HMI TREND RESEARCH
FUTURE CONCEPTS OF HUMAN MACHINE INTERFACES

BRINGING MACHINES CLOSER TO PEOPLE

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With **SONAR Trend Platform Reply** is able to create an overview and mapping of relevant trends in the field of **Human Machine Interfaces**, based on their occurrence within expert media articles, mass media, patents and scientific publications.

SONAR

SONAR is an innovative, **DATA-AS-A-SERVICE TOOL** for quantified foresight. It recognises, compares and analyses existing trends, and identifies new developments in real-time.

LEARN MORE ABOUT SONAR
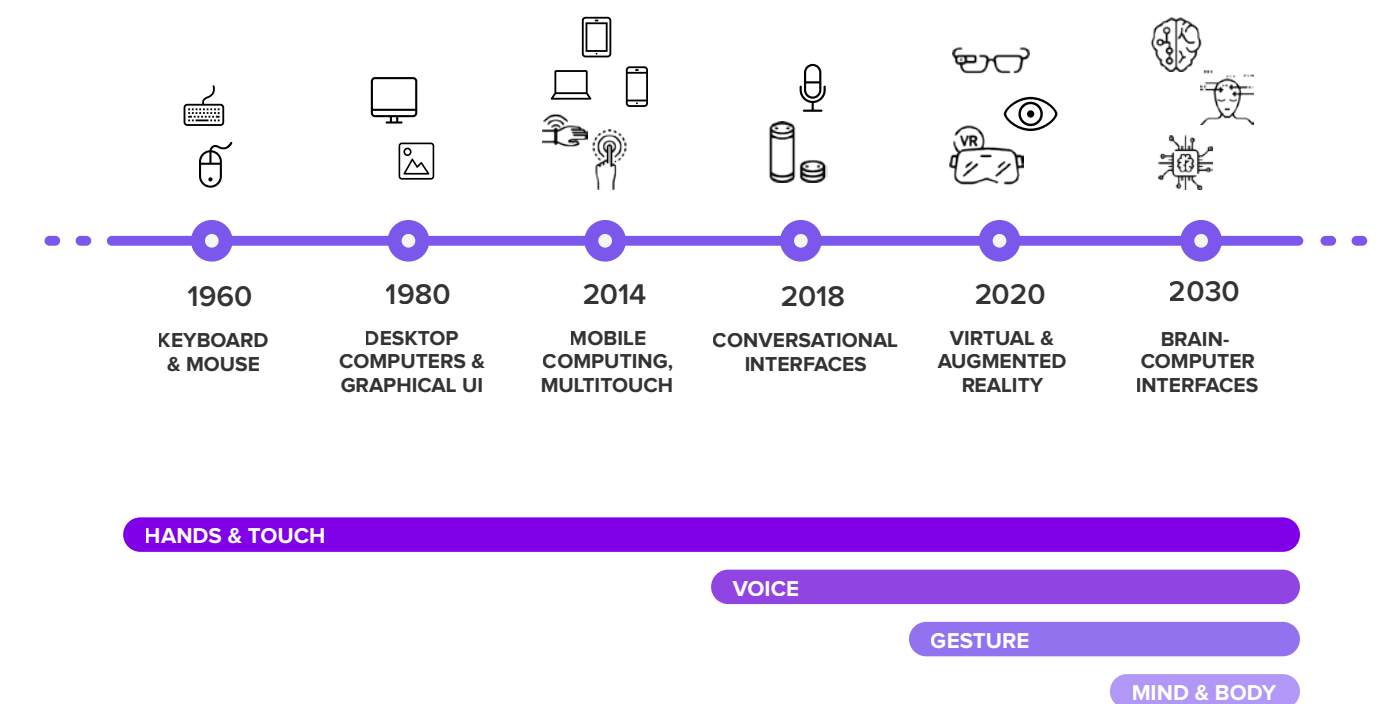**www.reply.com/en/sonar**

THE DEVELOPMENT OF HMIS

In today's fast-paced world, people are looking for products and services that work smoothly, save time and ultimately increase comfort, requiring **more intuitive and natural interfaces**.

Technology is increasingly in demand as a tool for expanding or even improving one's own abilities and senses. These two growing needs require **new intelligent and immersive user interfaces**.

We are currently moving from the age of "Hands & Touch", in which we operated buttons with our hands, to an age of "Mind & Body", in which we use our body as a user interface.

