NEW INTERFACES, ZERO INTERFACES

REPLY

INDEX

EXECUTIVE SUMMARY

Ever since the great industrial development of the 1950s and 1960s, we have been living in a world of buttons, handles and knobs. Since the significant adoption of smartphones, touchscreen interaction has spread widely. Then Coronavirus arrived. During outbreaks, we found ourselves not only disinfecting knobs and handles but also being asked not to touch everyday objects, especially in public places. The pandemic has accelerated the trend of adopting new interfaces in both consumer and professional fields.

So which new interface technologies can we expect to see coming to prominence in this 'new normal'? To find out, we launched a Research project based on our Trend Sonar AI-based platform and analysed the main studies, scientific articles and patents published in the last two years, integrating them with market data and relevant experiences of Reply customers.

New building blocks for new experiences

Smartphones and their operating systems have been enabling completely new experiences for almost 15 years; now 5G, high-speed connectivity, and edge computing are set to provide a further boost for user interface technologies. We can expect to see new relevant technologies such as wearables and AR/VR headsets building their future on the foundations laid by mobile computing.

Right now, smartphones and vocal assistants are the most familiar 'building blocks' for both consumers and organisations. However, we are still constrained by having to carry our screens around with us and use our touch to control them. There is a growing awareness of the side effects of all-day 'screen time' and demands for more intuitive and natural interfaces.

Today, three kinds of displays are attracting investment from tech players and interest from designers: flexible screens, microdisplays and head-mounted displays. However, we think the real game-changer will be the wide introduction of technologies such as gloves and suits that allow users to have the sense of touch and interact with hardware, and haptic holograms that enable mid-air tactile feedback, superseding buttons and knobs.

Extended Reality is here: we are now seeing real use of applications that leverage augmented and virtual technologies to give users an interactive and immersive experience via Websites or devices. Several industries are increasingly implementing extended reality technologies through mobile apps or special headsets, e.g. fashion and retail, real estate, and live entertainment, whilst Extended Reality is also set to greatly enhance workplace collaboration.

The human body is becoming an interface too. Multimodal interfaces are set to offer several distinct ways of interacting with a system, e.g. speech, gesture or gaze, including the ability to recognise and interpret the movements of the human body to control a computer system, without direct physical contact. Brain-computer interface (BCI) technology is accelerating, with research initially focussing on helping patients with paralysis or brain-related chronic diseases, but increasingly moving towards more consumer-oriented applications.

New day-to-day experiences

Easy living and augmented home interfaces are converging towards ecosystems led by Big Tech players. Although voice control is currently the interface of choice for consumers in the home, gesture and tactile feedback might be on the rise next. More recent developments have focused on integrating user interfaces into one master system, increasing device-to-device communication and lessening the number of human-to-machine interactions required. These interfaces are beginning to monitor day-to-day activities to implicitly predict users' needs, rather than awaiting explicit instructions.

Smart speakers are still most commonly used for basic services; comparatively complex tasks like making a purchase are still rare. However, we believe that there

is a wealth of opportunities for voice interaction, including allowing FMCG brands to literally speak, in their own tone of voice, directly to consumers – a much more intimate connection than that offered by traditional touchpoints.

Wearables, wellness, and inclusivity are topics becoming steadily more relevant in the field of daily-use interfaces, and we believe wearable usage will explode in the next decade. Wearable interfaces, meanwhile, are moving from touch and app-based control to voice or gesture activation. Rings, glasses, and hearables can be connected to smart assistants to help with daily life and monitor behaviour. Combined with next-gen smartwatches, this kind of wearables could become the first full-alternative, independent, consumer-ecosystem to the smartphone. Companies are now focusing on the practicalities of wearables, developing smart textiles and fabrics that will enable interfaces to disappear from human sight and become part of daily clothes.

Coronavirus has increased the demand for distance healthcare, and the need to reduce touch-based interactions. We are seeing more innovations designed to reduce the need to touch public devices, maintain distance from others or improve daily life in isolation. Lifestyle wearables, smart fabrics, and micro-sensors are now being developed to be in tune with wearers' mood and health needs, and consumers are looking for interfaces that work the way they want and help them immerse themselves in the experience.

New experiences on the go

The mobility industry is experiencing seismic shifts at tremendous speed. Although the driving experience is still largely mechanical, the future of human-vehicle interaction means we will be able to distribute the burden of communication across senses – from tangible and tactile to touchless – spanning voice and gesture recognition as well as sight communication with the car.

Led by electric vehicles, new interfaces are not only making new models of cars and trucks safer but more customised, predictive and entertaining as well. Trends in this area are currently mostly concerned with driver safety and monitoring, using cameras and artificial intelligence, and voice systems will soon be ubiquitous in cars too. Moreover, in the near future, autonomous driving will enable greater development of entertainment and advertising within vehicles.

New shopping experiences

Big Tech players are strongly investing in retail-related interface development, helping shoppers enjoy the benefits of physical shopping – tactile, sensory and social – in digital virtual spaces.

The use of AI-based and conversational interfaces will improve customisations up to the single individual customer's needs. AI and digital technology allow for more personalisation for customers, from inspiration to tackling sizing and fitting issues in fashion retail in terms of body and style fit. This in turn will drive customer acquisition, retention, and loyalty to new heights.

Physical and digital shopping environments are increasingly being blended, allowing customers to profit from the best of both worlds and experience frictionless and comfortable shopping. Experiences include seamlessly connected mobile, wearables blending payment function and style, and hands-free voice or biometric technologies.

Conclusions

We need to focus on designing 'future-proof' ways of interacting. Key considerations for designers and organisations include:

▶ Going beyond the limitations of the HMI paradigm – it is too limited.
▶ The progressive advent of robots driven by AI will push us towards interactions in which humans have at most a supervisory role
▶ Humans' need for touch will remain a strategic lever for the future - haptic holograms will become common within a few years
▶ Interfaces will be invisibly interwoven into everyday life and an increasing amount of device-to-device communication will no longer involve users directly
▶ Lastly, we must focus on being climate-friendly. Once the Coronavirus emergency is over, we believe humanity must focus seriously on environmental issues. New, ethically designed, powerful interfaces will allow humanity to overcome another challenge.

From buttons to Coronavirus

> " Around 80% of people now consider public touchscreens to be unhygienic. Only around 50% think they will be likely to interact with public touchscreens in the future. Conversely, the survey revealed an appetite for gesture control, with over 80% thinking it was hygienic, and over 70% saying they were likely to interact using gesture control in the future. "

Saurabh Gupta, Ultraleap [Ultraleap, 2020]

From the 'button era' to the triumph of touch

Today's designers have a particular interest in video clips from what we could define as the 'button era', born with the great industrial development of the 1950s and 1960s. In these videos, which are part of the 'retrofuturism' cultural trend, we see extensive use of hardware and human-machine interaction (HMI) mainly happening via knobs and keys.

The future was imagined with the tools of the time: large companies, mainly from the United States, promoted the videos. Of course, it is easy to find aspects of those videos that make us smile today. Yet those designers 60 years ago were able to think of concepts such as digital banking, e-commerce and distance learning, despite not being able to imagine what today's customer experience would be like. That world of buttons, handles and knobs still partially exists nowadays. Even advanced products such as premium cars sometimes suffer from less-than-immediate interfaces. PC keyboards have become more elegant, lighter and perhaps virtualised, but at the office, many of us still type as we did 30 or 40 years ago on the first personal computers. At home, even NFC-enabled new models of appliances often still utilise buttons and knobs.

If we have managed to get out of the 'button era', at least partially, it is because touchscreen interaction has spread widely over the past decade. Credit for this, according to many, goes to the very first iPhone, which in 2007 introduced the touchscreen on a product that would soon become widely available and used. As happens today with many other user interfaces too, Apple designers had made extensive use of skeuomorphism to help the digital transition towards the full touchscreen experience.

The first YouTube icon on iOS was a retro television with knobs: today it would probably be incomprehensible to Gen-Z, who recognise the unmistakable red YouTube icon from the cradle. Some details of the interface were classic of the operating systems that we were used to interacting with: for example, the '3D' effect, the concept of a desk with objects on it. These concepts are still not completely surpassed by today's mobile or desktop operating systems.

Touch is not only used in the consumer sector but has also deeply entered the industrial world. For example, in recent years Reply teams realised mixed hardware/software solutions in which the user interface is often 'touch', designed to be used wearing PPE (e.g. gloves), and useful for summarising an enormous potential in a single screen, adapted to the context that the operator is experiencing at that moment, on the production line or a logistic plant. Then Coronavirus arrived.

Coronavirus has accelerated the trend of adopting new interfaces in both the consumer and professional fields

Suddenly, touching objects or even each other seemed the most forbidden thing in the world. During Coronavirus outbreaks, we found ourselves not only disinfecting knobs and handles but also being asked not to touch everyday objects, especially on forms of transport or in public places. Each of us has reacted differently, as people and as organisations.

Previously marginal interactions such as infrared fever measurement became the daily standard. For months, nobody wanted to pick up a paper menu in a restaurant; in some countries, it was formally prohibited. QR-codes, neglected for years, became the main means of accessing information (and often payments) in several contexts.
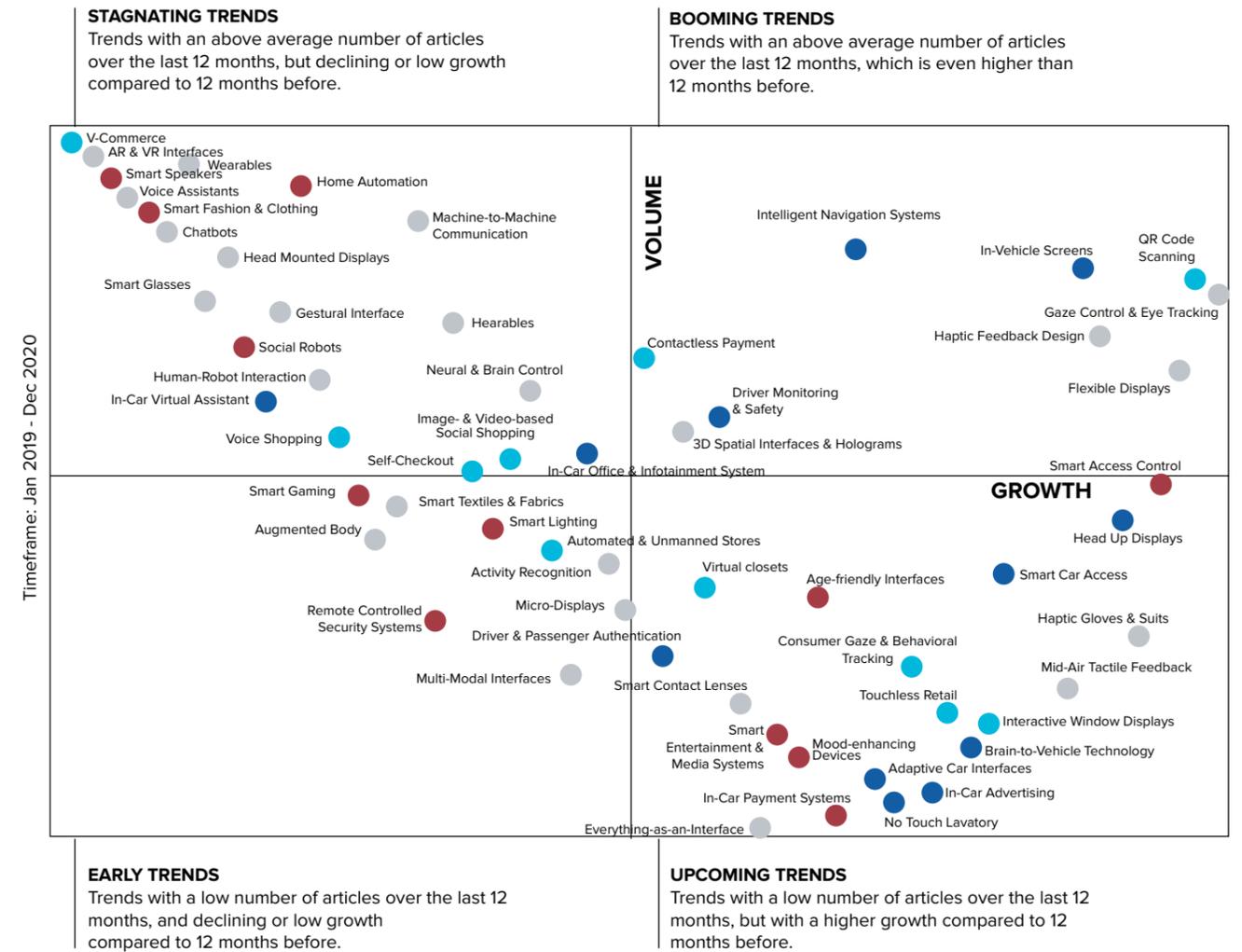
We have all begun to use videoconferencing extensively to interact, both personally and professionally. When we were looking for support, sometimes we did not find anyone on the other side, because the company was closed or the contact centres were overwhelmed by traffic. In many cases, automatic systems such as chatbots have helped us, via voice or text, to solve even complex problems.

