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# Software & Internet Implications of Generative AI and ChatGPT

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Credit: DALL-E, RBC Capital Markets



March 16, 2023

## RBC Imagine™: Software & Internet Implications of Generative AI and ChatGPT – Moats and Boats

In this deep dive, we discuss the evolution of the Generative AI (GAI) secular mega-trend and the potentially transformative effect it could have on technology, enterprise software & internet broadly, and MSFT and GOOGL more specifically. As highlighted under our **RBC Imagine Artificial Intelligence Activated** theme, we believe that GAI is tech's 4<sup>th</sup> major exponential capacity creator of the last 20+ years building on top of the transformative effects of bandwidth, SaaS/Cloud, and Mobility and as such, we see the potential for material TAM expansion for cloud & search in particular (directly benefiting datacenters) where fast adoption by companies of all sizes may become mission critical to develop or maintain competitive advantages. Meanwhile, we believe GAI's widespread adoption could also lead to commoditization for smaller companies in particular, allowing the ecosystem enablers like cloud providers & digital ad platforms to widen existing moats and accrue disproportionate value. **Our best plays on the GAI secular mega-trend:** Software — MSFT, HUBS, NICE, VEEV, MDB, CRWD, ESTC, GTLB, NET, NOW, and ADBE; Internet — GOOGL, AMZN, META, SNAP & PINS and to a lesser degree, BKNG, EXPE & ABNB; Datacenters — DLR. For ESG implications, see our review of Hyperscalers and Datacenters.

- With the release and unprecedented rapid adoption of ChatGPT, we believe GAI has turned from a long-term bet into a near-term reality that has the potential to upend a broad array of industries. **Most positively**, we believe GAI should drive significant cost efficiencies for software & internet companies and could be meaningful TAM expanders for cloud, search, and datacenter operators that specialize in hyperscale requirements, while also creating deeper & wider moats for the tech arms dealers like cloud providers and digital ad platforms to accrue the majority of the value. **Less positively**, customer-facing companies & use-cases could see initial AI-fueled information asymmetry advantages but GAI's widespread availability & adoption could create medium- & long-term participant commoditization, particularly for the smaller/less well-resourced players, where initial differentiation could erode more quickly than prior tech cycles given the faster pace of innovation.
- Microsoft has emerged as a significant player in GAI**, owing to its investments in OpenAI, where we think it is leveraging GPT as a means to not only disrupt search, but more importantly, enable potential share gains in Azure, drive further differentiation with O365 and Teams, serve as a meaningful driver for GitHub, and improve Dynamics' competitiveness, among other areas within Microsoft's expansive portfolio. Importantly, we don't believe this is priced into the stock today and view GAI as a "call option" on Microsoft's stock.
- GOOGL has a play on GAI...and it's not all bad like investors seem to think.** We believe GOOGL's GAI strategy is likely underappreciated with investors concerned about search disruption, search share loss and rising computing cost driving LT margin compression with less consideration for a number of important positive offsets like structural distribution advantages, incremental revenue drivers, vertical integration & differentiated data. We come away from a deeper quantitative downside analysis believing we may be within 10-15% of GOOGL approaching a worst-case disruption scenario (contact RBC sales for our choose-your-own-adventure model).
- Within Software and Internet specifically, we believe GAI will ultimately be a tailwind for three primary categories:** 1) cloud-native market leaders who are quick to embrace GAI and use their data and market leadership as a competitive advantage; 2) vertical-specific companies who can widen the gap vs. challengers and accelerate the winner-take-most dynamics of the TAM; and 3) disruptive mid-market software going after entrenched, legacy competitors, who can use GAI to narrow the gap. **On the other hand, we believe GAI will be negative for companies who:** 1) are slow to embrace it putting them at a competitive disadvantage (native GAI vs. adapted GAI); 2) on-premise companies, where integrating GAI becomes more difficult; and 3) analytics companies that have previously benefited from AI tailwinds.

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**GAI is tech's 4<sup>th</sup> exponential capacity unlock.** In the context of the last 20+ years of technology innovation, we believe AI represents the 4th major capacity unlock which exponentially expands technology's capabilities on top of the previous 3 in aggregate: Internet, SaaS/Cloud, and Mobility. Dating back to well-funded NASA projects in the late 1950s, which created much of the modern semiconductor industry & early mainframe computing, it wasn't until the early telephony-based & eventually, wireless broadband infrastructure came along which could support the bandwidth necessary to connect large networks of computers & users.

Second, this bandwidth then enabled cloud services - a relatively small number of large, scaled companies that could provide shared infrastructure for companies of all sizes allowing for expanded & more flexible enterprise workload capabilities alongside significantly greater capital/cost efficiency. Concurrently, the combination of bandwidth & cloud then led to the obsolescence of on-premise software as SaaS's revolutionary innovation potential & subscription model were born. The subscription model attracted enormous capital driving enormous innovation & new players which continues to revolutionize virtually every vertical end-market in the world. **Critical milestones:** 1) the introduction of Salesforce in 1999, which was the first widely-adopted enterprise application delivered over the Internet; and 2) the introduction of Amazon Web Services (specifically S3 storage and EC2 compute) in 2006, which allowed developers to build applications without worrying about the underlying infrastructure.

Third and finally, the late 2000s saw the rise of mobility which once again exponentially expanded computing capabilities with its ability to tie bandwidth, cloud-based, application-specific software together with location & mobility and created thousands of new utilities not previously possible with desktop computing. **Critical milestone:** the introduction of the Apple iPhone, which turned phones from a device to make calls into mobile computers that were simple to use.

With GAI, software development, education, advertising, content creation, professional services and a myriad of general personal & professional productivity tools will all likely see some amount of transformative change, and as humble observers of the still nascent industry, the ceiling to innovation could well be years if not decades away. The critical milestone with GAI has been the release of ChatGPT in November 2022, which has been the fastest-growing Internet service in history.

**GAI could be presenting itself at a moment poised for outsized value creation potential.** While the major tech revolutions haven't historically operated on the macro's timetable (smartphone explosion into the teeth of the GFC for example), investors' current hyper-focus on cash generation vs. growth-oriented call options (like GAI) means little is ascribed for this type of exponential value creator at this point, in our view. And so while this may also prompt the debate on whether the technology is even ready to release into the wild, one way or another, we think it's here to stay and will now presumptively lead to a veritable wild west period of digestion, exploration, development and ultimately, implementation which could drive seismic change in how people & businesses both seek information, communicate and operate.

**Moats & boats.** We see two primary outputs of GAI with 1) internal process efficiencies driving cost savings and 2) external, customer-facing capability expansion (sometimes fueled by internal efficiencies). For the internal efficiencies, we see the GAI's democratization of these powerful tools as a boon for all companies with exposure to leverage efficiency benefits. For external use-cases, after an initial digestion & exploration period, we see a rising probability of commoditization, particularly for smaller companies with fewer resources allowing the so-called 'arms dealers' like cloud providers, digital ad platforms & content creation enablers to potentially widen existing moats and accrue disproportionate value.



One of the hallmarks of technology businesses, particularly in software & internet is that the inherent network effects built on the foundation of bandwidth, Cloud, SaaS & mobility meant that the early colonizers of various vertical end-markets with a superior product and/or go-to-market often obtained outsized market share faster than more traditional/non-network effected-oriented industries which pre-dated widespread mobile & internet adoption. This of course has created massive competitive moats for companies like Apple, Microsoft, Google and certain others which short of regulation, would seem highly unlikely to be adversely affected for the foreseeable future.

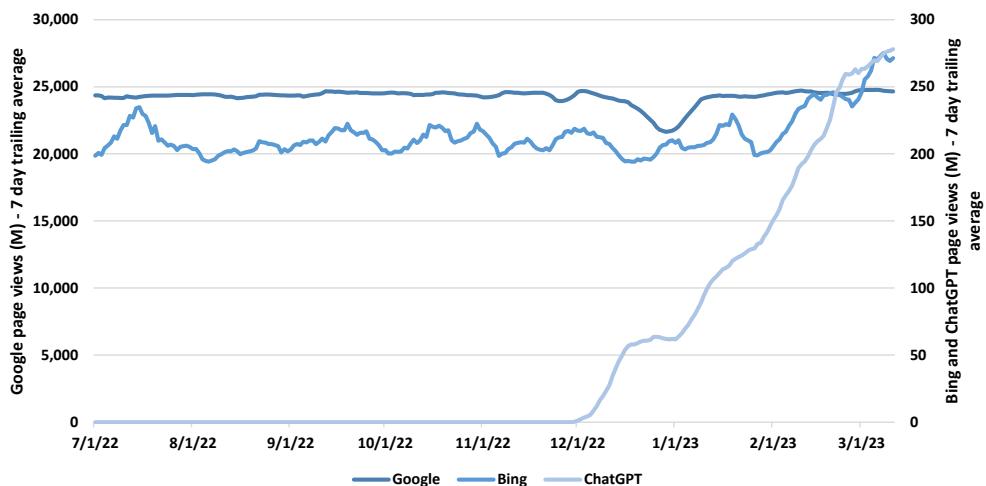
## GAI is likely a Cloud & Search TAM expander

With early ChatGPT/Bing usage data appearing incremental, we believe GAI could be meaningfully additive to not only the search market but also cloud driven specifically by a combination of incremental functionality driving incremental usage, net new workloads as native GAI businesses form and finally, higher compute cost for that incremental consumption.

### Search

Specifically for search, we leverage early data from downloads and page views (shown below) as a reflection of GAI expanding use cases and improving functionality & UX. Bing page views are up ~30% vs. pre-ChatGPT release averages while GOOGL traffic is largely flat vs. pre ChatGPT levels (all while ChatGPT traffic is 30% above Bing's total pre-ChatGPT levels).

**Figure 1 - Looking at page views, it appears as though Bing did get a noticeable uptick in traffic, coinciding with the rise of ChatGPT, while the impact to Google's traffic appears non-existent, implying Bing/ChatGPT traffic is incremental**



Source: Similar Web, RBC Capital Markets. Note: Bing and ChatGPT are on right axis and Google is on left axis

Given the incremental traffic over the past few months, we estimate the potential impact on total search TAM using page views as a proxy. On Bing, traffic is effectively up 160% since the public release of ChatGPT (30% from Bing itself and 130% from ChatGPT) while GOOGL has remained flat. We think the incremental search share gains should continue based on a) GOOGL has yet to implement a GAI solution into Search, b) ChatGPT is still in very early stages where we expect meaningful improvements going forward and c) the integration with Bing is still not rolled out to most users. Assuming GOOGL page views grows a modest 5% and Bing doubles its current incremental growth of 160%, we estimate Search TAM could grow by as much as 26% over the next couple of years as a result of GAI implementation and improvements.



Figure 2 - Given the advent of ChatGPT and integration with Bing has been driving incremental traffic, we estimate the total search TAM expansion as a result of GAI could be ~26%

Search Engine	Current search share	2022 search revenue (\$M)	TAM expansion related to GAI	Total search share post GAI
GOOGL	87.2%	\$162,450	5%	91.6%
Bing	6.9%	\$9,918	320%	28.9%
Yahoo!	3.1%	\$5,755	0%	3.1%
DuckDuckGo	2.4%	\$100	0%	2.4%
Other	0.4%		0%	0.4%
<b>Total</b>	<b>100.0%</b>	<b>\$178,223</b>		<b>126.4%</b>

Source: StatCounter, Similar Web, RBC Capital Markets

## Cloud

Along the lines of GAI's additive functionality and incremental traffic in search so far, we also believe there will accordingly be both organically and inorganically higher usage tailwinds translating to cloud spending over time. Further, higher compute cost also should layer on top of this as a driver. While it's difficult to unpack the three separate drivers (GAI driving incremental usage/development, GAI driving net new enterprises & workloads and GAI driving higher computing intensity & cost), we use the initial search uplift as an indirect proxy (admittedly part art/part science) as a way to estimate the uplift to the overall cloud market. Worth noting, we expect double-digit percentage annual cost improvements associated with scale and future (first-party and third-party) GPU generations, making GAI applications more affordable in the future.

Taking the TAM expansion to the models to give an example of the upside potential from increasing cloud adoption/use cases, we estimate an approximate 21% upside to Street's C'23 estimates. Admittedly, TAM expansion may not be meaningful in the near term, but we find it worthwhile as a way to size the potential eventual cloud expansion.

Expanding on our thesis, we see three distinct growth drivers for cloud as a result of generative AI:

**1) GAI workloads are more storage and compute intensive.** As the usage of GAI continues to grow (especially with enterprise adoption, such as GPT4 APIs), most of that flows through the hyperscale cloud providers (e.g. OpenAI workloads all go through Azure), this drives incremental cloud revenue.

**2) GAI drives incremental migration of existing workloads to the cloud.** This comes at an important time, when investors are worried about cloud saturation. GAI services are generally cloud-only, which means the urgency for enterprises to adopt GAI should accelerate the pace of migrating workloads.

**3) GAI platforms will lead to the next generation of startups.** As we outline later in this note, we believe there will be an entire generation of startups built on GAI platforms that natively leverage the technology. Much like the introduction of AWS (and later Azure and GCP) created an entire ecosystem of cloud-native startups and the introduction of the iPhone (and later Android) created an entire ecosystem of mobile applications, we expect the same with GAI. These are all incremental new cloud workloads that do not exist today.



Figure 3 - If we assume cloud TAM expands 26% there's an implied ~21% upside to Street's '23 cloud revenue estimates, though worth noting it's unlikely for the full TAM expansion to be realized this year

Cloud Provider	2022 Revenue (\$M)	Total TAM expansion	Incremental \$ revenue from TAM expansion	Street's '23 estimate	Street's '23 estimate + incremental \$ from TAM expansion	% implied upside to Street's '23 estimates
GCP	\$26,280	26%	\$6,833	\$33,211	\$40,043	20.6%
AWS	\$80,096	26%	\$20,825	\$93,660	\$114,485	22.2%
Azure	\$50,468	26%	\$13,122	\$64,347	\$77,469	20.4%
<b>Total</b>	<b>\$156,844.4</b>	<b>26%</b>	<b>\$40,779.6</b>	<b>\$191,217.5</b>	<b>\$231,997.1</b>	<b>21.3%</b>

Source: Company Reports, Factset, RBC Capital Markets



## What is GAI, what is OpenAI, and what is ChatGPT? (according to ChatGPT)

Generative AI, or artificial intelligence that can create new content, is a rapidly developing field with enormous potential to revolutionize industries from creative writing to music composition to product design. Unlike traditional AI models that use pre-existing data to generate predictions or responses, GAI models are trained on vast amounts of data in order to create original content that is similar in style or form to the original.

One of the leaders in the development of generative AI is OpenAI, a non-profit research organization founded in 2015 by a group of tech luminaries including Elon Musk, Sam Altman, Greg Brockman, Ilya Sutskever, and John Schulman. OpenAI's mission is to "ensure that artificial intelligence benefits humanity", and the organization's work spans a wide range of applications, from natural language processing and robotics to climate modeling and bioinformatics.

One of OpenAI's most well-known achievements is the development of GPT-3, a generative AI language model that is capable of generating human-like language with remarkable accuracy and coherence. GPT-3, which was released in 2020, has already been used in a wide range of applications, from chatbots and virtual assistants to content creation tools and language translation software.

ChatGPT is a specific implementation of the GPT-3 language model that has been designed specifically for conversational applications. ChatGPT is capable of engaging in free-form conversations with users, providing responses that are both contextually relevant and grammatically correct. As a result, ChatGPT has become one of the most popular conversational AI tools available, with applications in customer service, marketing, and education.

The importance of generative AI, OpenAI, and ChatGPT lies in their potential to transform the way we interact with machines and with each other. As generative AI models become more sophisticated and more widely deployed, they have the potential to replace or augment many of the routine tasks that humans perform, freeing us up to focus on more complex and creative work. At the same time, they can help us to communicate more effectively with each other and with the machines that surround us, making it easier to access information, solve problems, and connect with others across the globe. Ultimately, generative AI has the potential to change the way we live and work, and OpenAI and ChatGPT are at the forefront of this exciting new field.

*(This entire section was written by ChatGPT).*

## Why is ChatGPT so important?

With ChatGPT's boilerplate intro out of the way, the big questions are: 1) why is ChatGPT so important; and 2) is ChatGPT worth the hype?

### Why is ChatGPT so important?

Before ChatGPT, we saw two distinct trajectories for AI systems.

The first is enterprise-grade AI, which includes offerings by companies such as Google, IBM, and Microsoft, among others. These systems have shown impressive milestones over time, such as IBM Watson winning Jeopardy and Google DeepMind defeating a professional human Go player. These systems, although powerful, generally require heavy customization (AlphaGo, for example, is its own computer program, built by DeepMind) and targeting data scientists.

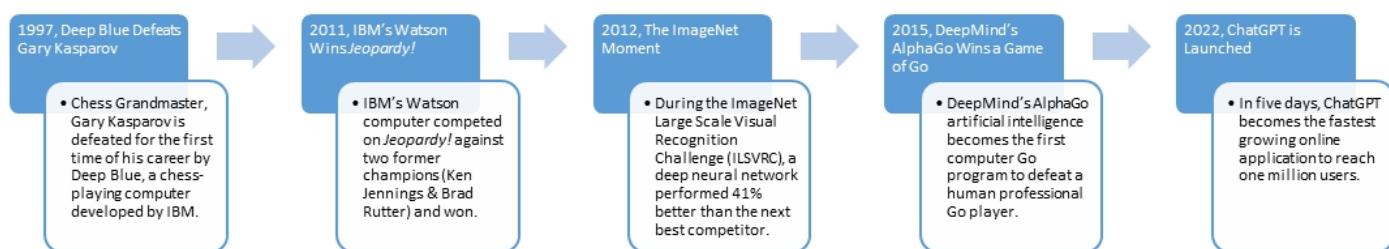
The second is consumer-grade intelligent agents, such as Amazon's Alexa and Apple's Siri, which targeted the consumer and were easy to use (both relying on voice). These systems are intuitive and make use of natural conversational language, but also provide very basic output, such as



simple Internet searches or controlling connected devices.

