WAVESTONE

THE RISE OF INTELLIGENT VOICE ASSISTANTS:

NEW GADGET FOR YOUR LIVING ROOM OR WINDOW OF OPPORTUNITY TO RESHUFFLE THE CARDS IN THE WEB ECONOMY?

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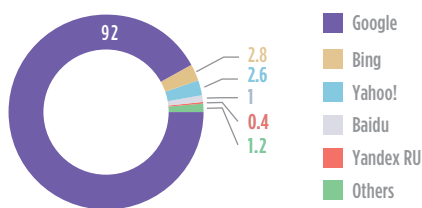**benjamin.gautier@wavestone.com**

Only 20 years ago, search engines were dominated by Yahoo!. The Californian company was dethroned by a Silicon Valley start-up, Google, which has since become the undisputed leader of written web search and related services. The market now seems to be undergoing a new revolution with the emergence of voice control and intelligent assistants, a revolution that could upset the established competitive order and transform the way that users consume services...

GOOGLE, THE UNDISPUTED LEADER IN SEARCH ENGINES FOR OVER 15 YEARS

Founded in 1998, in Silicon Valley, Google quickly imposed itself as the leader in search engines. In 2016, 92% of searches worldwide were made using its platform, compared with 2.8% for Bing and 2.6% for Yahoo!.

Google's dominance is a fact in almost every country around the world, with the exception of China, where Baidu enjoys a 76.5% market share (as opposed to 2.0% for Google), and Russia, where Yandex has a position equivalent to that of Google (respectively 45.4% and 49.1% market share in the final quarter of 2016)[1].
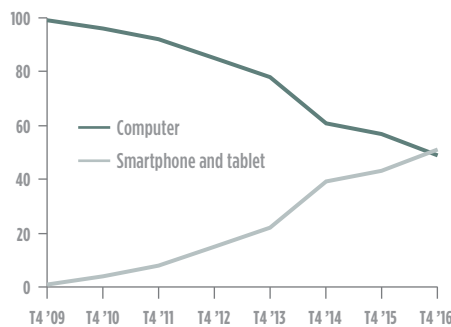
Global market shares of search engines in 2016 (%)

Source: Statcounter; Analyses: Wavestone

Global leadership of search engines in Q4 2016

Source: Statcounter; Analyses: Wavestone   ■ Google   ▥ Yandex RU   ■ Baidu

A simple search index at the outset, Google has since then greatly expanded its range of services, making the most of the rise of digital marketing. Online advertising now represents 88% of the group's revenue[2] and Google captures 1/3 of global net spending on online advertising[3]. Its revenue comes mainly from the advertising space on its search engine (e.g. AdWords, AdSense) and the tendency towards paid indexing.

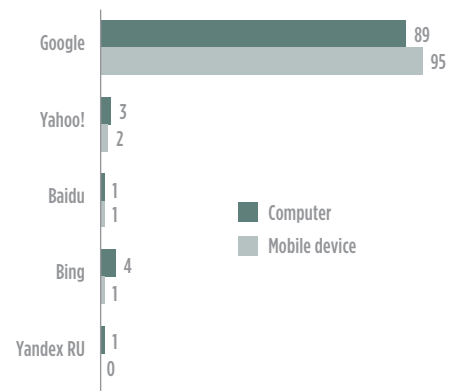The last decade has seen strong growth in the use of mobile terminals, such strong growth that, at the end of 2016, the number of searches conducted via smartphones or tablets has, for the first time, overtaken that of searches using a computer (51% vs. 49%)[4].

