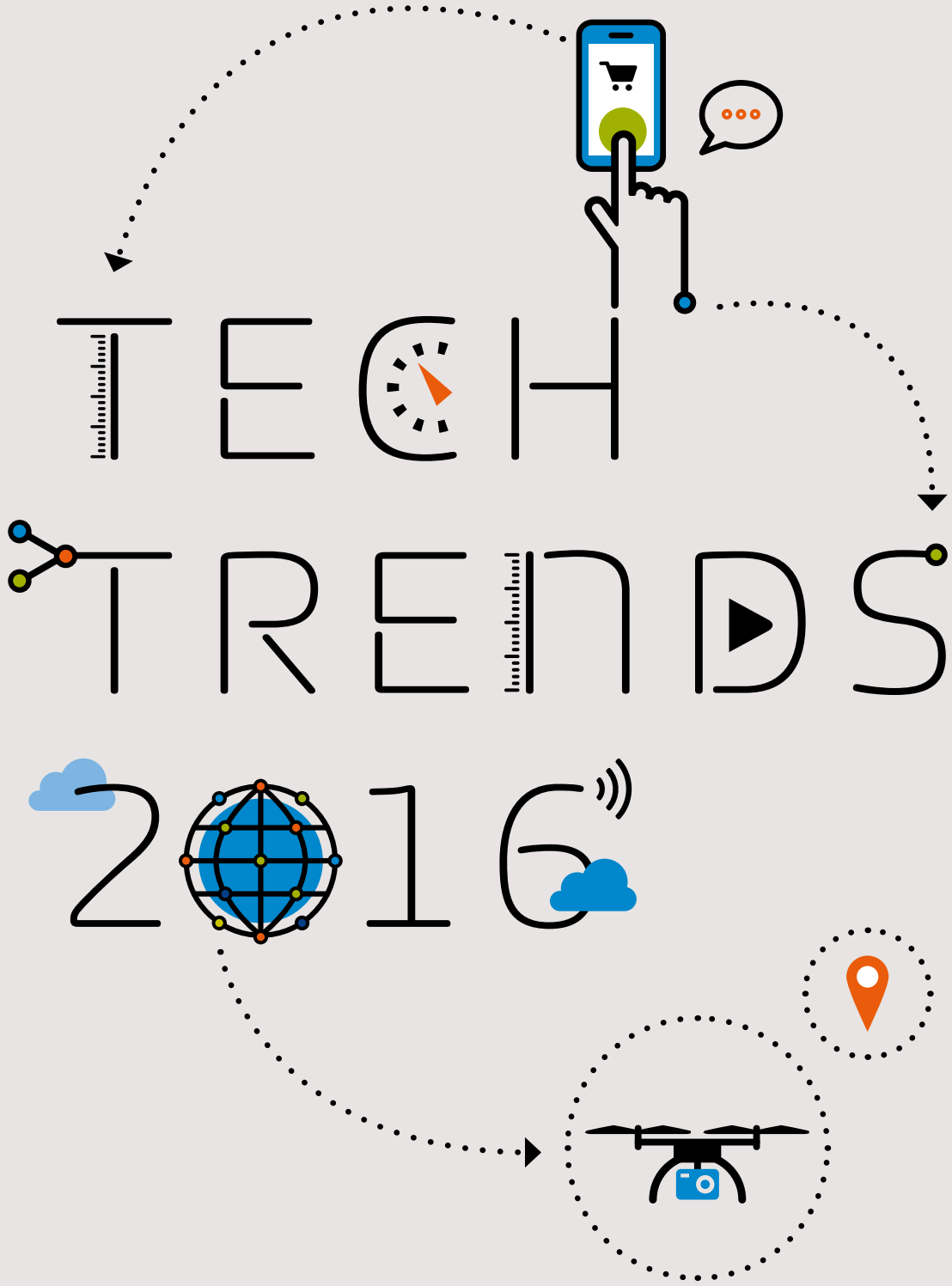
Technology



UNDERSTANDING THE DRIVING FORCES
BEHIND THE CONNECTED CONSUMER

INTRODUCTION

Technology is a dominant force across every industry, constantly reimagining and redefining our lives. As connected consumers adopt new technologies, their behavior leaves an impression in the form of data. Embracing analytical cultures and invisible analytics, some organizations have become expert at converting that data into business success. The result is improved customer engagement, insight that informs creativity and better ways to customize offers.

Our experts have chosen ten Tech Trends from all of the technological disruptions happening around us that will have the most impact in the near future. Some you'll be familiar with – mobile payments, video growth, connected cars and wearables – but others such as artificial intelligence and virtual reality are still in their infancy. For some of the ten – as with smart home and drones – success will come with the realization of a vision. And last but not least, you may feel a distinct "blast from the past" with 3D printing.

Choosing ten trends is always a challenge, but we believe those that have made the cut this year embody the future for brands, business and, crucially, the connected consumer.

CONTENTS

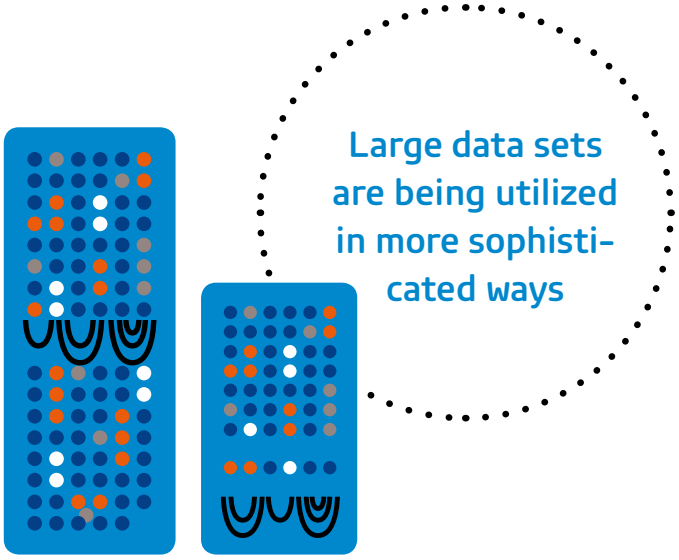
INVISIBLE ANALYTICS

The resulting complex **analysis of customer data** is essential to understanding consumers and **optimizing products** and services for them.

INVISIBLE ANALYTICS: DATA QUALITY NOT QUANTITY

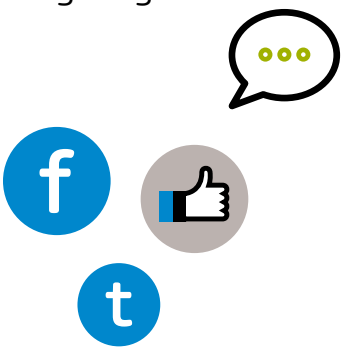
Every one of the ten trends in this edition of Tech Trends is connected with, and in some cases rooted in and borne from, data. As consumers become increasingly connected, they leave a trail of their interactions with businesses. That might be ordering their weekly groceries, to the time of day they do their banking, to the ads they've viewed, to the brands they love. Whether it's the smart home, connected car, mobile payments, video viewing behavior or gaming in virtual reality, all these tech trends generate data. Businesses and consumers alike will benefit from the sophisticated and sensitive use of it.

More organizations are utilizing the large data sets they collect from their consumer interactions and doing so in more sophisticated ways. The resulting complex analysis of customer data is essential to understanding consumers and to developing and optimizing products and services for them. This is invisible analytics. Think quality, not quantity. It's about maximizing more of that data, converting it into meaningful innovation and insights as a basis for better business decisions. The benefits of this are many: It provides crucial competitive advantage, improves return on marketing investment and supports new product development, to give just three examples.



There's a lot of data available to organizations too and, as the articles in this edition of Tech Trends show, there's going to be more and more of it:

- customer purchase records, transaction and usage logs
- email and messaging metadata
- social media information and tracking
- data from connected devices such as smart appliances and connected cars
- geolocation activity data from wearable devices and smartphones



If we're looking at the quality of the data, it's important to sift the sheer quantity of information being gathered and to focus only on the most relevant, actionable source material. Artificial intelligence needs to make things happen fast: data collection, analysis and action need to be almost instantaneous. Critically, action must be embedded in the process.

Artificial intelligence and machine learning will have a pivotal role to play in making sense of the weight of data, filtering it to deliver the right information to the relevant person exactly when it's needed. They may also be able to help in presenting how the resulting analysis is used. Our research shows that consumers all over the world have concerns about the way their data is gathered, stored and used, although the level of those worries differs by market[1]. But we also believe that consumers aren't conscious of the amount of their data that is being used in analytics, or its value.

Organizations need to use their clever analysis with caution, however. The way that data is used in marketing activities, for instance, needs to be seamless, not spooky. This is particularly pertinent as new technologies emerge. Invisible analytics could, for example, be the key ingredient in the effective use of augmented and virtual reality in retail environments, as this involves having the right information about a consumer. But if businesses go too far and overstep what the consensus deems to be acceptable behavior, we could see more legislation to protect consumers.