In many ways, ChatGPT brings together the best of both of these worlds. Underlying ChatGPT is powerful AI, but the actual interface is conversational and iterative and very simple to use. In other words, ChatGPT has democratized AI in a way that other AI systems have not done before. Importantly, the conversational component means users have to react to answers with follow-ups in order to get closer to the answers they desire. ChatGPT can also be trained on specific datasets to provide user-specific or company-specific insights, versus just general insights from the broad Internet.

Figure 4 - Timeline of Major AI Milestones



Source: RBC Capital Markets

### Is ChatGPT worth the hype?

We believe ChatGPT is to generative AI what Netscape was to the Internet and what the iPhone was to mobile.

However, the importance of generative AI goes beyond just the consumerization of AI. As the name implies, generative AI can create brand-new content, versus providing answers to existing questions or insights on existing data. This content isn't just limited to text, but also includes unstructured content like images (OpenAI's DALL-E 2 can create original images from a text description), code (we discuss GitHub Copilot later in this note), and video.

While there certainly are limitations to ChatGPT today, it has meaningfully surpassed our expectations of where AI would be today. We also note the public version of ChatGPT is a "free research preview" and likely behind ChatGPT version 3 (ChatGPT-3) in capabilities, while version 4 (ChatGPT-4) has recently been announced. And as we see companies embrace ChatGPT for their own use cases, opening up vast volumes of data, we may end up even more impressed than we currently are.

So is it worth the hype? We absolutely believe so. Generative AI itself represents a major advancement in AI systems beyond deep learning and has flipped the switch on the purpose of AI from analyzing and learning to creating. ChatGPT and the consumer-like interface only magnifies this exponentially, as it opens up significantly more use cases that were previously unheard of (some of which we explore later in this note). Finally, the quality of output from these systems has surpassed our expectations meaningfully and has real societal implications, which we discuss in the following section.



## Ten Generative AI predictions

1. **Companies who don't truly embrace GAI will see their multiple compress by 50% over the next five years.** We believe every technology company needs a strategy to truly embrace generative AI (and not just pay lip service to the technology), otherwise they will be left behind by those that do. Not only will these companies see market share losses over time, but they will also see multiple compression as investors lose confidence in the ability of those companies to be "future-proof". We would draw the analogy to the cloud -- on-premise companies that were late to embrace the cloud (e.g. Cloudera, Tableau) saw meaningful multiple compression as a result.
2. **Generative AI will be negative for software companies and stocks that have previously benefited from AI tailwinds.** We've seen a number of companies whose businesses have benefited from being associated with AI in the past, including Palantir, and Alteryx. We believe many enterprises will prioritize their spending towards generative AI and view some of those previous solutions as a 'stop-gap' measure. We expect the same to apply to stocks that have outperformed as a result of investor interest in AI, including names like C3.ai, BigBear.ai, and SoundHound.ai, as public investors realize there are few ways to directly invest in generative AI today.
3. **Accelerated adoption of AI drives next leg of public cloud growth.** One of the big worries investors have is around cloud saturation and how much of the slowdown in hyperscale cloud vendors (AWS, Azure, GCP) is because of macro versus a general slowdown in migration to the cloud. Given the resources necessary for generative AI, we believe that accelerated adoption will drive a major increase in public cloud workloads. In addition, as the hyperscale cloud vendors look to add generative AI services on top of their existing offerings, we believe this also drives up overall growth in the hyperscale cloud vendors.
4. **Governments & regulatory bodies will increasingly scrutinize GAI.** The rise of generative AI brings about a number of ethical and legal concerns, some of which we discuss in our section on societal implications. We believe governments throughout the world will create legislation around generative AI, including the use of generative AI systems, preventing malicious use, and the use of customer data.
5. **Generative AI will lead to the next generation of start-ups.** Much like the introduction of the iPhone led to an entire economy of mobile applications and the rise of AWS created entire enterprise software companies made to be cloud native, we believe ChatGPT and generative AI will be the foundation for the next generation of tech start-ups. We also believe the cloud workloads associated with these new start-ups will also be additive to overall cloud growth.
6. **Security attacks will become more complex.** We believe malicious groups will be able to use generative AI to create more complex and creative cyber-attacks, which can serve as a tailwind for security companies. On the flip side, we think security companies that embrace both AI/ML and GAI more specifically will be in a better position to stop advanced threats. Critical to this thesis is large cloud dataset to train AI and ML models. In particular we think this benefits both CRWD and PANW.
7. **GOOGL changes the narrative** that GAI prompts an existential crisis over the next 6-12 months as it a) releases new tools, b) demonstrates incremental revenue associated with those tools and c) capex doesn't ramp more than expected from current levels as it does all of this as the market sees further evidence of scaled cost improvements with iterative rollouts of new models.
8. **AMZN begins publicizing more of its own GAI progress (which has been integrated with its cloud capabilities far longer than GOOGL or MSFT)**, with its go-to-market messaging more geared through its developer ecosystem distribution channel which could demonstrate its own but more platform-centric approach to enabling more efficient model training and implementation vs. competitors as opposed to creating the models themselves.
9. **META brings new GAI tools to market** enabling a differentiated level of automated campaign



creation - and driving advertiser content cost savings that could be incrementally allocated to advertising. These tools become especially important for Reels as advertisers increasingly move to the structurally higher content creation costs in the short-form video.

**10. The OTAs (ABNB, BKNG & EXPE) get more vocal on their leveraging of GAI solutions,** potentially to get out in front of any negative narrative that may arise surrounding customer acquisition headwinds if and as search discoverability becomes more challenging. While we've never touted loyalty as being a meaningful driver in travel (ie the connected trip or the like), we actually could be turned by a prospective introduction of GAI onto an OTA site where the interactiveness and incremental data capture opportunities relative to any other non-vertical specific discovery engine could be significantly differentiated and drive an acceleration in organic loyalty, if not in actuality.



## Societal implications

We've already seen landmark use cases of generative AI and ChatGPT that illustrate just how far the technology has come and its potential to change society. [We wrote on this topic](#) in November 2021 and we are already starting to see some of this play out:

- ChatGPT has passed exams for both law school (four courses at the University of Minnesota) and business school (at Wharton).
- Congressman Jake Auchincloss delivered a speech written by ChatGPT on the U.S.-Israel Artificial Intelligence Center Act.
- Insilico Medicine is beginning clinical trials for a COVID-19 drug designed entirely by generative AI (ISM3312).

### **From here, we see several major societal implications:**

First, we expect disruption in every major industry. Traditionally, automation has been focused on replacing manual labor, but we believe generative AI can do tasks that traditionally fall to 'white collar' jobs and, in many ways, has the potential to displace some of those jobs. For example, generative AI can write articles, legal briefs, blog posts, and scientific research papers, which potentially impacts jobs done by journalists, lawyers, marketers, and scientists.

Second, most discussions around AI impacting white collar jobs have traditionally focused around tasks done by those at more entry level positions and work that is already being outsourced. Examples include analyzing x-rays, researching prior legal opinions, and summarizing events. However, with the advent of generative AI, we see room for even more senior positions to be impacted—for example, not only can generative AI research prior Supreme Court rulings, but has the ability to write legal arguments based on those prior rulings.

Third, having said that, we do not view generative AI as a zero sum game. In many examples we can think of, generative AI can be used to automate more routine tasks, allowing the user to focus on higher value-add actions—for example, a journalist could use generative AI to summarize the background to a piece, spending more time on original research and generating unique insights. We also believe generative AI can be yet another tool for high-skilled workers to have in their arsenal and to be more productive. Instead of a marketer writing every single blog post and starting from scratch, the marketer can use ChatGPT to create a basic template and then build on top of that, allowing them to meaningfully increase the volume of blog posts, thus generating more new business and greater pipeline.

Fourth, relationship building becomes even more important. Arguably, at the top of many professions, be it law, banking, or consulting, relationships are one of the most important ways to distinguish from the competition. With many other areas potentially getting commoditized by generative AI, the ability of senior people to build relationships with others and better understand the unique problems they're trying to solve becomes even more paramount.

Fifth, we believe generative AI will soon become tablestakes and every company will have to have a strategy around utilizing generative AI. Those companies that don't will be left behind, while those that do will likely use generative AI to enhance the business itself and customer relationships, but may struggle to directly monetize the technology. Generative AI, however, will make the economic moat around data even more powerful.

Sixth, generative AI can narrow the gap between traditional players and digital natives. As we've discussed in the past, it's increasingly important to differentiate what is a technology company from what isn't—for example, a mattress company doesn't become a technology company just by selling goods online and having a mobile application. Similarly, we've seen many traditional industries where a startup disrupts the landscape with more technology-enabled functionality,



as well as self-service capabilities – for example, insurtech companies like Lemonade, Hippo, and Root, have disrupted traditional property and casualty insurers with their easy-to-use mobile apps, but the capabilities of generative AI could soon leapfrog what those insurtech companies offer. This would allow traditional insurers to quickly narrow the gap and hurt the differentiation the insurtech players offer, even if they claim to have AI and ML capabilities.

Seventh, widespread adoption of generative AI brings about myriad ethical and legal concerns. If a developer builds an application using code generated by ChatGPT, who owns that code? If a student submits an essay written by ChatGPT, is it their own work? These are tough questions to answer, and we believe there will be endless debate on these topics.

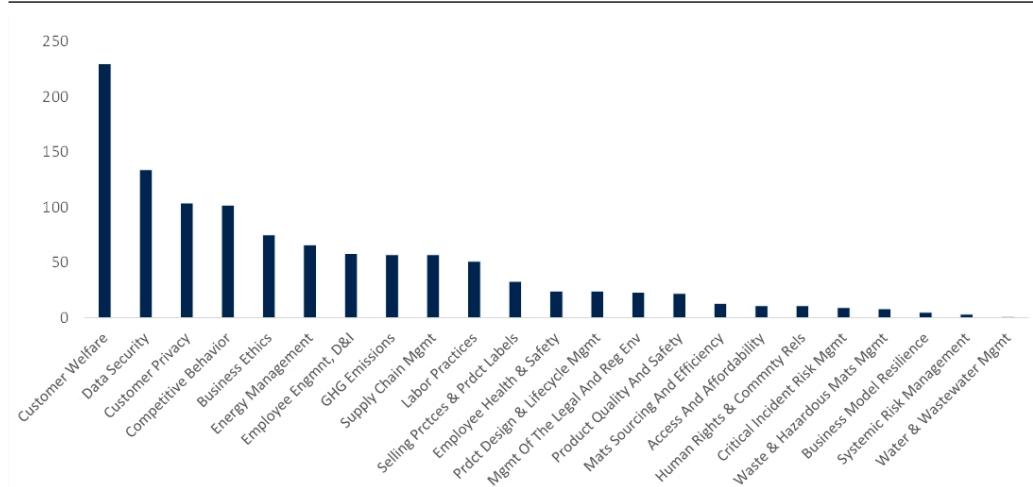
Eighth, in response to the legal side of the equation, we expect governments around the world to take action around generative AI, potentially restricting its use in certain areas and putting guard rails around the use of personal data. In addition, if someone uses generative AI for nefarious reasons, does the creator of that AI hold any liability for not having enough guardrails around safety and compliance? If a sick person uses ChatGPT for medical advice, does OpenAI bear any liability if the advice is wrong or are the current disclaimers enough (or is ChatGPT compared to a website like WebMD instead)?

Ninth, we expect generative AI to change the very nature of work. In addition to changing what is important or differentiated in each job, generative AI has the ability to make each worker more productive. On one hand, this could mean an individual is just completing more tasks and doing more work in the same amount of hours, and potentially mean there are fewer jobs available, resulting in higher unemployment. On the other hand, generative AI could become truly additive and accelerate growth in the economy and even potentially result in shorter workweeks for the average knowledge worker.

## Examining ChatGPT/Generative AI Through An ESG Lens

In the figure below, RBC's ESG Strategy team has partnered with the RBC Elements™ team to examine which SASB topics have been coming up the most in ESG related news activity specific to ChatGPT/Generative AI. Their search included news articles, industry publications, and NGO documents from November 2022 through mid-March 2023. While much of the focus has been on "S" related implications, there are also "E" and "G" issues to consider. In this section of the report, we dive into emerging ESG risks and opportunities as it relates to Customer Welfare, Data Security & Customer Privacy, Human Capital Management, and Resource Use.

**Figure 5 - ESG Related News Activity Specific To ChatGPT/Generative AI By SASB Topic (# Articles)**



Source: RBC ESG Strategy, RBC Elements, Factset

**Customer Welfare:** The SASB category that has been the biggest source of ESG related news activity is Customer Welfare. For ChatGPT/Generative AI, this could include impacts from potentially accelerating the spread of false/misinformation (particularly in this current era, as companies are rushing to compete and integrate AI technology) and perpetuating biases. From a financial materiality perspective, associated risks could potentially open companies up to regulatory scrutiny (and costs of compliance). Some examples of recent regulatory initiatives focused on digital rights and content moderation more broadly include, the EU's Digital Services Act and Digital Markets Act which were adopted in July 2022 (and applies starting in early 2024), as well as the EU's AI Act which is expected to be voted on later this year.

**Data Security & Customer Privacy:** Another consideration is around how ChatGPT/Generative AI could impact data security and customer privacy through its collection of data in training models, as well as how the tool could potentially be leveraged for malicious use (e.g. more sophisticated cybersecurity attacks). We have already seen a number of companies such as AMZN, VZ warn employees on their use of ChatGPT due to concerns that sensitive data could be exposed. Similarly, the potential for this tool to harvest and leverage customer data brings up customer privacy concerns. From a financial materiality perspective, these issues could potentially open companies up to reputational impacts and costs if they aren't properly managing heightened security risks.

**Human Capital Management:** As highlighted earlier in the report, use of ChatGPT/Generative AI has the potential to transform the nature of work. On the one hand, there have been concerns



about the automation of certain tasks related to legal professions, research, coding, that have raised concerns about job losses and higher unemployment and could lead to reputational impacts for companies engaging in layoffs, particularly if viewed to be mismanaged. Improved productivity from the automation of repetitive tasks could also free up more time for employees to focus on higher value tasks, potentially improving employee engagement and wellbeing at a time when burnout is high across many industries.

**Resource Use:** In terms of environmental impact, concerns have been raised around the resource consumption (energy, water usage) and emissions needed to fuel, train and utilize Generative AI tools. Some of these impacts can be reduced through making the models/processors more efficient and increasing usage of renewable energy. Additionally, a number of benefits could be realized from the application of this technology. For example, generative AI could be leveraged to aid climate scenario analysis, as well as better manage and measure a company's resource use and carbon footprint in their operations and supply chains.



## Microsoft: A multi-pronged strategy well-positioned for the next wave of compute

First, let's discuss our over-arching thesis of what we believe Microsoft's strategy is with OpenAI and publicly going after search. We believe Microsoft's primary goal is to have Azure become the de facto standard cloud platform for AI workloads, in order to help close the gap with Amazon Web Services and create further distance from other hyperscale cloud vendors, like Google Cloud Platform and Oracle Cloud Infrastructure.

We believe Microsoft's messaging around gaining share in search, to an extent, is a deliberate effort to pressure Google. Microsoft's share in search today is small, with Microsoft's Search and News Advertising (includes all advertising revenue, except LinkedIn) revenue of \$12.0B in CY22, or roughly 7% the size of Google's Search revenue of \$185.2B. Therefore, even if Microsoft significantly degrades the Search businesses' gross margins, reflecting the higher compute intensity of AI-based search (according to various sources and conversations, estimates range from 2-10x), the downside impact if share gains don't materialize is negligible, while the upside impact if share gains do materialize could be meaningfully EPS accretive, in our view. Also, regardless of the EPS impact, if successful, this could lead to multiple expansion given investors have historically not given Microsoft much credit, if any, for Bing. At the same time, this could distract Google from more aggressively competing in cloud infrastructure.

In the worst case scenario, Microsoft gains minimal share of search and absorbs some margin impact, while defending share dominance in productivity suites (from Google Workspace and potential AI-based disrupters). In the best case scenario, Microsoft gains a few points of share in search, gains share in CRM/ERP with Dynamics (by using large language models and generative AI to enhance the product suite), defends share dominance in productivity suites, creates further differentiation in cybersecurity, and, most importantly, Azure becomes known as the de facto standard cloud platform for AI workloads.

### Background of Microsoft's relationship with OpenAI

In 2019, Microsoft invested \$1B in OpenAI. Leading up to this initial investment, OpenAI transitioned from a non-profit to a unique capital structure with a capped-profit element, whereby economic returns for investors and employees are capped at 100x. Perhaps more importantly, this opened the door for OpenAI to seek out investment from venture capital funds and public companies. We believe there are a few dynamics restricting Microsoft from outright acquiring OpenAI. Aside from the unique capital structure, we believe the consortium of founders are likely unwilling to sell, especially since they would then lose control of the company's founding mission to build safe and beneficial artificial general intelligence.