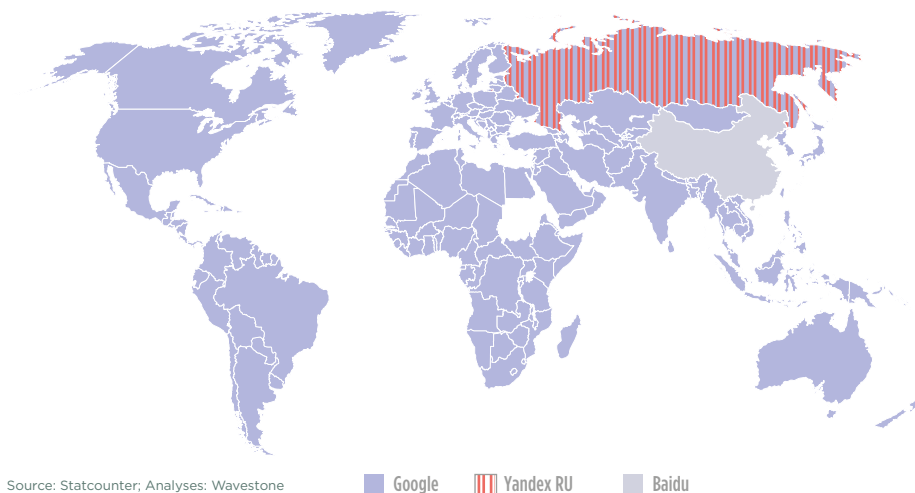## Changes in the market shares of global web searches according to connection terminal (%)

Sources: Merkle, StatCounter; Analyses: Wavestone

The trend towards mobile devices has benefited Google as it has further reinforced its dominance with over 95% market share in 2016 (compared with 89% on computer)[5]. In fact, 56% of 'googlers' prefer to use a mobile device for searches as opposed to just 44% for computers[6]. Conversely, the transition to "mobile first" for Bing seems to be more reluctant with only 18% of the volume of its searches being conducted on mobile devices and a global market share of 1.2% of total searches, which makes it the 4th search engine for mobile devices behind Yahoo and Baidu.

Market shares of web searches via computer and mobile devices by search engine in 2016 (%)

Source: Statcounter; Analyses: Wavestone
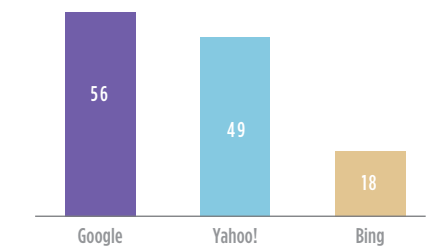
Mobile share of organic search engine visits in the United States in Q1 2017 (%)

Sources: Merkle; Analyses: Wavestone

In less than 20 years, Google has become the leading player in search engines on the web. Nevertheless, it would seem that it is no longer the only channel favored by the younger generation for finding information. Social media and mobile applications are beginning to compete with the search engines with shares of 35 and 27% respectively in the 16 to 24-year-old age group, who claim that these are the channels they most frequently use for their web searches[7].

The most popular web search channels in the world according to the users in Q3 2015 (%)
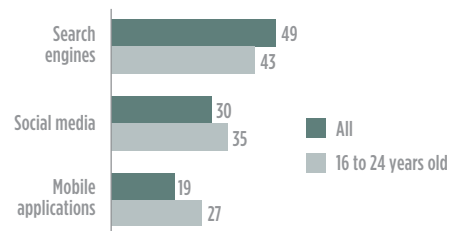
Source: Global webindex; Analyses: Wavestone

1- Source: Statcounter
2- Source: Alphabet, Rapport annuel 2016
3- Source: Statista

4- Sources: Merkle, StatCounter
5- Source: StatCounter
6- Source: Merkle

7- Source: Global webindex

VOICE SEARCHES, A RAPIDLY EXPANDING MARKET

Intelligent personal assistants, the spearhead for voice-based web searches

In 2011, by integrating Siri into the iPhone, Apple became the pioneer in terms of intelligent personal assistants (IPA). These applications are based on two complementary technologies: voice recognition and artificial intelligence. They allow the user to conduct a web search in the form of a conversation.

Searches by voice control have gradually become part of our daily lives: 65% of smartphone users in the United States had used an IPA in 2015, two times more than in 2013[8]. Frequency of use would also seem to be on the increase as 36 million Americans will use a personal assistant at least once per month in 2017[9], and 50% of searches could be by voice by 2020[10].