To understand the state of the art of the interfaces in this 'new normal' and their development prospects, we launched a research project based on analysis of the main studies, scientific articles and patents published in the last two years, integrated with the experiences of Reply companies in supporting' their customers. Our artificial intelligence-based platform Reply Trend Sonar has plumbed millions of online sources to identify the most popular trends, placing them in different quadrants of a matrix that displays the growth and citation volume of each topic.

New Interfaces, Zero Interfaces
Trend Hype-Cycle

● BUILDING BLOCKS ● DAY-TO-DAY EXPERIENCES ● EXPERIENCES ON THE GO ● SHOPPING EXPERIENCES

STAGNATING TRENDS
Trends with an above average number of articles over the last 12 months, but declining or low growth compared to 12 months before.

BOOMING TRENDS
Trends with an above average number of articles over the last 12 months, which is even higher than 12 months before.

VOLUME

GROWTH

Timeframe: Jan 2019 - Dec 2020

V-Commerce
AR & VR Interfaces
Wearables
Smart Speakers
Voice Assistants
Home Automation
Smart Fashion & Clothing
Machine-to-Machine Communication
Chatbots
Head Mounted Displays
Smart Glasses
Gestural Interface
Hearables
Social Robots
Neural & Brain Control
Human-Robot Interaction
In-Car Virtual Assistant
Image- & Video-based Social Shopping
Voice Shopping
Self-Checkout
Smart Gaming
Smart Textiles & Fabrics
Augmented Body
Smart Lighting
Activity Recognition
Micro-Displays
Remote Controlled Security Systems
Driver & Passenger Authentication
Multi-Modal Interfaces
Smart Contact Lenses
Everything-as-an-Interface

Intelligent Navigation Systems
In-Vehicle Screens
QR Code Scanning
Gaze Control & Eye Tracking
Haptic Feedback Design
Contactless Payment
Flexible Displays
Driver Monitoring & Safety
3D Spatial Interfaces & Holograms
In-Car Office & Infotainment System
Smart Access Control
Automated & Unmanned Stores
Head Up Displays
Virtual closets
Smart Car Access
Age-friendly Interfaces
Haptic Gloves & Suits
Consumer Gaze & Behavioral Tracking
Mid-Air Tactile Feedback
Touchless Retail
Interactive Window Displays
Smart Entertainment & Media Systems
Mood-enhancing Devices
Brain-to-Vehicle Technology
Adaptive Car Interfaces
In-Car Payment Systems
In-Car Advertising
No Touch Lavatory

EARLY TRENDS
Trends with a low number of articles over the last 12 months, and declining or low growth compared to 12 months before.

UPCOMING TRENDS
Trends with a low number of articles over the last 12 months, but with a higher growth compared to 12 months before.

The trends and technologies analysed were then collected in the four study areas of this Research:
▶ The 'building blocks' which are allowing and will increasingly allow designers to imagine effective customer experiences
▶ The interfaces we use at home and in daily life, grouped in 'Day-to-day experiences'
▶ The most interesting innovations in the field of mobility, with a specific eye on the automotive sector, included in the 'Experiences on the go' cluster
▶ The most interesting trends in retail, e-commerce and marketing, which enable new 'Shopping experiences'.

We will dedicate a chapter of this research to each of these areas. For each of them, we will share relevant experiences of Reply companies, collected by interviewing customer spokespersons and Reply Partners.
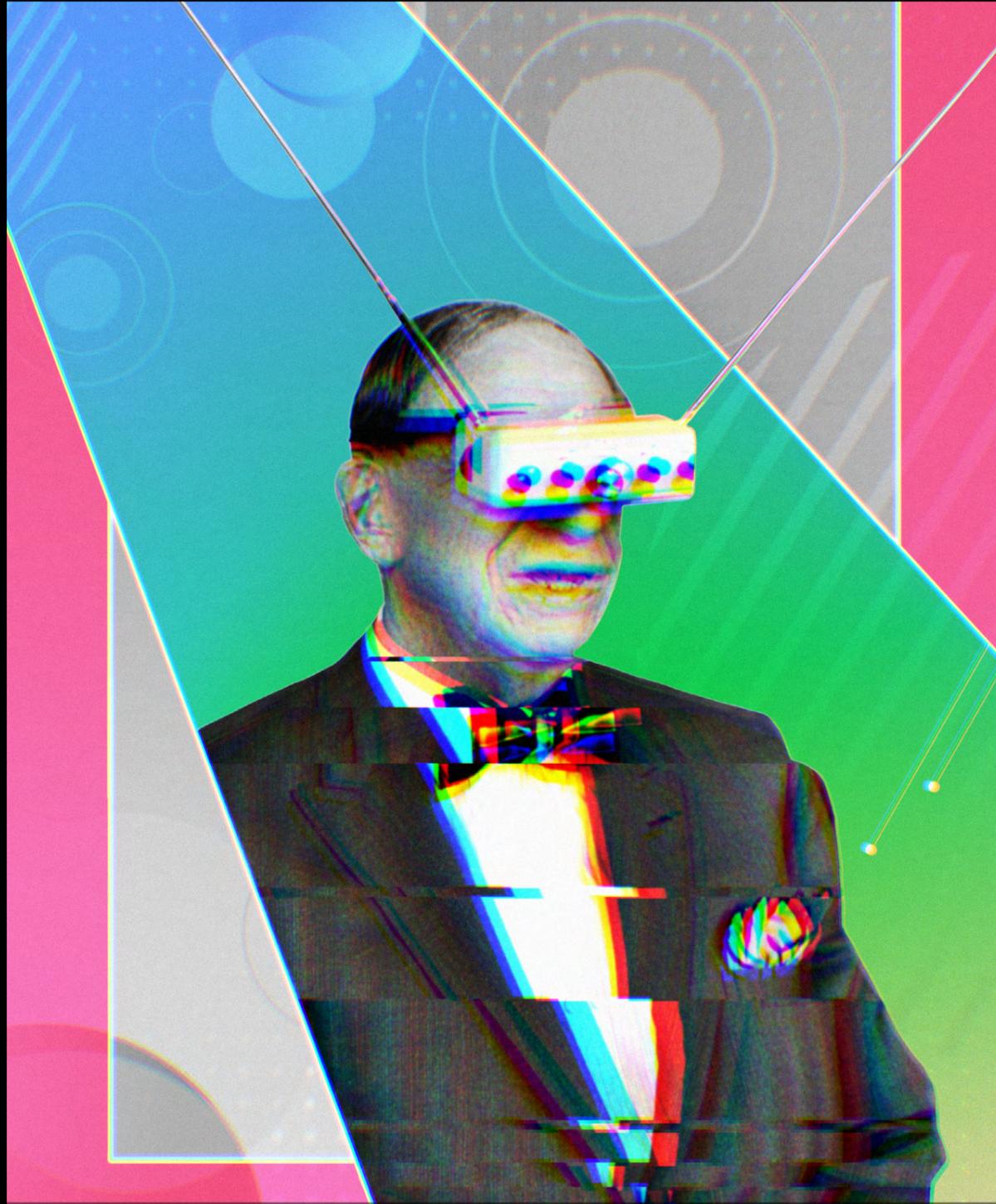
New building blocks for new experiences

" By 2023, 50% of all major business applications will include at least one or more types of no-touch experience, such as voice, augmented reality or virtual reality. "

Saikat Ray, Jim Scheibmeir, Brent Stewart, Gartner
[Gartner, 2020-1]

Mobile devices are still the main enablers for the digital evolution of organisations and customer experiences

We already have an abundance of hardware: in our homes, in our offices, on us. Every time we can imagine an innovative function, we have billions of smartphones that can support it: a possibility never offered before to any designer in the history of humanity. Smartphones and their operating systems have been enabling completely new experiences for almost 15 years; now 5G and high-speed connectivity, as well as edge computing, will provide a further boost for UI technologies like Virtual and Augmented Reality.

We can expect to see a growing development of solutions based on these building blocks. Digitalisation and the smartphone revolution have led to more compact, low-cost processing power, in addition to cheaper but more sophisticated sensors and cameras and ubiquitous wireless connectivity. New relevant technologies such as wearables, smart speakers and AR/VR headsets are building their future on the foundations laid by mobile computing.

One of the most relevant advantages of smartphones and tablets is their wide use for both personal and professional contexts. Adopting mobile solutions enables workforces to be more productive; designing interfaces for specialised users enables them to bring the power of the cloud to the workplace. Then, the global pandemic has clearly shown that 'the workplace' can be everywhere, thanks to mobile devices and mobile connectivity.

Right now, smartphones and vocal assistants are the most familiar 'building blocks' for both consumers and organisations. However, in the mid-term, their use as 'platforms' will change: smartphones will be hardware orchestrators thanks to their connectivity capacity, while vocal assistants will be pure cloud-based/software 'platforms'. We will design use cases on these 'virtual' voice-based platforms, even though right now most of them 'live' inside the hardware of a smart speaker.

From touchscreens to haptic technology

While mobile computing has redefined the way we interact with computers and the digital sphere, we are still constrained by having to carry our screens around with us and using our touch to control them where voice features are not supported or not comfortable. Furthermore, people are increasingly noticing the side effects of all-day 'screen time' and being 'always on' and are thus demanding more intuitive and natural interfaces.

Our research highlighted three kinds of displays that are attracting investment from tech players and interest from designers:

► **Flexible screens**
Electronic visual displays made from flexible plastic film that lowers the risk of breakages and can be folded

► **Microdisplays**
Small-scale displays that provide high resolution while using lower amounts of energy and which will increasingly be included in smaller digital gear

► **Head-mounted displays**
They are small pieces of display technology integrated into glasses or mounted on a helmet or hat.

These screens will probably represent next waves of development on the personal hardware arena, especially in mobility. However, we think that the real game-changer will be the wide introduction of haptic and predictive technologies. An example is the Predictive Touch technology, developed by the University of Cambridge and Jaguar Land Rover, useful for avoiding dangerous distractions for drivers: the touchless screen reduces input errors and lets them focus on the road.