MAINSTREAM TECHNOLOGIES

1960	1980	2014	2018	2020	2030
KEYBOARD & MOUSE	DESKTOP COMPUTERS & GRAPHICAL UI	MOBILE COMPUTING, MULTITOUCH	CONVERSATIONAL INTERFACES	VIRTUAL & AUGMENTED REALITY	BRAIN-COMPUTER INTERFACES

HANDS & TOUCH

VOICE

GESTURE

MIND & BODY
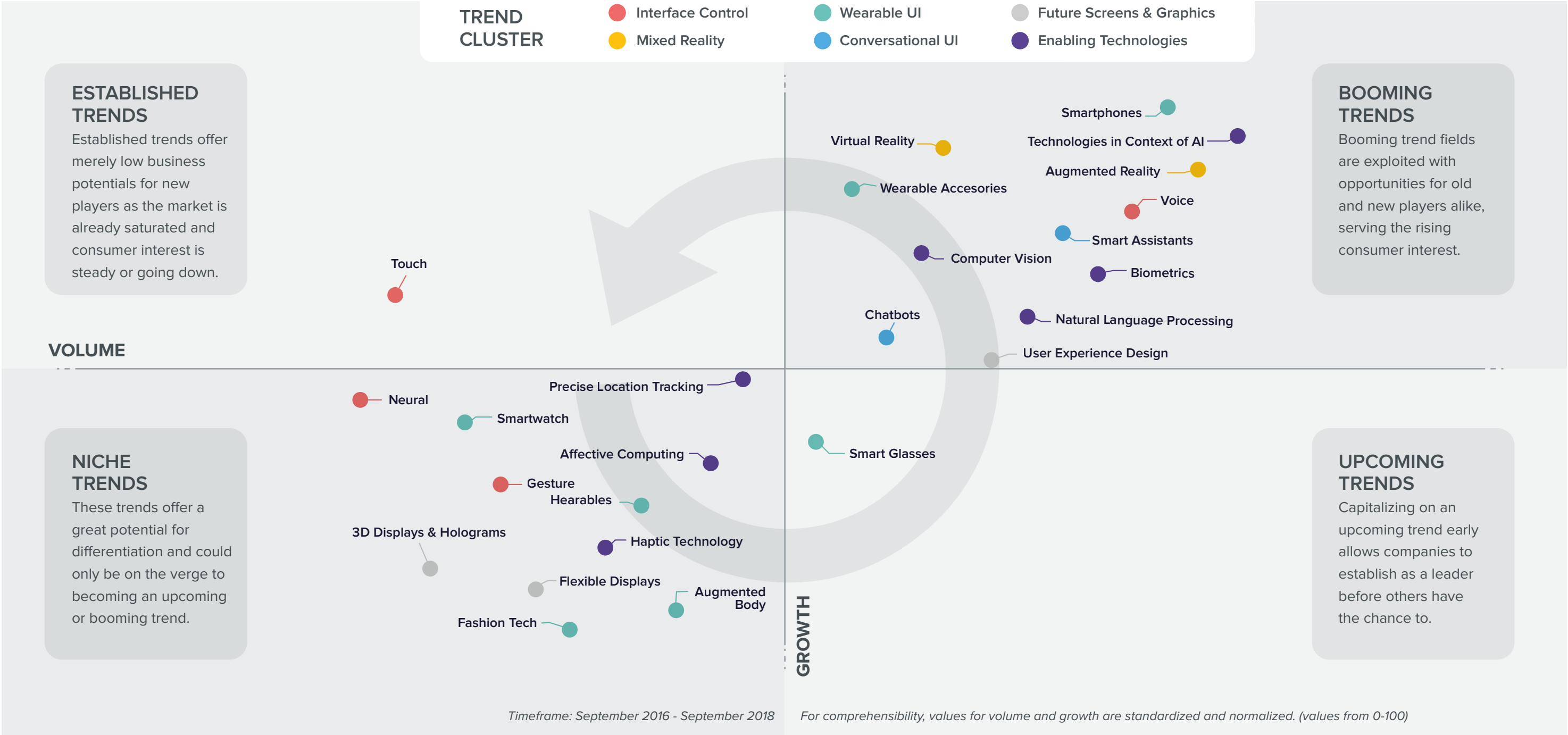
WHAT IS TRENDING IN THE WORLD OF HMI?

Here's an overview and illustration of the **relevant trends** around Human Machine Interfaces, based on their appearance in trade media, mass media, patents and scientific publications.

The arrow in the illustration implies a typical trend development and a life cycle from a small and growing trend - which is discussed in relatively few scientific articles and publications - to a larger, established trend with stagnating growth, which has long been discussed in various media and has shifted from niche circles into the mainstream.

TREND CLUSTER

- Interface Control
- Mixed Reality
- Wearable UI
- Conversational UI
- Future Screens & Graphics
- Enabling Technologies

ESTABLISHED TRENDS
Established trends offer merely low business potentials for new players as the market is already saturated and consumer interest is steady or going down.

BOOMING TRENDS
Booming trend fields are exploited with opportunities for old and new players alike, serving the rising consumer interest.

NICHE TRENDS
These trends offer a great potential for differentiation and could only be on the verge to becoming an upcoming or booming trend.

UPCOMING TRENDS
Capitalizing on an upcoming trend early allows companies to establish as a leader before others have the chance to.