US market shares for smartphone owners using an intelligent personal assistant (%)
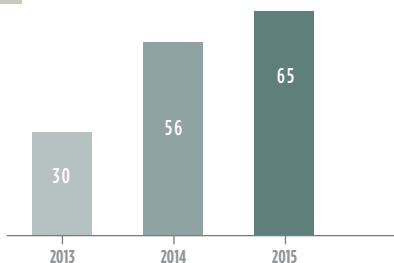
Source: KPCB; Analyses: Wavestone

Which among the following intelligent personal assistants do you use on your device? (% of positive answers; survey conducted in the United States)
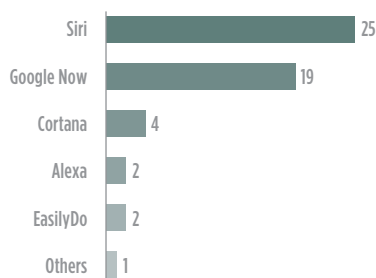

Source: Forester's North American Consumer Technographics; Analyses: Wavestone

Attracted by a rapidly expanding market (1.8 billion IPA users forecast by 2021)[11], a number of players have followed Apple by jumping into the race to develop an IPA. In 2015, the market contained four major players: Siri by Apple, Google Now by Google (now known as Google Assistant), Cortana by Microsoft and Alexa by Amazon. Competition is about to become more intense with the forthcoming arrival of the intelligent assistants Bixby by Samsung and M by Facebook, as well as new entrants from the world of telecoms (Djingo by Orange etc.). All of them hope to capture a share of this market that could generate revenues of close to 16 billion dollars in 2021, among others from e-commerce, the sale of user data and advertising[12].
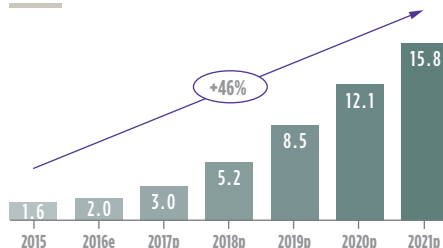
Changes to the numbers of virtual assistant users around the world

Modelling including users of Siri, Google Now, Cortana, and Alexa, but excluding business use
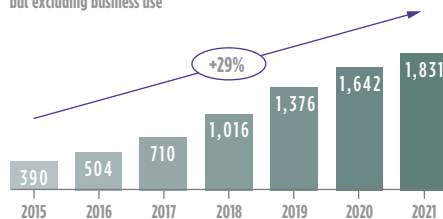
Source: Tractica; Analyses: Wavestone

Changes to the global market for intelligent personal assistants ($ billions)

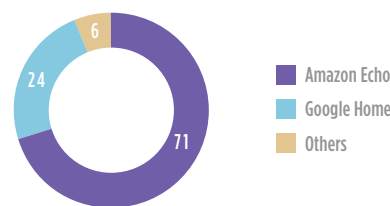Source: Tractica; Analyses: Wavestone

An upcoming explosion of the IPA market thanks to smart speakers?

Limited until now to mobiles, the battle for the IPA market has now moved into the homes of consumers. Introduced into the American market in November 2014 with Amazon Echo, smart home speakers represent a very promising emerging market with 5.9 million units sold in 2016

(of which 4 million in the final quarter alone) and a forecast of more than 60 million units in 2022[13]. This new object includes the intelligent personal assistant technology (the same as that in smartphones) in a speaker connected to the house Wi-Fi, equipped with microphones that the user can use to give instructions by voice control.

With more than 88% of the units sold in the world in 2016, Amazon Echo is the undisputed market leader, well in front of Google who started selling Google Home in the US in November 2016 and has just launched its product in France, a market where Amazon is still absent[14]. Other players will soon be entering the market: Apple with HomePod, Microsoft with Invoke, Alibaba in China with Tmall Genie, and Orange with its Djingo IPA that will include a version in the form of a speaker.

US market shares for smart speakers – April 2017 (%)


Source: eMarketer Analytics; Analyses: Wavestone

Consumers prefer the most functional and least intrusive smart speakers (listening and collection of conversations etc.). Perception of functionality depends on the ease and quality of interactions between the user and the speaker (language, voice recognition and understanding of requests, relevance of the results) and the number of native or optional functions offered on a downloading platform. The latter, known as "*Skills*" by Amazon Echo and "*Actions*" by Google Home, are equivalent to applications designed exclusively for use by voice with smart speakers. Fully aware of this challenge of functionality, Amazon has opted for an open source model of platform, and has thus been able to multiply by 10 the number of skills offered by Alexa in less than one year, breaking the symbolic 10,000 function barrier in the first quarter of 2017.