Haptic gloves and suits are allowing users to experiment with the use of haptic technology to interact with existing personal hardware. Gaming is already one of the main markets for this kind of enabling technology. In the medium term, mid-air tactile feedback — a type of hologram that makes use of sound waves and allows users to have the sense of touch and interact with it — will become a relevant way of interacting with interfaces. A growing ecosystem of haptic technology is already arising, superseding buttons and knobs for enhanced and augmented consumer experiences spanning more senses and introducing the so-called 'tangible Web'.

Extended Reality is here

After at least two decades of announcements and rising expectations, the market is now assisting real use of applications that leverage augmented and virtual technologies to give users an interactive and immersive experience via websites or devices. Moreover, major tech players, including main cloud providers, are supporting 3D spatial interfaces that allow human-machine interaction by enabling computers to track a user's physical movements in a 3D space.

Virtual reality, augmented reality and haptic feedback have struggled to gain mainstream adoption due to heavy equipment, clunky interfaces/technologies or for being applicable to super-specific uses only. This is beginning to change by enabling the use of many different types of interfaces within one wearable, creating a very immersive experience.

Today, these wearables are mostly used within the gaming sector but they are moving into training spaces to simulate stressful situations as well as medical use cases such as surgery. Several industries are increasingly implementing extended reality technologies through mobile apps or special headsets.

► **Fashion and retail**
Offsite smart shopping through AR mobile apps enabling rendering of products directly at home, before purchase

► **Real estate**
Explore and visit apartments and other estates remotely thanks to virtual home tours and VR staging services

► **Live entertainment**
Virtual events attendance: sports events, movie premieres, concerts and festivals in VR or AR with integrated VR social networks

► **Travel and tourism**
AR guided city or museum tours, VR experiences that let one 'visit' the travel destination, hotel, etc.: this industry is experiencing a necessary evolution driven by limitations to travel due to Coronavirus

► **Education**
AR and VR for storytelling or to enhance history or culture classes, or to show complex physical concepts, amongst others

► **Manufacturing and logistics**
AR in the context of smart factories emerges, e.g. smart glasses for line/warehouse workers to scan items, receive information or for quality control, amongst many other use cases

Extended Reality is set to greatly enhance workplace collaboration, offering teams much better ways of meeting and sharing ideas and thoughts in the virtual world. In a context strongly conditioned by Coronavirus, this will further remove the distance factor and eventually boost new ways of working and business structures.

In this new context, new products and services will offer completely novel solutions to tell and visualise stories and information. For example, immersive analytics will allow us to create better visualisations of data to better understand and present it to others, whereas new immersive graphic design will spark reality-changing, highly interactive digital illustrations and worlds.

> " Doctors have shown great enthusiasm for the use of mixed reality to investigate complex issues, defining this learning methodology more effective than the classic methods used so far in medical information events "

Carlotta Gaggini, Product Manager Tecentriq, Cancer Immunotherapy, Roche

An example of the real use of Mixed Reality is research-led healthcare company Roche's presentation of oncological therapies through holograms. Infinity Reply and McCann Health designed and realised a 3D system based on Microsoft HoloLens, dedicated to healthcare professionals, who are able to 'touch' the mechanism of action of immunotherapy drugs. Starting from a 3D model of a patient torso, it is possible to reproduce a model obtained from real CT scans carried out during different evolutionary phases of the disease, thus allowing doctors to view them in progressive sequence to verify the evolution throughout the course of treatment.

The human body is becoming an interface too

People are looking for products and services that reduce friction, save time and ultimately lead to convenience and comfort gains. Technology is also increasingly sought after as a tool to augment and even enhance a person's abilities and senses. Both of these growing needs demand new intelligent and immersive experiences. The information on the surrounding environment that devices can collect goes far beyond what we see with our senses. Computer vision and widespread sensors will provide us with user experiences that today we can only imagine, to guide technological implementations. We are moving to the so-called 'Everything-as-an-Interface' paradigm: sensors and microprocessors embedding computational capability into everyday objects within a network of connected devices.

Multimodal interfaces will provide several distinct ways of interacting with a system, e.g. speech, gesture or gaze for input and output of data. A relevant part of this family will be gestural interfaces: the ability to recognise and interpret the movements of the human body to interact with and control a computer system without direct physical contact. Gaze control and eye tracking will allow people to control, communicate and interact with machines based on eye movement patterns, fixations and pupil reaction.

Brain-computer interface (BCI) technology is accelerating, with the focus still on a medical and scientific level but within increasing diffusion into other areas, blurring the lines of computing and biology. The story of Ian Burkhart, who regained motion and a sense of touch after an accident thanks to a microchip from NeuroLife

implanted in his brain, inspired many politicians and journalists to investigate further the realm of Brain-Machine Interfaces (BMI) and full immersion technologies. Various startups, big players and national research agencies are already conducting research and releasing prototypes of BMI such as neural control headsets and brain implants. So far, medical applications dominate, with many researchers aiming to help patients with paralysis or brain-related chronic diseases. However, with the entry of bigger tech players, the field itself is set to steadily move towards more consumer-oriented applications.

Among the tech players attracting more visibility, these are worth mentioning:

▶ Kernel, a team of neuroscientists and engineers focused on improving and expanding human cognition, is working on exploring how to build and implant chips into skulls of those with some form of neurological disease and dysfunction to reprogram their neural networks and restore some of their lost abilities.

▶ AlterEgo lets users communicate with a device designed by MIT Media Lab, useful for executing tasks on a laptop. Scientists estimate the device correctly understands the wearer up to 92% of the time. The interface is now being used in healthcare, to help patients with ALS.

▶ Nuro developed a brain-computer interface using neurological signals, making it possible for paralysed and aphasic people to express themselves. It consists of a headband and sensor that monitors signals from the brain and eyes and allows the wearer to control a tablet.
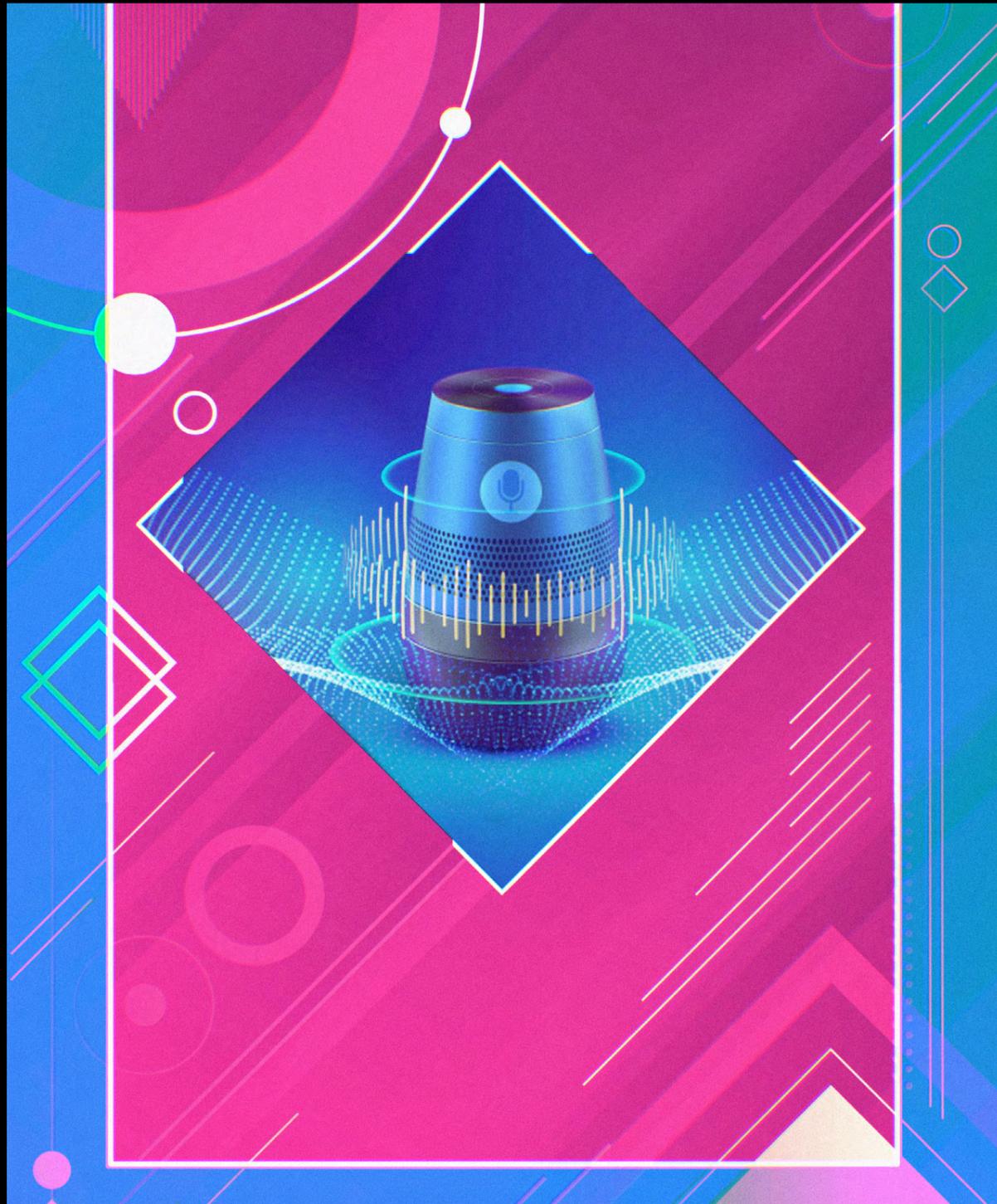
New day-to-day experiences

"Among surveyed US online adult respondents who currently use smart speakers, the most common task is checking the weather, at 65% of smart-speaker users, and the least common, ordering or reordering products, is at 5% of smart-speaker users. Complex tasks and interactions with brands, such as online searches, checking bills, making payments or ordering items, are still relatively rare, and they won't get easier anytime soon.

Frank Gillet, Forrester [Gillet, 2020]

Easy living and augmented home interfaces are converging towards ecosystems led by Big Tech players

User interfaces within the home, entertainment and wearables have conventionally focused on creating more intuitive and therefore more efficient ways to interact with technology. The increasing diffusion of convenient technologies and solutions like voice assistants, seamlessly connecting services natively and intuitively, is increasing consumer acceptance and providing a way for a sophisticated user interface to become part of everyday life. Whereas voice control is cementing as an interface of choice for consumers in the home, gesture and tactile feedback might be on the rise next.

More recent developments have focused on integrating technologies into one master system, lessening the number of interactions between human and machine, but increasing device-to-device communication. Interfaces are becoming invisibly embedded across all devices within the home, such as TVs and security, and will soon move to be integrated further afield with one seamless interaction from home to car to retail to office. These interfaces are beginning to monitor day-to-day activities to implicitly predict users' needs rather than awaiting explicit instructions.