VOLUME

GROWTH

Chart labels: Smartphones, Virtual Reality, Technologies in Context of AI, Augmented Reality, Wearable Accesories, Voice, Smart Assistants, Computer Vision, Biometrics, Chatbots, Natural Language Processing, User Experience Design, Touch, Precise Location Tracking, Neural, Smartwatch, Affective Computing, Smart Glasses, Gesture, Hearables, 3D Displays & Holograms, Haptic Technology, Flexible Displays, Augmented Body, Fashion Tech

Timeframe: September 2016 - September 2018

For comprehensibility, values for volume and growth are standardized and normalized. (values from 0-100)

A SHIFT TO FULL IMMERSION

Human Machine Interfaces are shifting to being gateways to evermore natural forms of communication between humans and machines. Hence, we find ourselves in the journey further towards full immersion, a world in which our reality is overlaid, mixed and even extended with the digital sphere. For businesses, the path towards such a world is characterized by a myriad of opportunities.

Amongst many others**: closer, more engaging, more personalized and much more emotional customer interactions, better ways of visualising and analysing information.**
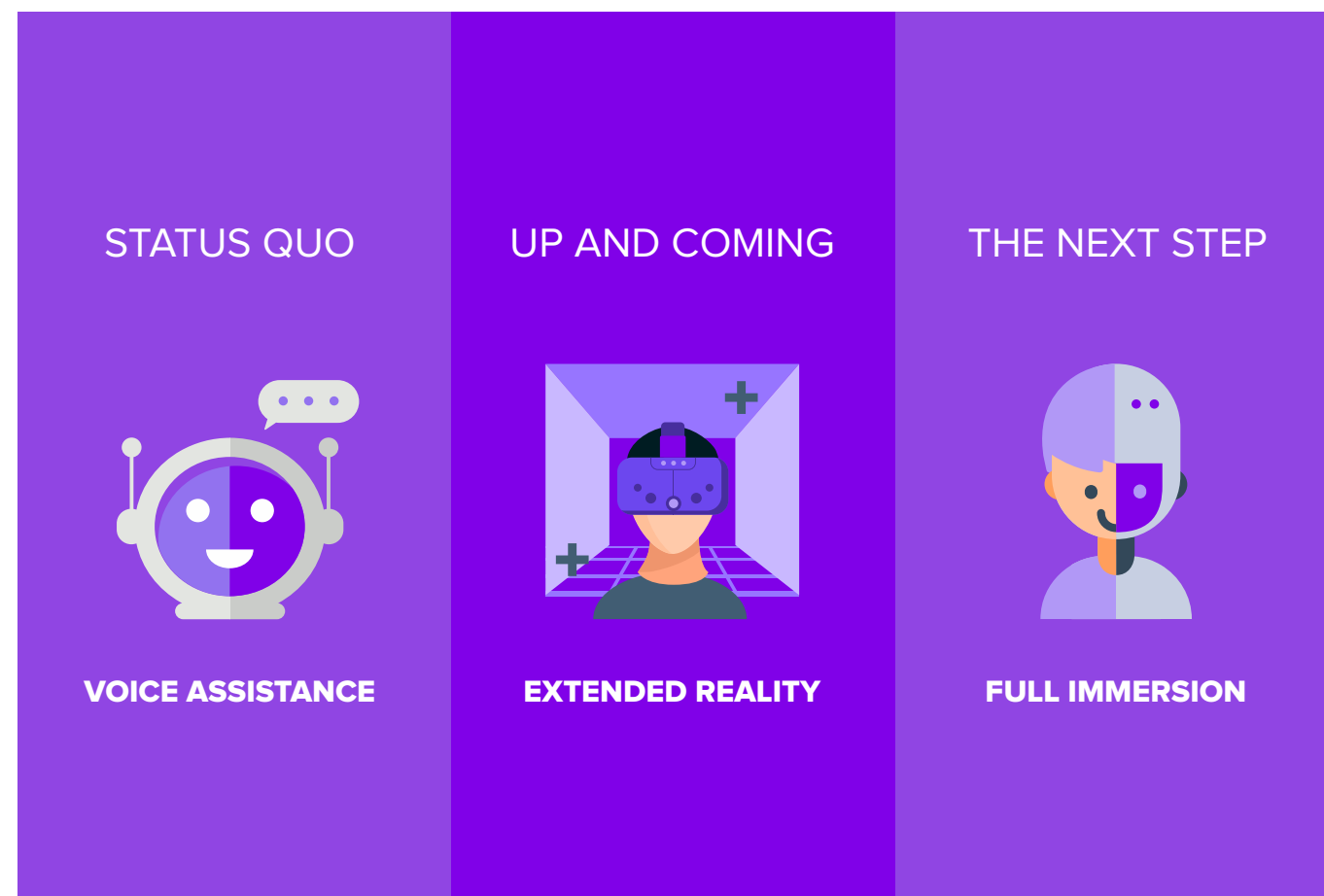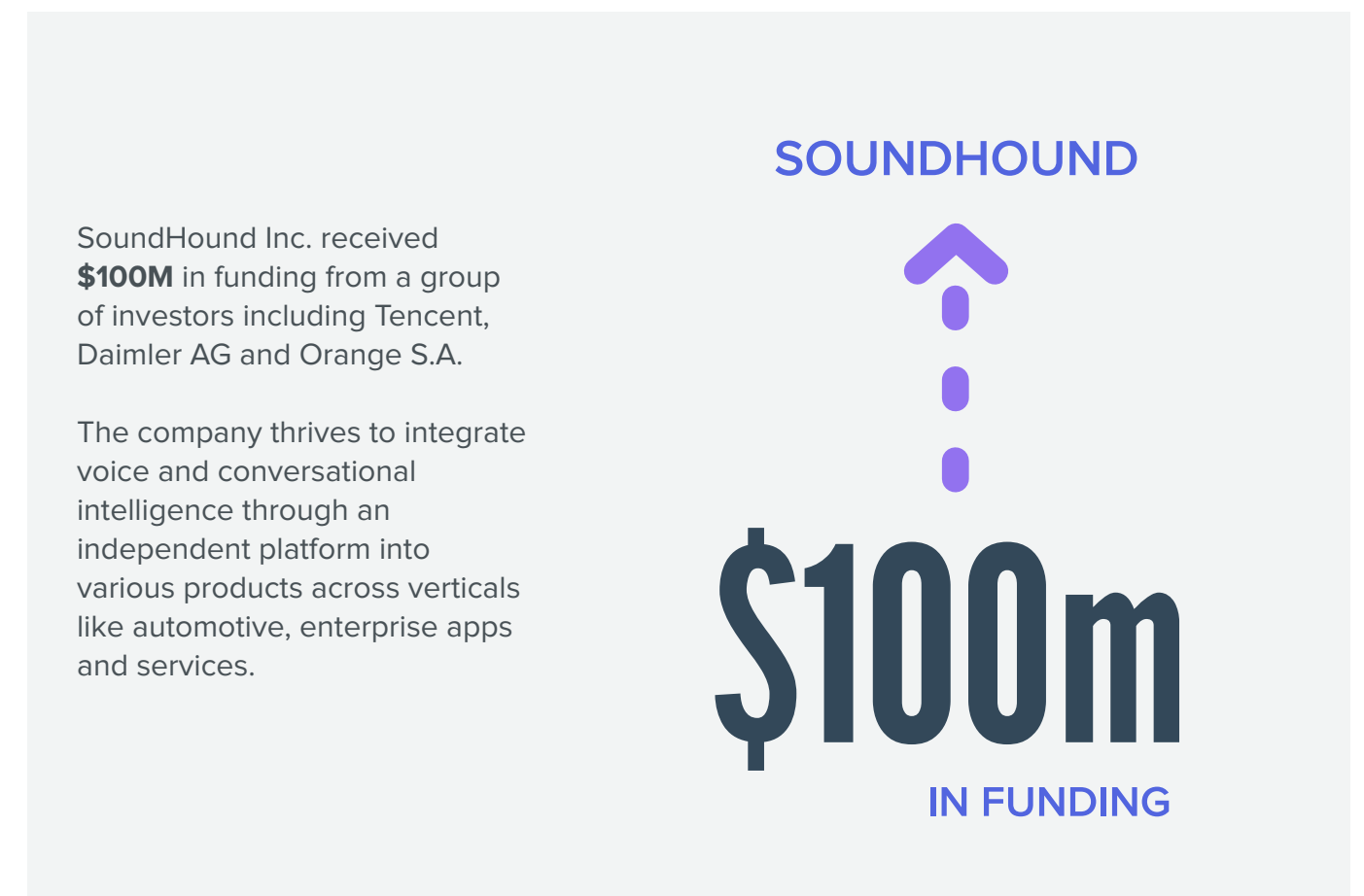
VOICE ASSISTANCE