We believe OpenAI chose Microsoft as a partner for several reasons. First and foremost, Azure provides AI-scale core compute and storage, with an exhaustive list of up-the-stack infrastructure solutions, including security and governance, data and analytics (database, data warehouse, data lake, data governance, etc.), and developer tools. Second, Microsoft has arguably the broadest portfolio of enterprise application software, spanning productivity suites, collaboration, communication, CRM, ERP, and more. In addition to this giving OpenAI a route to commercialization/monetization in the enterprise (Office alone touches nearly 400M users), it provides OpenAI with the corresponding enterprise datasets to train models. Third, Microsoft had already developed its own family of large AI models, the Microsoft Turing models, which had been used to improve language understanding tasks across Bing, Office, Dynamics, and more.



Figure 6 - Timeline of Microsoft and OpenAI's combined innovation



Source: Company website and press releases, RBC Capital Markets

## Azure's push to become de facto cloud platform for AI

On one hand, we believe Microsoft's intentions are clear. In our view, Microsoft established a first-mover advantage in turning generative AI into commercial products with the ambition of becoming the de facto cloud platform for AI workloads. Following viral adoption, ChatGPT is not only a household name, but we believe has provided Microsoft-OpenAI with early mindshare in the enterprise. Several companies (Spotify and Snap to name a couple) are not only experimenting with OpenAI's foundation models, but are releasing OpenAI-powered applications into production. To us, the strong early adoption of OpenAI indicates fast followers likely need to show strong differentiation, in order to convince enterprises already experimenting on OpenAI to look elsewhere. Furthermore, Microsoft-OpenAI have already enacted preemptive price reductions to quickly establish a large ecosystem of partners and customers, as well as to limit the potential for competition on price alone.

On the other hand, we do subscribe to the idea of generative AI as a rising tide lifting all boats, in



reference to the hyperscale public cloud vendors. We acknowledge AI as a market opportunity remains early and dynamics, despite progressing at an exponential rate. In terms of competition, we also would not discount the technology of close followers who, similar to Microsoft, have been investing in AI for more than a decade.

All together, we believe Microsoft Azure is currently in a strong position to win an above-average share of AI workloads running in the cloud and has been executing well strategically to sustain its early advantage.

### Azure OpenAI Service

Azure OpenAI Service became generally available in January and already has 1,000+ enterprise customers. Azure OpenAI Service provides professional developers with API access to OpenAI's foundation models, including GPT, DALL-E, Codex, and Embeddings. Developers can use OpenAI's algorithms out-of-the-box to build new applications or augment existing applications with generative AI functionality. In addition, developers can fine-tune OpenAI's models by training them on their own datasets, in order to tailor the technology to specific use cases, similar to how Microsoft molded GPT-3.5 into Prometheus to make the technology more useful as a search engine alternative. As shown in the Figure below, there are the three model families available in the Azure OpenAI Service today.

Figure 7 - GAI models available in Azure OpenAI Service

Generative AI models			
GPT-3	Codex	DALL-E	ChatGPT
<p><b>Prompt:</b> Summarize this personal finance article in 2 sentences: <a href="https://www.fidelity.com/learning-center/personal-finance/tax-pitfalls">https://www.fidelity.com/learning-center/personal-finance/tax-pitfalls</a></p> <p><b>Response:</b> Tax pitfalls can be costly, so it's important to be aware of them. Some common tax pitfalls include failing to file or pay taxes on time, not reporting all income, claiming too many deductions, and not keeping accurate records.</p>	<p><b>Prompt:</b> Table customers, columns = [CustomerId, FirstName, LastName, Company, Address, City, State, Country, PostalCode]</p> <p>Create a SQL query for all customers in Texas named Jane</p> <p><b>Response:</b> SELECT * FROM customers WHERE State = 'TX' AND FirstName = 'Jane'</p>	<p><b>Prompt:</b> a colorful illustration of a busy beehive to show the efficiency and enthusiasm of our media company</p> <p><b>Response:</b></p> 	<p><b>Prompt:</b> I'm having trouble getting my Xbox to turn on.</p> <p><b>Response:</b> There are a few things you can try to troubleshoot this issue, First, ... Next, check the power cord ...</p> <p><b>Prompt:</b> Thanks! That worked. What games do you recommend for my 14-year-old?</p> <p><b>Response:</b> Here are a few games that you might consider: (bulleted list) ...</p>

Source: Company website

On March 9th, Microsoft announced the more out-of-the-box ChatGPT model is available in public preview. Using ChatGPT, developers can easily augment applications with AI functionality to summarize content, generate email copy, and act as an intelligent virtual assistant. Similar to the other models, developers can adapt the technology to better serve business-specific or vertical-specific use cases by training the model on their own datasets.

Azure can monetize OpenAI in several ways. As mentioned, Azure can sell API access and SDKs for OpenAI's large language models. More importantly, each workload using an OpenAI model (in testing and production, or to train a model) requires compute and storage, generating infrastructure-as-a-service (IaaS) revenue for Azure. This not only refers to the IaaS needed to support OpenAI's own offerings, such as the production version of ChatGPT, but all the workloads being powered by OpenAI's technology, such as Spotify's DJ, Snap's My AI, Salesforce's Einstein GPT, etc.



OpenAI Service's pricing is based on a pay-as-you-go consumption model with a cost per inference, which varies depending on the underlying model. For reference, an inference refers to the process of calculating a response to the query (i.e., for simplicity, think of each response generated by ChatGPT as an inference). We note this inference pricing is associated with AI models in testing or production. Also, in order to further train models, which is more compute intensive process than inferencing, Microsoft charges an hourly rate based on compute units.

OpenAI plans to sell subscriptions for solutions built on top of the company's large language model, such as the recently introduced \$20 monthly subscription to ChatGPT. While it's unclear how Microsoft earns a share of revenue from the subscription plan, the more important takeaway is all cloud compute and storage associated with supporting ChatGPT usage translates to Azure revenue.

Figure 8 - Azure OpenAI Service Pricing

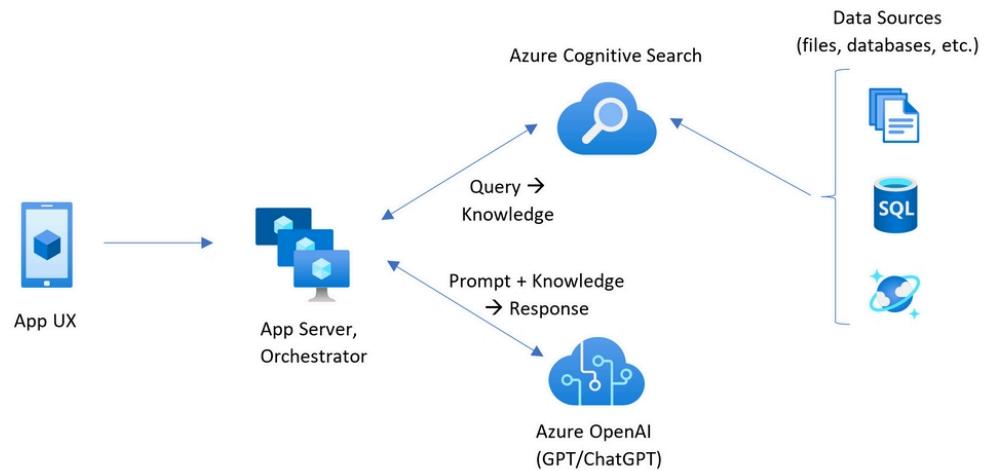
Azure Open AI Service: Pricing			
Series	Models	Inferencing (per 1K tokens)	Hosting (per hour)
Base Series	Ada	0.0004	N/A
	Babbage	0.0005	N/A
	Curie	0.002	N/A
	Davinci	0.02	N/A
Base Series Fine-Tuned	Ada	0.0004	0.05
	Babbage	0.0005	0.08
	Curie	0.002	0.24
	Davinci	0.02	3.00
Codex Series	Code-Cushman	0.024	N/A
	Code-Davinci	0.10	N/A
Codex Series Fine-Tuned	Code-Cushman	0.024	0.54
Embeddings Series	Ada	0.0004	N/A
	Babbage	0.0005	N/A
	Curie	0.002	N/A
	Davinci	0.02	N/A
Azure Open AI Service: Pricing, fine-tuning training			
Series	Models	Inferencing (per 1K tokens)	Training (per compute hour)
Base Series Fine-Tuned	Ada	N/A	20.00
	Babbage	N/A	22.00
	Curie	N/A	24.00
	Davinci	N/A	84.00
Codex Series Fine-Tuned	Code-Cushman	N/A	26.00

Source: Company website, RBC Capital Markets

### Translates to more revenue for Azure's up-the-stack offerings too

**Increased adoption of Azure OpenAI Service not only generates more Azure IaaS revenue, but should lead to increased interest in Azure's broader data and analytics platform.** Microsoft has an extensive portfolio of artificial intelligence, machine learning, data, and analytics offerings. As customers increasingly adopt Azure OpenAI Service, we believe there is a strong value proposition around leveraging Microsoft's broader data and analytics portfolio, given out-of-the-box integrations and connectors for authentication (Azure Active Directory), security and compliance (Defender, Sentinel), and data stores (CosmosDB, Synapse, Data Lake), to name a few.

Figure 9 - Example of how Azure OpenAI opens the door to the broader Azure data and analytics portfolio



Source: Company website

- **Azure Cognitive Services:** On top of OpenAI's foundation models, developers can purchase API access and software development kits (SDKs) for Microsoft's broader set of machine-learning models within Azure Cognitive Services. Microsoft is already showcasing efforts to cross-sell OpenAI's models with Microsoft's in-house technology, such as Azure Cognitive Search. As an example, developers can combine Cognitive Search to index, understand, and retrieve data from their own datasets (e.g., a company's knowledge base) and ChatGPT to understand leverage this foundation to answer questions or have a human-like conversation. Azure Cognitive Services includes APIs and services spanning vision (computer vision, custom vision, face recognition), speech (speech-to-text, text-to-speech, speech translation, speech recognition), language (natural language processing, machine-based text translation, conversational AI), decision (anomaly detector, content moderator, personalizer), and of course, OpenAI's models.

Figure 10 - Gartner Magic Quadrant for Cloud AI Developer Services

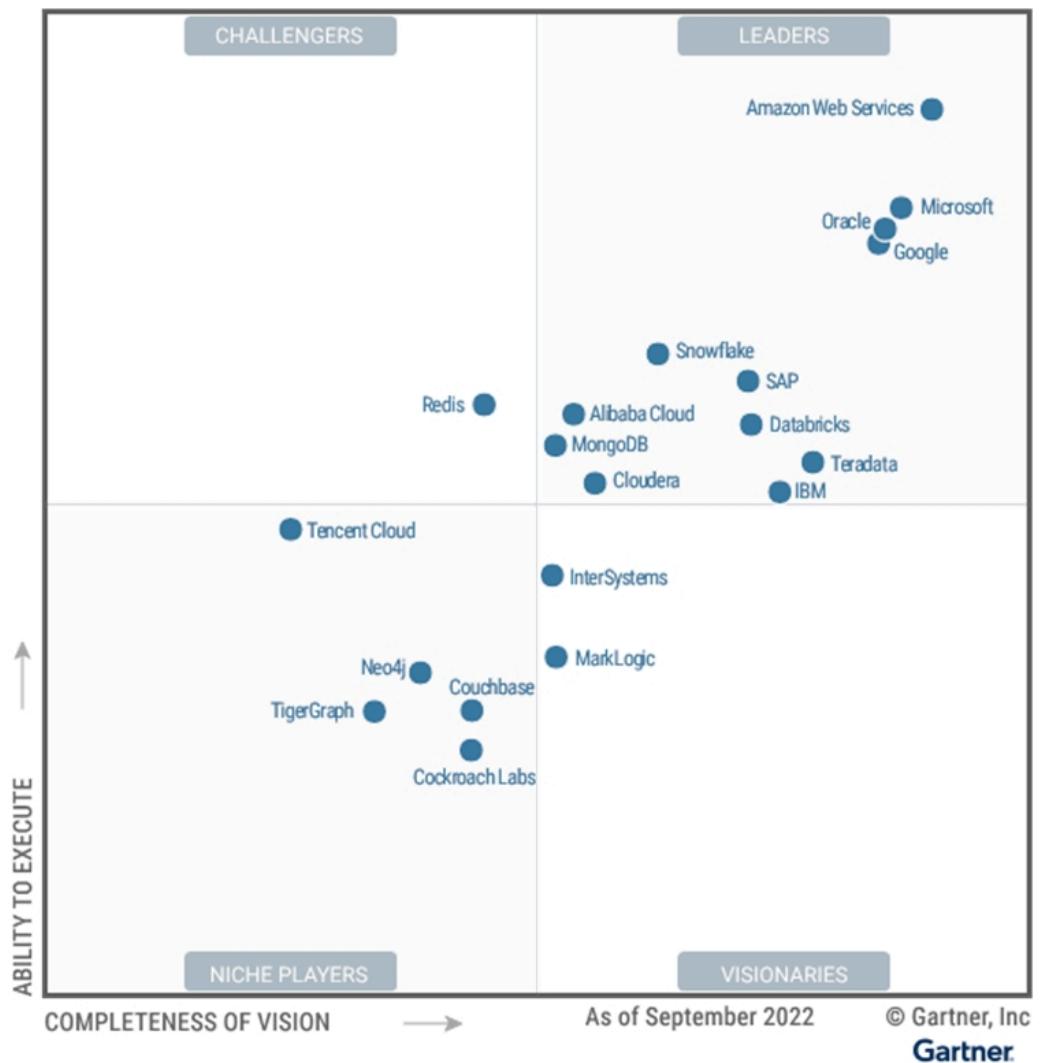


Source: Gartner, Magic Quadrant for Cloud AI Developer Services 23 May 2022 Baker et al.

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- **Data stores:** Not always appreciated is the fact that Microsoft is actually among the top providers in the aggregated database, data warehouse, and data lake landscape. Based on market share data from Gartner, Microsoft was actually the overall share leader in 2021, above Oracle and AWS. This is important, because AI is compute-intensive, requires large datasets train models, and generates equally large data volumes once in production. This data needs to be stored, queried, manipulated, and analyzed, hence we believe the database, data warehouse, and data lake software markets are likely to be clear secular beneficiaries of the AI wave. Microsoft's flagship offerings are in the database side of the market, with Azure SQL and SQL Server for relational workloads and CosmosDB for non-relational workloads. On the data warehouse side, Azure Synapse and Azure Data Lake are less established, but certainly appear to be growing in popularity.

Figure 11 - Gartner Magic Quadrant for Cloud Database Management Systems



Source: Gartner, Magic Quadrant for Cloud Database Management Systems, 13 December 2022, Cook et al.

## Differentiation in DevOps and Low-Code

Initial collaboration between Microsoft and OpenAI was focused on enhancing Microsoft's developer toolset, including GitHub and Visual Studio for professional developers and Power Platform for low-code, no-code tools. GitHub Copilot was the most notable innovation, in our view. While more niche in focus, GitHub Copilot saw viral adoption similar to ChatGPT, as Copilot gained 400,000+ subscribers just one month after becoming generally available in June 2022.

### GitHub Copilot

**So, how does GitHub Copilot work?** When a developer begins writing lines of code, GitHub Copilot will recommend code that can complete the operation (similar to how Outlook will finish your sentence for you when you start typing). Also, a developer can prompt GitHub Copilot to generate code by describing the task in plain English. For example, a developer could prompt GitHub Copilot with, "Write a function to remove all duplicates from a list" and Copilot will then generate code to best match this description. In terms of the underlying technology, GitHub Copilot is powered by OpenAI Codex, a machine learning model based on GPT-3 and trained

using the millions of lines of code in open-source source projects hosted on GitHub. Copilot can also use previous code written by a developer to adapt to their individual programming style over time. GitHub Copilot supports a number of programming languages, including popular ones like Python, JavaScript, TypeScript, Ruby, PHP, and Go, as well as more niche languages like Rust.

**Figure 12 - Example prompt of how Github Copilot writes code based on natural language prompts**

The screenshot shows a GitHub Copilot interface. At the top, there are tabs for 'runtime.go', 'course.rb', 'time.js', and 'IsPrimeTest.java'. Below the tabs, a Go code editor displays the following code:

```

1 package main
2
3 type Run struct {
4     Time int // in milliseconds
5     Results string
6     Failed bool
7 }
8
9 // Get average runtime of successful runs in seconds
10 func averageRuntimeInSeconds(runs []Run) float64 {
11     var totalTime int
12     var failedRuns int
13     for _, run := range runs {
14         if run.Failed {
15             failedRuns++
16         } else {
17             totalTime += run.Time
18         }
19     }
20
21     averageRuntime := float64(totalTime) / float64(len(runs) - failedRuns) / 1000
22     return averageRuntime
23 }

```

A blue button labeled 'Copilot' is visible at the bottom left of the code editor. At the bottom right, there is a 'Replay' button.

Source: Github website

**A legitimate differentiator in the developer toolchain market.** GitHub Copilot could be a game-changer for developer efficiency, which provides Microsoft with a source of competitive differentiation in the developer toolchain market. While we believe competitors could eventually build a rivaling solution (AWS has a similar solution named Whisper), no other companies have the dataset of GitHub's large repository of open-source code upon which Copilot/Codex has been trained. Also, Copilot is already being monetized today as a seat-based subscription offering for individuals (free trial then \$10/month or \$100/year) and business (\$19 per user per month).

### Power Platform

**Turning low-code into no-code with PowerFx.** During Build in May 2021, Microsoft announced the first features based on GPT-3 as part of Power Apps, the company's low-code application platform. The feature, called Power App Ideas, allows business users to create applications by turning conversational language in Power Fx, an open-source low-code programming language similar to Excel formulas/functions. In other words, this feature can effectively transform Power Apps from low-code to no-code, enabling a wider audience to build apps and workflows on the platform. Since then, Microsoft has introduced express design in Power Apps, which turns design into code. Using large AI models including DALL-E image recognition and Codex, users can turn design or Figma files into a fully functioning application.