Our analyst, Norbert Wirth, says:

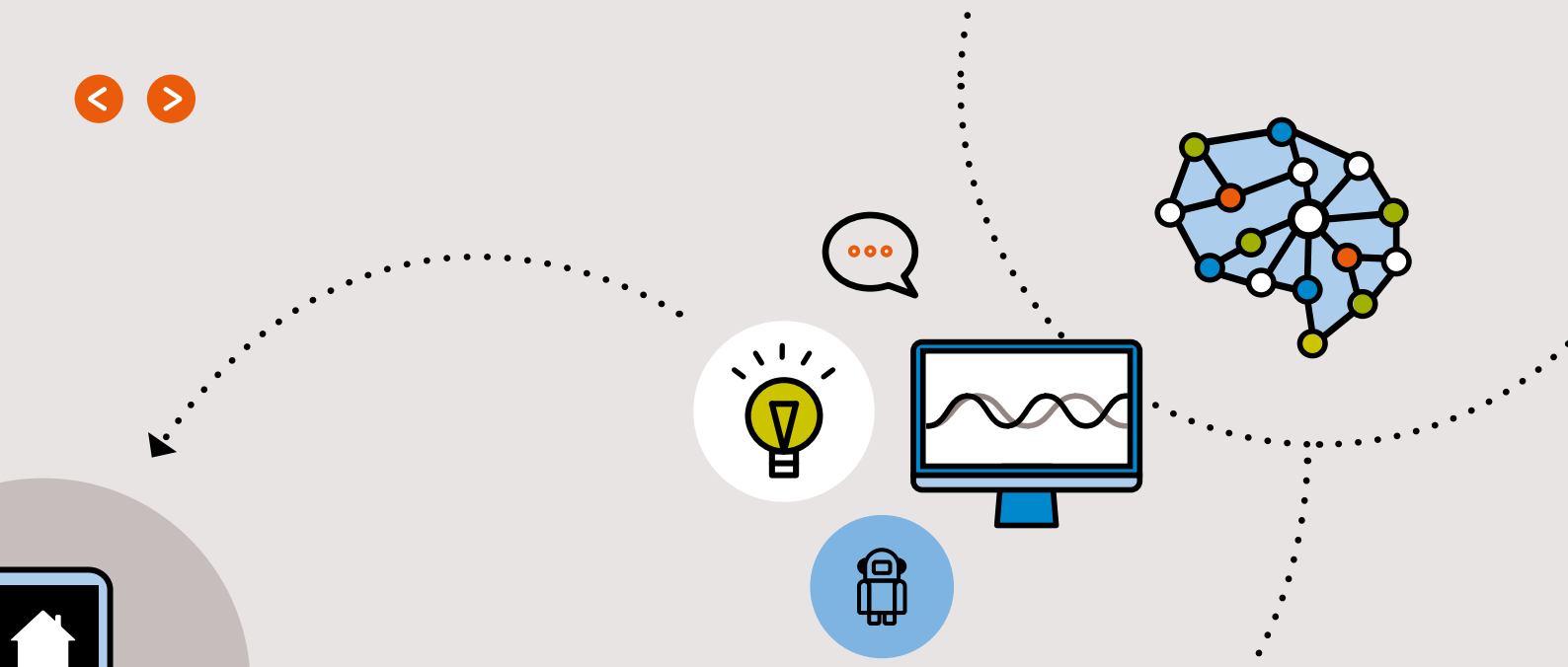
"It is increasingly important for brands and businesses to have an analytical culture. This is needed to maximize the opportunities stored in the data sets available to them – now and in the future. In our view, if one brand doesn't take the initiative to do this, another will do so instead."

16%

of global consumers (up from 12% in 2013) cite "personal information getting into the wrong hands" as one of the three things they're most concerned about[2]

[1] GfK Consumer Life (Roper Reports®) 2015. Survey data from 20 markets.

[2] GfK Consumer Life (Roper Reports®) 2015. Survey data from 20 markets, respondents asked to choose three options from a list of 21 that includes crime and lawlessness, terrorism, recession and unemployment, and economic inequality.



ARTIFICIAL INTELLIGENCE

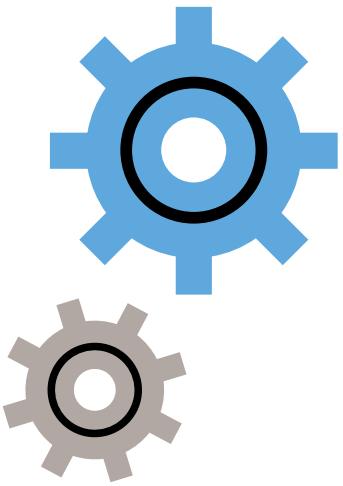
Early forms of AI based on machine learning are **increasingly infiltrating our lives**.

THE RACE TO HARNESS ARTIFICIAL INTELLIGENCE

Home cube, Power Badge, RankBrain, Hound. You might not recognize these terms today, but in 2016 and beyond they could become part of the consumer tech vocabulary. According to the Financial Times (FT), "The artificial intelligence (AI) stampede has become one of the hottest trends in start-up investing since the 'Big Data' slogan launched a thousand entrepreneurial dreams."[1] With major players including Apple, Facebook and Google investigating this space, the FT's comment is no exaggeration. In fact, AI has the potential to disrupt everything – from the lives of connected consumers to every industry.

The ultimate AI recreates the human thought process. A man-made machine, it has our intellectual abilities: learning, reasoning, using language and formulating original ideas. That is the *ultimate* AI, though, and while this will be possible at some point in the future, there is little evidence of the full execution of AI coming anytime soon. However, early forms of AI based on machine learning are increasingly infiltrating our lives. Amazon uses it to suggest products; Netflix to recommend movies; Facebook and Twitter to choose what posts to show. Plus there's voice command services including Siri, GoogleNow, Cortana and, most recently, Amazon Echo.

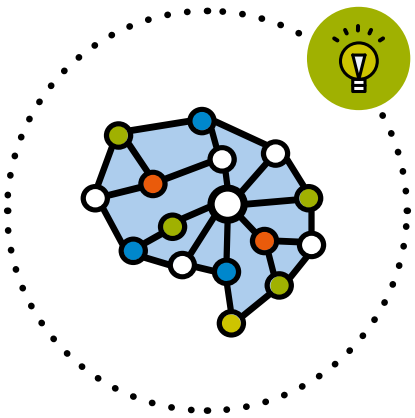
The latter is particularly interesting because it can distinguish between commands and general background noise. This technology could become a critical springboard for other developments in the space – for example, as a voice-activated home automation control, a way to order products and a link to cloud services.



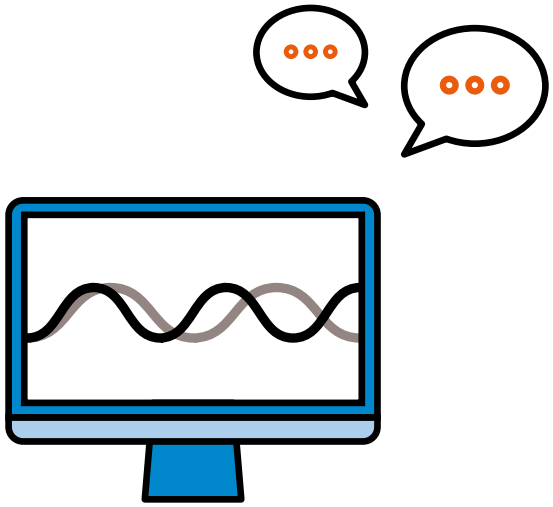
In 2016, we expect AI assistants to take the significant step of evolving beyond smartphones. For example, the Home cube and Power Badge platforms will enable connected consumers to have their personal assistant at home and on the move. This software is sophisticated. Cubic, which represents a new frontier in digital assistants, can connect with and operate all the devices, apps and services in the connected consumer's life: their smartphone, smart-watch and car. The smart home and its appliances may be next.

RankBrain from Google brings AI into yet another sphere: marketing. It improves Google's ability to return accurate searches for more conversational or ambiguous queries and examines search behavior to "learn" how to perform better searches. And there's Hound, with its Speech-to-Meaning capability. Could it be the new way to search and perform tasks faster without typing?

And let's not forget Apple and Facebook. Machine learning is already a big part of Apple's "intelligent assistant" Siri and there's evidence to suggest that the company is investing heavily in this space, albeit quietly. In the second half of 2015, Apple acquired a small UK-based AI business, VocalIQ. A speech-related AI company, VocalIQ uses its technology as a core component in the delivery of the Internet of Things. Facebook is more openly supportive of AI, and has assembled two teams of AI experts. The first is focused on products, the other tasked with carrying out academic research within Facebook. One of the company's key products is its own virtual assistant 'M', currently being trialed in San Francisco.



Speech recognition is also a key focus in AI. What's interesting is how different these applications are and how the players have opted to follow their own unique directions. AI has so many possible uses that it is a market waiting to be explored and exploited.

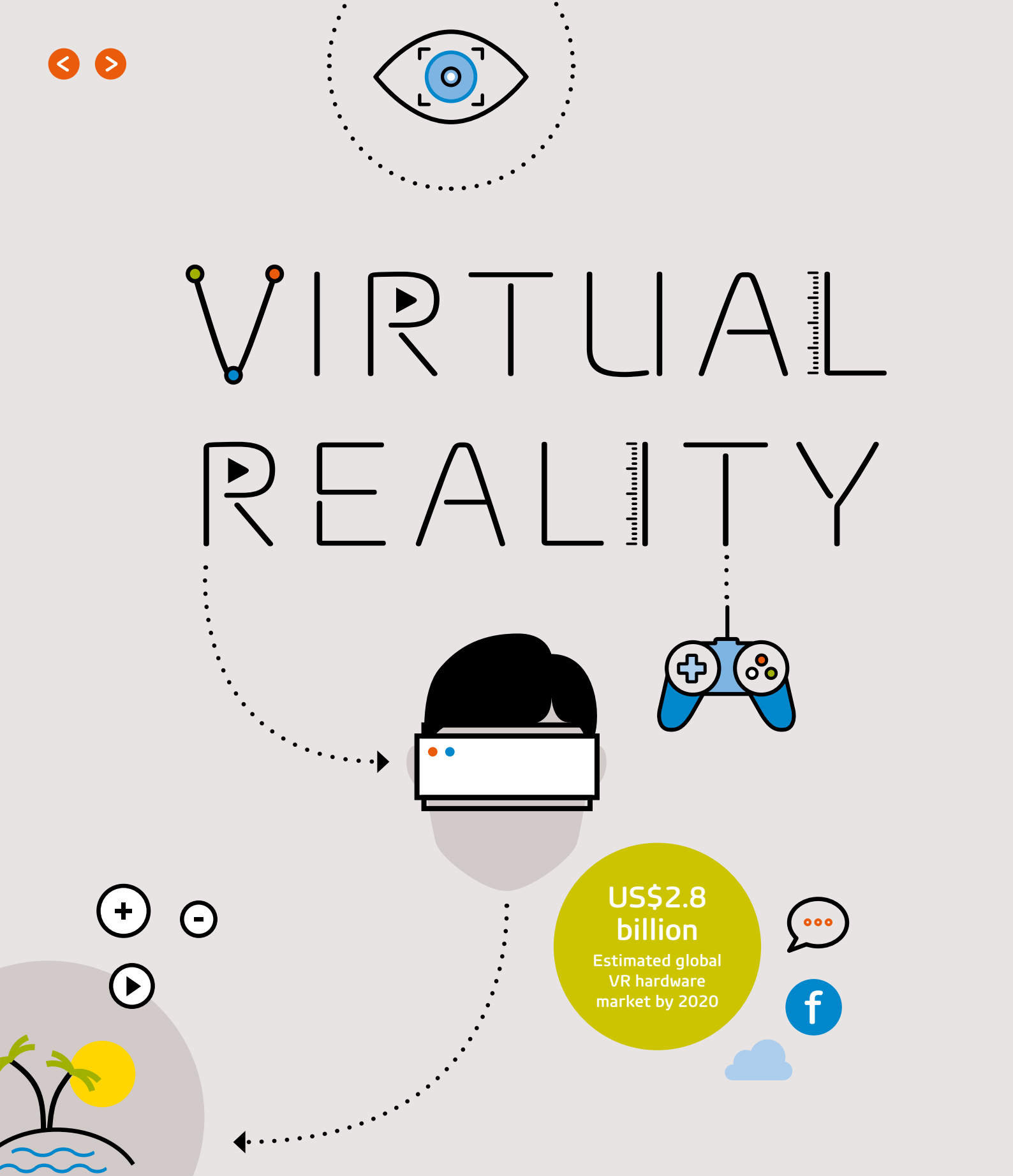


Our analyst, Anne Giulianotti, says:

"The ultimate artificial intelligence might be a long way off, but we are increasingly going to see the impact of machine learning on our lives, influencing our decisions and purchases. For connected consumers, AI presents even more opportunities for brands to reach them with relevant messages and recommendations. For brands, there is the chance for a dialogue with consumers that builds trust. Right now, brands should be focusing their efforts on monitoring and assessing the market impact of AI."

