress, will create even more value than the destination itself.

Better serve patients

Immersive solutions can optimize patient interactions considerably by bringing about opportunities for patient-centric services. XR has its place in many therapies as a revolutionary technology, gentle and easy to use. It can be a therapeutic aid for a large number of pathologies or circumstances. In fact, there has already been a lot of uses so far:
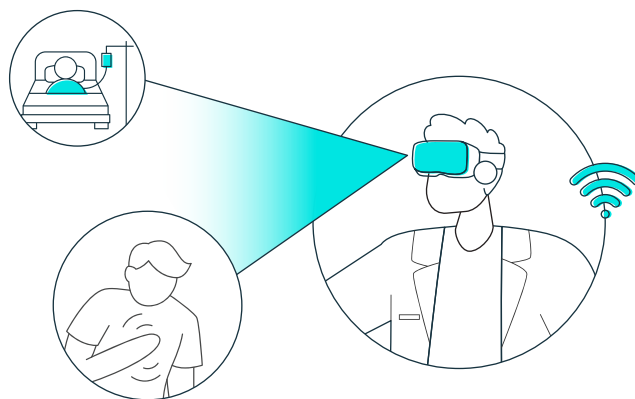
To aid stroke patients in their motor rehabilitation, VR systems that include important elements of neurobiology and motor learning have been developed.[1] For people with autism, a solution named XRHealth and VR/AR specialized in digital therapeutics treat autism related disorders, such as anxiety and stress to attention, memory, mobility and coordination, and frustration tolerance.[2]

In collaboration with Sanofi and Montpellier University Hospital, we at Capgemini have developed a VR solution to reduce pre-operative anxiety in children undergoing surgery. It allows them to discover the path they will take to the operating room, creating a sense of déjà vu, and explaining to them the different noises and materials they will encounter.[3]

Another great value created is that these technologies can bring immediate benefit to the weakest individuals and those in need of inclusion: a Japanese café, DAWN[4] (Diverse Avatar Working Network) hires human pilots with impairments to operate the robots, providing accessible hospitality jobs for those who are frequently bedridden and unable to leave their homes.

These are only a few examples of the vast usage of immersive experiences. With these uses, it can bring about tailored, personalized healthcare: practitioners can thus propose an experience according to the therapeutic indications and sensitivities of each patient.

In addition, the leveraging of patients' communities that already exist is paramount to the prosperity of such solutions. Indeed, connecting, engaging, and sharing experiences via such a medium will not just enhance patient adherence, but can also bring about a freeing sentiment from social impairments, alleviating overall burdens (both physical and mental)
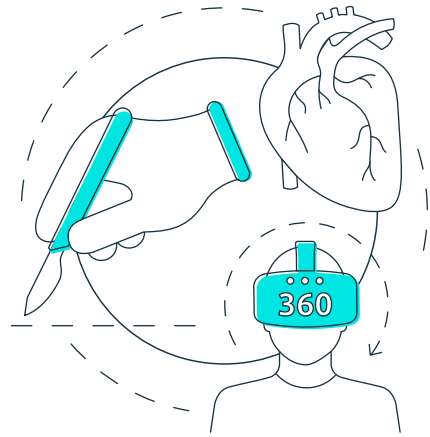
[1] https://www.youtube.com/watch?v=hOJ5TPC94SU

[2] https://www.xr.health/asd-therapy/

[3] https://www.capgemini.com/fr-fr/actualites/communiques-de-presse/une-solution-de-realite-virtuelle-pour-diminuer-lanxiete-preoperatoire-des-enfants-chu-montpellier/#

[4] https://dawn2021.orylab.com/en/

A new era for HCPs practices and interactions

Among the many duties of a healthcare professional lies the need to be trained and up to date with the most advanced scientific knowledge and practices. It is without a doubt a crucial, yet time-consuming part of daily care. The increased use of connected tools (favored by the Covid-19 pandemic) has accelerated the development of innovative solutions, such as immersive training. The combination of augmented and virtual reality in a Metaverse-like dimension could simultaneously enhance medical trainings and transmission to the greatest number of HCPs. In addition, it would improve quality of care, precision, and reduce the costs of purchasing equipment (e.g., virtual surgery training by the company ScienceSoft).[6] Several companies in France and abroad already developed immersive training projects. Osso VR, Simango, and Simforhealth provide training for health professionals, enabling them to develop new skills and procedures using virtual reality training fields.

In fact, VR has already shown the tremendous potential it holds for concrete cases. Indeed, the use of VR was key for a highly surgical procedure: twins who were joined at the head at birth have been successfully separated with the help of this technology.[8] By having the surgeons spend hours in virtual training prior to the surgery, the real procedure was facilitated and completed as a total success.