Voice technology triggers interest and investments and its impact on individuals and businesses is increasingly significant.

This is reflected by the increasing media attention for Voice Control and Smart Assistants. These are very much correlated and led by the big players who have fiercely competed by launching their smart speakers with integrated digital assistants. Among the list of the biggest players, led by the usual suspects Google, Amazon and Microsoft, is also high-end speaker company Bose. Companies experiencing the highest growth rates since 2016 are Facebook, which wants to compete the incumbents with Facebook Portal, and the music system company Sonos, with its Sonos One, a smart speaker allowing use of Alexa and Google Assistant.

STATUS QUO	UP AND COMING	THE NEXT STEP
VOICE ASSISTANCE	EXTENDED REALITY	FULL IMMERSION

SOUNDHOUND

SoundHound Inc. received **$100M** in funding from a group of investors including Tencent, Daimler AG and Orange S.A.

The company thrives to integrate voice and conversational intelligence through an independent platform into various products across verticals like automotive, enterprise apps and services.

$100m
IN FUNDING

HOW CAN VOICE ASSISTANTS SUPPORT YOUR BUSINESS?

With advances in machine learning, voice assistants are able to automate more and more tasks: This ranges from the fact that hands are no longer needed for input to the possibility of letting the assistant complete entire tasks, such as taking minutes, e-mailing or even telephoning.

This increases productivity and leaves more time for more meaningful tasks.
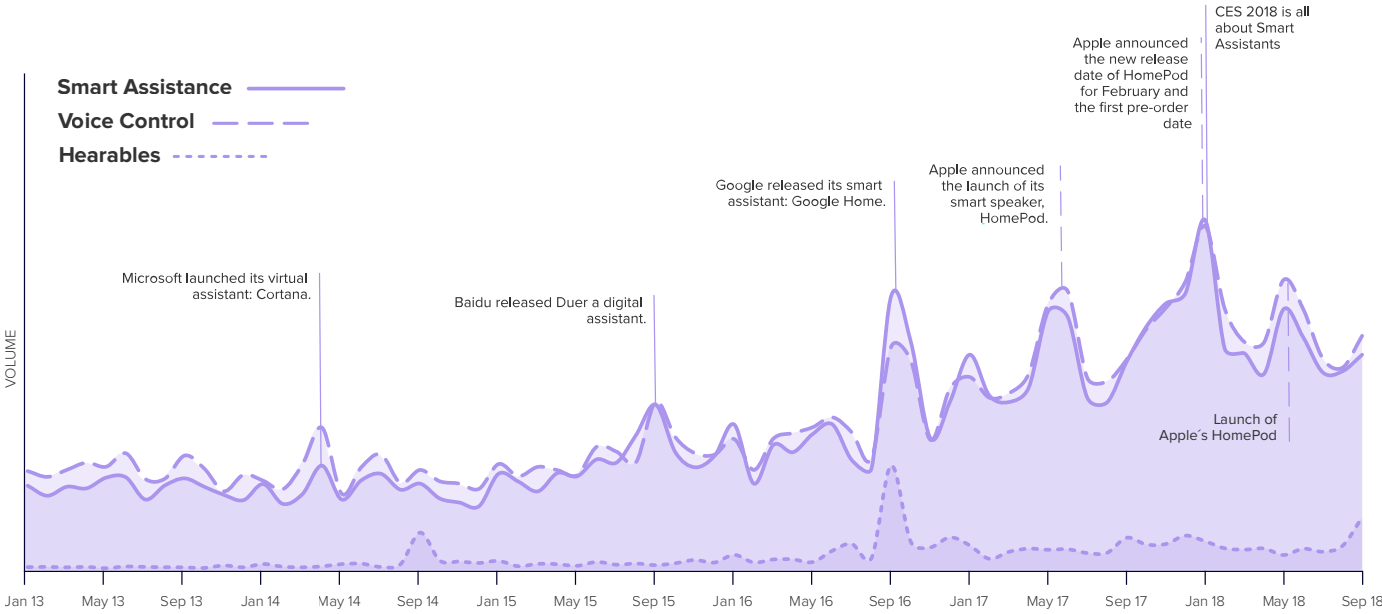
VOICE INTERFACES
allow people to use voice input to control computers and other devices.

SMART ASSISTANTS
are software agents that can perform tasks or services.

HEARABLES
are electronic in-ear-devices designed for multiple purposes, ranging from wireless transmission to communication objectives.

Smart Assistance ———
Voice Control — — —
Hearables - - - - - - -

Microsoft launched its virtual assistant: Cortana.

Baidu released Duer a digital assistant.

Google released its smart assistant: Google Home.

Apple announced the launch of its smart speaker, HomePod.

Apple announced the new release date of HomePod for February and the first pre-order date

CES 2018 is all about Smart Assistants

Launch of Apple's HomePod

VOLUME

Jan 13   May 13   Sep 13   Jan 14   May 14   Sep 14   Jan 15   May 15   Sep 15   Jan 16   May 16   Sep 16   Jan 17   May 17   Sep 17   Jan 18   May 18   Sep 18

These are booming or upcoming trends, meaning the number of articles in various media dealing with these phenomena has drastically increased over the past 12 months.

EXTENDED REALITY

Extended Reality (XR) revolutionises both our way of consuming and our way of interacting with people and our environment.

The technologies combined under XR enable completely barrier-free communication and eliminate geographical distances. Augmented, Virtual and Mixed Reality support the engagement and motivation of consumers through strong, immersive experiences, lead to cost reduction and more security through virtual representation as well as more efficiency and a more productive environment.

Magic Leap, the American mixed reality startup enabling users to interact with digital devices in a completely visually cinematic way, raised **$461M** from the Saudi Arabia's Public Investment Fund. The company already raised **$502M** in October 2017 – one of the most notable financings in Mixed Reality that year.

2017
502 millions
USD

2018
461 millions
USD
From Saudi Arabia's Public Investment Fund

Magic Leap

87%
OF EXECUTIVES

87% of executives are already in the process of exploring, piloting or deploying mixed reality.
Microsoft & HBR Survey of 394 executives, June 2018.