[1] The Financial Times, January 4, 2015, Investor rush to artificial intelligence is real deal.

VIRTUAL REALITY



The VR trial in gaming will generate **more awareness** and could drive **appetite** among connected consumers to try it out in other aspects of their life beyond entertainment.

VIRTUAL REALITY – A "TELEPORTER" TO EVERY-WHERE AND EVERYONE

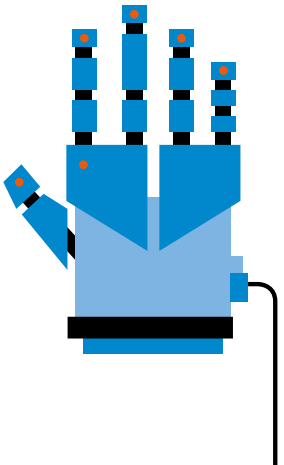
Could 2016 be the year that virtual reality (VR) comes into its own? Estimates suggest a US$2.8 billion global VR hardware market by 2020[1], with head-mounted displays (HMDs) for gamers leading the charge. We believe the trialing of VR in gaming will generate more awareness of it and could drive appetite for its application beyond entertainment. This could result in VR penetrating other industries such as travel, retail, business and education. With Facebook saying it wants to "build a device that allows you to be anywhere you want, with anyone, regardless of geographic boundaries", is it finally time to get real about VR?

Sony, Valve, HTC and Facebook are among those leading the way in creating VR content for gaming platforms. The current focus is very much on the HMDs that provide a fully immersive, individual experience. Gamers can be interacting with players anywhere in the world, while being practically isolated from the people sitting next to them on the sofa.

Gamers are willing to spend

US$350

or more on VR headsets and accessories



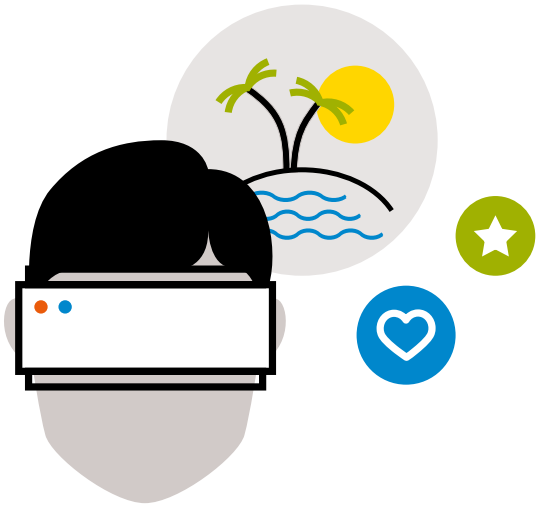
Much rests on how well these first HMDs and accessories perform. So what's going to be on offer for gamers? Sony has PlayStation VR, Facebook acquired Oculus Rift in 2014 and Valve has Steam VR (a headset produced by HTC). Microsoft has yet to announce a full VR product for Xbox. Its HoloLens currently provides a different spin on an HMD, offering augmented reality rather than a full virtual environment.

The gaming market won't be limited to first-party HMD manufacturers; third parties are already working on accessories that increase the perception of immersion via haptic feedback (i.e. the sense of touch in a user interface). Gloves are one of the first products on offer to gamers, and we expect other accessories and peripherals to follow. Numerous companies are offering them, including Gloveone, Control VR and Manus Machina. Teslasuit has a more ambitious approach: a full-body haptic feedback suit.

The gaming market caters to the tech-savvy, early adopter market that anticipates the arrival of technology such as VR headsets and accessories, and they are ready to part with US$350 or more to experience it. But how might VR develop beyond gaming? Marriott, Thomas Cook and Qantas Airways have already created promotional experiences using VR. The technology gives would-be travelers a taste of their possible destinations, as well as hotel facilities and rooms.

Shopping could become one of VR's top applications, allowing connected consumers to experience a full retail environment from their own home. British online fashion retailer ASOS is currently partnering with 3D and VR retail specialist Trillenium to bring its products to HMD headsets. Benefits for retailers include an improved retail design and shelf optimization, and reduced item returns. The latter is a massive challenge and cost for fashion retailers in particular, so they are keen to embrace any technology that could help to address this.

Applications in business include architectural design, home and office space planning, and rapid prototyping in product development and engineering. VR can also be used in healthcare to support training and remote robot-assisted surgery, allowing operations to be conducted from distant locations. The educational possibilities are vast too. It's easy to imagine a classroom full of schoolchildren experiencing ancient Rome via VR headsets.



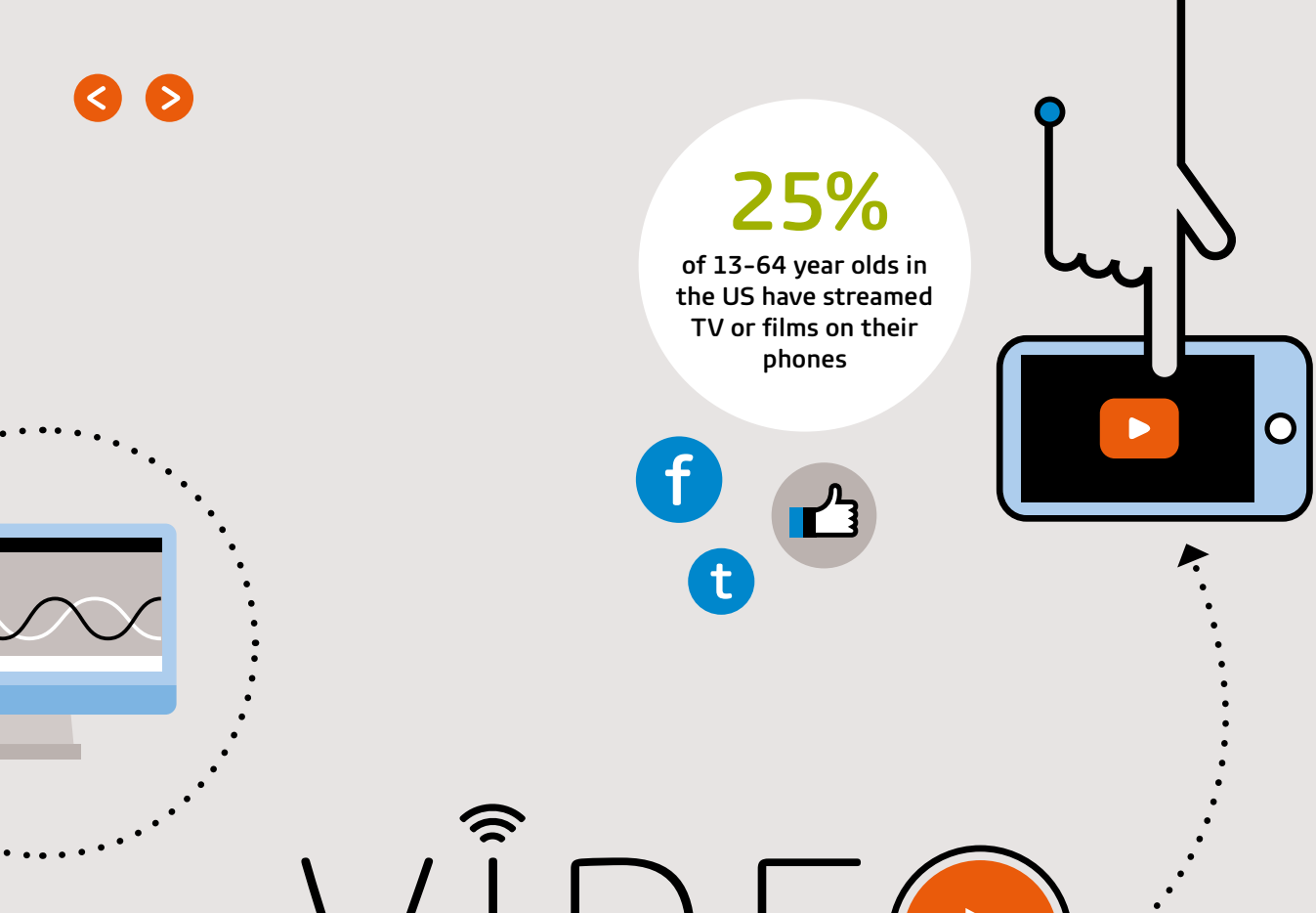
Our analyst, Jack Millership, says:

"The potential applications of virtual reality are endless and exciting. But, with this technology in its early stages focused on gamers, it's still unclear if awareness and familiarity will be enough to drive appetite among mainstream connected consumers. We know that Microsoft's Xbox 360 migrated from the gaming category to the home entertainment space, and the companies investing in VR will be hoping for history to repeat itself. Brands need to monitor the success of HMD headsets in 2016 and beyond, and be poised to respond if the consumer reaction is positive."