Number of skills available on Alexa

Quarter	Skills
Q1 '16	135
Q2 '16	1,000
Q3 '16	3,000
Q4 '16	5,000
Q1 '17	10,000
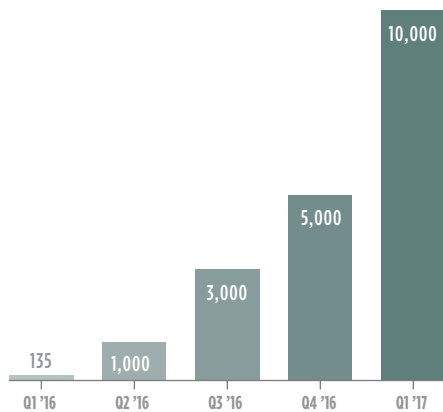
Sources: Amazon, Presse spécialisée; Analyses: Wavestone

For the time being, *Skills/Actions* are free-of-charge, but over time they will almost certainly depend on the same business models as smartphone applications (advertising models, *freemium*, paid services etc.) with Amazon and Google taking a percentage of the revenues generated.
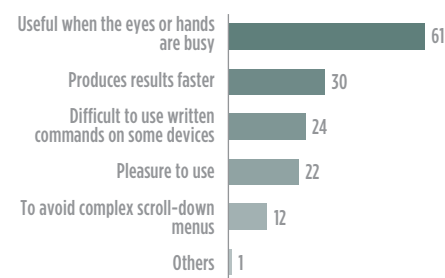
The latter also hope to monetize their model via sales of speakers and compatible connected objects, and positive externalities on their ecosystem: e-commerce, multi-media services, sales of user data, advertising etc.

Voice, a more practical means of interaction than writing in certain situations

So how to explain this enthusiasm for the voice based web? The first source of explanation could be the growing usage of mobile devices. As we have seen, mobile devices are now used more than computers to conduct searches on the Internet, and mobile devices tend to be well suited to voice searches, for several reasons.

One of the main advantages of voice searches is their rapidity. In fact, voice is reputed to be four times faster than a written search:
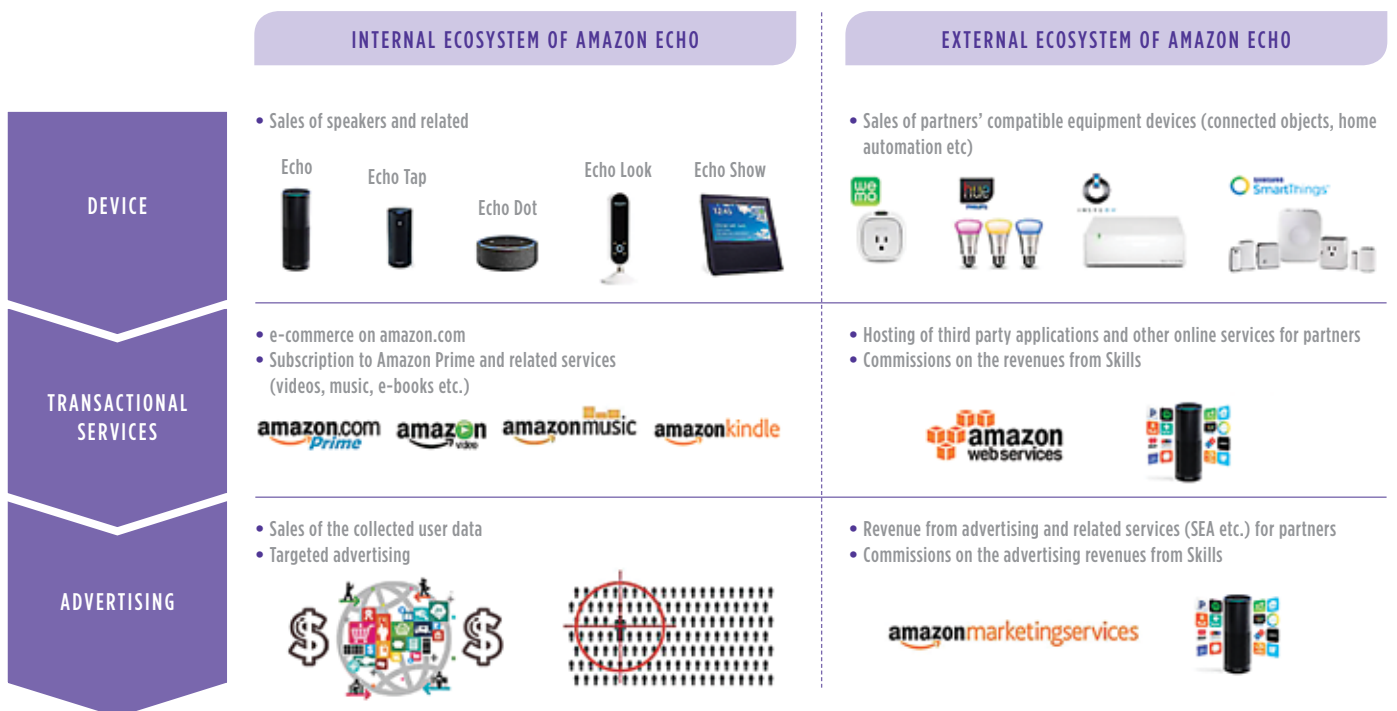
whereas we can write about 40 words per minute, we are capable of speaking around 150 during the same period of time[15]. In this respect, the ability of personal assistants to accurately recognize spoken words is a prerequisite for them to be adopted by consumers.