Easy living and augmented home interfaces
Interest registered from Reply Trend Sonar, per volume of mentions
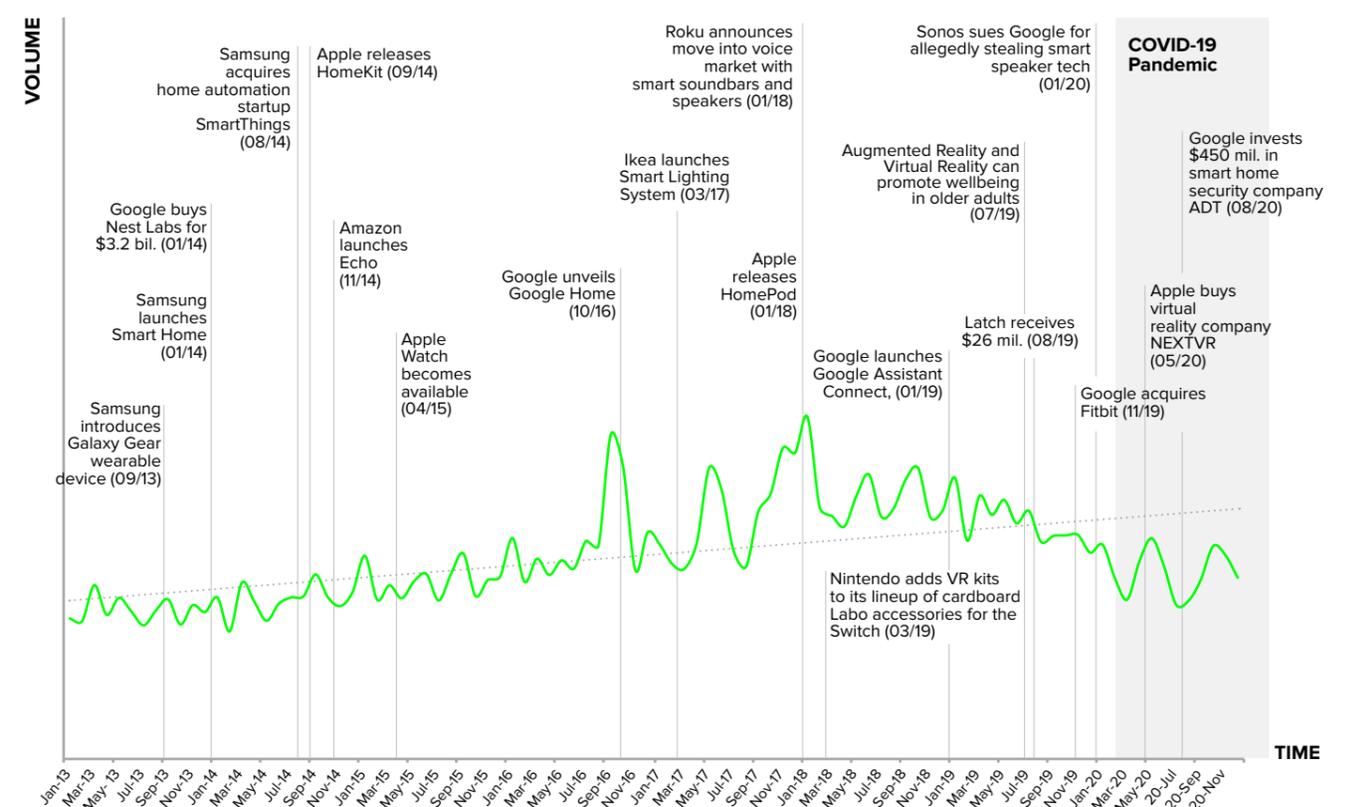
After a stable, upwards trend for home and living interfaces throughout 2019, interest slowed from the beginning of the global pandemic as expert debate outside of pandemic topics subsided. Coronavirus, however, pushed telehealth, remote wellness, and medical interfaces within the home. Heavy competition between big players, compatibility agreements between brands and expansions into new markets have all driven significant interest for augmented home devices and systems.

Trending players are expanding their portfolio into different new areas: wearables for Sensoria, smart grids and pandemic solutions for Honeywell and blood pressure tracking wearables for Valencell. In China, Lumi United Technology received $100M to launch their Aqara brand, which is compatible with Apple Homekit, Google Assistant and Amazon Alexa, to the USA and Europe.

Source: [Voicebot.ai, 2019]

Smart speakers use case frequency in USA, 2019 (cumulate %)

Legend: ■ Ever tried ■ Monthly ■ Daily

Big Tech ecosystems are led by voice interfaces

Google, Amazon and Apple reign supreme within easy living interfaces due to their attention to user experience, on top of each player's desire to create a mono-brand total home ecosystem. Whether consumers are willing to stay loyal to one brand of devices within their home remains to be seen, but will become clear with the wider adoption of Amazon ecosystem, Apple HomeKit, Google Assistant and Nest products.

Even if smart speaker sales are growing throughout the world, daily use outside of basic use cases is still very limited, even in the worldwide-leader market, the USA. However, we believe that there is a wealth of opportunities for voice interaction. Among other benefits for both companies and users, there is the possibility of creating a direct channel of communication. This is disruptive for FMCG organisations that can literally speak, with their tone of voice, to final customers without intermediaries.

Well-designed voice interfaces offer businesses the opportunity to give their brands not only a voice but also a personality, with a much more intimate and emotional connection to customers compared to traditional touchpoints. Hence, as adoption rates for voice assistants grow, brands are increasingly looking into this new platform to launch innovative marketing campaigns or even their own branded smart assistants to boost customer engagement and drive new touchpoints.

" Those who study and work in marketing have always sought direct contact with their consumers as much as possible: all systems that facilitate a relationship of this type are fundamental. We want to explore the full potential of our Alexa skill and further refine it. The evolution of digital tools is so fast that the first goal for a company is to know them, understand them and understand how to best integrate them within its strategies. **"**

Emidio Mansi, Global Marketing Director Pasta Garofalo

A case of creative use of Amazon Alexa skills comes from Pasta Garofalo, a well-known pasta brand in Italy. Thanks to Xister Reply, they were able to launch a vocal assistant expert on pasta recipes and secrets about pasta, using a custom voice with a Neapolitan accent, in line with the brand's roots. The Alexa skill was
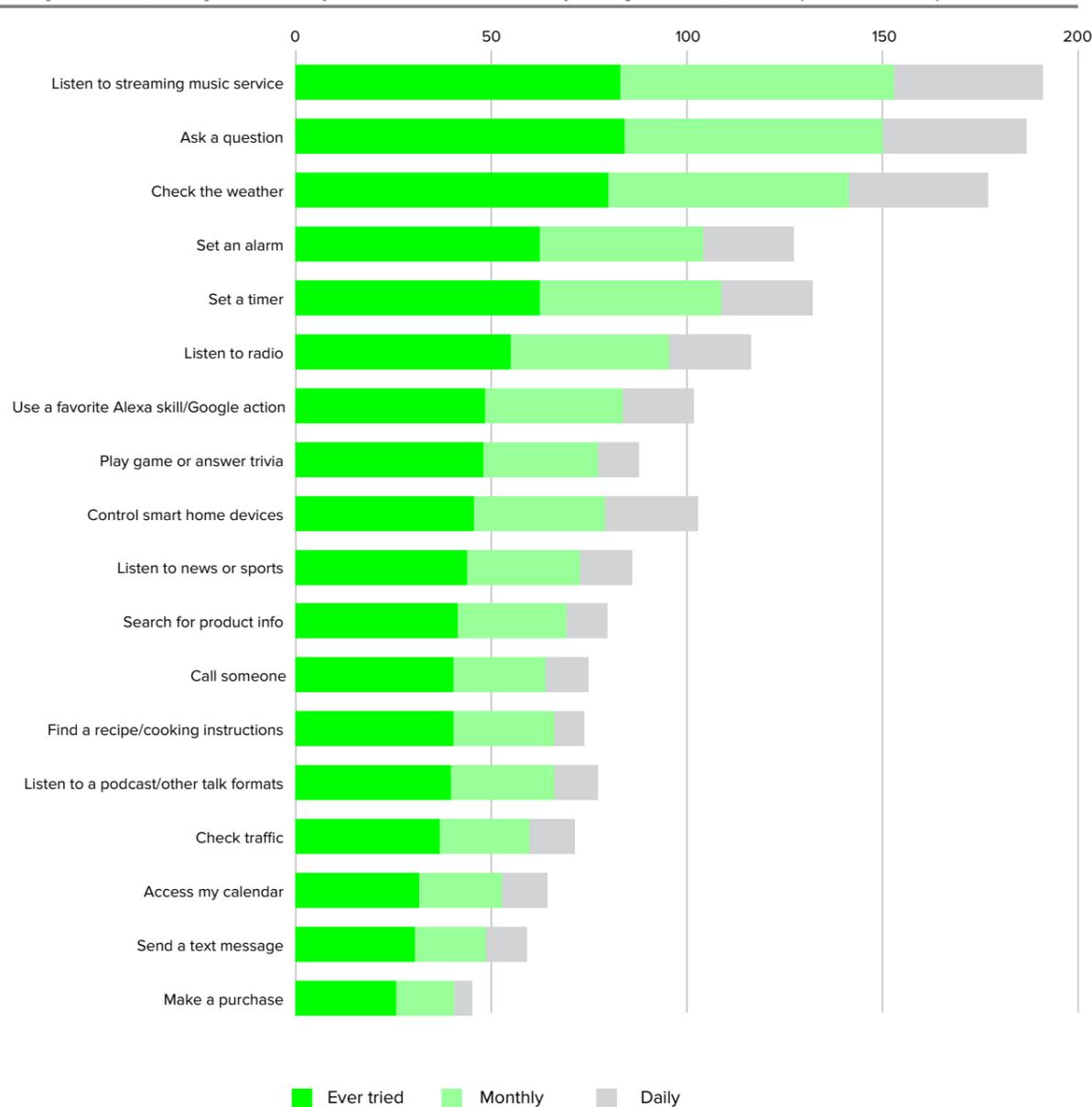
promoted through the Corriere Della Sera's food e-magazine, reaching a wide audience of interested users.

Among recent developments in the home assistant area, Bosch and Apple have joined forces to create compatibility between Bosch smart products and accessories with the Apple Home Kit, allowing total control via the Siri voice assistant or the Apple Home app. Another example is Google House Mouse, a physical device that can be used to control different devices in the house. The project is still in development but offers an alternative to those not comfortable or able to speak to their home.

The next evolution in home interfaces allows users to control all their connected devices via one overarching manufacturer-independent control interface. Moving away from singular devices that control one element of the connected home, these systems communicate directly with other smart devices, simplifying the experience for the users. These systems can control lighting, entertainment, security and temperature through invisible and embedded devices. The next step will be for these systems to pre-empt the user's behaviour, not only within the home.

Wearables, wellness and inclusivity are becoming more relevant topics for daily-use interfaces

Voice is a powerful building block for new experiences in daily life, besides hardware smart assistants. Wearable interfaces, for example, are moving from touch and app-based control to voice or gesture activation. Besides smartwatches, wearables now include rings, glasses and hearables connected to smart assistants to help with daily life and monitoring behaviour.

We believe that wearable usage will explode in the next decade, pushed by miniaturisation of processors and connection modules. Smart earbuds, for example, are evidently the first step towards a mature hearables market: born as accessories for smartphones, they are evolving as independent gear, mainly vocal-driven. Combined with next-gen smartwatches, they could become the first full-alternative, independent, consumer-ecosystem to the smartphone.

Companies are now focusing on the practicalities of these types of wearables, ensuring that they are suitable for all-day wear. Among the most innovative players, Sentien Audio has created the world's first all-day hearable, an open-ear audio headset conducting sound through the cheekbone to the inner ear. The device can be controlled by voice as well as via the Sentien Audio app.

If all these technologies, in some way, expand the actual paradigms of personal computing, we think that the area of smart textiles and fabrics could gain relevant attention from investors coming from different industries. With shrinking size of sensors and processing power, wearable technology is on the way to augmenting people physically as well as cognitively, also tapping into wearable biotech.