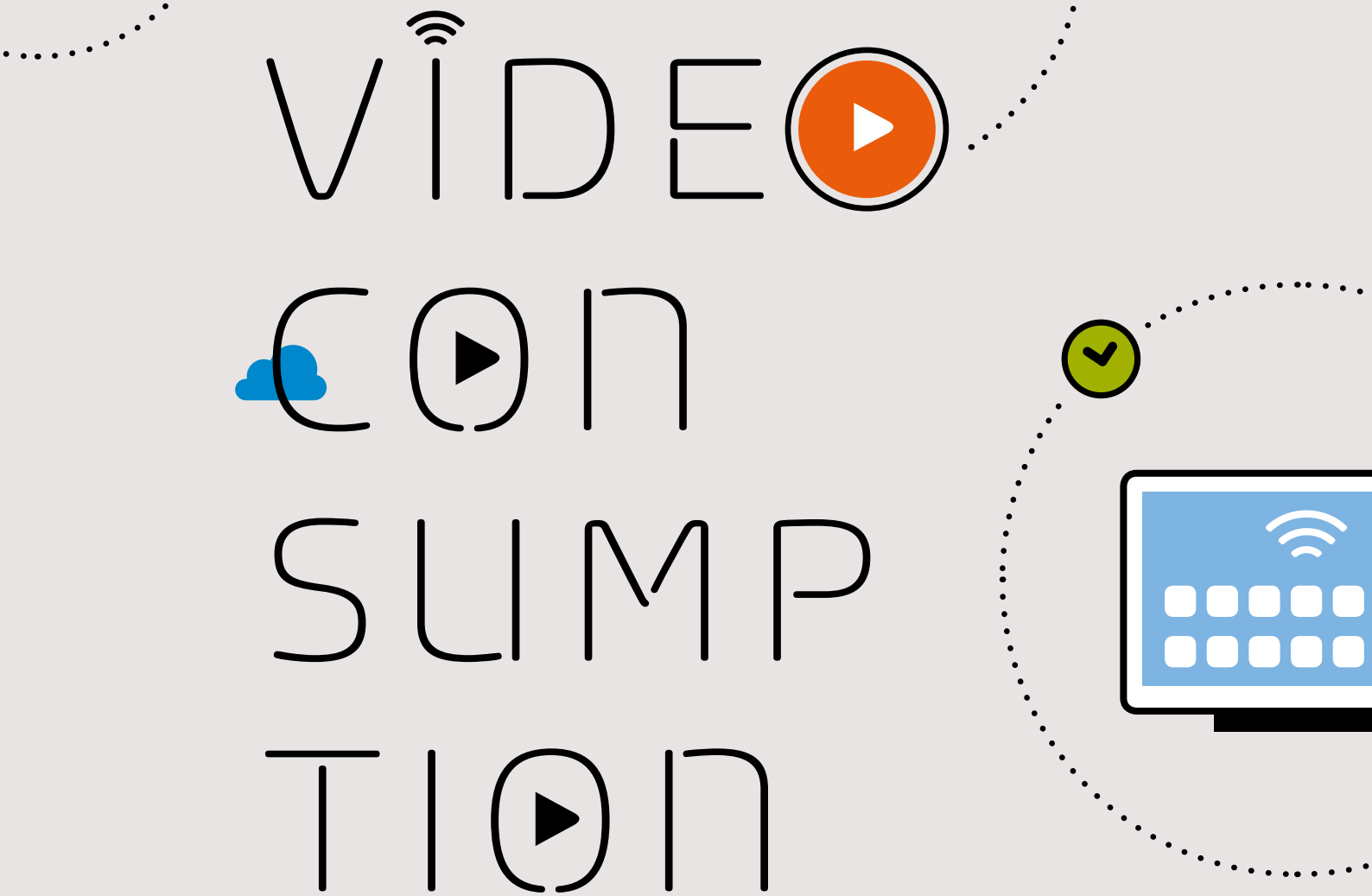
[1] Business Insider UK, April 2015, The Virtual Reality Report.

25%

of 13-64 year olds in the US have streamed TV or films on their phones



VIDEO CONSUMPTION



Video is **growing faster** than anyone anticipated and **online is becoming the go-to channel** on which to enjoy it.

ONLINE VIDEO: THE AGE OF THE SMALL SCREEN

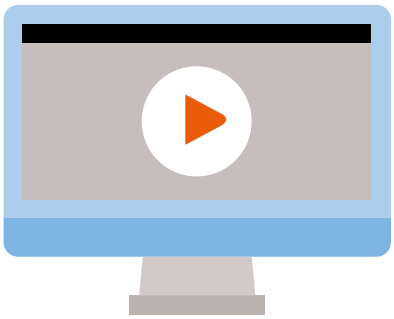
Consumption of video is growing faster than anyone anticipated and online is becoming the go-to channel on which to enjoy it. From short clips on social media to streaming movies and box sets, it seems the connected consumer will view video content on any platform and at any time. In fact, current predictions suggest 80% of all consumer internet traffic will be video by 2019.[1] How is this already huge market likely to evolve, and what does it mean for brands and businesses?

What characterizes this market is the speed at which it is evolving. Hardly a day goes by without the announcement of a new service or platform launch, or news of a technological development aimed at changing the way we view visual content. It is hardly surprising that consumers are enthusiastically embracing this newfound flexibility and choice.

As consumers turn to over-the-top (OTT) delivery platforms, streaming services and social media to curate their own personalized viewing mix, so linear viewing has declined with the landscape, shifting away from traditional pay TV providers and their big-bundle offerings. This is causing disruption to the traditional free and pay TV distribution models. In the UK, while three quarters of OTT subscribers also have a pay TV subscription, one quarter of these claim they have already cancelled it, or will do so in the future[3].

80%

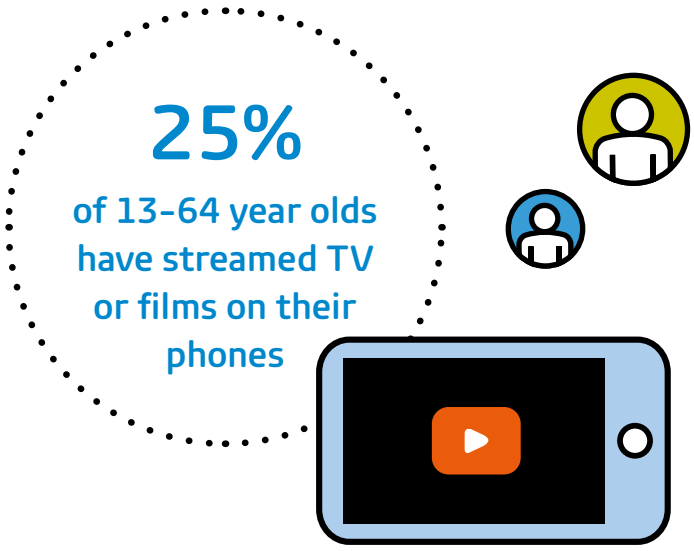
of all consumer internet traffic will be video by 2019



The latest figures from our global trackers say it all:

- In the US, more than a half (54%) of people have an internet-connected TV (either a smart TV or TV connected to the internet via another means)[2].
- 34% of the online UK population has access to one or more OTT subscription streaming services; this has doubled since 2013. Amongst 18-34 year olds, this was even higher with nearly half of this age group (45%) having access.
- In Singapore, thanks to high levels of smartphone ownership, 75% of the online population watches content via free online sites, rising to 83% amongst 18-34 year olds[4].

Video consumption is increasingly migrating to smartphones, particularly among millennials and pre-teens. Our US data suggests that 25% of 13-64 year olds have streamed TV or films on their phones, so it's not just short clips being viewed on smaller screens. Increasingly, this audience is engaging with video advertising on their smartphones too, and brands are maximizing the opportunity to use this platform to engage with them in this highly personal and targeted way.



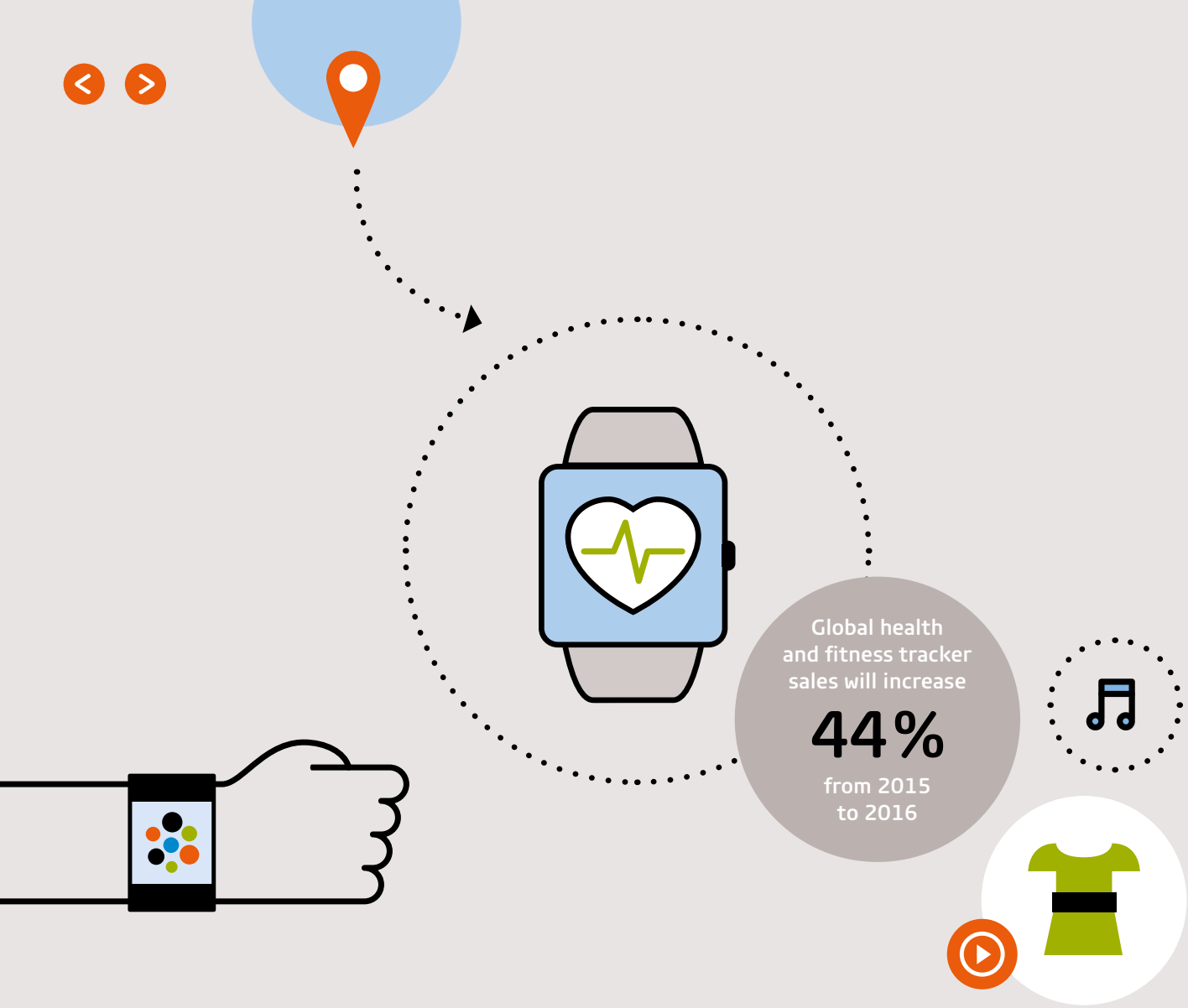
With so much video content being consumed, it is becoming more important to understand audience behavior: what people consume, where, on what device and what would make their experience better.