Figure 13 - Gartner Magic Quadrant for Enterprise Low-Code Application Platforms



Source: Gartner, Magic Quadrant for Enterprise Low-Code Application Platforms, 31 December 2022, Vincent et al.

### Nothing to lose in search

One of the areas where Microsoft hopes to gain share with generative AI is search, where even if the share gain is modest, it can be meaningful for the stock. During the investor session on the search opportunity, management noted each incremental point of share would equate to \$2B in revenue.

**Can Microsoft monetize chat-based search?** Currently, Bing's chat-based search function lies on the same webpage as Bing's traditional search, but on a separate tab. Over time, we would not be surprised to see future versions of Bing include both traditional search and chat search in one unified tab, where you can simultaneously get a response to your query in both formats. Most importantly, Bing provides embedded links (unclear whether these are sponsored or monetized today) to dive deeper into the answers to your query. So, yes, chat-based search is monetizable, and while the advertising opportunity might take some time to gain traction (based on our conversations, most advertisers seem to be in wait-and-see mode), Microsoft seems to already be making significant strides around the potential to make embedded links into sponsored ads



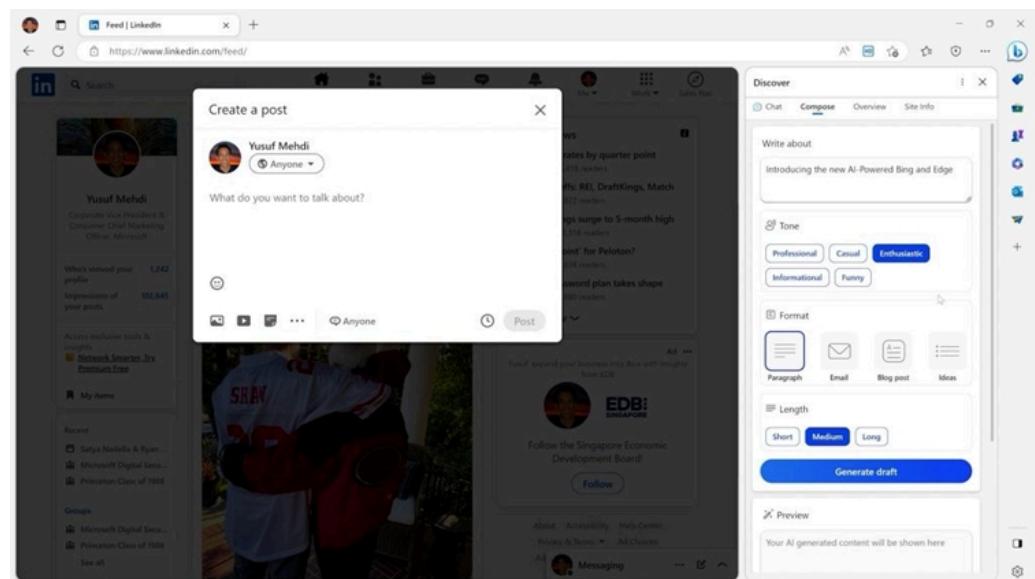
(eventually we expect display ads on the Bing Chat landing page).

In the Bing illustrative use cases section starting on page 185, we highlight a few use cases that illustrate the potential of ChatGPT for a typical consumer. Overall, we find the use cases to be really impressive, even if there are some slight inaccuracies and a learning curve to identify the right questions (known as "prompt engineering") to get the most useful responses. Some of these types of prompts are available on Github today.

The new Bing is powered by a large language model developed with OpenAI, called Prometheus, which management noted is more powerful than ChatGPT and tailored specifically for search. As part of the new Bing experience, Bing has a new sidebar with more detailed responses as well as an interactive chat experience (on the same webpage) for more complex searches with embedded links and citations (to the sites where Bing found the most relevant answers to the search). Also, Microsoft applied Prometheus to improve users' traditional search experience (i.e., the basic search engine and ranking algorithm).

The new Edge now has new functionalities in the sidebar – Chat and Compose. This allows users to leverage Bing's interactive chat experience to summarize an article or webpage and explore the content further, without opening a separate tab. In addition, users can prompt for AI-generated content in multiple tones, formats, and lengths, as shown in the Figure below. Importantly, the new sidebar adapts to the webpage a user is on for additional context.

Figure 14 - Edge Sidebar with Chat and Compose AI



Source: Company website

## Making productivity suites more productive

We believe Microsoft can leverage OpenAI's large language models to drive more innovation around the core productivity and collaboration suite of apps, including Word, Excel, PowerPoint, Outlook, and Teams, further extending its share dominance in the space.

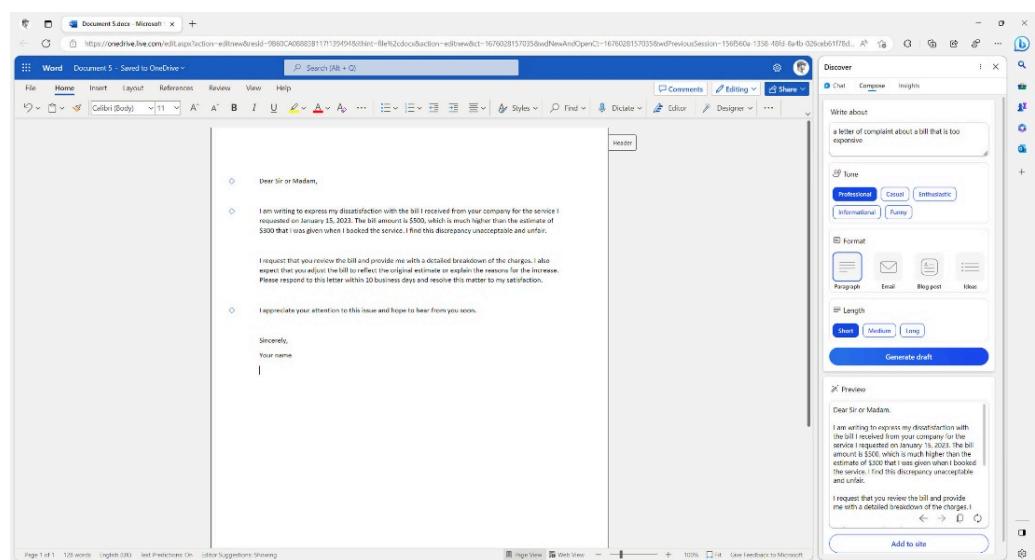
**Frustrated with Outlook's search experience?** So are most people, in our view, but large language models should help improve it. Given Microsoft's enhancements to Bing's search engine, we believe a logical next step would be to take the learnings from Bing with Prometheus to give Outlook's search experience a much-needed face lift. We would not be surprised to see



Microsoft introduce chatbots to help search through emails and calendar invites (so rather than typing in keywords, you could ask the bot “find my most recent email conversation with Rishi”).

In addition, we believe other low-hanging fruit where AI can enhance Outlook is by helping write, finish, and edit emails. Microsoft has already announced Copilot for Viva Sales, which uses Azure OpenAI Service and GPT to help sellers respond to customers or prospects. We believe the logical next step would be to extend this functionality to all Outlook users, by using the context of conversation history, org charts, etc. to curate a personalized or role-based experience. Technically, this functionality is already available in the browser-based version of Office applications, as users can use the new Edge sidebar outlined above in order to compose an email or a paragraph as shown below.

Figure 15 - ChatGPT Auto Generates Emails



Source: Company website

**Could we see a new Clippy, but useful?** In our view, it is not hard to imagine how a real AI assistant could contribute meaningful value to Outlook (as described above), Word (AI-generated paragraphs, sentence completion), Excel (formula suggestions, automating macros), and PowerPoint (auto-formatting, AI-generated slides based on a Word document).

**What has been announced so far?** Microsoft is already incorporating generative AI in Teams Premium. We believe it is important to mention Teams Premium has several incremental features unrelated to OpenAI's technologies but for the purpose of this report we will only mention features that leverage OpenAI's technologies.

Teams Premium became generally available in February 2023. Teams Premium features leveraging OpenAI's large language model include:

- Meetings:** AI enhancements to standard Meetings in Teams include post-meeting transcription translations, AI-generated chapters (analogous to Spark Notes for each meeting, tailored to each meeting participant), time stamps for when a participant joins or leaves a meeting and when a participant's name is mentioned, recommended tasks, and more.
- Virtual appointments:** AI enhancements to virtual appointments includes auto-generated post-appointment follow-ups and organizational / departmental analytics.
- Premium events:** In addition to the features outlined above, AI enhancements to Events



include full transcripts.

- **Live Transcription and Translation:** Participants can focus on paying attention to the meeting (and not taking notes word-for-word) given the meeting will be fully transcribed in live time (and then summarized using GPT-3) and participants will be provided with to-do suggestions. Teams Premium can translate 40 spoken languages (only the meeting organizer needs Teams Premium for all users to see the live transcription and translation features).

In terms of monetization, Teams Premium is available as an add-on for users with an Office 365 or Microsoft 365 subscription and costs \$10 per user per month. For a limited time, users can experiment with a 30-day free trial or lock in a 30% discount or \$7 per user per month.

## First-mover advantage in intelligent applications

On March 6<sup>th</sup>, Microsoft announced Dynamics 365 Copilot, which brings capabilities from generative AI into Microsoft's portfolio of CRM and ERP apps. While monetization routes remain unclear, we do believe this helps improve Microsoft's value proposition in the space and can drive increased interest in the platform with a first-movers advantage around generative AI.

- **Dynamics 365 Sales and Viva Sales:** Here Copilot helps sellers write email responses to customers, creates email summaries of Teams meetings in Outlook, and pulls in details from the CRM system, like product and pricing information.
- **Dynamics 365 Customer Service:** Here Copilot helps customer service agents respond to customer inquiries in both chat and email (i.e., drafts answers based on the context) as well as provides context data from the knowledge base, case history, and more. In addition, Microsoft is now offering more out-of-the-box Power Virtual Agents, in order to build custom bots faster and to leverage Azure OpenAI Service and Bing to provide answers from company websites and integrated internal knowledge bases.
- **Dynamics CDP and Marketing:** Here, Copilot helps marketers segment customers using data from Customer Insights (Microsoft's CDP product). In addition, marketers can leverage generative AI to generate ideas for marketing campaigns.
- **Dynamics 365 Business Central:** For commerce, Copilot helps streamline the process of product listings for ecommerce, product descriptions can be auto generated using GPT prompts, and there are integrations to Shopify.
- **Dynamics 365 Supply Chain Management:** Here, Copilot helps flag external factors such as weather, financials, and geography that might cause supply chain issues. Supply chain planners can use Copilot to auto generate email alerts to send to the appropriate colleagues and partners when there is a detected issue with materials, inventory, carriers, distribution, etc.



## GOOGL: Down but certainly not out

Along the lines of our thinking that the GAI strategy for hyperscalers must include best-in-class LLMs driving a user-facing GAI chatbot, MSFT has taken the lead with the rollout of ChatGPT, in the minds of investors. This has driven an unprecedented, almost existential crisis for GOOGL shareholders as this advance hits at both its core search business as well as its budding cloud business, which are the two primary sources of the company's cash generation and the stock's call optionality, respectively.

While this is the perception today, we think much of the difference relates to the marketing & aggressive messaging out of MSFT to date. As such, we see GOOGL having plenty of artillery to help shape a less destructive narrative for itself related to GAI over time through a few different means. 1) We expect Bard (which is based on GOOGL's LaMDA model) to get increasing play in mainstream media (as well as Google's other several larger models) which may help ease search share losses which is the easy-to-arrive-at conclusion. 2) We expect it to become clearer in the coming months that GOOGL is implementing many leading-edge GAI capabilities across its entire workspace suite that are intended to drive functionality that already mirrors the next generation of ChatGPT, which has not yet been released (ChatGPT4), and should also drive improving news flow and public awareness of GOOGL's own industry leadership. 3) Along these lines we'd expect enterprises & developers to take increasing notice, which should drive better partnership/buy-in and accordingly API adoption into using GOOGL's models & tools; this would be similar to the MSFT strategy and thus could/should become its own cloud adoption tailwind.

### The four main debates around GAI's implications for GOOGL

**1) Search disruption.** The first key question is whether GAI displaces a significant amount of existing search activity by responding to queries with more relevant, more intended and/or easier to understand responses. Later in the note, we lay out several dozen examples of search next to the GAI where some level of displacement seems likely, but whether it would displace or reduce the monetization of search appears much more of an open question. Our work suggests that Google or any other search engine in control of their own solution would have meaningful latitude to manipulate the taxonomy of the UI such that it could still be solving for monetization with adequate conversion to support the economics in-line if not better than what's available today.

**2) Google search share loss.** With ChatGPT, OpenAI's MSFT partnership and the imminent Bing launch with ChatGPT integration, this has driven enormous buzz in both the enterprise & startup community along with mainstream media. Along these lines, it has driven an order of magnitude increase to Bing/Edge downloads and a significant increase already in Bing page views, which is obviously concerning for GOOGL given Bing's LSD share today. The share loss scenario becomes quite simple in that to the degree Bing's salesforce or self-serve platform can monetize the incremental traffic, we'd expect advertisers to look to move more budget over. With that said, we don't think this is occurring today and given the Google traffic & download data is essentially unchanged since the launch of ChatGPT, the early data suggests that much or all of the usage is incremental at this point. All that said, we're reserving further judgment until a full integration of GAI at Bing and we're better able to observe Bing's competitive advances in the wild.

**3) GAI tools driving cloud share shift.** Based on ChatGPT's first-mover advantage and strong early momentum, an important longer-term concern for GCP is that many of its customers will or already have begun leveraging the ChatGPT model through APIs and in doing so, those customers will be forced to run those workloads through Azure which could open up broader cloud service discussions leading to GCP being displaced. The opposing argument to this would be that GOOGL's already rolling out tools with bigger models & more capability vs. the current



version of ChatGPT, and as enterprises & developers become more aware of this (GOOGL not exactly doing great at marketing at this point), enterprises & developers will suddenly have two significant generative AI tools to work with. And while we think MSFT has the strategy & resources to price these tools aggressively, given its lack of vertical integration for both software & its foundation models, we'd think that compute costs could be meaningfully more attractive on GCP (also AWS) vs. Azure while it can leverage that into pricing advantages on other application layers within the broader cloud service offering (again, AWS likely has the best overall value prop here given its broader array). Sustaining first-mover advantages tends to work best when the advantage itself allows the technology to maintain the advantage and, given that's already not the case, it's unclear to us how much impact MSFT's Trojan horse strategy can drive if it has a finite shelf life.

**4) Rising compute cost drives persistent margin compression.** While we've yet to get clarity on what GAI queries (as an example) may cost relative to traditional search queries, we've heard estimates ranging between 2-10x which is obviously concerning relative to GOOGL's gross margins and capex intensity and is a key reason for the stock's recent underperformance after MSFT's CEO commented publically that search gross margins would decline 'forever'. Further, as larger, higher-parameter models come out, we believe there's a strong correlation between parameter count & compute intensity which only bolsters the margin compression bear case (which the market is well aware of at this point). While we certainly have our concerns on this topic, there are solid reasons why this may not be as impactful as it might appear and secondarily, we do think this is at least partially baked into the stock at this point given MSFT's prolific commentary to the markets 3 weeks ago.

- a) On its Q4 earnings call, GOOGL management was asked about the cost of rising compute intensity associated with GAI and basically dismissed it as a concern highlighting that it has always approached its capital intensity for all of its innovation keeping a keen eye on ROIC. Given the company announced it is rolling out a fully capable GAI solution within many parts of workspace earlier in the week (6 weeks after the earnings conference call), we believe the company may already be displaying signs of leveraging the technology with virtually no discernible impact on capex intensity.
- b) We believe having its own hardware and vertically integrating with the LLM may be a longer-term competitive advantage. We believe the use of 1p GPU vs. merchant silicon can be as much as 50% cheaper where GPU vendors may actually have significant pricing power for leading edge chips to non-vertically integrated players given most hyperscalers can use their own.
- c) Further, as future generations of 1P GPUs are achieved, we think the scale and cost improvements relative to current levels could be substantial where even if GAI query costs are on the order of 5-10x vs. traditional search queries today for example, it seems very unlikely that that gap wouldn't significantly narrow over a time frame which could have a substantial upward effect on GOOGL's terminal margin that is very likely not the case today.
- d) The simplest and most obvious offset not discussed would be revenue where GAI aspires to drive additional functionality & intelligence for which we think GOOGL can extract more revenue. Performance Max has been the best example of this (ML/DL) where while there likely has been higher computing costs associated with it, we've consistently heard that not only does Pmax extract more revenue on an apples-to-apples basis but there's also a widely held view that it is driving better conversion by automating campaign creation, audience building and ultimately, performance. We think things like targeting, productivity tools and the potential business model adaptation based on differentiated value could all serve to offset any compute cost difference.