Furthermore, in certain cases, voice searches prove to be more practical for users. This is the case when on the move, but also in situations in the home during which the user is busy doing something (for example, cooking or watching the television). Therefore, the situations in which voice assistants are the most used is in the home (43%), the car (36%) and when walking or on public transport (19%)[16].

Main reasons for using voice control in the United States in 2016 (% of positive answers)

Reason	%
Useful when the eyes or hands are busy	61
Produces results faster	30
Difficult to use written commands on some devices	24
Pleasure to use	22
To avoid complex scroll-down menus	12
Others	1

Source: Kleiner Perkins Caufield & Byers; Analyses: Wavestone

Situations where voice control was used most in the US in 2016 (%)

Situation	%
In the home	43
In the car	36
In public transport or when walking	19
At work	3
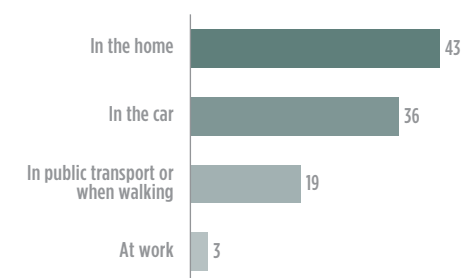
Our vision of the Amazon Echo business model and its ecosystem

	INTERNAL ECOSYSTEM OF AMAZON ECHO	EXTERNAL ECOSYSTEM OF AMAZON ECHO
DEVICE	• Sales of speakers and related Echo, Echo Tap, Echo Dot, Echo Look, Echo Show	• Sales of partners' compatible equipment devices (connected objects, home automation etc)
TRANSACTIONAL SERVICES	• e-commerce on amazon.com • Subscription to Amazon Prime and related services (videos, music, e-books etc.)	• Hosting of third party applications and other online services for partners • Commissions on the revenues from Skills
ADVERTISING	• Sales of the collected user data • Targeted advertising	• Revenue from advertising and related services (SEA etc.) for partners • Commissions on the advertising revenues from Skills

Source: Wavestone

15-16- Source: Kleiner Perkins Caufield & Byers, 2016 Internet Trends

Finally, the decisive factor that drives users to prefer voice searches is not so much the fact of being on the move as having their eyes and hands tied up with other domestic tasks, which represent a not insignificant part of our active time.

VERY LUCRATIVE UNDERLYING MARKETS

The explosion in the number of users of virtual assistants is far from insignificant. Underlying web searches, whether written or voice, lies the challenge of their monetization; and the forms of monetization are many (e-commerce, sales of personal data, advertising, paid indexing and so on), and can be rolled out on both fixed and mobile media.