Another consequence of the Covid-19 pandemic is the wider use of remote communication. Although the various lockdowns have suppressed human contact, human interactions have developed through digital tools. It is therefore easy to imagine large scientific gatherings, such as congresses and symposiums, being held within a virtual platform. Even more so, they could be held within a dedicated Metaverse that would allow the connections created to last beyond the event, share medical knowledge, and even evolve towards real-time cross-collaboration formats between specialists from all over the world. In this sense, it is clear that completely digitalized care structures could be developed thanks to the progress of technology. This is the case, for example, of the CardioVerse's[9] digital twin hospital in Lausanne, where follow-up consultations in cardiology have taken place. Digital Therapeutics (DTx) could even be the advent of such structures that could be extended to other specialties and allow for large-scale optimization of patient care, reducing unnecessary associated ambulatory costs.

[6]https://www.scnsoft.com/virtual-reality/healthcare/vr-surgery

[8]https://www-bbc-com.cdn.ampproject.org/c/s/www.bbc.com/news/technology-62378452.amp

[9]https://pubmed.ncbi.nlm.nih.gov/35568263/

Digital twins to go beyond

As the Metaverse proposes benefits for patients and healthcare professionals by creating a deeper and more effective interaction amongst them, another trend is promising: the use of digital twins.

For R&D, Metaverse solutions can help create a bank of digital twins to run in silico molecules modelling; that way, physicians across the world could collaborate, leveraging cross-fertilization, as Nanome is currently developing.[10] Going even further, from twining organs and muscle groups, it would be possible to twin a whole body, revolutionizing drug research.

In the same vein, more futurist but highly valuable applications remain in the clinical trials area. Following the trend of decentralized clinical trials, Metaverse Clinical Trials could appear one day. Beside monitoring patients remotely to conduct a trial with IoT devices, we can completely imagine a time in which we run silico trials on human digital twins, recruiting patients, and

HCPs directly in the Metaverse. The Metaverse is a solution that has the potential to reach a wider population, expand field of possibilities, and accelerate clinical trials.

After examining their processes and operations, Siemens Healthineers[11] built a digital twin model for the radiology department of one of their clients. By minimizing lengthy wait times, efficiently managing emergency services, maximizing the use of lab and medical equipment, staffing needs, and managing device downtime, this simulation enhances the process and the patient experience.

[10]https://nanome.ai/

[11]https://www.siemens-healthineers.com/perspectives/humanizing-medtech
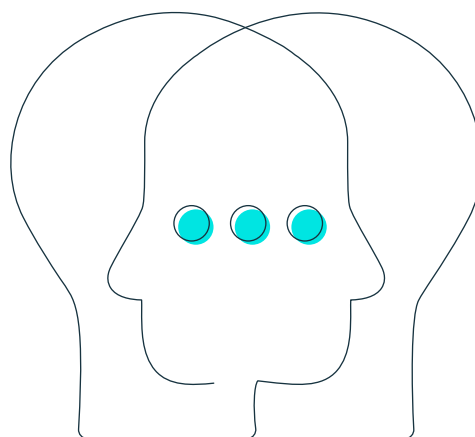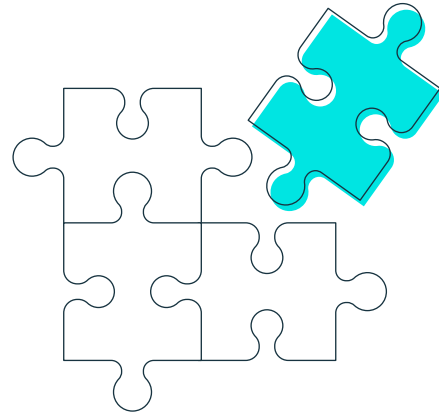
What challenges are we facing?

The Metaverse is evidently subject to a lot of technological disruptions (persistence, real-time interaction, interoperability…). These hurdles will need to be overcome before even beginning the manage industry-specific challenges. Another great challenge will be to have a standardized platform to be able to connect and interoperate efficiently. As of now, several companies are already implementing VR platforms: you can enter 14 different platforms, ranging from games, fashion, or social media purposes.[12] A lot more could emerge going forward, and a streamlining will be needed to ensure adoption and engagement from all parties involved.

Healthcare industries are commonly very restricted and subject to several regulations. Any testing in the Metaverse, even when synchronized with real-world testing, will surely have to be rock solid for regulatory bodies to allow any deployment on larger scales. The legal aspect of these series of testing would need to be robust as well. There is a need for even higher transparency and traceability of drug testing, whether in discovery or during clinical trials. This will be key in assuring trustworthiness and adoption in the development of Metaverse.