These kinds of materials have digital and technological components embedded into them, allowing garments to be used for different purposes and to become a 'second skin' for both input and output of information from/to cloud/edge computing platforms. It is another case of interfaces disappearing from human sight, becoming part of daily clothes.

Looking at the impacts of Coronavirus on daily-used interfaces, we can see two major impacts: on one side, a broader demand for distance healthcare; on the other, the mandatory need to decrease touch-based interfaces. Many recently announced innovations within fashion are solutions to help protect the wearer from viruses and bacteria by reducing the need to touch public devices, maintain distance from others or improve daily life in isolation.

As many of these innovations already existed before Coronavirus, we can expect to see more advances in this space, particularly for use cases where consumers are less in control of surfaces, such as elevators and shared transport. In this new context, lifestyle wearables, smart fabrics and micro-sensors are now moving to be in tune with wearers' mood and health needs, in ways which are more natural and accessible. This includes decreasing stress and increasing focus, particularly important for remote work, aiming for the reduction of health-related issues, such as cognitive decline and viruses.

Wearable devices that track the user's vital health signs such as heartbeat, breathing and electro-dermal activity, and respond to help reduce stress and relax the wearer, are becoming more popular. These devices react via a vibration, elevating heart rate or sending reminders for the wearer to take a walk or text a friend. Interfaces can also help to promote focus, which is useful within remote working situations and in busy or noisy offices. These interfaces are expected to move from external pulses to sending relaxing pulses directly to brain areas responsible for mood improvement.

As Reply, we give particular attention to the so-called accessible interfaces, to devices and equipment that are designed for users who might struggle with standard interfaces, which are often designed with just one type of user in mind. We believe in inclusive design, as it ensures that the latest technology is accessible to everyone from different backgrounds and, eventually, even those with personal limitations. Even big players are working hard on inclusive interfaces for daily use. Project Euphonia by Google, for example, aims to improve speech recognition products for those with impaired speech. Initially working with ALS patients, the project hopes to improve Google Assistant.

Video entertainment, predictions, and social robots are the most interesting development areas

Smart entertainment and media systems (e.g. smart TVs or systems that recognise and react to users' hand movements such as playing videos with the swipe of a hand) and smart speakers are the most popular smart devices in the home context. If sales of the former devices are often driven by the evolution of decades-long habits and by new technological waves (e.g. adoption of DVB-T2, 4K resolution) more than from new interfaces, the latter represents a relatively new market, becoming more popular thanks to their role of pivots of home ecosystems.

More than ever, consumers are looking for interfaces that work the way they want and help them immerse themselves in the experience. Integrating touchless interfaces within a typical screen setup makes this easy. These interfaces can be used to seamlessly bring entertainment from outside into their houses, from home cinema setups, equipped with lighting and haptic feedback to live-stream VR technology to make the user feel like they are at the event.

Touchless displays can also be used to aid remote working, removing the need for specialised equipment and aiding conference calls. The Cinera Edge headset is an example of a very immersive cinema experience wearable that includes a 66° widescreen and surround sound using Dolby Digital headphones.

Current innovations at home focus on removing the interaction burden from the user and increasing the capability of the device to communicate with each other, analyse situations and only interact with the user when necessary. Interfaces are beginning to predict user behaviour, reducing the need to actively interact with smart devices. This is extending past the home into the car and the workplace, providing personalised settings to suit each user depending on the environmental information around them.

Social robots and smart interfaces are becoming more intuitive and natural in their interactions with humans. Voice assistants are expected to become more like social robots and vice versa, giving the assistants 'eyes' to explore and interact with the world around them. Humans are also becoming more receptive to social robots as they become more natural and users understand the benefits of these companions via affective computing and emotion AI. Robots' voice recognition is also set to become more natural, with work underway to process more natural sentence structures, with wake words placed anywhere within the sentence rather than at the beginning of the command.

Examples of social robots include:
- Omron Automation's Forpheus, an emotion-reading robot able to interpret body language and then generate messages of advice and encouragement
- Samsung's Ballie, a 'life companion' that rolls around the home to help support with various household tasks. The robot responds to voice commands and has an in-built camera to recognise and reply to users.
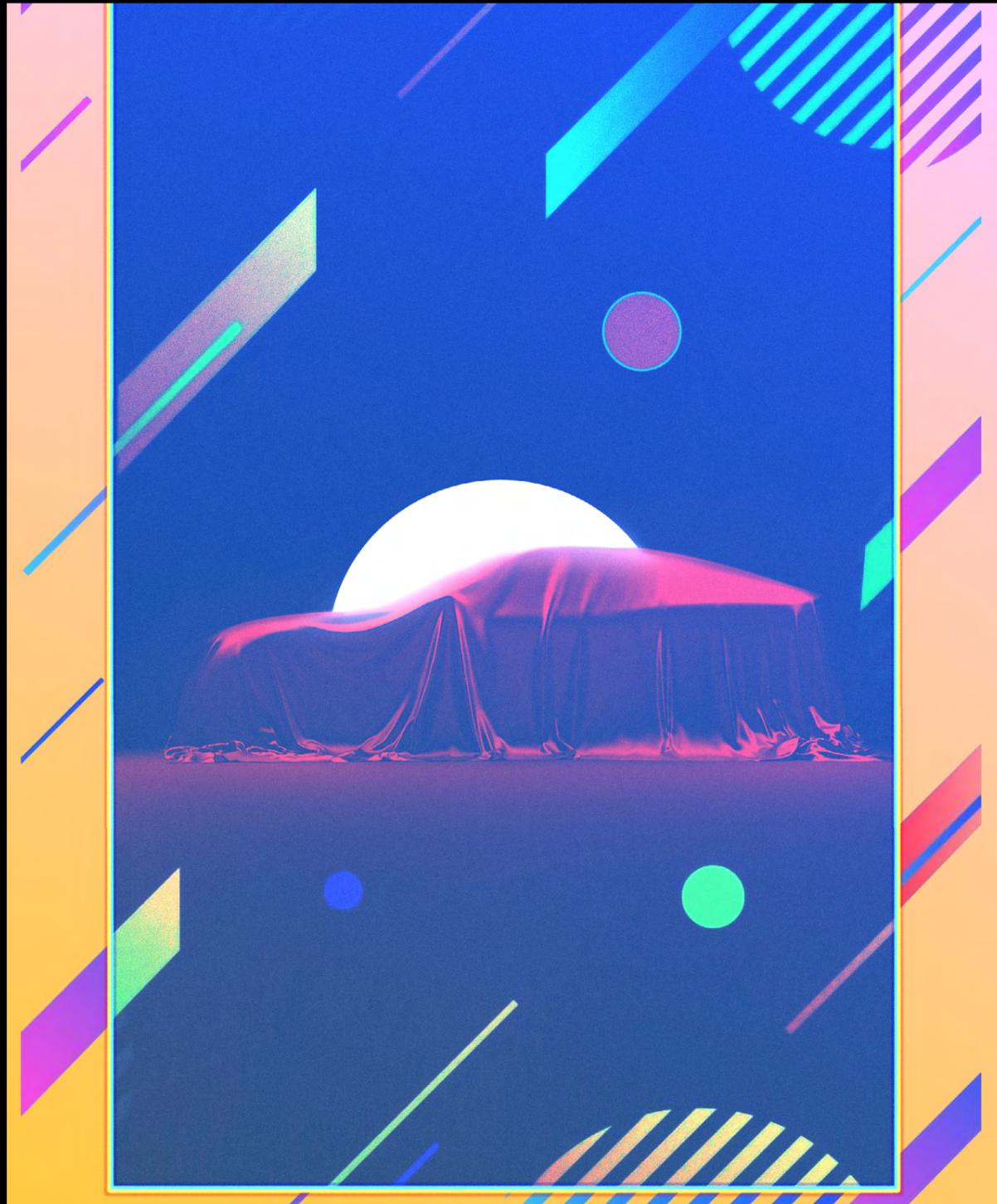
New experiences on the go

> " Today, no automaker operates a truly global, scalable connectivity platform. The reality is that automakers must maintain heterogeneous software versions of countless infotainment variants and generations. An exciting, fully automated experience – where needs are recognised early on and personalised and operated via an engaging and innovative Human Machine Interface (HMI) – would be transformative for the customer. "

Jan Burgard, Berylls Strategy Advisors [Burgard, 2020]

The mobility industry is experiencing seismic shifts at tremendous speed, driven by tech giants and new players

The driving experience for consumers and professionals is still largely mechanical, using physical tactility to shift gears, steer and adjust controls. The future of human-vehicle interaction means distributing the burden of communication across senses – from tangible and tactile to touchless – spanning voice and gesture recognition as well as sight communication with the car.

As electric vehicles have started entering the mainstream market, consumers are becoming more aware and open to driving experiences which adapt to their needs; from starting the ignition with a button, to 'revving' the engine with the voice. By enabling new interfaces in the vehicles, the experience of new models of cars and trucks becomes not only safer but more customised, predictive and entertaining as well.

In-vehicle and automotive user interfaces
Interest registered from Reply Trend Sonar, per volume of mentions
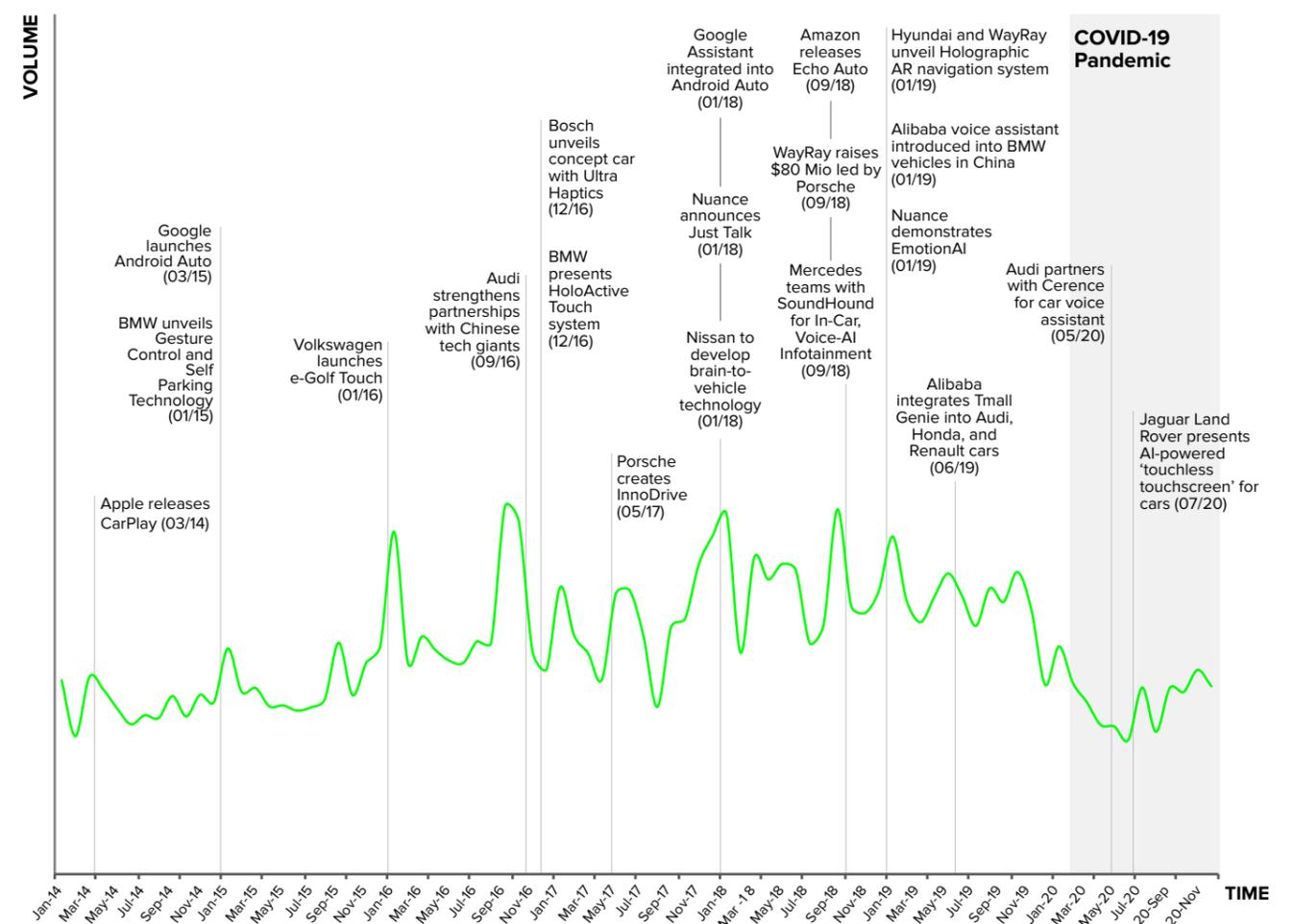
Trends related to next-generation user interfaces within vehicles on the way towards an autonomous future are highly concerned with driver safety and monitoring — bringing cameras and artificial intelligence into the vehicles. Smart authentication of drivers allows for more convenience as well as personalisation of services, e.g. adaptive car interior. Display technology, especially head-up displays and monitors, are also taking a relevant stage in the evolution of vehicle cabins and user interface design concepts.