HOW CAN EXTENDED REALITY SUPPORT YOUR BUSINESS?

The advent of Extended Reality offers companies countless and unprecedented opportunities to reinvent traditional marketing through better storytelling opportunities and immersive experiences and to leverage immersive marketing.

VR lets people dive into brand or product stories, while AR offers the integration of an additional layer of information into the real world.

GESTURE CONTROL
is the ability to control a computer system without direct body contact, purely through movement.

VIRTUAL REALITY
is an artificial, computer-generated simulation of a real environment.
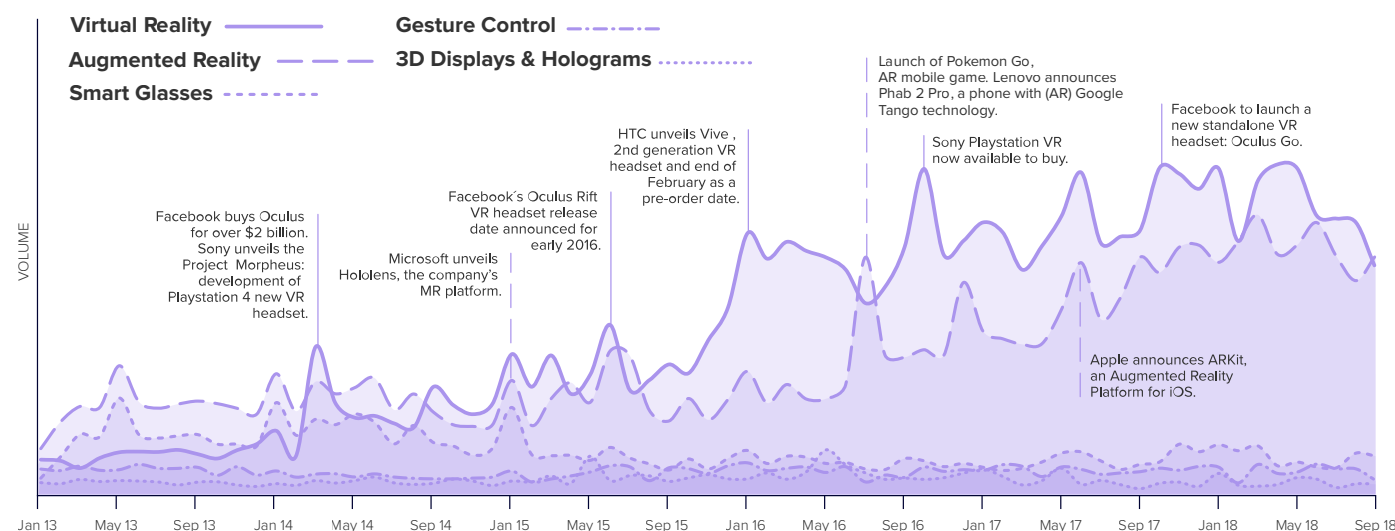
AUGMENTED REALITY
overlays reality with computer-generated extensions or improvements.

3D DISPLAYS & HOLOGRAMS
are a set of technologies enabling a 3D vision of contents without the need of wearable devices.

SMART GLASSES
are wearable computer glasses thatadd information alongside or to what the wearer sees.

Virtual Reality
Augmented Reality
Smart Glasses
Gesture Control
3D Displays & Holograms

VOLUME

Facebook buys Oculus for over $2 billion. Sony unveils the Project Morpheus: development of Playstation 4 new VR headset.

Microsoft unveils Hololens, the company's MR platform.

Facebook's Oculus Rift VR headset release date announced for early 2016.

HTC unveils Vive, 2nd generation VR headset and end of February as a pre-order date.

Launch of Pokemon Go, AR mobile game. Lenovo announces Phab 2 Pro, a phone with (AR) Google Tango technology.

Sony Playstation VR now available to buy.

Facebook to launch a new standalone VR headset: Oculus Go.

Apple announces ARKit, an Augmented Reality Platform for iOS.

Jan 13 May 13 Sep 13 Jan 14 May 14 Sep 14 Jan 15 May 15 Sep 15 Jan 16 May 16 Sep 16 Jan 17 May 17 Sep 17 Jan 18 May 18 Sep 18

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FULL IMMERSION

Progress in immersive technologies and neuroscience is increasingly suggesting that a world in which humans are fully connected to computers may not be so far away.

Already today, the latest developments, especially in science and medicine, show that it is possible to connect the human brain to computers in order to control them with mere thoughts or even to exchange simple thoughts between people – be it via headsets or brain implants. Right now start-ups lead the list of most frequently mentioned players within expert media.

Companies experiencing the highest recent growth rates are led by Proteus and Microchips Biotech who want to revolutionise drug delivery within the body with microchip-based implants. Abbott takes the third place by entering the market with Confirm Rx, an insertable cardiac monitor. Top patent filings have been made by Oculus, Lenovo and Bae Systems.