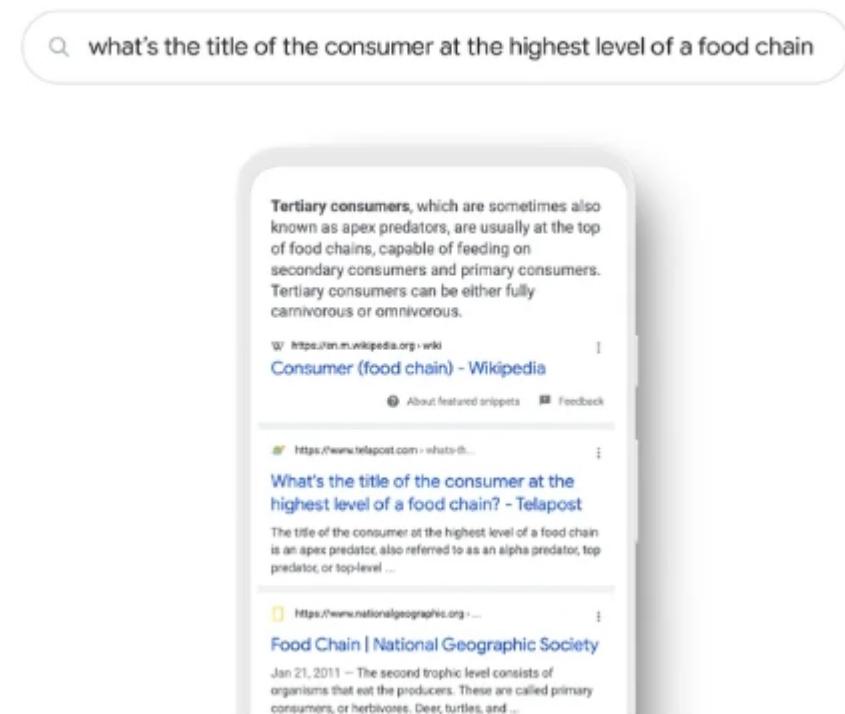
## What is GOOGL doing with AI/ML today?

While OpenAI and MSFT have gotten the lion's share of AI attention recently, it's worth remembering that GOOGL has been developing and implementing AI/ML in their business for years. Over six years ago CEO Sundar Pichai spoke to GOOGL being an AI first company and the company has pioneered several innovations in the space, particularly their 2017 Transformer research paper. Given some of the ML/AI innovations are less well-publicized than ChatGPT, we highlight some of the work GOOGL has been implementing across Search, Advertising and Cloud below.

### Search

**RankBrain**, launched in 2015, was the first AI implementation in Search and helps the engine relate words to concepts. This innovation broadened the capabilities of Search where it can better understand less explicit queries and improve the relevance of results. As an example, with RankBrain the search engine is able to produce more relevant results by recognizing the context and concepts relevant to the query where previously it may have not recognized the user is looking for the term "apex predator" vs. results related to human consumers.

Figure 16 - With RankBrain, the search engine is better able to identify the context of a user's query and produce more relevant results



Source: Google Blog

**Neural Matching** was implemented in Search in 2018 and better understands how queries relate to pages. This innovation builds upon RankBrain's foundation to enhance the engine's ability to process more ambiguous queries by looking at the entire query vs. keywords and a better comprehension of the underlying concepts, broadening the index search to return the most relevant results. For example, if you search "why does my TV look weird", the engine will recognize the context of the query and return results for "soap opera effect" even though the search text doesn't include any of those keywords.



Figure 17 - With Neural Matching, the search engine is able to identify concepts and produce a relevant result despite the search text not including any of the keywords of the correct response

The screenshot shows a Google search results page. The search query in the bar is "why does my tv look weird". Below the search bar are filter buttons for All, Images, Videos, News, Shopping, and More, with "All" being selected. The text "About 790,000,000 results (0.43 seconds)" is displayed. The first result is a snippet from Forbes.com: "Chances are you have an LCD TV or similar, and what you're experiencing is called the **"soap opera effect"**. It's actually a function of the motion smoothing or motion compensation functions, and relates to how your television processes the signals due to frame rate differences." Below the snippet is the date "Mar 13, 2019". A link to the full article at <https://www.forbes.com/sites/quora/2019/03/13/if-movies-look-strange-on-your-tv-at-home-this-is-probably-a-motion-compensation-effect/#:~:text=Chances%20are%20you%20have%20an%20LCD%20TV%20or%20similar,%22soap%20opera%20effect%22.%20It%27s%20actually%20a%20function%20of%20the%20motion%20smoothing%20or%20motion%20compensation%20functions,&text=and%20relates%20to%20how%20your%20television%20processes%20the%20signals%20due%20to%20frame%20rate%20differences.> The snippet ends with "If Movies Look Strange On Your TV At Home, This Is Probably ...".

Source: Google.com

**Bidirectional Encoder Representations from Transformers (BERT)**, launched in 2019, understands how different combinations of words have different meanings and intents. Instead of identifying each keyword individually, BERT can comprehend the sequence of words and how that relates to the context of a query, thereby improving web page rankings. In the example below, BERT can recognize the user is looking to pick up medicine for someone else where previously the search engine might have omitted the word "for" and provided results on how to fill a prescription for yourself.



Figure 18 - With BERT, the search engine can better relate combinations of words to user intent where the sequence of words in the query is important to the context of the search

Answer: Yes. A pharmacist may use professional judgment and experience with common practice to make reasonable inferences of the patient's best interest in allowing a person, other than the patient, to pick up a prescription. Dec 19, 2002

<https://www.hhs.gov/hipaa/conta...>  
Can a patient have a friend or family member pick up a prescription for her? | HHS.gov

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People also ask

Can I get a prescription for someone else?

Can a pharmacist give medications?

Feedback

<https://www.ncbi.nlm.nih.gov/pmc...>

Source: Google Blog

**Multitask Unified Model (MUM)** was introduced in May '22 and can better understand and generate language (in 75 languages), which Google describes as 1,000 times more powerful than BERT. Beyond text, MUM can also understand images. While still relatively early days, GOOGL plans to further integrate and implement MUM applications in their products going forward.

**Language Model for Dialogue Applications (LaMDA)** was announced in 2021 and importantly adds conversation capabilities to GOOGL's AI foundation where the AI can engage in conversation with users where previously the AI functionality was largely limited to better language comprehension.

**Bard** was announced in February '23. Powered by LaMDA (initially on the lightweight version of the model), Bard allows users to engage in conversation with the chatbot similar to ChatGPT. While still in the testing phase GOOGL plans to make it more widely available and integrate within Search, again, similar to Bing integrating ChatGPT.



Figure 19 - An example of Bard's capabilities to generate text responses

The screenshot shows a conversational interface. A user asks, "what new discoveries from the James Webb Space Telescope can I tell my 9 year old about?" Bard responds with information about galaxies nicknamed "green peas" and exoplanets. Below the response, a note says, "These discoveries can spark a child's imagination about the infinite wonders of the universe." At the bottom are social sharing icons (like, dislike, share) and a "Check it" button.

what new discoveries from the James Webb Space Telescope can I tell my 9 year old about?

Your 9-year old might like these recent discoveries made by The James Webb Space Telescope (JWST):

- In 2023, The JWST spotted a number of galaxies nicknamed “green peas.” They were given this name because they are small, round, and green, like peas.
- The telescope captured images of galaxies that are over 13 billion years old. This means that the light from these galaxies has been traveling for over 13 billion years to reach us.
- JWST took the very first pictures of a planet outside of our own solar system. These distant worlds are called “exoplanets.” Exo means “from outside.”

These discoveries can spark a child's imagination about the infinite wonders of the universe.

Source: Google Blog

## Advertising

**Performance Max (PMax)** launched in 2021 and allows advertisers to access all of GOOGL's ad inventory in a single campaign. PMax uses machine learning models (Smart Bidding) to automatically optimize for an advertiser objective(s) (traffic, leads, sales, etc.) in real time across their ad properties. Creating a PMax campaign is relatively straightforward. Advertisers simply select a goal, budget & bidding strategy and location & languages, add their assets/asset groups (images, videos, logos, etc.) and publish the campaign. A key component of PMax is discovering new customers advertisers might not have been previously targeting in manually created campaigns. Using AI to understand an advertiser's historical customer behavior, GOOGL can better identify converting audiences outside of a perceived target market without necessarily lowering advertiser ROI. Additionally, when advertisers define the value of each type of conversion (phone call, online form fill, etc.), the AI can take that information into account when bidding across their ad properties. With responsive search ads, campaigns can adjust content in real-time based on users' searches to improve performance.

## Cloud

GCP has been incorporating AI/ML tools for years for a broad range of applications (see table below). Beyond the software tools/capabilities, GCP also has their own custom TPUs purpose built for training models, which could lower costs vs. to off-the-shelf silicon. Most recently, GOOGL announced (on 3/14) new AI tools within Google Workspace (which appear similar to ChatGPT's capabilities) and importantly a GAI app builder. For example, a "Help Me Write" tool will be integrated within Docs and Gmail to assist users in creating text, editing syntax & tone, adjusting the language based on the intended audience, etc. The tool will be launched in the U.S. for testing in March.



Figure 20 - GCP has an extensive array of AI/ML Cloud API/capabilities which we expect them to build upon going forward

Use Case	Product	Description
Scientists	Vertex AI	Centralized UI to manage all ML workflows. Pretrained APIs to quickly develop GAI applications
Scientists	Vertex AI Workbench	Development environment to manage the entire application/model workflow. Allows for faster building and training, better scale and data analysis
Scientists	Vertex Explainable AI	Set of tools/frameworks to better understand ML outputs to debug and improve model performance.
Developers	AutoML	Simplified ML development for less experienced developers across image, text, video, translation, etc applications
Developers	Natural Language AI	Analyzes unstructured text to provide better insights including sentiment analysis, content classification, syntax analysis, etc
Developers	Dialogflow	Customer service chatbots/voicebots
Developers	Media Translation	Real-time audio translation
Developers	Speech-to-Text	Converts audio to text in 125+ languages. Available on-premise or via cloud.
Developers	Text-to-Speech	Converts text to speech at near human quality levels in 40+ languages in 220+ voices. Ability to train custom voice models via customer audio recordings.
Developers	Recommendations AI	Analyzes customer data to maximize metric business is optimizing for at scale to improve conversions and ROAS
Developers	Translation AI	Translate text in 100+ languages
Developers	Video AI	Automatically recognizes 20k+ objects/places/actions. Generates video metadata. Builds video apps.
Developers	Vision AI	ML models to analyze videos and images. Detects objects and handwriting. Pretrained APIs to extract metadata.
Infrastructure	Deep Learning Containers	Environment to develop, test and deploy AI applications
Infrastructure	Deep Learning VM Image	Access to VMs with pre-installed applications
Infrastructure	Cloud GPUs	Access to GPUs to improve job speed with a wide range of performance and prices
Infrastructure	Cloud TPUs	Access to TPUs for larger workloads and ML model training/interating
Infrastructure	TensorFlow Enterprise	Enterprise-grade CPU, GPU, TPU resources
Solutions	Contact Center AI	Human-like AI for customer service
Solutions	Document AI	Provides structured data from documents
Solutions	Intelligent Products	Customer insights to develop and monetize new products
Solutions	Product Discovery	Implement Google-quality search on websites

Source: Google, RBC Capital Markets



### Google's investment in Anthropic

Google invested ~\$400M in Anthropic for a ~10% stake in the company as reported by Bloomberg, and the money will be used in part to acquire additional computing resources. Anthropic was created in 2021 by Dario Amodei and other executives who were colleagues at OpenAI. The founders left due to a disagreement with OpenAI pertaining to the original mission of the company vs. the current direction. Prior to taking money from Google, the startup had raised \$700M+. Anthropic has developed a chatbot called Claude, that has similar capabilities to ChatGPT.

### How might search business models to be altered or at least adapt to the inclusion of GAI

Given the inevitably higher compute costs associated with GAI, we think it's possible to see the business model evolve over time - not necessarily just for search per se but for higher frequency GAI users where we'd think there could be several different ways to at least partially or fully cover the higher associated compute costs.

**Traditional ad load but with better economics due to more clicks above the fold etc:** Depending on taxonomy fueled by a likely whole new realm of A/B testing, to the degree that user engagement for above-the-fold GAI responses is better than traditional search (which seems plausible), conversion would inevitably be better as well, which would drive CPMs higher. What's unclear to us is whether the showing of fewer ad impressions in general would be at least somewhat of a headwind of CPM inflation as a function of theoretically same intent (or more in the event that monetizable usage is truly incremental). Directionally, we're reasonably confident that CPM inflation will result here not only as a function of GAI, but more broadly as AI increasingly drives targeting & performance, however, the magnitude of that improvement is what is likely to remain an open question.

**Throttling.** Within 2 months following launch, driven by server overload and a host of bad actors using the product in a variety of manipulative & sometimes nefarious ways, OpenAI & MSFT have already put caps on how many questions can be asked on a daily basis from an initial 6 chats/day which was then expanded to 60 with an expected increase to 100 chats per day in the future. A common initial reason which drove this change, in our view was that the bot was being drawn into acrimonious conversations which were then publicized and obviously carried reputational risk with potential to both indict the technology as doing more harm than good which, of course, could then threaten its virality & adoption. Underneath this, we have to think OpenAI (& maybe MSFT) decided to contain the likely rapid compute cost expansion as they worked through the initial kinks & bugs phase of making the product & underlying tech more commercially viable. Over time, we also think throttling could be an important mechanism to limit cost as just like traditional search, LLMs will have an enormous responsibility to index as much of the web as possible on a daily/weekly/monthly periodic basis in order to maintain the quality & relevance to provide a durably differentiated experience both vs. its own search engine as well as competitors.

**Subscription/pay-to-play.** Between the likely large group of individual GAI super-users combined with companies wanting enterprise access to both the bot as well as any of the underlying LLM's, we have to think there'll be a price to pay for this type of access & associated elevated compute cost. We'd think a normal consumption model would be sufficient here and while this would at some level manifest as a price increase, ie impediment to adoption, we think this should align well with companies (both new GAI native as well as those migrators) which are drawing increasing competitive advantages & associated incremental revenue.

**Ad paywall.** The viability of an ad-supported model is less clear given that there's already likely to be a hefty amount of ad load in the core use-case to a certain threshold. Beyond that point,

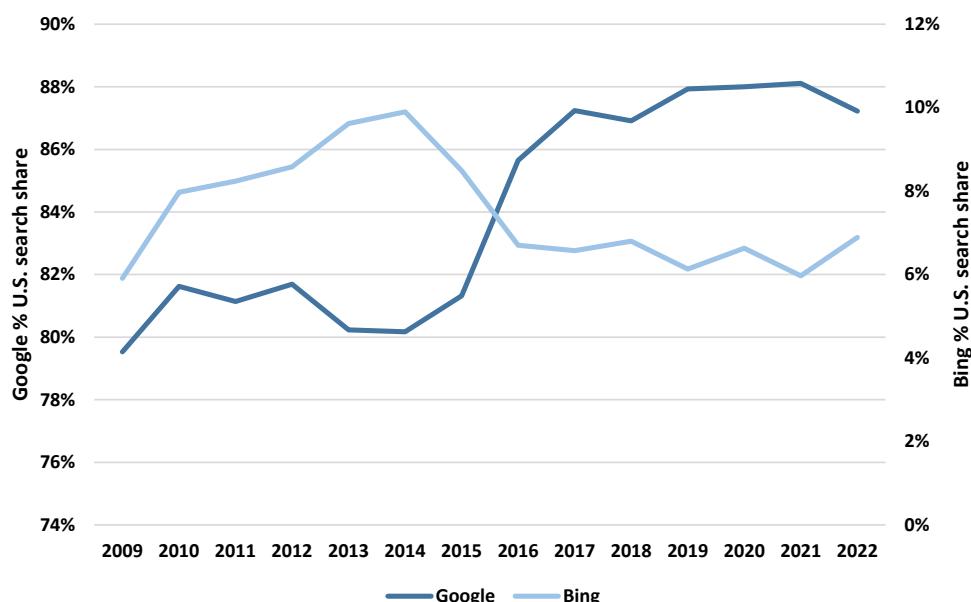
the Netflix analog could hold true in that subscription would entirely support plenty of adoption for elevated usage and then as more of user-behavior & habits became known over time and adoption slowed down, then a plausible incremental layer of adoption & usage could be driven by an ad-supported tier. We'd think the economic contribution from this would likely be dilutive due to relevance & monetization potential while also would likely precede something of a more mature state and therefore could be many years if not decades away.

## What is ChatGPT's impact on traditional search and social platform engagement, if any?

**The increasing interest in ChatGPT doesn't appear to have had any/a material impact on Google or engagement on social platforms so far.** With the meteoric rise of ChatGPT, reaching 100M users in ~2 months, according to Similar Web, investors are likely contemplating the impact on Bing and Google search engines (particularly post ChatGPT integration with Bing) and social media usage. That said, the traffic, download and time spent data suggests the interest in Bing/ChatGPT is incremental.

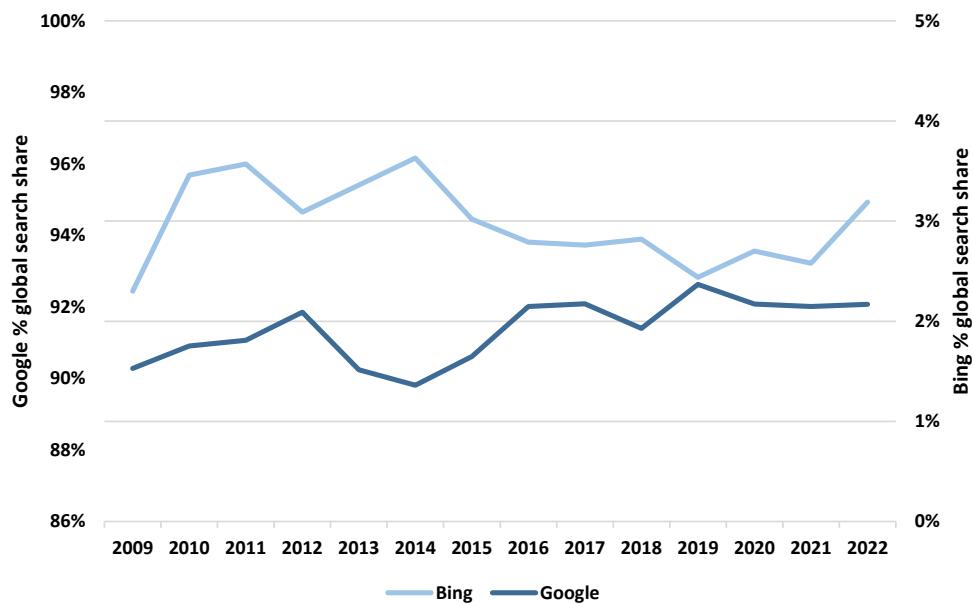
As background for our analysis, we look at historical search engine market share in the U.S. and globally where GOOGL is the dominant player and has been gaining share over the past decade+.