As connectivity and tech evolution are increasingly stretching the concept of vehicles towards being connected and smart devices rather than a means of transport only, the future of in-vehicle UX is a decisive quest. Human-vehicle interaction is moving away from buttons and knobs towards more intuitive control via digital interfaces incorporating voice control, touch-sensitive surfaces and displays, interior-facing cameras, sensors, gesture recognition and haptic feedback.

Among leading players, Reply Trend Sonar highlighted the popularity of:
▶ Ultraleap, developing mid-air haptic gesture-controlled UI for cars
▶ Nippon Seiki and Gentex showing off automotive iris biometrics at CES
▶ BMW Group, investing over €30 billion for new technologies, including an HMI portfolio
▶ Mitsubishi, introducing a new speech recognition technology for noisy environments
▶ Tesla, putting a heavy focus on infotainment services, like 'Caraoke' or 'Tesla Arcade'.

Big Tech's ecosystems are involving cars as part of their everywhere/every time service model

Automotive interfaces are moving towards more integrated and multi-OS environments, allowing for a free flow of information between systems and embedding different input technologies. Enabled by cameras, computer vision and smart algorithms, gesture technology is also entering the playing field. Gesture tech is moving from swiping through suggestions on smart dashboards, towards detection and control — such as in-air and 3D-gesture control — allowing for in-air haptics feedback and factoring in a myriad of smart inputs for the car to react more efficiently. Cerence, for example, has developed a windshield user interface that responds to gesture suggestions for controlling widgets on music, navigation, weather and more.

Major tech players are strongly positioning themselves in mobility services, with heavy investments on car-related technologies. Google and its Android Auto platform received some major updates within the last year, although the Assistant Driving Mode is still awaited. Apple made headlines with the move to open Carplay to third party services. Amazon is moving Alexa into the car with Echo Auto: this allows drivers to access the capabilities of household favourite Alexa integrated with navigation capabilities.

Voice controls — already ubiquitous in smartphones and at home — have proven themselves as an important dimension of interfaces in the automotive universe. Passengers already accustomed to speaking to their cars to change songs or temperature can look forward to a future with a myriad of other capabilities accessed via voice and adapted according to context. Voice systems will soon be ubiquitous in cars too, as developers rush for seamless switching of different assistant systems as well as between the car and other devices.

TIMMusic is an amazing example of how a company can leverage on the Big Tech players' ecosystems, focusing on different entertainment interfaces in mobility too. The telecommunication company has been fostering its music streaming platform on multiple device solutions. Open Reply supported TIM to decline its music platform on multiple devices, created a skill for Amazon and Google voice assistants and enforced its presence into automotive platforms such as Android Auto and Apple CarPlay.

New interfaces will have a crucial role in the safety and the security of vehicle drivers and pedestrians

With motor accidents still a major daily threat for passengers worldwide, advancements in new interfaces expand driver cognition and senses, creating a new level of opportunities for enhanced protection. These are not only a matter of protecting pedestrians and passengers in terms of physical threats — like enhancing smart seatbelts and airbags — but also securing the car from malicious activities by ensuring data protection.

Data-savvy hackers could force the IoT systems and the connectivity of devices to influence and access a car's controls. Encrypted and localised data management systems help to not only protect the car itself from unauthorised entering but also protect the data in the car from nefarious intervention. FogHorn, for example, is producing a smart unlocking system that employs an infrared camera, enhanced with multi-factor authentication to another user's smart device.

Biometric-based technologies like retina detectors and voice profiling can help increase the overall safety and security of the driving experience. Static provisions like seatbelts are becoming smarter with sensing technologies to anticipate and react to different magnitudes of collisions, whereas gaze sensors and pulse-monitoring devices on steering wheels are combining with AI to detect driver mood and distraction. For example, Guardian Optical Technologies has developed in-cabin 'micro-vibration' sensing system to check seatbelt use, adjusting elements like airbag deployment velocity based on a passenger's weight.

Communicating with vehicles is not only important for the person behind the steering wheel. With the advent of smart cars and autonomous vehicles, other drivers and pedestrians also need further indicators of feedback and acknowledgement while on the road and pavement. Osram Rear Combination Light technology, for example, uses rear lighting to communicate with other drivers and pedestrians on the road. Audi is introducing Oled segments on its cars' rear lighting to improve communications, too.

With sight being an indispensable aspect of navigation, innovations have allowed for extended and augmented screen experiences for drivers. This is done both by providing more 'eyes' for capturing images and perspectives, but also by providing augmented viewing capabilities to see past notorious blind spots in everyday driving. One of the most interesting solutions comes from WayRay, who have developed a holographic AR display presenting images 15 meters ahead of the car in a contextual relationship to objects.

The future of human interfaces within vehicles will include visual elements like screen messaging, light interactions and digital eyes for visual cues, to provide contextual information and feedback. Micro-displays will also be more prevalent within the cabin to provide information to drivers and passengers. Moreover, new interfaces bring hope for a future of more types of drivers and passengers, ideally creating opportunities to include those who might be hearing/sight-impaired.

Entertainment, value-added services, and advertising in mobility will use new interfaces

As mobility innovations gear towards a future of autonomous vehicles, the consumer need for entertainment comes increasingly to the fore. While devices are already utilising voice-recognition to bring audio-games to focused drivers, a future where screen space can be maximised for ultimate rider entertainment is spurring developments and will be fuelled by 5G rollout and edge AI. Future integration of XR and haptic feedback technologies will allow new types of in-car entertainment.

As augmented screens become more sophisticated in parallel with autonomous driving, these features gain relevance beyond the safety aspect, allowing movies to be watched or video games to be played through the windshield in the future. Bosch, for example, combined LCD technology with a driver-facing camera for a virtual display sun shield adapting to light shining through the display for an enhanced driving experience.

Different players from the automotive, entertainment and technology industries are working together to design new value-added services and ways of entertaining vehicles' passengers. For example, relevant market players Intel and Warner Bros.

have produced a demo autonomous vehicle, which features interactive mobile entertainment in the form of smart and responsive screens.

Short-term innovations in vehicles will be focused on enabling consumers to seamlessly connect with additional services. Consumers are always looking for ways to maximise their time, have micro-experiences and transition between activities throughout the day. Turning the vehicles into not only the mode of transportation but also the mode of interaction, communication and commerce, allows for seamless integration of consumer lifestyles and enhancement of daily experiences.

The potential of capitalising on the so-called 'fourth screen' (after smartphone, TV and tablet/PC) is drawing investment attention not only from vehicle manufacturers but also from financial institutions and CPG brands. Using a combination of location-based data and interactive sensing, advertisers are finding several opportunities to attract the attention of drivers and pedestrians.

Beyond the simple concept of moving billboards, the features of 'dynamic digital - out of home' technologies respond to viewers interactively with facial recognition and data on drive times and destinations, allowing brands to make meaningful impressions. Octopus, for example, brings games and advertisements to rideshare passengers. It features facial monitoring tech to track the effectiveness of ads.

Adapting the in-car cabin settings and information provided according to context and situation enhances comfort and driving experience. Providing means for consumers to access products and services and simplify cashless payments is furthermore a near-term market focus for manufacturers and brands alike. As an example, Jaguar, collaborating with Shell, has begun rolling out cashless refuelling in their latest models, enabled by a smartphone app, which connects seamlessly to the car.

New shopping experiences

" "Sizes will go out of the window 10 years from now," Bergh said at CNBC Evolve. "Everyone can do their own body scan on a camera." "

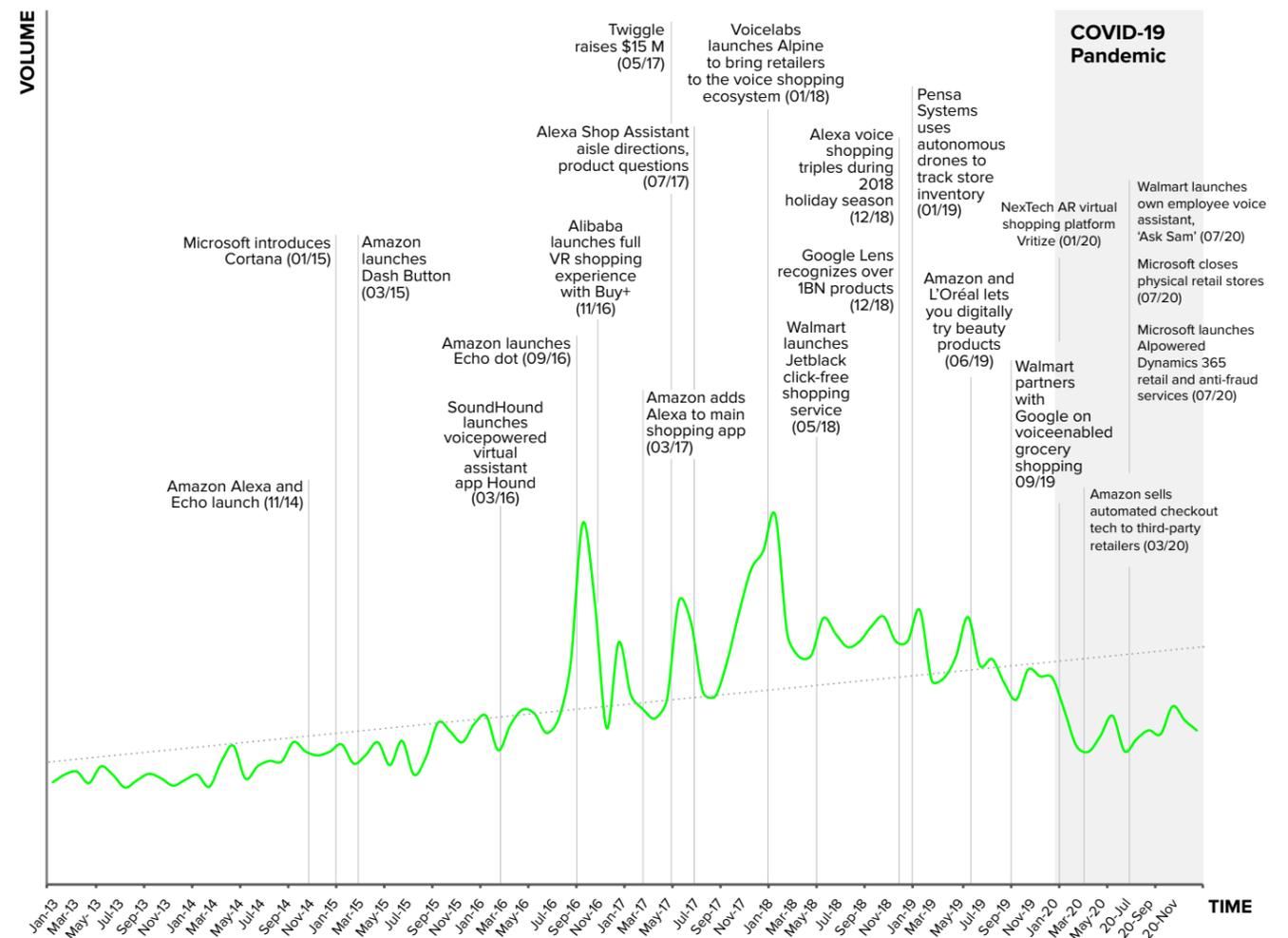Chip Bergh, CEO, Levi Strauss [Rosenbaum, 2019]