Brand marketers will not only need to embrace the new opportunities for better optimization of their advertising and marketing, but will also need to use them to offer the consumer relevant information. If they do not use video as a fundamental part of their communications, their competitors will. And with so many players involved – from content producers and publishers to brands – there will be a need for partnership and collaboration. This is particularly pertinent at present, as much of the data currently exists in silos – its power can only be unlocked through a mutual exchange of information.

Our analyst, Josh Hedley-Dent, says:

"Whether it's for entertainment or information, the vast amount of video consumption online is leaving a data trail for media owners and brands alike. These organizations have an opportunity to use this information to target content creation, distribution and interaction more effectively. Along with technological advances such as 4K, Oculus and 360-degree viewing, this is a market with an exciting future and many possibilities. Given the vast ocean of video content, players know they will need to use their customers' data carefully so that everyone benefits. The connected consumer is certainly interested in a personalized service, but one that doesn't become too intrusive. Getting that balance right will be key to success."

[1] Cisco Visual Networking Index: Forecast and Methodology, 2014-2019 Whitepaper.
[2] GfK Home Technology Monitor™, 2015 Ownership and Trend Report. 3,000 households surveyed in the USA.
[3] GfK ViewScape study, November and December 2015. 15 markets, online adults 18 years old and over, UK sample 1,147, Singapore sample 1,312.
[4] GfK How People Use® Media Report, Over-the-Top TV 2015. 1,000 persons aged 13-64 surveyed in the USA.



WEARABLES

Wearables will increasingly be able to **migrate from the wrist to clothing**, footwear and even jewelry in the near future.

WHERE ARE THE WEARABLES?

What will it take for wearable devices such as smartwatches, fitness trackers, cameras, GPS tracking devices and heart rate monitors to go mainstream? Although high-profile launches such as Google Glass and Apple Watch have captured the consumer's imagination, few have adopted these high-end devices. In comparison, the popularity of health and fitness trackers, which represent approximately 58% of wearables sales volume in Europe [1], provides insights into the elements needed to turn the wearables market "mass".

Today's connected consumers – millennials in particular – are no strangers to being monitored. In fact, they are quite used to having everything tracked and measured, from their possessions to their vital signs. For manufacturers of wearables, this familiarity and appetite for information presents numerous opportunities. From healthcare monitoring for the elderly and long-term sick, to monitoring the location of children, to tailored alert and alarm systems, the uses for wearables are extensive. It's no wonder, then, that the market value is forecast to hit US$12.1 billion in 2016, up 41% year-on-year [2].

However, if wearables are to become a part of more consumers' lives, we believe four elements need to be addressed:

1. Invisible and seamless

Being able to incorporate your wearable device into an existing personal technology ecosystem is going to be fundamental to market take-up. This becomes even more important as connected consumers link up with their homes and cars, and look to manage these from wearable devices as well as their smartphones. For example, controlling your Philips Hue lighting system from your Samsung Gear S2.

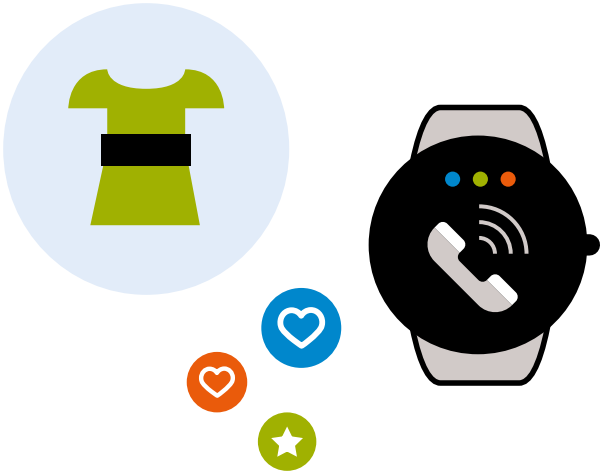
Health and fitness trackers represent

58%

of wearables' sales volume in Europe

2. Style and substance

Style has been a key barrier to the adoption of wearables to date. Some fashion brands have spotted this opportunity and, recognizing they lack the technical know-how to make their own wearables, have instead opted for partnerships. For instance, high-end watchmakers Fossil and TAG Heuer are collaborating with brands such as Intel and Google to develop smart devices. The next step in the style stakes will be "made-to-fit" clothing and medical devices. Brands including Nike are already incorporating nanotechnology into their apparel ranges.



3. Accurate and efficient data collection, storage, processing and reporting

Improving data validity and interpretation is another area manufacturers are tackling. As sensor technology improves, the quality of the data output from wearables will become more reliable and accurate. This information will increasingly be stored and processed in the Cloud, proactively providing contextual and actionable information for consumers.

4. Compelling new use cases

We believe the use of distinctive, tailored characteristics will provide a link to the individual. For instance, heart rhythm could replace a written password, unlock a car door, or moderate temperature in the home. In this way, the holy grail of a mass market device that is tailored to each unique connected consumer will be achieved.

Key facts at a glance:

- In Europe, smartwatches make up 22% of wearables sales [1].
- Global health and fitness tracker sales will increase 44% from 2015 to 2016, while smartwatches will see a substantial increase of 87% [2].
- The smartphone is the biggest rival to most wearables in terms of functionality and benefit.

Our analyst, Jan Wassmann, says:

"Success in this market is all about finding the unique and specific benefits that wearables offer, and this is where the market has struggled to date. But this is about to change. We predict that innovation will focus on creating smarter ways to interpret the data collected using wearables. It is the processing, analysis, interpretation and delivery of the personal information that holds the key to success. Connected consumers will expect their wearables to be completely personalized to their needs – be that the medication they need to remember to take, their daily calorie allowance, their blood pressure, or monitoring their home while they are at work. Smaller devices are what consumers crave. That means wearables will increasingly migrate from the wrist to clothing, footwear and even jewelry in the near future."

[1] GfK Point of Sales Tracking. Tracking of health and fitness trackers, wrist sport computers and smartwatches, January–September 2015, 16 European markets.
[2] GfK Trends and Forecasting, December 2015. Wearables forecast (excludes connected watches).

The mobile payments market is only really **evolving now**. In some markets there is still a need to **raise awareness**, while in others it's all about **increasing accessibility**.

AROUND THE WORLD IN 80 MOBILE PAYMENT MECHANISMS

The global mobile payments market is complex. Incumbent payment mechanisms are entrenched in many mature markets and are proving difficult to supersede. In contrast, a number of African and developing Asian markets have gone straight to mobile payments. In such a fragmented environment, it is crucial for brands, manufacturers and retailers to understand the global picture now and how it might evolve. Only then can they ensure they meet the needs of connected consumers who, according to our research, increasingly want to pay by mobile [1].

Let's first look at Kenya, where consumers are already using their mobiles to communicate with their banks, and internet operators like Orange have been promoting their own banking solutions such as Orange Money. When near field communication (NFC) becomes available, this market is poised for rapid growth.

Poland is one of Europe's most innovative markets. In as early as 2014, Visa teamed up with the major banks in this country to facilitate mobile payments.

In China, third-party players like Alibaba and Tencel have taken the lead to encourage connected consumers to pay by mobile in physical and virtual spaces alike. The availability of affordable payment-enabled smartphone models from Xiaomi, Oppo and Meizu mean that mobile payment is not only visible but also accessible in this market.

In stark contrast to these examples is the situation evident in markets that we might expect to adopt emerging technology first. In the UK and US, for example, the challenge is that only a small number of high-end handsets are enabled for "tap and pay". This is something that Visa, Google, Apple and Samsung, in particular, are investing in heavily. They will know that there is an appetite among UK consumers to pay by mobile (27% agree "I like it when I can pay for something in a store using my mobile"), and they can see the benefits it provides to shoppers (33% of consumers say it makes shopping "faster" and 30% "more efficient"). As these brands work to raise awareness of and the accessibility to mobile payment, they will want and need to tackle the view held by almost one half (49%) of consumers that mobile payment is a "gimmick"[1].

It may have been the starting point for mobile payments in Europe, but chip and PIN was only introduced in the US in September 2015. The timing wasn't ideal. This "old" technology arrived in the slipstream of two highly visible and trusted mega-brands – Apple Pay and Android Pay – which suggests that it may never gain traction in the market. In 2016, we expect to see a shift to Payments 2.0 in the US – a move to value-added services including shopping lists, rewards, benefit points, discounts and location-based offers.

Our analyst, Courtney Bergh, says:

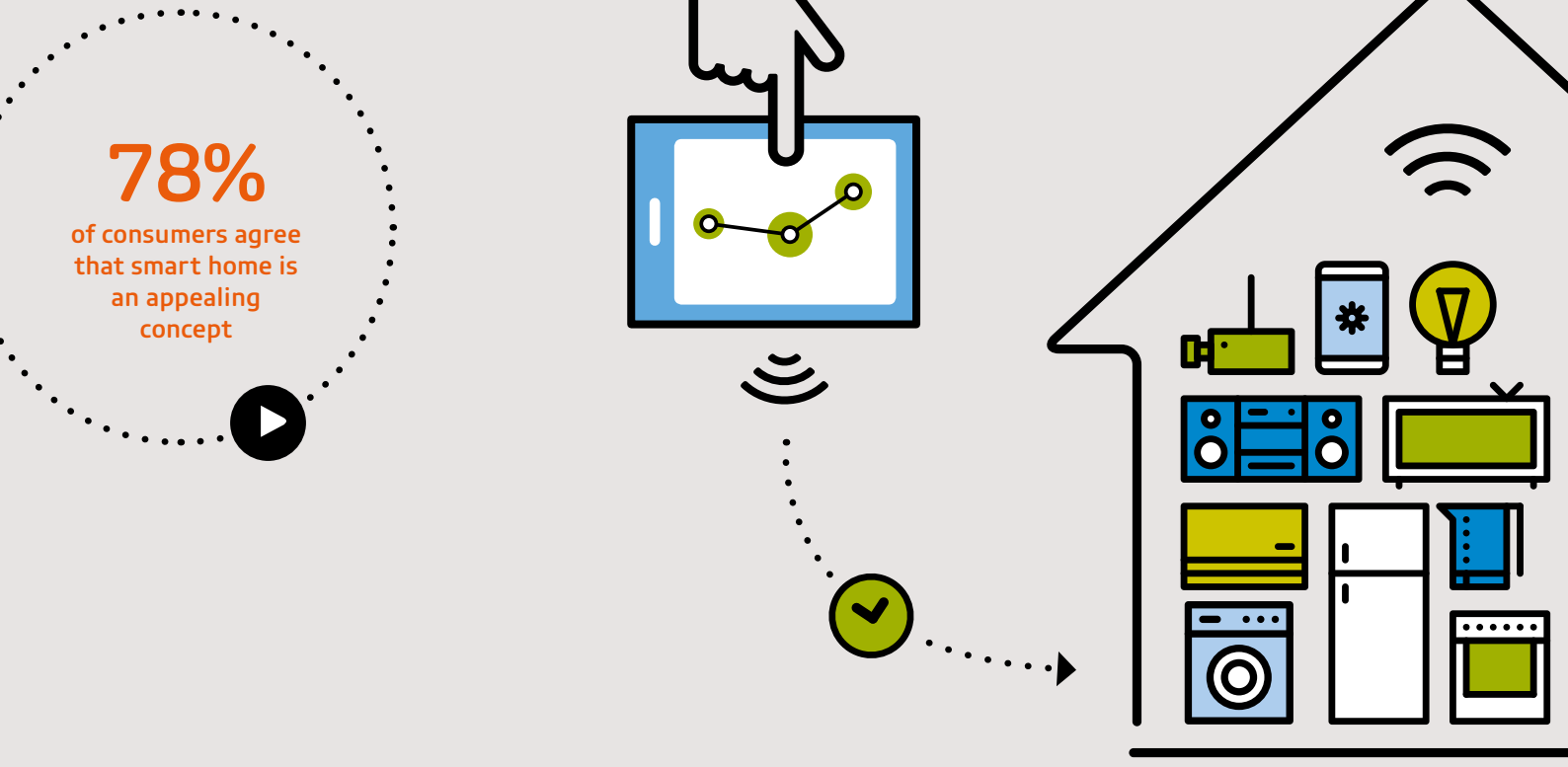
"Although it's been spoken about for at least ten years, the mobile payments market is only really evolving now. In some markets there is still a need to raise awareness, while in others it's all about increasing accessibility. What is certain is that overcoming security concerns and technical issues, while simultaneously communicating the positive consumer benefits of convenience, customized incentives and loyalty rewards, will be a key focus for retailers everywhere in 2016. It will perhaps be more of a priority for retailers in the UK and US, however, as they are currently lagging behind other markets globally."

The advantages of paying by mobile[1]:

	I like it when I can pay for something in a store using my mobile.	Making payments with my mobile device is faster than other methods.	Making payments with my mobile device is more secure than other methods.
CN	66%	74%	41%
IN	58%	65%	52%
PO	27%	42%	25%
SK	35%	47%	20%
UK	27%	33%	23%
US	16%	27%	16%

[1] GfK FutureBuy study, October 2015. Six markets.

SMART HOME



78%
of consumers agree that smart home is an appealing concept

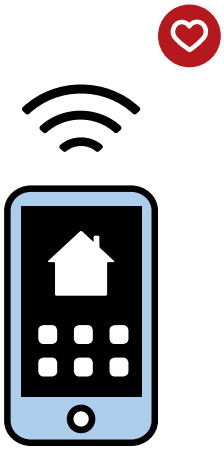
For homes to be smart they must also be **simple** and **seamless** – operating systems, appliances and devices must **talk to each other**.

THE HOME IS GETTING SMART(ER)

There is a smart home "gold rush" happening now as all sorts of organizations, from manufacturers, utility companies, global technology providers and retailers look to maximize their involvement in tomorrow's home. Demonstrating to consumers how smart home technology fits with and enhances their lives – as well as delivering an engaging and effective user experience – will be critical to success. This is the time when collaboration and education are needed to accelerate demand and to propel smart home innovation from a manufacturer-led evolution into a consumer-led revolution.

The smart home certainly has currency. Most consumers (nine in ten) are aware of the term, 50% globally expect it to impact their lives, and 78% agree it is an appealing concept. Furthermore, taking Leading Edge Consumers (LECs) as an indicator of future take-up more broadly, the evidence suggests that the smart home will become increasingly popular. However, the current challenge for manufacturers is that consumers still know little about the smart home and its capabilities, with only 10% saying they "know a lot" about it. This presents an opportunity for manufacturers to educate people about their vision for the smart home.

The lack of knowledge of the potential of the smart home means that at present its adoption is piecemeal. Consumers are only thinking in terms of purchasing specific smart home devices to meet a particular need, rather than the benefits of a home full of devices that are connected. Even then, take-up of these devices is slow with only one quarter owning today's most popular smart device: a smart TV. A further

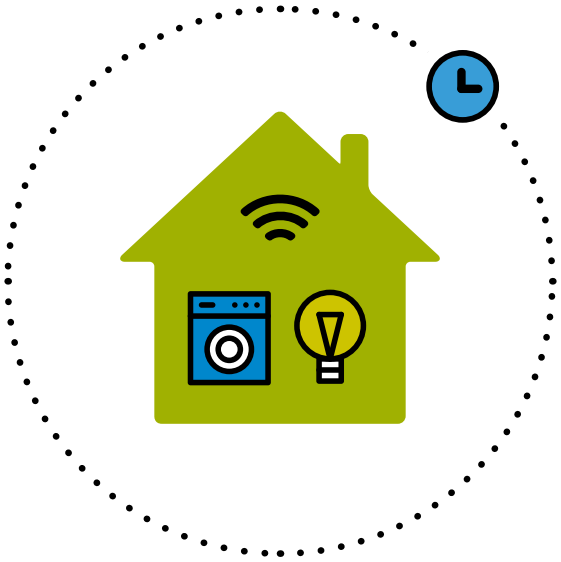


reason for the slow speed of take-up is that the market has been tech-led rather than consumer-led. The fact that consumers don't necessarily know when their homes are smart can also be explained by how the market has so far evolved. Advancements in devices linking together, for example, have simply happened without them realizing.

The current situation means that, for now at least, homes will become smart by increment rather than by design as appliances and devices are replaced over time with newer "smart" models. The exception will be LECs who have the means and desire to invest in the smart home now. It is this group that represents the most immediate opportunity for providers.

When consumers think about what the smart home can offer, their expectations are high. They want smart home products and services to operate seamlessly with each other. Many want a single vendor to manage all their smart home products and services, and would pay for a single app to manage every smart device in the home.

To realize the opportunities of the smart home, competitors will need to collaborate and unusual partnerships will be formed. This will ensure disparate devices and services connect together in the background to meet that all-important desire for simplicity. Only at this point will the true value of the smart home be enjoyed.



Our analyst, Ranjiv Dale, says:

"The smart home is extremely complex to implement. Every home is different and so are the needs of its occupants. To encourage mass market take-up, manufacturers must communicate the benefits of the fully-realized smart home clearly. Critically, the technology must be simple and seamless. Success will come when organizations work together to deliver the positive user experience that home owners crave."

Key stats at a glance[1]:

The smart home categories that most appeal to Leading Edge Consumers (LECs) are:

53%
security and control

50%
energy and lighting

47%
smart entertainment and connectivity

44%
smart health

43%
smart appliances

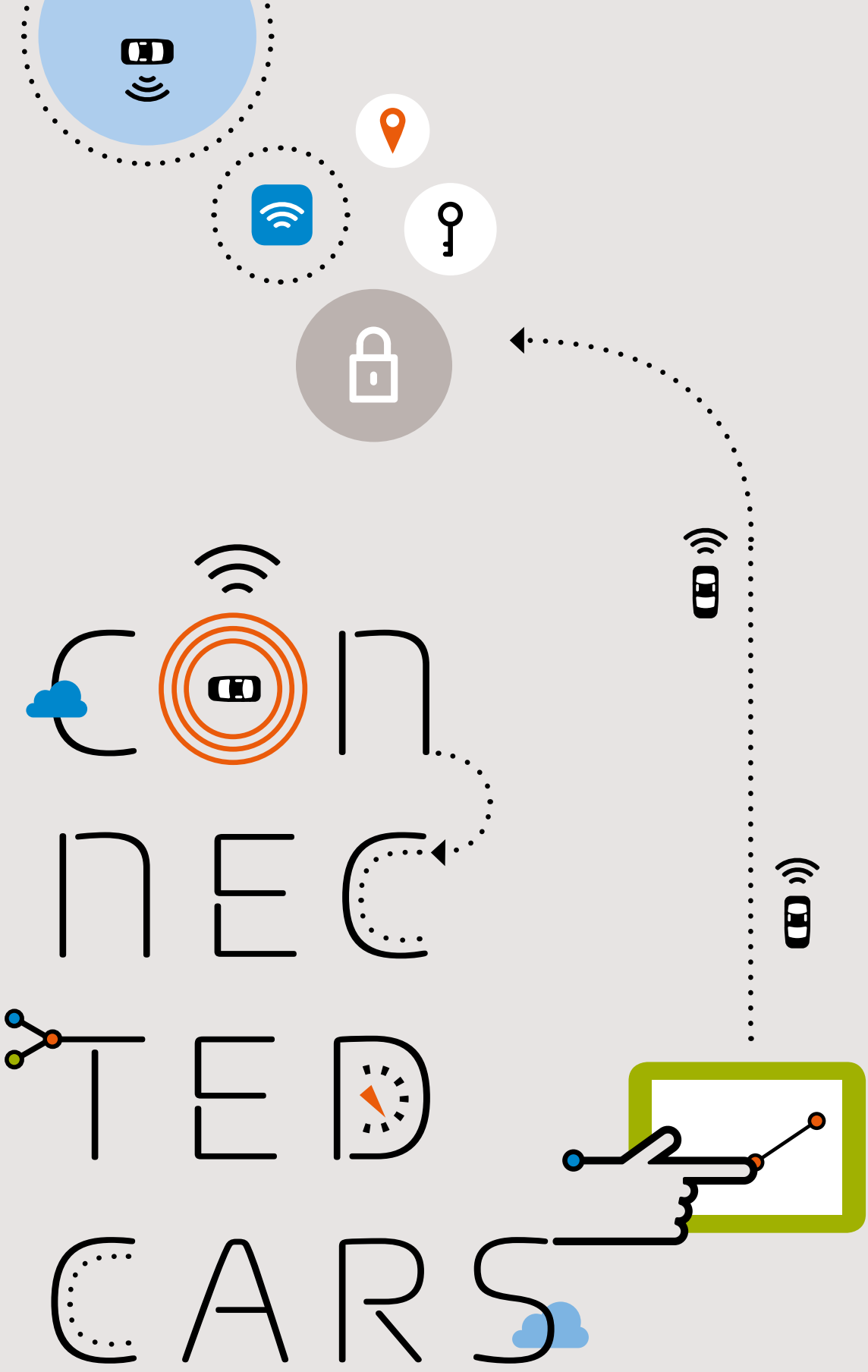
For all consumers, the main barriers to purchasing a smart home device are:

33%
cost

24%
privacy concerns

47%
lack of product knowledge

[1] GfK smart home study 2015. +7,000 consumers surveyed across seven markets.