**Figure 21 - Google Search vs. Bing market share in the U.S. since 2009 and find Google has gained ~800bps of share**



Source: StatCounter, RBC Capital Markets

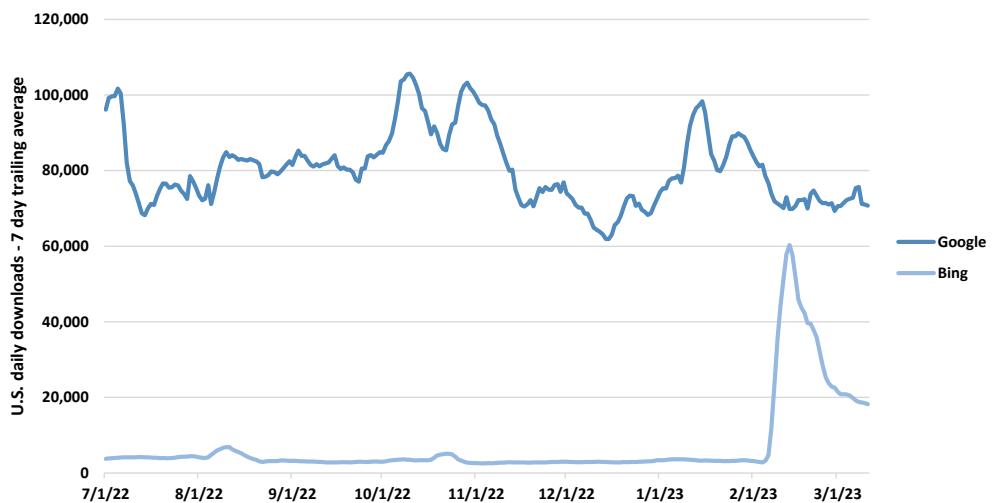
**Figure 22 - Globally, Google has steadily gained share, though less than in the U.S., since 2009 while Bing share has been flat/slightly down**



Source: StatCounter, RBC Capital Markets

One of the more intuitive conclusions investors could draw is that Bing could take search share from Google as it integrates ChatGPT into the search engine. However, the download and web traffic data would generally refute that notion (though worth noting ChatGPT integration in Bing isn't available to all users yet and traffic is something we'll monitor going forward). While Google had been on a downtrend, downloads largely troughed before the spike in Bing interest and had since risen from the lows (worth noting these are 7 day trailing average daily downloads so some volatility is to be expected). Additionally, Bing downloads are down 70% from the peak which may be an indication the recent interest in Bing is temporary vs. durable share gains.

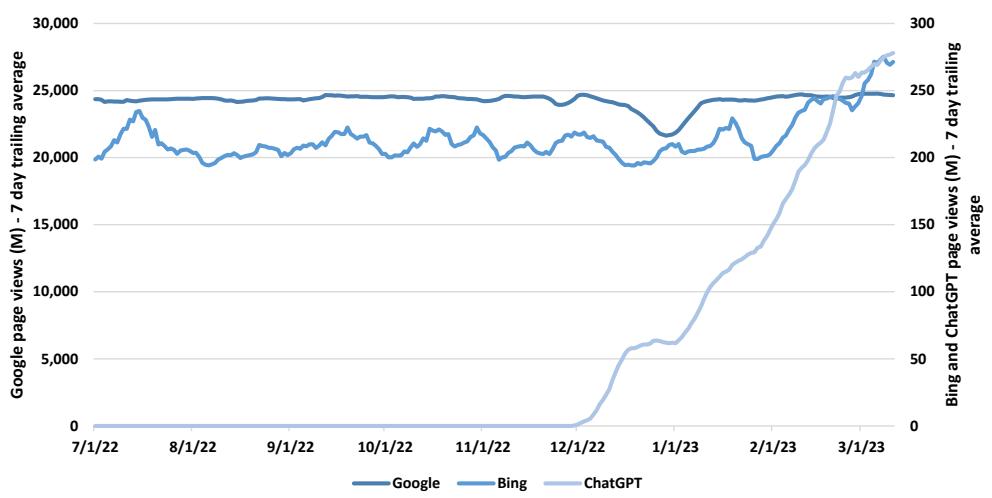
**Figure 23 -** As shown in the U.S. app download data, Bing downloads spiked in February which may have been a marginal headwind to Google downloads at most, though downloads have actually risen since the lows in February and Bing downloads declined significantly after



Source: Sensor Tower, RBC Capital Markets

On web traffic, the uptick in Bing in the beginning of the year is noticeable but doesn't appear to be at the expense of Google, implying the Bing traffic is incremental.

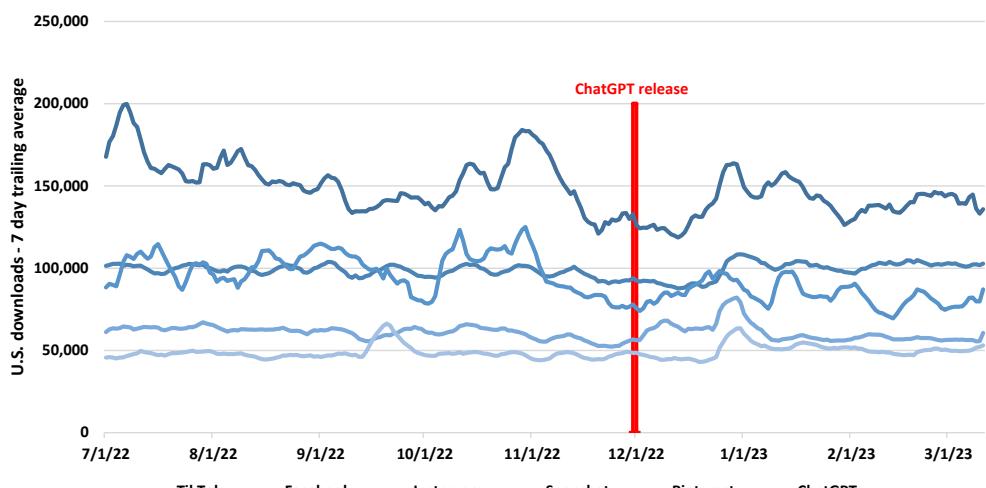
**Figure 24 -** Looking at page views, it appears as though Bing did get a noticeable uptick in traffic, coinciding with the rise of ChatGPT, while the impact to Google's traffic appears non-existent, implying Bing traffic is incremental



Source: Similar Web, RBC Capital Markets. Note: Bing and ChatGPT are on right axis and Google is on left axis

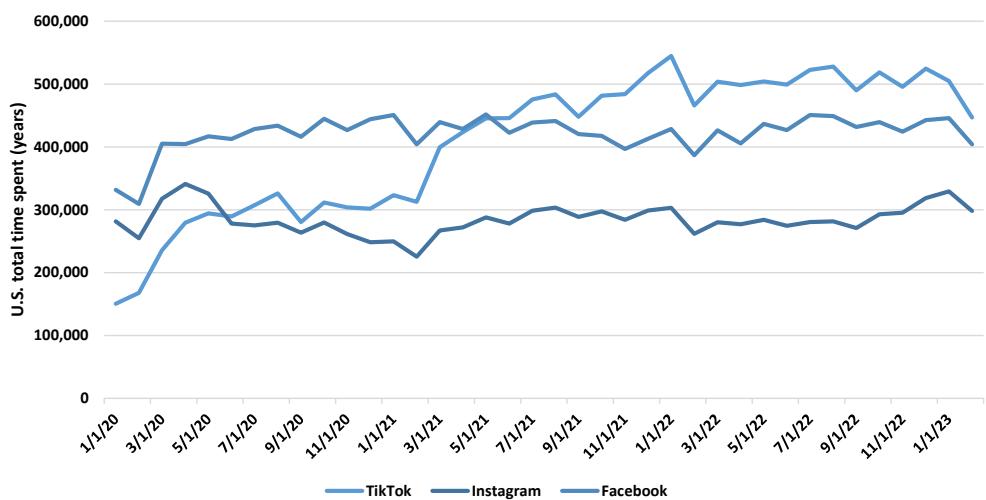
On the social side, download data suggests no/minimal impact from ChatGPT as all five apps' downloads are higher now than they were when ChatGPT was released. Engagement (total time spent) on social apps also appears to continue following seasonal trends despite the viral interest in ChatGPT.

**Figure 25 - ChatGPT doesn't appear to have a downward impact on social downloads as all five apps' downloads are up since the release of ChatGPT**



Source: Sensor Tower, RBC Capital Markets

**Figure 26 - While total U.S. time spent on popular socials did come down in February, it doesn't appear materially different than normal seasonality and we wouldn't infer the m/m decline as driven by ChatGPT taking mindshare from social platforms**



Source: Sensor Tower, RBC Capital Markets

### **Side by side: Does ChatGPT replace traditional search use cases?**

In our analysis of ChatGPT and the potential ramifications for search advertising, we did a side-by-side comparison of general searches in different verticals on both Google and ChatGPT. The screenshots of each vertical are shown on page 97-184. Given the closed nature of ChatGPT currently, some searches are not perfectly analogous, but we wanted to demonstrate the potential and where ChatGPT could disrupt the search business.

**Big brands vs. the long tail (SMBs).** We see a top-of-funnel shift to GAI having the potential to



widen the moat for big brands & agencies vs. the long-tail of internet/Ecommerce participants (which are the majority of the economy - and critical to digital ad players in particular like GOOGL & META). Specifically, we expect those with greater resources to leverage both internal & external tools to create the most compelling content, thus creating both an SEM as well as an SEO discoverability headwind for those smaller companies lacking the resources to leverage GAI to their advantage. An area of significant intrigue for us lies in whether the purveyors of LLM's will allow developers to build solutions which effectively can replicate near-perfect relevance (think dynamic content algorithmically optimized) to drive outsized discoverability. Can anyone become a search engine? If digital ads were the new rent, does GAI become the new digital ad?

**Key themes that stood out as we observed & analyzed side-by-side comparisons of search vs. ChatGPT (@ also within Bing):**

1. In terms of ad load, we found that most cases produce results that are largely similar and thus, we believe a search operator should have a similar ability to manipulate the taxonomy on the page to build in efficient ad load within the GAI UI. With that said, to the degree that GAI's responses hit the mark on the first page more than traditional search, CPM's would likely rise further given the higher conversion which would net out any ad impression weakness with less searching required.
2. GAI results in significantly lower SEO organic results in many commercially monetizable search categories like travel, professional services, auto retail & real estate as some examples. Unclear here which force is stronger though - either a) organic search scarcity & the higher odds of conversion off the first page or two of GAI responses driving potentially significant upward CPM pressure OR b) do the organic headwinds created by the reduced organic page space simply weaken the long tail of sites seeking to be discovered which in turn, drives reduced demand by those same entities which are frequently also SEM customers. Our view is that the former likely outweighs the latter given we think SEO discoverability for the long tail is already a significant minority of traffic, but it's simply too early in our understanding of likely user behaviors to say for certain.
3. The back and forth potential of GAI should create better recommendation engines for paid ads (as well as organic) which should push conversion higher and accordingly, CPMs & CPCs. Traditionally, the goal of any search engine is to find the most relevant response in working with only one question or query. With GAI enabling follow-up questions, this should raise the odds of hitting the most relevant results which should also yield more relevant ads - hence, the likely potential of higher CPC/CPMs.
4. On the one hand, a consistent GAI UI over time will likely provide growing comfort levels for digesting & hopefully trusting content - on the other hand, we believe that many searches ultimately require a primary source to ensure a user is comfortable with the validity/accuracy of what they found. Conceding we're fighting an extreme amount of dogma given our own two decades of exclusive Google usage, to the degree that GAI's UI would suffice for a response, we'd think a similar outcome would happen in traditional search where Google often returns a similar, singular response (though coming from a single website referenced below it). We'd think the inclusion of linked sources seems critical to augment that comfort level which again, could challenge the taxonomy on the page to the degree that ad load is increasingly incorporated.
5. GAI may be the closest approximation to a truly unbiased response mankind has ever seen, however, given it is often a single response to a question with multiple answers, it is by definition not possible to be biased in at least some direction (should you visit the Colosseum in Rome on the first day of your trip or third for example, or which movie theater has the best air conditioning). In lieu of providing simple lists of primary sources as responses which will ultimately likely require further clicks, we don't see a way around giving users the choices of primary sources which most users would usually desire. When it comes to anything subjective, (even those searches which must subjectively select a set of objective responses),



we see GAI facing a virtually impossible task of satisfying all users without the prospect of offering adequate permutations of correct responses.

6. Categories where visual-based search is important or necessary seem better protected from disruption - it's difficult to come up with an Ecommerce category of goods or even services where at least some level of visual shopping isn't involved before moving further down the funnel in a targeted way on the way to conversion/purchase. Over time, we'd expect GAI UI's to reflect a similar image/text mix where applicable for different types of searches but again, given the ease of manipulating taxonomy to maximize ad load, we'd think a GAI wouldn't have any trouble delivering an optimal image/text mix to drive shopping & down-funnel conversion.
7. SEO professionals need to become GAI experts asap. To the degree that GAI greatly reduces organic discoverability, we'd imagine we'll see a significant education period by SEO professional followed by a substantial increase in demand for GAI SEO discoverability.

Figure 27 - Past 10 years of top Google searches

Search Rank	Trending Searches									
	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
1	Wordle	NBA	Election results	Disney Plus	World Cup	Hurricane Irma	Powerball	Lamar Odom	Robin Williams	Black Friday
2	Election results	DMX	Coronavirus	Cameron Boyce	Hurricane Florence	Matt Lauer	Prince	Jurassic World	World Cup	Cyber Monday
3	Betty White	Gabby Petito	Kobe Bryant	Nipsey Hussle	Mac Miller	Tom Petty	Hurricane Matthew	American Sniper	Ebola	Daytona 500
4	Queen Elizabeth	Kyle Rittenhouse	Coronavirus update	Hurricane Dorian	Kate Spade	Super Bowl	Pokemon Go	Caitlyn Jenner	Malaysia Airlines	Chinese New Year
5	Bob Saget	Brian Laundrie	Coronavirus symptoms	Antonio Brown	Anthony Bourdain	Las Vegas shooting	Slither.io	Ronda Rousey	Flappy Bird	Tour de France
6	Ukraine	Mega Millions	Zoom	Luke Perry	Black Panther	Mayweather vs McGregor fight	Olympics	Paris	ALS Ice Bucket Challenge	AMAs
7	Mega Millions	AMC Stock	Who is winning the election	Avengers: Endgame	Mega Millions Results	Solar eclipse	David Bowie	Agar.io	ISIS	French Open
8	Powerball numbers	Stimulus Check	Naya Rivera	Game of Thrones	Stan Lee	Hurricane Harvey	Trump	Chris Kyle	Ferguson	Cinco de Mayo
9	Anne Heche	Georgia Senate Race	Chadwick Boseman	iPhone 11	Demi Lovato	Aaron Hernandez	Election	Fallout 4	Frozen	Yom Kippur
10	Jeffrey Dahmer	Squid Game	Playstation 5	Jussie Smollett	Election Results	Fidget Spinner	Hillary Clinton	Straight Outta Compton	Ukraine	LA Auto Show

Source: Google Trends, RBC Capital Markets

Figure 28 - Average GOOGL search CPC by vertical

Industry	Average CPC
Legal	\$6.75
Consumer Services	\$6.40
Technology	\$3.80
Finance & Insurance	\$3.44
B2B	\$3.33
Home Goods	\$2.94
Dating & Personals	\$2.78
Health & Medical	\$2.62
Industrial Services	\$2.56
Auto	\$2.46
Education	\$2.40
Real Estate	\$2.37
Employment Services	\$2.04
Travel & Hospitality	\$1.53
Advocacy	\$1.43
E-Commerce	\$1.16

Source: WordStream.com, RBC Capital Markets



Figure 29 - Average GOOGLE search CPA by vertical

Industry	Average CPA
Technology	\$133.52
Real Estate	\$116.61
B2B	\$116.13
Advocacy	\$96.55
Consumer Services	\$90.70
Home Goods	\$87.13
Legal	\$86.02
Finance & Insurance	\$81.93
Industrial Services	\$79.28
Health & Medical	\$78.09
Dating & Personals	\$76.76
Education	\$72.70
Employment Services	\$48.04
E-Commerce	\$45.27
Travel & Hospitality	\$44.73
Auto	\$33.52

Source: WordStream.com, RBC Capital Markets

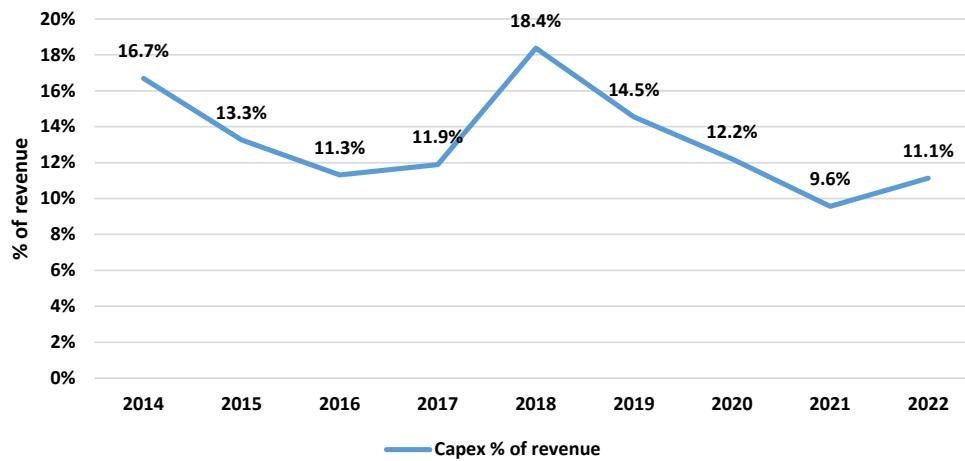
### Taking it to the model - Impact on GOOGL's '24 estimates

But first, a look at CapEx over the past several years. As GOOGL continues to build out AI, ongoing technical infrastructure (data centers) investments will likely be required. That in mind, we look at historical CapEx as % of revenue vs. when GOOGL rolled out their major AI advancements (worth noting GOOGL does have other CapEx not related to AI but is at least directionally consistent, in our view).