The market for e-commerce, 1st source of revenues on the web

The leading source of revenues on the web is, not surprisingly, e-commerce. This market, which began to emerge at the end of 1990s with companies such as Amazon, eBay and AOL, still enjoys sustained growth. In 2016, it was estimated to be worth more than $1,900 billion and will probably reach more than $4,000 billion by 2020[17].

Changes to the global market for e-commerce ($ billions)
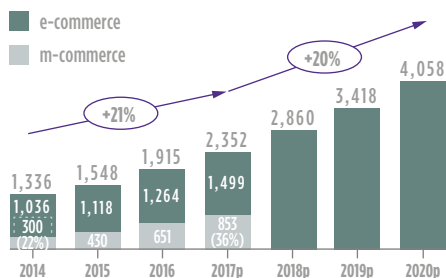
Sources: eMarketer, Paypal / Ipsos; Analyses: Wavestone

It is, however, interesting to note that this growth has been driven more by the m-commerce performance (purchases made via a mobile device) which has grown three times faster than traditional e-commerce (purchases made on the Internet via a computer) over the last four years[18], a trend that is expected to continue and is a godsend for the voice-based web.

Personal data, a much-prized business that is currently monopolized by the GAFA…

The market for personal data collected on the Internet has also become particularly lucrative. In Europe alone, it was estimated to be worth €60 billion in 2016, and could reach €80 billion in 2020[19].

This market is monopolized to the tune of 95% by the GAFA (Google, Apple, Facebook, Amazon), starting with Google which makes the most of its dominant position in search engines and its as yet majority share of users who conduct written searches… a situation that could change with the rise in voice control.

The stakes in the battle for control over input data are high as this represents the raw material for another even more lucrative business: that of web-based advertising.

The trend for personal data
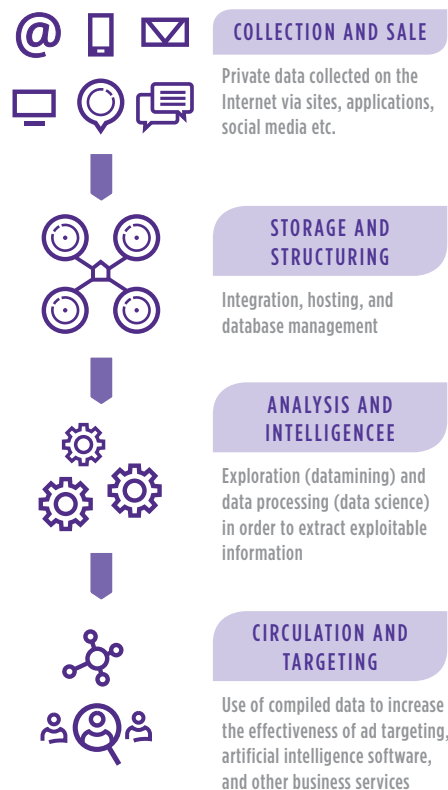
Source: adapted from Le Monde

… and which constitutes the key to entering the lucrative market for advertising on the web

The market for digital advertising on the Internet is also experiencing strong growth. It reached €162 billion in 2015 and could be worth more than €330 billion in 2020[20]. As the market leader with a market share of almost a third, here again Google benefits from its near monopoly in the area of search engines, as the advertising revenues generated via the search channel (also called paid indexing or SEA for *Search Engine Advertising*), account for more than 50% of the global market for digital advertising[21].

Changes to the global market for digital advertising ($ billions)
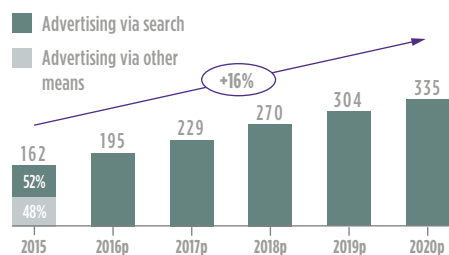
Source: Statista; Analyses: Wavestone

Google enjoys a 55% share of the SEA market which constitutes a potentially lucrative opportunity for players on the voice web. The advertising-spend on key words reached almost $80 billion in 2015 and is expected to continue to grow at an average rate of 12% per annum over the next four years, a rate that is driven, as for e-commerce, by mobile tools, well suited to using virtual assistants[22].