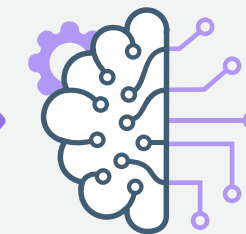**August 2017:** Startup Neurable unveils the **World's 1st** brain-controlled VR Game.

August 2017

NEURABLE
WORLD'S 1ST BRAIN-CONTROLLED VR GAME.

RL Labs
28 millions
USD

RL Labs raises **$28M** from Google Ventures and Lux Capital for its brain-machine interface.

MindMaze, a startup that fuses neuroscience and VR to create human machine interfaces, has received a funding of **$100M** in 2016 from Hinduja Group following by an undisclosed investment by Leonardo DiCaprio.

MindMaze
$100m
USD

HOW CAN EXTENDED REALITY SUPPORT YOUR BUSINESS?

It's easy to think "That doesn't even exist yet" when full immersion technologies are discussed. The opposite is actually the case.

Many companies are already working on mind-controlled headsets, communication via thought transmission or computer chips for the brain. One example is Emotiv's "Insights" Headset. Users can control electronic devices such as televisions and drones.
They can also monitor their neuronal processes with the aim of monitoring and optimizing their mind, such as improving concentration and reducing stress.

NEURAL CONTROL INTERFACES
are direct communication pathways between an enhanced or wired brain and external devices.
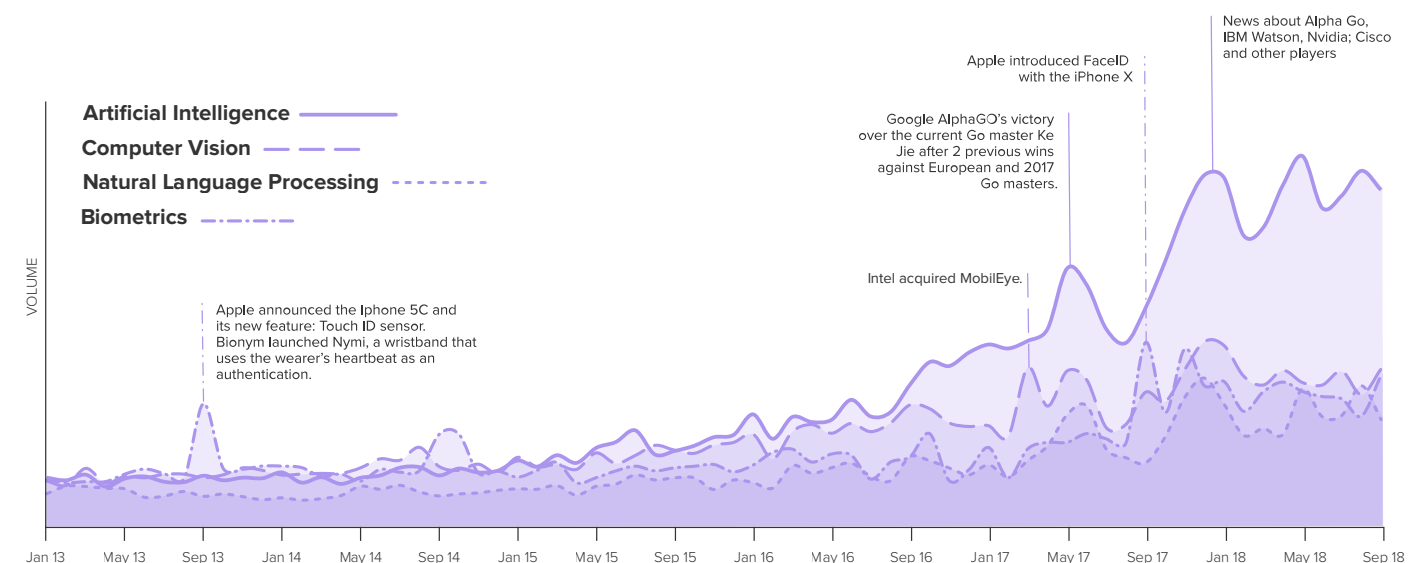
AUGMENTED BODY
also known as human enhancement aims at "improving" the human body and its performance through artificial means, such as implants or electronic tattoos.
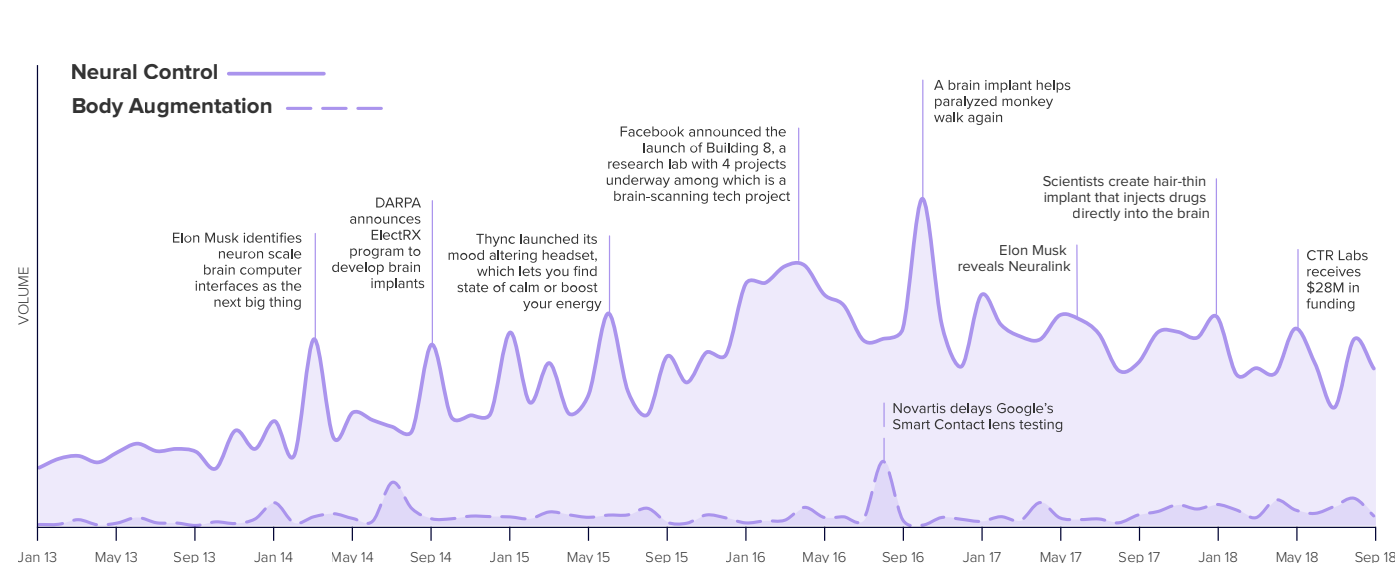
THE ENABLERS OF FUTURE HMIS