2018 was the year with highest CapEx intensity which preceded the launch of BERT in 2019 and 2014 is the second highest which preceded the launch of RankBrain, both of which were significant innovations in Search. Since 2018, CapEx intensity has come down consistently with the exception of 2022 which notably featured the launch of MUM and the rise of LaMDA & Bard. Going forward, significant CapEx intensity increases seem unlikely, in our view, given a) revenue has grown so much over the past few years and b) the company has already been investing in AI for nearly a decade already. Directionally higher CapEx intensity in the next few years is certainly possible, but we don't expect going back to '18 levels.



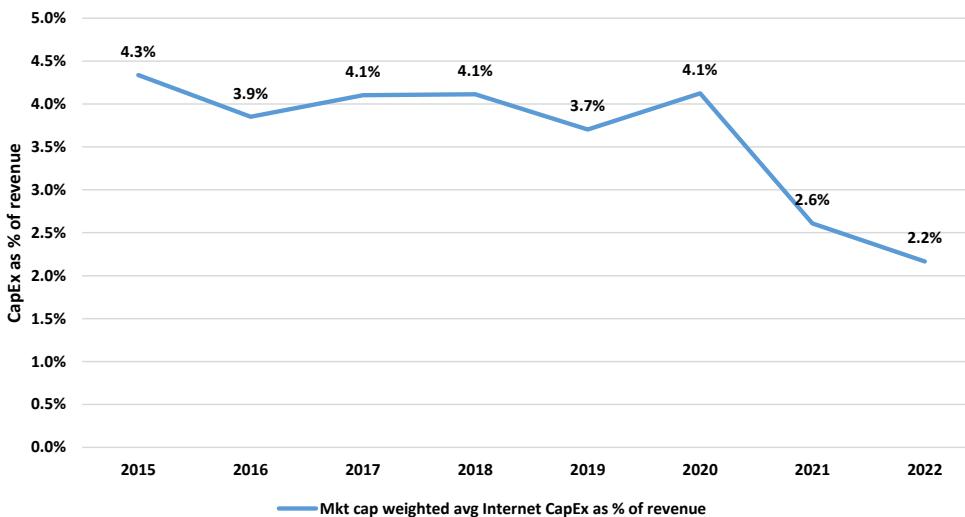
Figure 30 - GOOGL's capex as % of revenue is near historical lows



Source: Company Reports, RBC Capital Markets

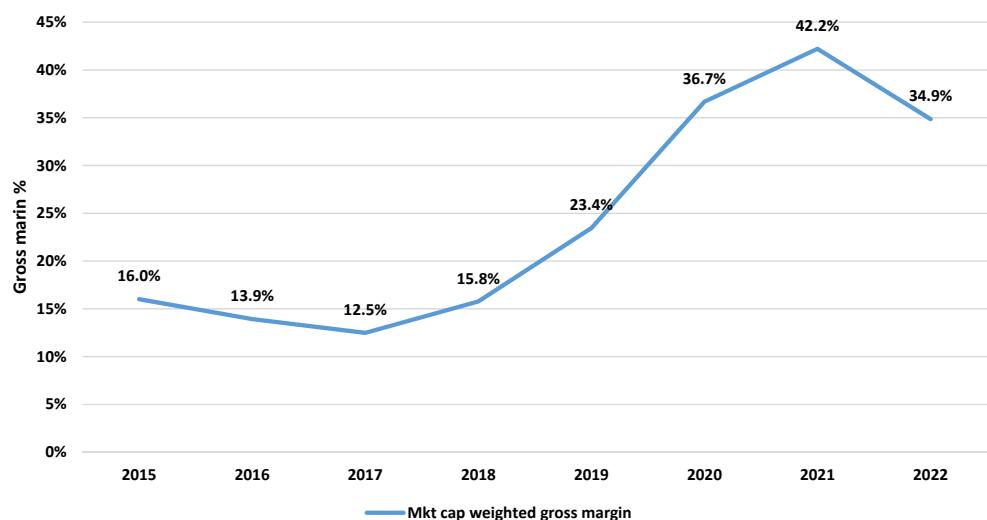
Looking across our internet coverage more broadly (excl. AMZN, GOOGL, META), CapEx intensity years has fallen over the past several years even as the adoption of AI has grown over that period. And while some may argue the CapEx leverage is a result of cloud adoption where the costs were largely shifted from CapEx to COGS, gross margins increased significantly over the same time period suggesting that the increasing compute intensity associated with historical shifts to AI has not translated into margin pressures as scale and processor innovation has been able to offset. Admittedly, GAI's compute intensity is likely altogether higher than legacy AI workloads but to the extent that computing becomes increasingly more efficient as in past generations, we'd expect investor fears on the matter to abate over time.

Figure 31 - Across our Internet coverage, CapEx as % of revenue has been trending downwards over the past several years, coinciding with the rise of AI



Source: Company Reports, Factset, RBC Capital Markets

**Figure 32 - And at the same time, GMs have been increasing, implying the rise of AI has not driven margins downwards**



Source: Company Reports, Factset, RBC Capital Markets

**The potential impact of GAI going forward is unknown.** Given investor attention on the topic, we attempt to size the revenue/gross margin impact on the Street's '24 estimates under three separate scenarios: 1) Impact on GOOGL's search revenue due to share loss to Bing. 2) Impact on GOOGL's search revenue based on GOOGL searches fulfilled by their own GAI chatbot. 3) GOOGL search GM impact due to compute intensity delta between GAI and traditional search. While these scenarios likely won't occur in a vacuum, we think sizing the range of potential impacts of each scenario separately will help investors dimensionalize the factors that could affect GOOGL's search business. For purposes of this analysis, we don't assume any Search TAM expansion as a result of GAI.

At a high level - we think investors are already contemplating much of the potential adverse impact to GOOGL's earnings associated with GAI & ChatGPT. As is summarily shown below in Figures 48-50, we estimate a base case scenario where there's a theoretical 12-13% downside risk to '24 EPS under what we'd argue are somewhat generous assumptions around share losses to Bing (5% points of share), the portion of Bing's share-gain searches which are monetizable (7.5%) and the compute cost relative to traditional search (base case assumes 4x).

So with the stock having dislocated by 12% YTD and virtually sitting on top of its 9 year trough at just below 15x '24 EPS, assumptions of more than 5% share gains, double digit monetizable searches from share gains and 6x+ relative compute costs would have to be the assumption to arrive at a downside scenario closer to 25-30%.

#### **Variable 1 - Impact on GOOGL's search revenue due to share loss to Bing**

**Bing taking share from Google Search will likely not be a significant revenue headwind.** The integration of ChatGPT in Bing has been widely followed by the media and appears to be a strategic move by MSFT as CEO Satya Nadella recently noted in an interview that he's willing to demonetize Bing (accept higher compute costs associated with GAI) in order to take share from GOOGL given Bing margins are incremental to the business, even at higher CoR levels. We conduct an analysis to determine the range of outcomes of GOOGL share losses to Bing and the % of share losses that would have otherwise been monetized by GOOGL (GOOGL currently monetizes ~20% of total search queries), and calculate the implied % revenue impact. We find



that if Bing took 10% share (highly unlikely, in our view) and 30% of those searches were monetizable by GOOGL, the estimated total revenue headwind be under 2%.

Figure 33 - We sensitize the potential impact on GOOGL search and total revenue due to search share loss to Bing and the % of the share loss that was monetizable by GOOGL

GOOGL search revenue share loss to Bing sensitivity analysis (\$M) - Current '24 search revenue estimate = \$185.2B							
% of Bing share gain as monetizable searches	GOOGL % share loss to Bing					GOOGL search % change in revenue sensitivity analysis	
	1.0%	2.5%	5.0%	7.5%	10.0%		
	15%	\$184,930	\$184,513	\$183,818	\$183,124	\$182,429	-0.1%
	30%	\$184,652	\$183,818	\$182,429	\$181,040	\$179,651	-0.3%
	45%	\$184,374	\$183,124	\$181,040	\$178,957	\$176,873	-0.4%
	60%	\$184,096	\$182,429	\$179,651	\$176,873	\$174,095	-0.6%
	75%	\$183,818	\$181,735	\$178,262	\$174,790	\$171,317	-0.7%

GOOGL total revenue share loss to Bing sensitivity analysis (\$M) - Current '24 total revenue estimate = \$333.6B							
% of Bing share gain as monetizable searches	GOOGL % share loss to Bing					GOOGL total % change in revenue sensitivity analysis	
	1.0%	2.5%	5.0%	7.5%	10.0%		
	15%	\$333,290	\$332,873	\$332,179	\$331,484	\$330,790	-0.1%
	30%	\$333,012	\$332,179	\$330,790	\$329,401	\$328,012	-0.2%
	45%	\$332,735	\$331,484	\$329,401	\$327,317	\$325,234	-0.2%
	60%	\$332,457	\$330,790	\$328,012	\$325,234	\$322,456	-0.3%
	75%	\$332,179	\$330,095	\$326,623	\$323,150	\$319,677	-0.4%

Source: Company Reports, Factset, RBC Capital Markets

## Variable 2 - Impact on GOOGL's search revenue based on GOOGL searches fulfilled by their own GAI chatbot

From a revenue perspective, if/when GOOGL implements Bard into Search, we estimate the revenue headwind associated with Bard taking search share from traditional Search will likely not be a significant revenue headwind. With the recent Bard announcement and Bing adding ChatGPT functionality directly in search interface, we assume GOOGL will introduce similar GAI chatbot functionality into search and estimate the impact on search revenue as GAI fulfills a portion of total searches. Additionally, GOOGL currently only monetizes ~20% of searches which introduces another variable of what percentage monetizable search use cases can be fulfilled by GAI. We sensitize those two variables in the below tables and calculate the implied Search revenue % headwind. If GAI ends up fulfilling 15% of total searches but only 20% of those searches were monetizable (likely will be lower than 20%, in our view), the total revenue headwind would be under 2%.



Figure 34 - We sensitize the potential impact on GOOGL search revenue due to GAI fulfilling a % of total searches and the % of GAI searches that were previously monetizable

GOOGL search revenue sensitivity analysis (\$M) - Current '24 search revenue estimate						
% of searches fulfilled by GAI	% of monetizable search use cases fulfilled by GAI					
	10%	20%	30%	40%	50%	
	5.0%	\$184,281	\$183,355	\$182,429	\$181,503	\$180,577
	7.5%	\$183,818	\$182,429	\$181,040	\$179,651	\$178,262
	10.0%	\$183,355	\$181,503	\$179,651	\$177,799	\$175,947
	12.5%	\$182,892	\$180,577	\$178,262	\$175,947	\$173,632
	15.0%	\$182,429	\$179,651	\$176,873	\$174,095	\$171,317

GOOGL search % change in revenue sensitivity analysis						
% of searches fulfilled by GAI	% of monetizable search use cases fulfilled by GAI					
	10%	20%	30%	40%	50%	
	5.0%	-0.5%	-1.0%	-1.5%	-2.0%	-2.5%
	7.5%	-0.7%	-1.5%	-2.3%	-3.0%	-3.8%
	10.0%	-1.0%	-2.0%	-3.0%	-4.0%	-5.0%
	12.5%	-1.2%	-2.5%	-3.8%	-5.0%	-6.3%
	15.0%	-1.5%	-3.0%	-4.5%	-6.0%	-7.5%

GOOGL total revenue sensitivity analysis (\$M) - Current '24 search revenue estimate = \$333.6B						
% of searches fulfilled by GAI	% of monetizable search use cases fulfilled by GAI					
	10%	20%	30%	40%	50%	
	5.0%	\$332,642	\$331,716	\$330,790	\$329,864	\$328,938
	7.5%	\$332,179	\$330,790	\$329,401	\$328,012	\$326,623
	10.0%	\$331,716	\$329,864	\$328,012	\$326,160	\$324,308
	12.5%	\$331,253	\$328,938	\$326,623	\$324,308	\$321,993
	15.0%	\$330,790	\$328,012	\$325,234	\$322,456	\$319,677

GOOGL total % change in revenue sensitivity analysis						
% of searches fulfilled by GAI	% of monetizable search use cases fulfilled by GAI					
	10%	20%	30%	40%	50%	
	5.0%	-0.3%	-0.6%	-0.8%	-1.1%	-1.4%
	7.5%	-0.4%	-0.8%	-1.2%	-1.7%	-2.1%
	10.0%	-0.6%	-1.1%	-1.7%	-2.2%	-2.8%
	12.5%	-0.7%	-1.4%	-2.1%	-2.8%	-3.5%
	15.0%	-0.8%	-1.7%	-2.5%	-3.3%	-4.2%

Source: Company Reports, Factset, RBC Capital Markets

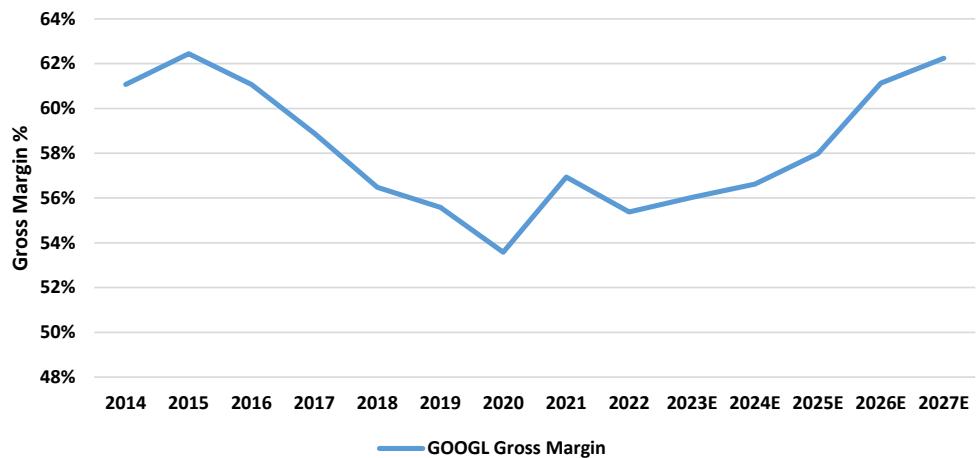
### Variable 3 - GOOGL search GM impact due to compute intensity delta between GAI and traditional search

From a gross margin perspective, the incremental compute intensity of GAI fulfilled searches could be a significant headwind. Given the compute intensity delta between GAI and standard search queries, we estimate that the gross margin dilution could be significant depending on the relative compute intensity and % of total searches fulfilled by GAI which we sensitize in the below tables. We assume that Search's GM ex TAC is approximately 85% and calculate the GM on Search and the entire company. While a likely draconian scenario, if relative compute costs are 10x and only 10% of searches are fulfilled by GAI, gross margins would fall 13%.

It appears as though Street estimates are not contemplating incremental compute intensity related to GAI as GMs are expected to expand over the next several years. While it's likely fair to say GAI compute intensity will fall on an absolute basis with scale and GPU innovation, we think GAI compute intensity relative to legacy search is still significantly higher and the transition to GAI-fulfilled queries will likely happen faster than costs can fall, at least in the near-term, where gross margins could see degradation over the next couple of years.