Changes to the global market for digital advertising via Search ($ billions)
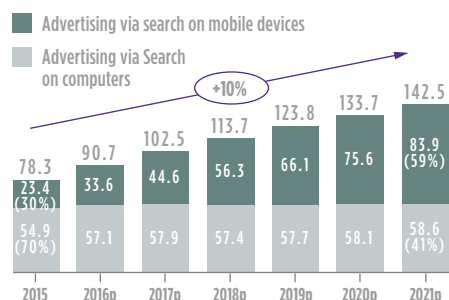
Source: Statista; Analyses: Wavestone

Nevertheless, SEA will have to evolve to adapt to voice searches. It focuses above all on key words, sometimes to the detriment of good syntax or natural language. The future market leaders will therefore be those who are able to best process voice requests. Indeed, the indexers make no mistake: they have put voice searches in their top 5 priorities for 2017[23].

## The 5 priorities of professional indexers in 2017 (%)

When questioned by SEO Camp, 471 professional indexers had to choose their priorities for 2017 from a list

Priority	Value
User experience	62
WebPerf	55
Semantic analysis	53
Netlinking	41
Voice searches	38
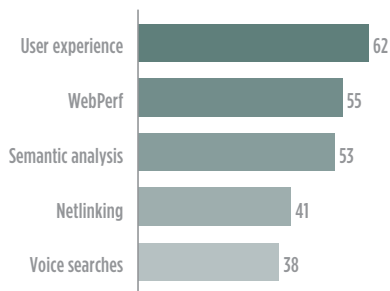
Source: JDN; Analyses: Wavestone

Deep underlying markets, robust and favorable growth drivers…all the conditions seem to be in place for the market for virtual assistants to explode. Furthermore, some people are already predicting an exponential growth in the advertising spend via virtual assistants: according to Juniper Research, the spend could increase from nearly $400 million in 2016 to over $12 billion in 2021.

Changes in advertising-spend via virtual assistants ($ billions)

12 billion expected in 2021
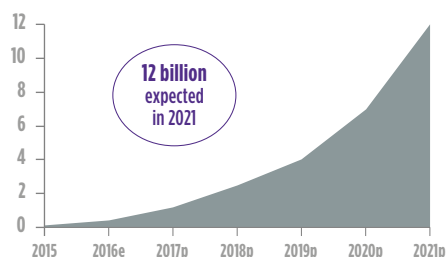
Source: Juniper Research; Analyses: Wavestone

Source: image extracted from the video (https://www.youtube.com/watch?v=FQn6aFQwBQU)

KEY SUCCESS FACTORS FOR A POTENTIAL TRANSFORMATION OF THE WEB SEARCH MARKET

Technical improvements needed

To create a real enthusiasm among users, voice assistants still have to fulfill certain technical criteria.

First, they must be capable of recognizing the words pronounced as accurately as human intelligence does. The assistants have made considerable progress in this area over the past few years: Google's voice assistant has improved from a recognition rate of less than 80% in 2013 to a rate that was slightly greater than 90% in 2015[24]. Similarly, in October 2016, the teams at Microsoft have announced that their voice assistant has reached a level of voice recognition comparable to that of human language[25].

Otherwise, for a user to be able to hold a real conversation with its assistant, it is essential for the latter to have developed a high level of contextual understanding. Contextual understanding means the ability to retain and remember the elements of a conversation in order to grasp the references and nuances. Not all assistants have reached the same degree of development in this respect. After asking Siri: "What is the best Italian restaurant near me?", it is not possible to also ask it: "What time is it open till?"; Siri will not understand what this question is referring to. On the other hand, Google's assistant is capable of holding this type of sustained conversation; but it cannot process a command such as "Book a table in one of my favorite restaurants". Its level of intelligence is not yet sufficiently developed to be able to understand what "favorite" means. The improvement of contextual understanding is the key to making a conversation with an assistant comparable to human interaction. New developments in this field would open up major opportunities for 'conversational' commerce.

Inherent limits for the use of voice

However, voice interaction is subject to limits that are inherent to it. Thus, in the United States, only 6% of users questioned in a panel declared that they used a voice assistant in public. It would seem that they are not yet comfortable using

23- Sources: SEO Camp / JDN

24- Source: Kleiner Perkins Caufield & Byers
25- Source: Bing IProspect

a voice assistant in public, partly because it is still not very natural to communicate orally with a smartphone, and partly because people do not necessarily wish to share their searches or the content of their messages with the general public.