With **increasingly sophisticated technology coming online** and **new business models emerging**, helping to fuel further investment in developing the technology, **new challenges** are coming to the fore.

FULL SPEED AHEAD FOR THE CONNECTED CAR

The idea of the connected car isn't new, but it's only in the last five years, with the explosion of the smartphone, that connectivity in vehicles has taken off. Almost every original equipment manufacturer (OEM) in Europe now offers connected features in their vehicles in some shape or form. So where should we set the map coordinates to next for the connected car?

As connectivity becomes more sophisticated, so will the features in the connected car. While many luxury vehicles already have large displays, and this trend is set to continue, additional displays for the front seat passenger are likely to start to appear in upper premium vehicle models and beyond by late 2016 or early 2017. OEMs are even looking to extend heads-up displays to incorporate the whole windscreen or side windows for a more "augmented reality" experience. This growth in display technology is already opening doors for an increasing number of consumer electronics technology businesses and startups, all trying to get ahead of the traditional automotive suppliers.

While in the past it has proved tricky for some OEMs to find the right business model, hampering the development of connected services and features, new opportunities are now opening up. Understanding the needs and desires of customers in specific markets and tailoring in-car apps and services to meet them will be key to getting them to pay more for connectivity. For example, Volvo's telematics system, On Call, traditionally saw take-up rates of around 5-10%. However, upon launching a smartphone app that allowed drivers to remotely control the climate system and to pre-heat their vehicle, take-up rates in Nordic countries skyrocketed. With the ability to add new apps and leverage consumers' smartphones, OEMs are now in the best place to tailor their offering to maximize market impact. That said, the key to their success will be having a deep understanding of their customers and, more importantly, finding an innovative partner to design and build these life-enhancing apps or features for their vehicles.

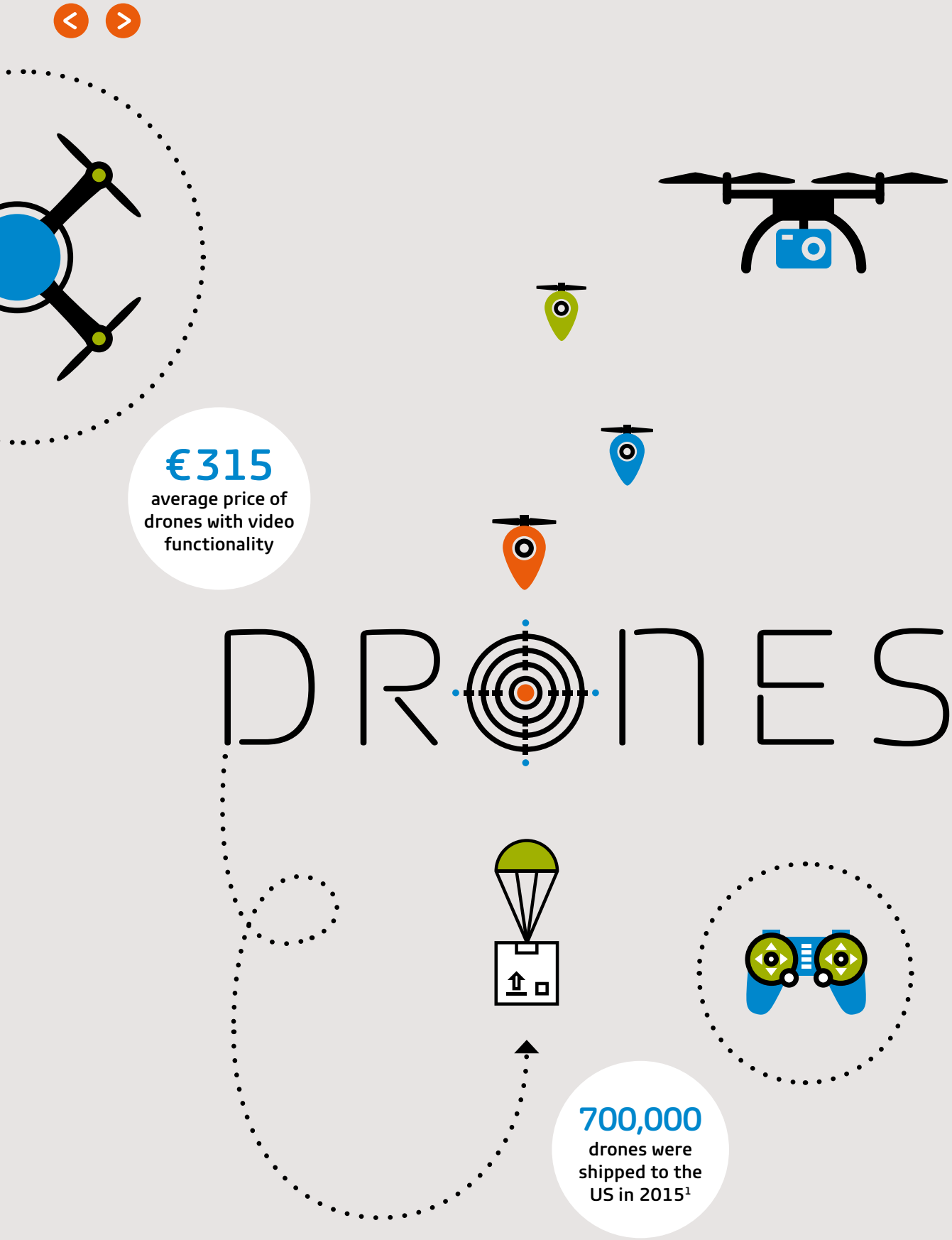
With increasingly sophisticated technology coming online and new business models emerging that are helping to fuel further investment in developing the technology, fresh challenges are coming to the fore. One potential issue is around data privacy – a subject regularly highlighted to consumers by the media's reporting of data losses, thefts and leaked information. While OEMs are bound by data privacy legislation, they also need to be sensitive to customer opinion on this subject if they are to succeed. As OEMs seek to promote more features and push targeted advertising via in-car displays, they will need to use more consumer data. To do this, they will need to:

- understand customer sentiments about privacy in the countries they operate in
- provide clarity to consumers on how their data will be used
- deliver a great value proposition to customers for using their data

To this end, vehicle manufacturers can learn a lot from the consumer electronics world and, for example, brands such as Facebook and Google. Customers understand the need to surrender their data to these brands and value what they get in return. The automotive industry needs to clearly communicate the value to its customers of them sharing their data.

Our analyst, Jack Bergquist, says:

"Technology in vehicles has advanced more in the past five years than in the previous 30, and in the next five years it is expected to continue to develop at full throttle. Not only will OEMs continue to tailor features to specific market needs but automated vehicles will become more prevalent too. Technological advancements will continue to provide greater opportunities for non-automotive companies to enter the field. However, having a clear understanding of the automotive industry will be essential to making this transition. For any company already in or moving into this space, understanding the customer will be more important than ever to ensure success."



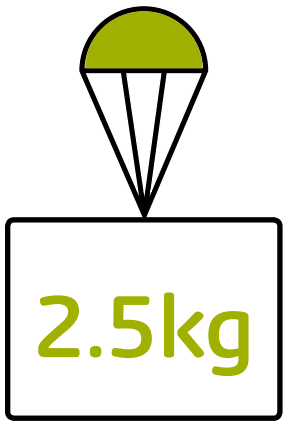
For businesses, drones will be a catalyst to **reduced cost** and **increased efficiency**. But there's a long way to go.

THE GAME OF DRONES

Despite the media attention, drones are not new. But with improvements in technology and falling costs, there is a real opportunity for these unmanned aerial vehicles to evolve from a hobbyist market into a mainstream technology. From their use in aerial filmmaking and landscape mapping, to commercial deliveries and aid deployment, and even the automation of mechanized farming, the extensive capabilities of drone technology are only now being realized and exploited by many businesses. For businesses to harness this market, effective and reliable automation holds the key.

In 2015, 700,000 drones were shipped to the US[1]. However, with their wide-ranging applications, and with prices of the most popular hobbyist drones ranging from less than €100 up to €400, the drone market is on an upward trajectory.

Within Europe alone, the largest regional market for consumer drones, two manufacturers currently account for around three quarters of the market's entire sales value: China's Dajiang Innovation Technology Co. and French wireless products manufacturer Parrot EPA. We expect that to change as companies new to the market look to seize the opportunity for growth that drones offer.



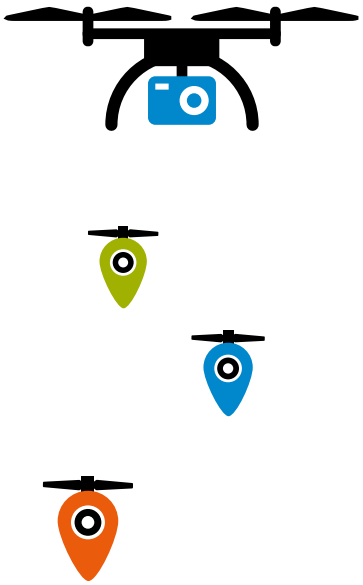
GoPro is set to launch a quadcopter in 2016, a natural extension of their action videography portfolio. Meanwhile, digital giants Facebook, Google and Amazon all have drones in their roadmaps – Facebook and Google to expand the Internet's reach, and Amazon and Google for deliveries. Amazon's objective to deliver packages of a maximum of 2.5kg to consumers in less than 30 minutes is challenging. With nine in ten orders qualifying for

this delivery service, the cost-effectiveness will be significant. But using drones for deliveries is still some way off. In the US, America's Federal Aviation Authority (FAA) is still testing drone deliveries, with the first federally approved drop undertaken as recently as July 2015.