Big Tech players are strongly investing in retail-related interface development

Omnichannel commerce is flourishing, blending retail and services, as well as online and offline environments. The physical way of shopping – tactile, sensory, and social – is finding its counterpart in the digital and virtual space. The global pandemic has heavily affected traditional commerce, especially physical retail, accelerating digital innovations and providing a way for a new model of contactless shopping.

Retailers are adopting solutions along the whole customer journey: from QR-codes, augmented shopping and try-out, touchless advertising screens, self-service checkout and virtual fitting to robotics, IoT and automated stores. The pandemic is also leading to changing customers' expectations and turning advanced digital solutions that allow respecting social distancing guidelines when shopping from 'nice to have' to a necessity.

Retail and shopping user interfaces
Interest registered from Reply Trend Sonar, per volume of mentions

VOLUME

COVID-19 Pandemic

Twiggle raises $15 M (05/17)

Voicelabs launches Alpine to bring retailers to the voice shopping ecosystem (01/18)

Alexa Shop Assistant aisle directions, product questions (07/17)

Alexa voice shopping triples during 2018 holiday season (12/18)

Pensa Systems uses autonomous drones to track store inventory (01/19)

NexTech AR virtual shopping platform Vritize (01/20)

Walmart launches own employee voice assistant, 'Ask Sam' (07/20)

Microsoft introduces Cortana (01/15)

Amazon launches Dash Button (03/15)

Alibaba launches full VR shopping experience with Buy+ (11/16)

Google Lens recognizes over 1BN products (12/18)

Amazon and L'Oréal lets you digitally try beauty products (06/19)

Microsoft closes physical retail stores (07/20)

Amazon launches Echo dot (09/16)

Walmart launches Jetblack click-free shopping service (05/18)

Microsoft launches AI-powered Dynamics 365 retail and anti-fraud services (07/20)

SoundHound launches voicepowered virtual assistant app Hound (03/16)

Amazon adds Alexa to main shopping app (03/17)

Walmart partners with Google on voiceenabled grocery shopping 09/19

Amazon Alexa and Echo launch (11/14)

Amazon sells automated checkout tech to third-party retailers (03/20)

Jan-13 Mar-13 May-13 Jul-13 Sep-13 Nov-13 Jan-14 Mar-14 May-14 Jul-14 Sep-14 Nov-14 Jan-15 Mar-15 May-15 Jul-15 Sep-15 Nov-15 Jan-16 Mar-16 May-16 Jul-16 Sep-16 Nov-16 Jan-17 Mar-17 May-17 Jul-17 Sep-17 Nov-17 Jan-18 Mar-18 May-18 Jul-18 Sep-18 Nov-18 Jan-19 Mar-19 May-19 Jul-19 Sep-19 Nov-19 Jan-20 Mar-20 20-May 20-Jul 20-Sep 20-Nov

TIME

33

According to Reply Trend Sonar, the top players are the tech giants, offering voice assistants, marketing solutions and e-commerce enablers: Amazon, followed by Google, Facebook, Apple, and Microsoft. Facebook looks particularly active after announcing Shops, which will allow businesses to set up online stores across Facebook, WhatsApp, Messenger and Instagram, as well as AI solutions for clothes shopping recommendations. Among specialist players scrutinised from Reply Trend Sonar, we could mention:

▶ 3D product imaging solution provider Cappasity
▶ Cloud-based omnichannel point-of-sale solution provider Lightspeed
▶ Estimote, local and proximity solution provider that extended their focus more recently from in-store to Coronavirus-tracking
▶ Relex, which raised $200M to help retailers predict demand and automatically replenish stock.

The use of AI-based and conversational interfaces will improve customisations The wealth of consumer information collected by brands is now expected to be used to design tailored experiences for the customer. Predicting what information is valuable will help drive customer acquisition, retention and loyalty to new heights. One example is the AI-powered app The Yes: it is building a virtual store around each customer, allowing for a new way of individually tailored shopping experiences.

AI and digital technology allow for more personalisation for customers, from inspiration to tackling sizing and fitting issues in fashion retail in terms of body and style fit. Promising solutions are flooding the market and consumers' perception has changed to positive. Some of the fast-developing innovations include 3D-body scanning or imaging (e.g. app-based, in-store, mirrors), micro-measurement technology, as well as data-based intelligent analytics solutions predicting style preferences and fit for improved satisfaction and lower return rates.

All the data available on customers through various data capturing modes — from image to location, speech and behavioural patterns — will be key to increase insight generation to a level never considered before: by recognising high-value client segments, including their motives, buying patterns and drivers explainable by life circumstances, better targeting in terms of time, location, channel and occasion becomes possible. For example, Gebni is a food delivery app based in New York City that uses real-time location data of its users, as well as participating restaurants, to provide dynamic market pricing based on demand.

Anticipatory tech will enable e.g. diets to be tailored in real-time, with optimal ingredients delivered to ones' door based on wearable data. Smart interfaces will monitor purchase behaviour, wardrobe style, mood indicators and body type to display digitally the most suitable offers to customers' wardrobe. These will be tailored to their measurements via sensor-geared smart environments. Moreover, the architecture of the retail future will be context-driven and event-triggered shopping.

Companies are combining 360° consumer footprint data, fetched via a myriad of new services and possible touchpoints, with AI and machine learning to further enhance consumer targeting. This uses the channel, time, occasion or even the mood of an individual customer: interfaces include AI recommendations, real-life website updates to present targeted product selections, location intelligence and in-app or in-game advertising. For example, McDonald's launched Selfie Premio in Colombia, where users of the McDonalds app are encouraged to take selfies for deals. The AI determines the location, as well as weather and age of the participant, to customise promotional offers.

The ease and convenience of shopping without lifting a finger attracts more and more consumers who are willing to use their voice assistants. This eventually increases impulse shopping as well as repetitive purchases. Thus, businesses — especially from the FMCG industry — are trying to take and strengthen their place on these channels, so that "Alexa, buy me some new toothpaste!" will be associated with their brand. Voice is an especially promising channel for shopping, although brands are expected to bring voice into physical stores.

Google's Shopping Actions programme enables customers to use their voice to add products to their shopping list and complete the purchase with a Google-hosted checkout flow. The programme promises great benefits to retailers such as increased basket size, loyalty and engagement. Interestingly, vocal interactions offered by Big Tech players could lead to direct e-commerce actions, or to traditional shopping-related actions (e.g. add the product to my habitual supermarket list).

The creativity associated with conversational assistants is fuelling new ways of advertising. Brands are working to create assisted experiences such as in-store or mobile chat, adapting to customers' habits and eventually increasing impulse shopping and repetitive purchases. Even when not related to a shopping act, voice is useful as a channel to inform and involve customers during the decision process.

Working together with Triplesense Reply, the German National Tourist Board is taking a systematic approach to implementing not just isolated, single-purpose vocal solutions, but rather an entire, centrally planned conversational strategy. The goal is to combine the brand of Germany as a tourist destination, all communication and marketing channels, open data pools of relevant tourist information, and chat and voice endpoints to provide prospect and repeat visitors to Germany with an engaging, user-friendly experience.

New interfaces are supporting innovative service models across digital commerce and traditional retail

Physical and digital shopping environments are increasingly being blended, allowing customers to profit from the best of both worlds and experience frictionless and comfortable shopping, independent of channel, touchpoint and/or interface. As retailers are faced with a recalibration of shopping environments to enable safe and convenient purchases, low-touch and zero interfaces like voice assistants enabling contact, as well as hands-free shopping experiences, may play an essential role in the post-pandemic economy.

Thanks to advancements in artificial intelligence, computer vision and biometric technologies, the automation of retail is happening from purchase to delivery and total supply chain logistics. Led by Amazon and Alibaba, the concept of autonomous retail is happening at a larger scale, especially in China: self-service kiosks, digital shelves, robotic in-store cleaning and replenishment as well as contactless checkout systems that analyse customer attention within stores. With an emerging number of startups providing the necessary tech, autonomous retail will become common in most urban areas.

Retail tech is increasingly invading all in-store touchpoints for a more native, convenient, hands-free experience. This spans navigation, interactive displays, advertising services and payment. Experiences include seamlessly connected mobile, wearables blending payment function and style, and hands-free voice or biometric technologies. The once optional solutions for enhanced convenience are now turning into a necessity due to the Coronavirus pandemic and changing customer expectations.

Unified experiences integrate all facets of different channels, interfaces, touchpoints and customer journey phases to create a frictionless superior experience for customers. For example, the 'phygital' Funan Mall in Singapore employs facial recognition technology to offer a smart interactive directory and recommendations of relevant stores and products to shoppers.

Social (media) commerce is evolving into an all-encompassing, well-designed experience, ready for mass adoption. Image- and video-based 'visual-first' channels like Instagram or Snapchat are changing the e-commerce landscape, being especially important during customers' inspirational phase. This enables consumers to interact with brands at a native level, instantly buying an interesting product.

Combined with the established strong influencer marketing, live-streaming and user-generated content, the switch to making these social channels shoppable within the app environment has provided a strong boost. Burberry, for example, opened a luxury fashion 'social retail' store in partnership with Tencent, integrating social media and gaming with the shopping experience.

Mixed reality and 3D have amazing potentialities in both B2C and B2B markets Whether digital-savvy customers are shopping online, on mobile or in-store, they expect a seamless and uninterrupted experience. As conversational interfaces are entering every type of connected device, multi-modal interaction and the convergence of voice, text and imagery, integrating technologies like augmented reality will take place.

Experiential e-commerce and virtual shopping will see a major upsurge with AR tech and 3D imaging enabling an increasingly hyper-realistic shopping experience, helping to reduce returns by using AR try-before-you-buy services. AR tech developer Vertebrae, for example, lets fashion retailers offer AR try-on on their websites without requiring shoppers to download an app to their smartphones. Immersive and extended reality experiences based on VR, AR and 3D imaging technology will see a strong boost in the retail sector – especially driven by the upcoming 5G network rollout. Many experiences analysed from Reply Trend Sonar, however, are already interesting today.