Additionally, in some countries, the recognition of XR treatment in relation to insurance will be a challenge. How major insurance companies will react will be critical to the definition of the legal framework for reimbursed care.

All opportunities mentioned in this PoV will bring about a surge of data (sometimes referred as data tsunami) and content. Despite being beneficial for the industry, the appropriate handling of so much information will surely be very demanding: the global acceleration of concerns regarding data privacy and data sharing will be a great challenge to overcome. While consumer data is a major concern for businesses, patent and intellectual property protection is also a key issue, which is why blockchain applications in the Metaverse would ensure data privacy and address these problems.

We have seen that the future is virtual. However, any virtual experience will require energy: the demand for this resource will rise even further in the upcoming years as all industries shift into this electrical way of life. More energy will be needed to store, analyze, and process data, as well as power all the servers. This will inevitably put immense pressure on the environment moving forward. A great challenge for the industry will be to incorporate the notion of sustainability by design early on.

Sustainable design can be defined as
"maximizing environmental, social, and economic benefits over a system's lifecycle, while minimizing associated social and environmental costs."

[12]https://geekflare.com/metaverse-platforms/

CONCLUSION

The Metaverse is paving the way for numerous opportunities: At Capgemini Invent, we already support our clients on several digital initiatives, ranging from decentralized clinical trials and solutions for remote events and congresses for HCPs, to VR solutions. The growing use of VR in medical education, the application of VR and AR in surgery, the use of gamification to connect hospital care givers and patients, interoperability, and other aspects that will enable the Metaverse are already playing significant roles in shaping the future landscape of healthcare.

A natural shift to the Metaverse ecosystem will come, since technologies are all converting to real-time delivery at scale. These technologies will bring about a myriad of opportunities: Meta-hospitals, patients' communities in the Metaverse, virtual pharmacies… and much more.

Healthcare organizations will need to gear up to not miss out on any opportunity, to optimize processes, improve HCPs practices, engage in better patient care, and essentially help build the prospect of healthcare in the Metaverse.

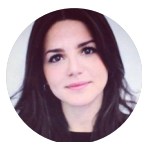# WRITERS:

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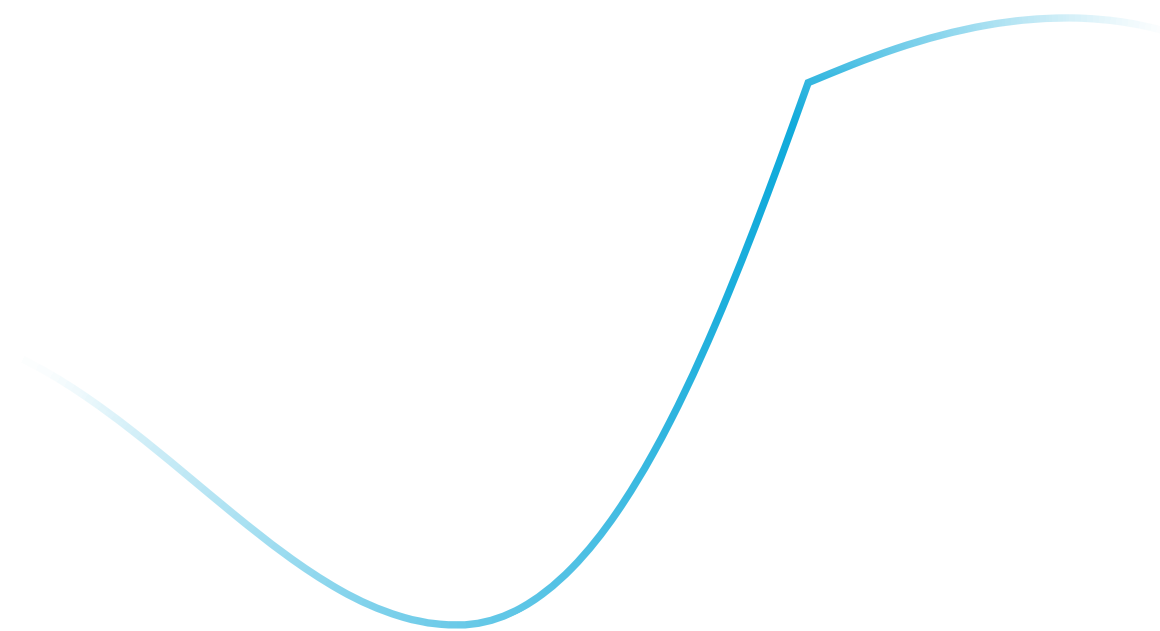
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