Today's drones aren't without their challenges. Obstacles include limited "sense and avoid" technology, weight-carrying restrictions, the lack of night vision and a short battery life. As new players enter the market, these challenges are being overcome and drones are becoming increasingly sophisticated. For example, the "Flying Wing" from VTOL Technologies can stay in the air for one hour, while Krossblade's "SkyProwler" can fly at 60mph.

Our analyst, Aatish Thakerar, says:

"This is very much a 'prosumer' market, one where businesses will use drones to meet the high expectations of connected consumers looking for a better, more seamless service across numerous industries. For businesses, drones will be a catalyst to reduced cost and increased efficiency. But there's a long way to go and progress in this market rests largely on the evolution of automation technology. Without automation there can be no drone presence in urban areas – which means no deliveries, and no standards for drone flying technology. Developing reliable, efficient "sense and avoid" and self-powering technology through automation is the single most important factor for the drone industry today."



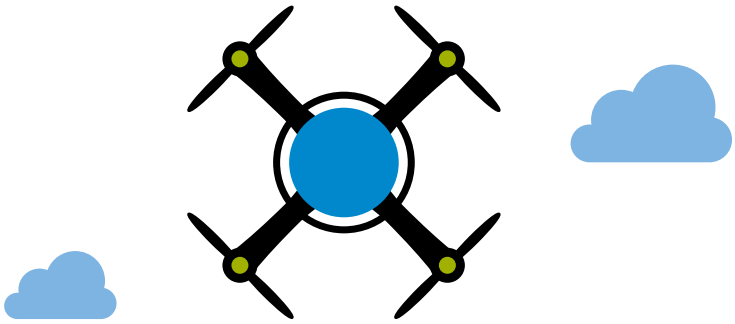
Approximately

4.3 million

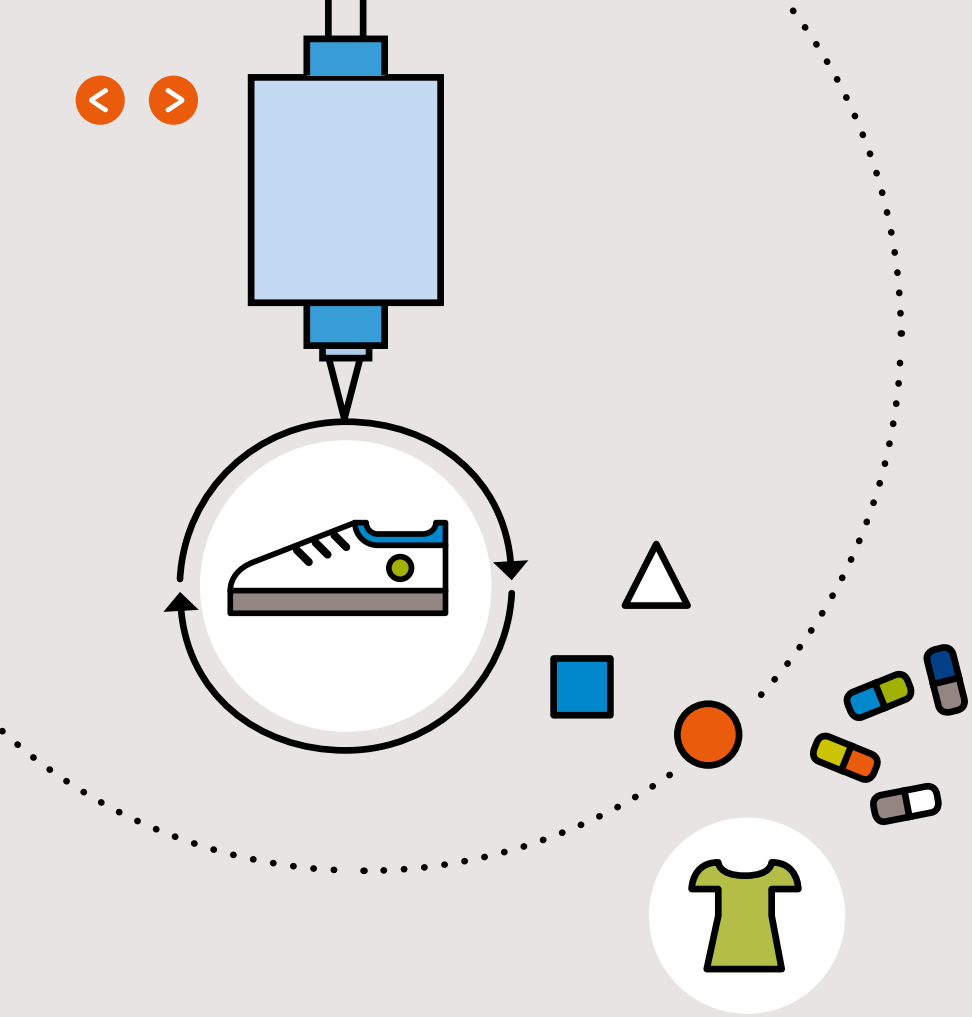
units of drones will be shipped globally in 2015[2]

Key stats at a glance:

- It is estimated that 4.3 million units of drones will be shipped globally in 2015, up 167% year-on-year and generating revenue of US$1.7 billion[2].
- Drones are sold both online and in-store. In Europe, two thirds of sales value is made online in the UK, Germany, Poland, Russia and Switzerland. In comparison, in-store sales dominate in Austria, Belgium, Italy, Netherlands, Portugal and Spain[3].
- Sales of "follow me" drones, which use GPS to autopilot and follow their user, surged during Q3 2015. In October alone, more than 20% of the drones were sold with this "follow me" functionality[3].
- In Europe, while the majority of volume sales comes from drones selling for less than €400, nearly 50% of turnover is generated from high-end drones with an average price of more than €1,000 (particularly in Switzerland, Austria and Germany).
- The average price of drones with video functionality is €315[4].



[1] CNBC, 17 November 2015. Holiday drones sales are big boon for producers.
[2] Mary Meeker, Internet Trends Report 2015.
[3] GfK Point of Sales Tracking. Sales of drones (with video functionality only), July-September 2015, 12 markets.
[4] GfK Point of Sales Tracking. Sales of drones (with video functionality only), October 2015, 12 markets.



3D PRINTING

~US$3,500
average price for basic consumer 3D printing systems

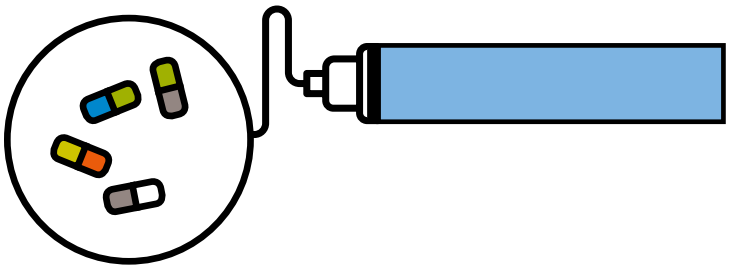
3D printing ranks at **number three** as a technology that consumers think is most likely to impact their lives.

THE FUTURE IN 3D

Picture the scene: your coffee machine needs a part. Rather than wait for it to arrive from Italy, you download the printing instructions from the manufacturer's website, send them to your local 3D printer, collect the exact part you need later that day and repair the appliance that evening. This may not be an everyday reality today, but 3D printing is becoming cheaper and, as prices fall, is increasingly accessible to both customers and businesses. We believe speculation that 3D printing is already dead is premature. This market has huge potential, and appetite from the connected consumer will be key in growing its disruptive forces. No business can afford to ignore 3D printing.

It's true that sales of 3D printers to date have been relatively small. Most of the business-to-business (B2B) demand has been served directly or through a very small number of dealers and resellers, and consumer sales have been meager. We expect this to change over the coming years. As more players enter the 3D printing market, B2B needs will be met by both distributors and IT/office dealers. For instance, mainstream manufacturer HP has recently launched 3D printers and Ricoh will be entering this space in 2016. For consumers, taking the German market as an example, our latest point-of-sale data shows 3D printer sales have increased by 71% in the past year and the market will continue to fuel that demand.

As might be expected with an emerging technology, cost is a major barrier to take-up for both business and customers. With basic consumer 3D printing systems currently priced at US$3,500, it's no wonder that a whole outsourcing industry has sprung up, with cottage industries offering 3D printing facilities to produce everything from toys to mobile phone covers, shoes and ornaments. As costs fall and price becomes less of an obstacle, the benefits will become more obvious and prominent: lower assembly costs, reduced waste, minimal transport and delivery charges, and the increased speed at which new designs can be brought to market. Ultimately, we're looking at a truly global/local market development that could herald a far more efficient supply chain for many items.



Although 3D printing may have largely dropped off the media agenda, our data suggests consumers find it extremely appealing. 3D printing ranks at number three as a technology that consumers think is most likely to impact their lives. This puts it ahead of the connected car, cloud computing, wearables and the Internet of Things, showing that knowledge of this new technology is high globally.

3D printing has the potential to be a hugely disruptive force. Manufacturers and designers will need to trademark, patent and copyright their intellectual property to avoid their latest designs going viral and appearing "in print" overnight. It may also mean that the true value of items becomes the thinking and concept behind the design.

Our analyst, Gavin Sugden, says:

"3D printing has the opportunity to impact consumers and businesses in many ways. It could enable a seismic shift from today's "historical" model of mass producing standardized items to producing tailor-made products locally. This could prompt the creation and growth of small, independent companies over global organizations. We could be looking at a future where manufacturers make their product designs available to customers to print at home, transforming delivery and logistics. A major beneficiary of these more efficient and green supply chains will be the environment."

Some applications of 3D printing:

- made-to-measure fashion – clothes and shoes designed to perfectly fit the buyer's 3D body scan
- pharmaceutical – prosthetic limbs, skin and tissue, and hearing aids – all personalized to the patient
- transport – spare parts for everything from cars to fighter jets, for when and wherever they are needed, from the motorway to the battlefield
- food – from printing chocolate, pasta and pizza here on earth, to NASA investigating the feasibility of printing food in space
- spare parts – for every type of household item, from dishwashers to toys

[1] GfK Point of Sales Tracking. Sales of 3D printers, Jan-Dec 2015 versus Jan-Dec 2014, Germany.
[2] GfK smart home study 2015. September-October 2015, seven markets.

Questions? Contact us!

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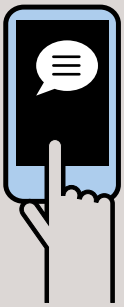

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