▶ Obsess, an e-commerce site acting as a VR/AR shopping centre, allows users to digitally visit numerous stores and view photo-realistic 3D models of the products.
▶ The virtual storefront platform startup Streetify aims to help shopping streets and malls go virtual by transforming stores and websites into branded virtual stores.
▶ Zara launched an AR experience to connect the online and offline shopping experiences. At certain stores, podiums show dedicated images from the online store and bring to life Zara models, showcasing the latest styles.
▶ PreSize is a 3D body-scanning technology that uses any smartphone's camera input to find the best fit for the users' individual body.
▶ Toms matches every pair of shoes purchased with a new pair of shoes for a child in need; they have created a VR experience that allows viewers to go on a trip to Peru and see where the other pair of Toms shoes goes to.

Enhanced augmented online as well as offline-integrated shopping experiences will enable access to further information or products, photo-realistic environments, immersive marketing experiences or virtual try-on of products. The augmented experiences will be extended with a new dimension of human-machine interaction with tactile and haptic sensors. This kind of technology will have amazing effects on both B2C and B2B textile markets.

Protocube Reply launched a full suite of services for the textile industry, including a digital twin system for high definition realistic preview of textures, an automated render module of fabric, a 3D real-time configurator of clothes and virtual interactive showrooms. One of the most interesting cases is the creation of 3D Digital Fabric for Reda Group, which allowed the company to reduce the number of samples, manage and archive digital fabrics, and improve communication with buyers.

CONCLUSIONS

We need to focus on a 'future-proof' design

Far from stopping during the pandemic, innovation ran fast and we saw an impressive response capacity from designers and organisations who quickly reshuffled their ideas. We have learned the need, the urgency, and the possibility of thinking about future-proof ways of interacting. However, what does it mean to future-proof design? Probably, first of all, it means going beyond the strict HMI paradigm, which is too limited.

Machine-to-machine (M2M) interactions are already frequent today, but the progressive advent of robots (more or less) driven by artificial intelligence will push us more and more towards interactions in which humans have at most a supervisory role. There are many interesting scenarios of new interactions between humans, IT devices, intelligent objects and robots, especially in the logistics and manufacturing sectors.

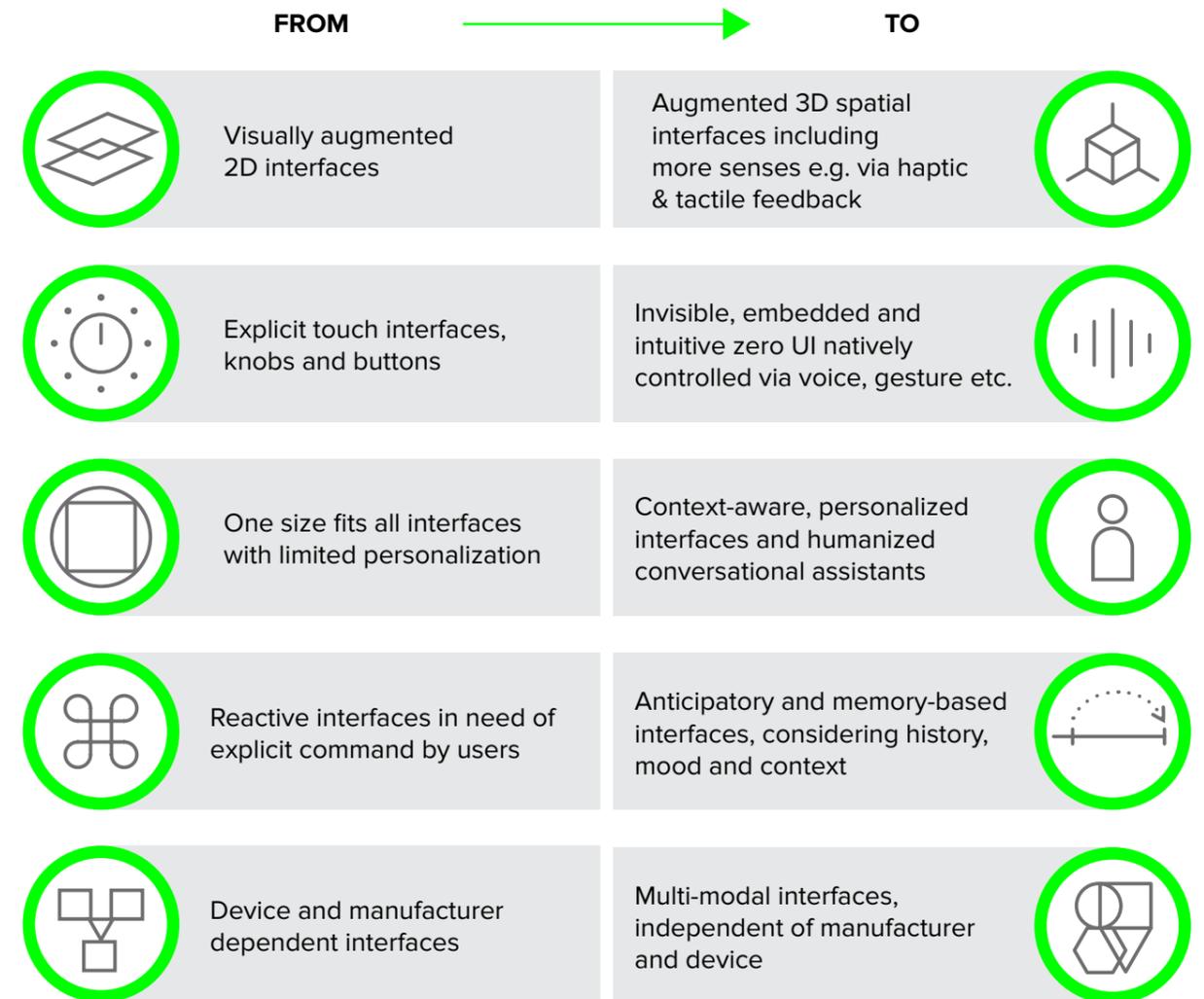| FROM	TO
Visually augmented 2D interfaces	Augmented 3D spatial interfaces including more senses e.g. via haptic & tactile feedback
Explicit touch interfaces, knobs and buttons	Invisible, embedded and intuitive zero UI natively controlled via voice, gesture etc.
One size fits all interfaces with limited personalization	Context-aware, personalized interfaces and humanized conversational assistants
Reactive interfaces in need of explicit command by users	Anticipatory and memory-based interfaces, considering history, mood and context
Device and manufacturer dependent interfaces	Multi-modal interfaces, independent of manufacturer and device

> " Companies transition toward interfaces that rely on voice, gesture and proximity instead of touch – sometimes known as 'zero UI'. This will apply not only to in-person purchases but to other publicly-shared UI controls such as ATM screens, in-store feedback buttons, checkout PIN pads, elevator buttons, smart boards and more. That will be good for consumers and for the companies that succeed at the transition eventually. But in 2021, companies will find that touchless interfaces are harder to design well than it seems at first blush. "

David Truog, Forrester [Truog, 2020]

Humans' need for touch, which is what still makes us bask in the 'button era' and has led to the success of touch interfaces, will also be a strategic lever for the future. In particular, haptic holograms are no longer science fiction and will become common within a few years, especially as events such as Coronavirus push us to minimise contact with physical objects and interfaces.

With increasing sensor integration and natural embedding into the surrounding world, interfaces will be invisibly interwoven into everyday life and work environments, turning anything into an interface, seamlessly communicating with each other and expanding human cognition and senses. Moreover, the blending of AI and IoT with an increasing amount of device-to-device communication is no longer involving users directly, allowing interfaces to react and adapt in a personalised and context-aware manner, and allow anticipatory interaction based on former or predicted user behaviour and preferences.

> **" By 2040, 30% of the world's population will be enhanced with biosynthetic devices on or inside their bodies. "**

Marty Resnick, Dale Kutnick, Dave Aron, James McGovern, Gartner
[Gartner, 2020-2]

The role of AI and ethical concerns on automatic actions based on human behaviour is currently under scrutiny by forward-looking political entities and larger organisations. This is an important consideration for the long-term implementation of user interfaces throughout our lives. The evolution of data security and privacy laws are important political drivers as voice assistants and behaviour monitoring devices grapple with the use and storage of personal data within the GDPR and other national frameworks.

In the business area, automation and efficiency-enhancing production and manufacturing are driving the rise of intelligent robot systems, connected devices, remote control, augmented services and wearable assistive devices. We should not be scared of robots taking over the roles of human beings; right now, it is evident their role is to be supporters and enablers for new jobs. Furthermore, their use in hazardous environments with long-distance control interfaces can save human lives and reduce exposure to dangerous elements.

The last future-proof suggestion is being climate-friendly. Energy use and climate emissions have pushed business and consumers to reduce their footprint. New interfaces monitor energy-efficient user behaviour, passively reacting based on needs and surrounding environment for lighting, temperature, pollen and CO_2 levels within the home, retail or workspace. Once the Coronavirus emergency is over, we believe humanity will focus seriously on environmental issues and consequently new, ethically designed, powerful interfaces will allow humanity to overcome another challenge.

APPENDIX

References

▶ [Burgard, 2020] Jan Burgard, Big Tech vs the automakers: The battle for the connected car, 2020

▶ [Gillet, 2020] Frank Gillet, Getting Consumers Beyond Simple Tasks On Smart Speakers Is Challenging, Forrester, 2020

▶ [Gartner, 2020-1] Saikat Ray, Jim Scheibmeir, Brent Stewart, Maverick* Research: No-Touch Interfaces Will Transform Humanity Faster Than You Think, Gartner, March 2020

▶ [Gartner, 2020-2] Marty Resnick, Dale Kutnick, Dave Aron, James McGovern, Maverick* Research: Being Human 2040 - The Life of the Architected Human in a More-Than-Human World, March 2020

▶ [Rosenbaum, 2019] Eric Rosenbaum, Levi Strauss CEO: 'Sizes will go out the window 10 years from now', 2019

▶ [Truog, 2020] David Truog, Predictions 2021: Trust, Safety, And Inclusion Will Be At The Core Of Customer Experience, October 2020

▶ [Ultraleap, 2020] Ultraleap, The end of public touchscreens?, 2020

▶ [Voicebot.ai, 2019] Voicebot.ai, Smart speaker use case frequency in the United States as of January 2019, 2019

Disclaimer

Mentioned trademarks and logos of customers belong to them.
Reply has been authorised by Reply customers' Managers to report their quotes. Such quotes are personal and do not necessarily represent the Managers' companies nor Reply's positions.

This Research is for disseminative and informative purposes and is not aiming to exhaust the panorama of information available on the topic.

This Research is based on information also collected from third party sources, which Reply considers updated and accurate. However, Reply cannot guarantee the adequacy, accuracy, completeness or correctness of such information, nor can we guarantee or represent that the Research is in every respect complete. Reply therefore expressly declines any liability related to the use of the information provided, and makes no warranty of any kind with regard to the information provided, including, but not limited to, warranties of merchantability or fitness for a particular purpose.

Reply also does not warrant that the quality of the information obtained by readers through this Research will meet their expectations.

⫪ REPLY

REPLY specialises in the design and implementation of solutions based on digital media and new communication channels. Through its network of highly specialised companies, Reply partners with major European corporations in the telecoms and media, industry and services, banking and insurance, and public administration sectors, to devise and develop business models built on the new paradigms of big data, cloud computing, digital media and the Internet of Things. Reply's services include: Consulting, Systems Integration and Digital Services. www.reply.com