Since 2016, the Artificial Intelligence trend has been characterised by steady, high growth, driven primarily by Google DeepMind, Nvidia and IBM, but also by thriving start-ups such as Bonsai and Mindmeld, both recently acquired by technology giants. In addition, **Computer Vision, Biometrics and Natural Language Processing are driving the development of HMIs**, but their growth over the same period was slower.

Looking at the last 12 months of SONAR data, the start-up Cognitive Scale, a developer of **Augmented Intelligence Systems**, is the most frequently cited player, followed by tech moguls such as Nvidia, Google or Intel's Mobileye.

Neural Control
Body Augmentation

Elon Musk identifies neuron scale brain computer interfaces as the next big thing

DARPA announces ElectRX program to develop brain implants

Thync launched its mood altering headset, which lets you find state of calm or boost your energy

Facebook announced the launch of Building 8, a research lab with 4 projects underway among which is a brain-scanning tech project

A brain implant helps paralyzed monkey walk again

Scientists create hair-thin implant that injects drugs directly into the brain

Elon Musk reveals Neuralink

CTR Labs receives $28M in funding

Novartis delays Google's Smart Contact lens testing

VOLUME

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Artificial Intelligence
Computer Vision
Natural Language Processing
Biometrics

News about Alpha Go, IBM Watson, Nvidia; Cisco and other players

Apple introduced FaceID with the iPhone X

Google AlphaGO's victory over the current Go master Ke Jie after 2 previous wins against European and 2017 Go masters.

Intel acquired MobilEye.

Apple announced the Iphone 5C and its new feature: Touch ID sensor. Bionym launched Nymi, a wristband that uses the wearer's heartbeat as an authentication.

VOLUME

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AND YET THERE IS MORE TO COME

Sonar has collided some of the futurist ideas that companies are working on and visions that will take quite some time to come true. Here there is the **future outlook of the top four:**

1 SENDING THOUGHTS

Full immersion technologies lead to a world in which the exchange of information with machines and other people takes place instantaneously. We will be able to share ideas, feelings and memories with friends through mind control and open up an unimaginable world of frictionless, intimate communication and networking.

2 HUMAN ENHANCEMENT

Brain-machine interfaces could be used to improve human perception. By coupling our brain with computers, AI-controlled assistants and the Internet, we could one day not only have instant access to the world's information, but also download know-how into our brain or even merge it with super-intelligent AI systems.

3 NEURAL HEALTHCARE

Immersive technologies will in many ways lead to disruption in the healthcare industry as they enable the recovery of diseases that are currently often incurable: from the treatment of severe depression or PTSD and other mental illnesses, to the cure of Parkinson's disease, to helping paralyzed patients walk. In addition, drug release could change completely and become more neurology- and data-driven as suitable brain-machine-interfaces become available.

4 VIRTUAL COPIES

By connecting our minds with computers, they can store any form of data transmitted by our neurons, i.e. thoughts, memories or feelings. In the future, this could be used to make virtual copies of ourselves that can be stored to one day create our immortal digital self. That, at least, is the vision predicted by the American inventor, Futurist and Google's Director of Engineering, Ray Kurzweil.

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