Nevertheless, behaviors are changing quickly, and few people would have imagined only a few decades ago how normal it has become to communicate en masse via social media or the intensive use of smartphones to carry out all sorts of tasks (communication, music, Internet searches, online purchases etc.).

The winning strategy: creating a revolutionary type of user experience

Faced with this inherent limit in the use of voice, the winning strategy for voice technology players should consist of adapting to the situations in which users find themselves.

As seen previously, Internet connections using mobile devices (smartphone, tablets) are constantly increasing and have overtaken connections using a computer. Even in the home, consumers now tend to use their smartphones for Internet searches, while using their computers for other things. The voice technology players therefore need to try to capture the moments when the user is not in front of their computer, while capitalizing on the private sphere, as use in public is not currently in vogue.

It is in rising to this challenge that Amazon and Google launched their smart home speakers. These connected objects, intended for installation in the home, combine the functionalities of a musical speaker and an intelligent assistant. Equipped with a very advanced voice recognition system, they are capable of hearing the user's voice up to a distance of about six meters, and they can recognize the voices of the different members of the family thus being able to offer services appreciated by each of them.

Smart speakers are different from the other common digital objects in the home that are computers and smartphones,

Source: image extracted from the video (https://www.youtube.com/watch?v=r0iLfAV0plg)

which are strictly personal objects that have to be carried from one room to the next to be used. On the other hand, Amazon Echo and Google Home have been designed to be static, but omnipresent and family objects, which can hear the voice of a user and obey their commands wherever they are located in the house, and which can be used by all members of the household. In this respect, these smart speakers constitute a real revolution in the user experience.

However, to be as attractive as possible, these smart speakers need to be constantly expanding their ecosystems of applications, particularly in the universe of the connected home. And the developers have fully understood this: Amazon Echo and Google Home already offer multiple possibilities of interfacing with connected objects in the home, including via voice control of the most widespread home automation platforms (or smart hubs): Samsung SmartThings, Philips Hue and Insteon Hub.

Beyond interaction with connected objects, these two speakers are also competing to offer users the widest possi-

ble range of applications. Nevertheless, for the time being, Google and Amazon have mainly developed voice applications in their traditional areas of excellence. The owners of an Amazon Echo are therefore very easily able to place orders using e-commerce and have meals delivered (via dedicated applications such as Domino's, Just Eat, Pizza Hut etc.), whereas Google Home offers an optimal user experience for streaming, video and music, but it is not yet possible to order the delivery of a meal or reserve a taxi using Google Home, and Amazon Echo is not interfaceable with Netflix.

The opening up of ecosystems to outside developers will be the cornerstone for enriching the application environments of home speakers.

Finally, to acquire real competitive advantage, connected speakers will have to go further than just a wide choice of functions by providing the most personalized user experience possible. To do so, the developers must place their emphasis on machine learning in order to reinforce the contextual understanding capacity of intelligent assistants.

One might imagine, for example, that in the future one of the decisive criteria when choosing to buy a home speaker will be its ability to filter advertising based on a good understanding of the overall context of the searches conducted by the user.

A WEB REVOLUTION IS UNDERWAY...

In 2016, Satya Nadella, CEO of Microsoft, said: "*Natural language is the new user interface. Bots are like apps and digital assistants are like metas apps, or new Internet browsers*". A new war over intelligent assistants, and in general for the mastery of voice interactions between consumers and web services, would therefore seem to be well and truly underway. The GAFA and other titans of digital technologies are pulling out all the stops to keep up with the pioneer and current leader in the market for smart home speakers, Amazon.

Web searches conducted via mobile devices have only just overtaken those carried out using a computer, and the analysts are already predicting that 50% of searches will be via voice by 2020. Taking a position in voice searches has therefore become a key challenge for players on the web who dream of threatening Google's crushing dominance, built essentially on control of written searches. All of them are hoping to capture market share that could generate tens of billions of dollars within five years through the many underlying possibilities: sales of devices, commissions on e-commerce sales and revenues from voice applications, digital advertising etc.