Figure 35 - Gross margins have been declining relatively steadily over the past several years where Street estimates imply expanding margins over the next several years



Source: Company Reports, Factset, RBC Capital Markets

Figure 36 - We sensitize the potential impact on GOOGL search GM due to increased compute intensity associated with GAI searches relative to the % of total searches done by GOOGL's GAI and the relative compute intensity vs. traditional search

GOOGL search gross margin sensitivity analysis - assume 85% GM ex TAC						
% of searches fulfilled by GAI	GAI compute cost intensity vs. traditional search					
	2x	4x	6x	8x	10x	
	5.0%	84.3%	82.8%	81.3%	79.8%	78.3%
	7.5%	83.9%	81.6%	79.4%	77.1%	74.9%
	10.0%	83.5%	80.5%	77.5%	74.5%	71.5%
	12.5%	83.1%	79.4%	75.6%	71.9%	68.1%
	15.0%	82.8%	78.3%	73.8%	69.3%	64.8%

GOOGL % change in search gross margin ex. TAC sensitivity analysis						
% of searches fulfilled by GAI	GAI compute cost intensity vs. traditional search					
	2x	4x	6x	8x	10x	
	5.0%	-0.9%	-2.6%	-4.4%	-6.2%	-7.9%
	7.5%	-1.3%	-4.0%	-6.6%	-9.3%	-11.9%
	10.0%	-1.8%	-5.3%	-8.8%	-12.4%	-15.9%
	12.5%	-2.2%	-6.6%	-11.0%	-15.4%	-19.9%
	15.0%	-2.6%	-7.9%	-13.2%	-18.5%	-23.8%

GOOGL total GM sensitivity analysis - Street estimates imply 56%						
% of searches fulfilled by GAI	GAI compute cost intensity vs. traditional search					
	2x	4x	6x	8x	10x	
	5.0%	55.4%	54.5%	53.7%	52.9%	52.0%
	7.5%	55.2%	53.9%	52.7%	51.4%	50.2%
	10.0%	54.9%	53.3%	51.6%	49.9%	48.3%
	12.5%	54.7%	52.7%	50.6%	48.5%	46.4%
	15.0%	54.5%	52.0%	49.5%	47.0%	44.5%

GOOGL % change in total gross margin sensitivity analysis						
% of searches fulfilled by GAI	GAI compute cost intensity vs. traditional search					
	2x	4x	6x	8x	10x	
	5.0%	-0.7%	-2.2%	-3.7%	-5.2%	-6.7%
	7.5%	-1.1%	-3.4%	-5.6%	-7.8%	-10.1%
	10.0%	-1.5%	-4.5%	-7.5%	-10.5%	-13.4%
	12.5%	-1.9%	-5.6%	-9.3%	-13.1%	-16.8%
	15.0%	-2.2%	-6.7%	-11.2%	-15.7%	-20.2%

Source: Company Reports, Factset, RBC Capital Markets

### Impact of all three scenarios on the full P&L

Putting all three scenarios together, we estimate bull, base and bear case scenarios to size the impact to the Street's implied EPS estimate. While the combined revenue headwind from Scenarios 1 & 2 may not be significant even in a bear case scenario, the potential impact on EPS is meaningful, in our view. Note: in the below tables, green borders denote the variables driving our EPS downside estimates.

**Figure 37 - In a bull case, we estimate only a marginal 4% downside to Street's implied '24 EPS estimate for GOOGL**

GAI sensitivity analysis to '24 Street revenue and gross profit estimates		Impact of GAI on Street's '24 full PnL			
Line Item	Value	In M except for EPS	Street estimates	Adjusted estimate	Delta
Total revenue	\$333,568.0	Total revenue	\$333,568.0	\$332,388.1	-0.4%
Search revenue	\$185,207.4	CoR	\$147,506.8	\$149,568.0	1.4%
Total CoR	\$147,506.8	Total gross profit	\$186,061.2	\$182,820.1	-1.7%
Search CoR	\$27,781.11				
Total gross profit	\$186,061.2	S&M	\$30,497.7	\$30,497.7	
Search gross profit	\$157,426.3	G&A	\$17,336.9	\$17,336.9	
Search GM (ex TAC)	85.0%	R&D	\$45,702.6	\$45,702.6	
Total GM	55.8%				
<b>Key Variables</b>	<b>Value</b>	<b>EBIT</b>	<b>\$92,524.1</b>	<b>\$89,283.0</b>	<b>-3.5%</b>
% share loss to Bing	1.0%	Interest expense	\$1,600.0	\$1,600.0	
% of searches Bing gains are monetizable	7.5%	Tax expense	\$15,755.0	\$15,193.4	
% of searches fulfilled by GOOGL GAI	7.5%	Tax rate	17%	17%	
% of monetizable search use cases fulfilled by GOOGL GAI	7.5%				
GAI compute cost intensity vs. traditional search	2.0x	<b>Net Income</b>	<b>\$75,169.0</b>	<b>\$72,489.5</b>	<b>-3.6%</b>
<b>Scenario 1 - Share loss going to Bing</b>		Diluted shares outstanding (4Q22)	12,947	12,947	
% share loss to Bing	1.0%	<b>EPS</b>	<b>\$5.81</b>	<b>\$5.60</b>	<b>-3.6%</b>
% of searches Bing gains are monetizable	7.5%				
Search revenue % headwind	0.1%				
Search revenue post share loss to Bing	\$185,068.5				
Total revenue % headwind	0.0%				
Total revenue post share loss to Bing	\$333,429.1				
<b>Scenario 2 - GAI fulfills a % of GOOGL searches</b>					
% of searches fulfilled by GOOGL GAI	7.5%				
% of monetizable search use cases fulfilled by GOOGL GAI	7.5%				
Search revenue % headwind	0.6%				
Search revenue post shift to GOOGL GAI	\$184,027.5				
Total revenue % headwind	0.3%				
Total revenue post shift to GOOGL GAI	\$332,388.1				
<b>Scenario 3 - Compute costs on CoR</b>					
Search CoR post share loss to Bing	\$27,760.3				
Total CoR post share loss to Bing	\$147,485.9				
% of searches fulfilled by GOOGL GAI	7.5%				
GAI compute cost intensity vs. traditional search	2.0x				
Increase in compute costs impact on search CoR	8%				
Search CoR including impact of GAI higher compute intensity	\$29,842.3				
Search GM	83.9%				
Search GM bps impact	-113 bps				
Total % increase in CoR	1.4%				
Total \$ CoR	\$149,568.0				
Total GM	55.1%				
Total GM bps impact	-64 bps				

Source: Company Reports, Factset, RBC Capital Markets

**Figure 38 - In a more base case scenario, our assumptions imply 13% downside to Street's implied '24 EPS estimate for GOOGL**

GAI sensitivity analysis to '24 Street revenue and gross profit estimates		Impact of GAI on Street's '24 full PnL			
Line Item	Value	In M except for EPS	Street estimates	Adjusted estimate	Delta
Total revenue	\$333,568.0	Total revenue	\$333,568.0	\$329,421.7	-1.2%
Search revenue	\$185,207.4	CoR	\$147,506.8	\$155,570.2	5.5%
Total CoR	\$147,506.8	Total gross profit	\$186,061.2	\$173,851.4	-6.6%
Search CoR	\$27,781.11				
Total gross profit	\$186,061.2	S&M	\$30,497.7	\$30,497.7	
Search gross profit	\$157,426.3	G&A	\$17,336.9	\$17,336.9	
Search GM (ex TAC)	85.0%	R&D	\$45,702.6	\$45,702.6	
Total GM	55.8%				
<b>Key Variables</b>	<b>Value</b>	<b>EBIT</b>	<b>\$92,524.1</b>	<b>\$80,314.3</b>	<b>-13.2%</b>
% share loss to Bing	5.0%	Interest expense	\$1,600.0	\$1,600.0	
% of searches Bing gains are monetizable	15.0%	Tax expense	\$15,755.0	\$13,639.4	
% of searches fulfilled by GOOGL GAI	10.0%	Tax rate	17%	17%	
% of monetizable search use cases fulfilled by GOOGL GAI	15.0%				
GAI compute cost intensity vs. traditional search	4.0x	<b>Net Income</b>	<b>\$75,169.0</b>	<b>\$65,074.9</b>	<b>-13.4%</b>
<b>Scenario 1 - Share loss going to Bing</b>		Diluted shares outstanding (4Q22)	12,947	12,947	
% share loss to Bing	5.0%	<b>EPS</b>	<b>\$5.81</b>	<b>\$5.03</b>	<b>-13.4%</b>
% of searches Bing gains are monetizable	15.0%				
Search revenue % headwind	0.8%				
Search revenue post share loss to Bing	\$183,818.4				
Total revenue % headwind	0.4%				
Total revenue post share loss to Bing	\$332,178.9				
<b>Scenario 2 - GAI fulfills a % of GOOGL searches</b>					
% of searches fulfilled by GOOGL GAI	10.0%				
% of monetizable search use cases fulfilled by GOOGL GAI	15.0%				
Search revenue % headwind	1.5%				
Search revenue post shift to GOOGL GAI	\$181,061.1				
Total revenue % headwind	0.8%				
Total revenue post shift to GOOGL GAI	\$329,421.7				
<b>Scenario 3 - Compute costs on CoR</b>					
Search CoR post share loss to Bing	\$27,572.8				
Total CoR post share loss to Bing	\$147,298.4				
% of searches fulfilled by GOOGL GAI	10.0%				
GAI compute cost intensity vs. traditional search	4.0x				
Increase in compute costs impact on search CoR	30%				
Search CoR including impact of GAI higher compute intensity	\$35,844.6				
Search GM	80.5%				
Search GM bps impact	-450 bps				
Total % increase in CoR	5.6%				
Total \$ CoR	\$155,570.2				
Total GM	53.2%				
Total GM bps impact	-261 bps				

Source: Company Reports, Factset, RBC Capital Markets

**Figure 39 - In a bear case scenario, our assumptions imply a 26% downside to Street's implied '24 EPS estimate for GOOGL**

GAI sensitivity analysis to '24 Street revenue and gross profit estimates		Impact of GAI on Street's '24 full PnL			
Line Item	Value	In M except for EPS	Street estimates	Adjusted estimate	Delta
Total revenue	\$333,568.0	Total revenue	\$333,568.0	\$326,229.2	-2.2%
Search revenue	\$185,207.4	CoR	\$147,506.8	\$164,192.8	11.3%
Total CoR	\$147,506.8	Total gross profit	\$186,061.2	\$162,036.3	-12.9%
Search CoR	\$27,781.11				
Total gross profit	\$186,061.2	S&M	\$30,497.7	\$30,497.7	
Search gross profit	\$157,426.3	G&A	\$17,336.9	\$17,336.9	
Search GM (ex TAC)	85.0%	R&D	\$45,702.6	\$45,702.6	
Total GM	55.8%				
<b>Key Variables</b>	<b>Value</b>	<b>EBIT</b>	<b>\$92,524.1</b>	<b>\$68,499.2</b>	<b>-26.0%</b>
% share loss to Bing	7.5%	Interest expense	\$1,600.0	\$1,600.0	
% of searches Bing gains are monetizable	20.0%	Tax expense	\$15,755.0	\$11,592.1	
% of searches fulfilled by GOOGL GAI	12.5%	Tax rate	17%	17%	
% of monetizable search use cases fulfilled by GOOGL GAI	20.0%	<b>Net Income</b>	<b>\$75,169.0</b>	<b>\$55,307.1</b>	<b>-26.4%</b>
GAI compute cost intensity vs. traditional search	6.0x	Diluted shares outstanding (4Q22)	12,947	12,947	
<b>Scenario 1 - Share loss going to Bing</b>		<b>EPS</b>	<b>\$5.81</b>	<b>\$4.27</b>	<b>-26.4%</b>
% share loss to Bing	7.5%				
% of searches Bing gains are monetizable	20.0%				
Search revenue % headwind	1.5%				
Search revenue post share loss to Bing	\$182,429.3				
Total revenue % headwind	0.8%				
Total revenue post share loss to Bing	\$330,789.9				
<b>Scenario 2 - GAI fulfills a % of GOOGL searches</b>					
% of searches fulfilled by GOOGL GAI	12.5%				
% of monetizable search use cases fulfilled by GOOGL GAI	20.0%				
Search revenue % headwind	2.5%				
Search revenue post shift to GOOGL GAI	\$177,868.6				
Total revenue % headwind	1.4%				
Total revenue post shift to GOOGL GAI	\$326,229.2				
<b>Scenario 3 - Compute costs on CoR</b>					
Search CoR post share loss to Bing	\$27,364.4				
Total CoR post share loss to Bing	\$147,090.1				
% of searches fulfilled by GOOGL GAI	12.5%				
GAI compute cost intensity vs. traditional search	6.0x				
Increase in compute costs impact on search CoR	63%				
Search CoR including impact of GAI higher compute intensity	\$44,467.1				
Search GM	75.6%				
Search GM bps impact	-938 bps				
Total % increase in CoR	11.6%				
Total \$ CoR	\$164,192.8				
Total GM	50.4%				
Total GM bps impact	-542 bps				

Source: Company Reports, Factset, RBC Capital Markets



Given the model's sensitivity to relative compute costs of GAI fulfilled queries, we show the below data tables which calculate the EPS impact of GAI headwinds at different relative compute costs ranging from 2x-10x vs. traditional search. The two variables we sensitize are share loss to Bing and % of searches fulfilled by GOOGL's own GAI while holding both % of searches Bing gains that are monetizable and % of monetizable search use cases fulfilled by GOOGL GAI constant at 15%. In a best case scenario, EPS would only fall by 3%, where in a worst case EPS falls nearly 48%.

Figure 40 - Given the incremental compute costs associated with GAI queries are still a debate amongst investors, we show several sensitivity tables, each based on a different compute intensity level, to calculate the impact on the Street's '24 EPS estimates for GOOGL

Impact on EPS assuming 2x compute cost intensity for GAI fulfilled searches						EPS % impact vs. current '24 consensus at 2x compute costs					
% of searches fulfilled by GAI	GOOGL % share loss to Bing					% of searches fulfilled by GAI	GOOGL % share loss to Bing				
	1.0%	2.5%	5.0%	7.5%	10.0%		1.0%	2.5%	5.0%	7.5%	10.0%
	5.0%	\$5.61	\$5.59	\$5.55	\$5.52	\$5.48	-3.3%	-3.7%	-4.3%	-5.0%	-5.6%
	7.5%	\$5.53	\$5.50	\$5.47	\$5.43	\$5.39	-4.8%	-5.2%	-5.8%	-6.5%	-7.1%
	10.0%	\$5.44	\$5.41	\$5.38	\$5.34	\$5.31	-6.4%	-6.7%	-7.4%	-8.0%	-8.6%
	12.5%	\$5.35	\$5.33	\$5.29	\$5.25	\$5.22	-7.9%	-8.3%	-8.9%	-9.5%	-10.1%
	15.0%	\$5.26	\$5.24	\$5.20	\$5.17	\$5.13	-9.4%	-9.8%	-10.4%	-11.0%	-11.6%

Impact on EPS assuming 4x compute cost intensity for GAI fulfilled searches						EPS % impact vs. current '24 consensus at 4x compute costs					
% of searches fulfilled by GAI	GOOGL % share loss to Bing					% of searches fulfilled by GAI	GOOGL % share loss to Bing				
	1.0%	2.5%	5.0%	7.5%	10.0%		1.0%	2.5%	5.0%	7.5%	10.0%
	5.0%	\$5.44	\$5.41	\$5.38	\$5.34	\$5.31	-6.4%	-6.7%	-7.4%	-8.0%	-8.6%
	7.5%	\$5.26	\$5.24	\$5.20	\$5.17	\$5.13	-9.4%	-9.8%	-10.4%	-11.0%	-11.6%
	10.0%	\$5.08	\$5.06	\$5.03	\$4.99	\$4.96	-12.5%	-12.8%	-13.4%	-14.0%	-14.6%
	12.5%	\$4.91	\$4.88	\$4.85	\$4.82	\$4.78	-15.5%	-15.9%	-16.5%	-17.1%	-17.6%
	15.0%	\$4.73	\$4.71	\$4.67	\$4.64	\$4.61	-18.6%	-18.9%	-19.5%	-20.1%	-20.7%

Impact on EPS assuming 6x compute cost intensity for GAI fulfilled searches						EPS % impact vs. current '24 consensus at 6x compute costs					
% of searches fulfilled by GAI	GOOGL % share loss to Bing					% of searches fulfilled by GAI	GOOGL % share loss to Bing				
	1.0%	2.5%	5.0%	7.5%	10.0%		1.0%	2.5%	5.0%	7.5%	10.0%
	5.0%	\$5.26	\$5.24	\$5.20	\$5.17	\$5.13	-9.4%	-9.8%	-10.4%	-11.0%	-11.6%
	7.5%	\$4.99	\$4.97	\$4.94	\$4.90	\$4.87	-14.0%	-14.3%	-14.9%	-15.5%	-16.1%
	10.0%	\$4.73	\$4.71	\$4.67	\$4.64	\$4.61	-18.6%	-18.9%	-19.5%	-20.1%	-20.7%
	12.5%	\$4.46	\$4.44	\$4.41	\$4.38	\$4.34	-23.1%	-23.5%	-24.0%	-24.6%	-25.2%
	15.0%	\$4.20	\$4.18	\$4.15	\$4.11	\$4.08	-27.7%	-28.0%	-28.6%	-29.1%	-29.7%

Impact on EPS assuming 8x compute cost intensity for GAI fulfilled searches						EPS % impact vs. current '24 consensus at 8x compute costs					
% of searches fulfilled by GAI	GOOGL % share loss to Bing					% of searches fulfilled by GAI	GOOGL % share loss to Bing				
	1.0%	2.5%	5.0%	7.5%	10.0%		1.0%	2.5%	5.0%	7.5%	10.0%
	5.0%	\$5.08	\$5.06	\$5.03	\$4.99	\$4.96	-12.5%	-12.8%	-13.4%	-14.0%	-14.6%
	7.5%	\$4.73	\$4.71	\$4.67	\$4.64	\$4.61	-18.6%	-18.9%	-19.5%	-20.1%	-20.7%
	10.0%	\$4.37	\$4.35	\$4.32	\$4.29	\$4.26	-24.7%	-25.0%	-25.6%	-26.1%	-26.7%
	12.5%	\$4.02	\$4.00	\$3.97	\$3.94	\$3.91	-30.8%	-31.1%	-31.6%	-32.2%	-32.7%
	15.0%	\$3.67	\$3.65	\$3.62	\$3.59	\$3.56	-36.9%	-37.2%	-37.7%	-38.2%	-38.7%

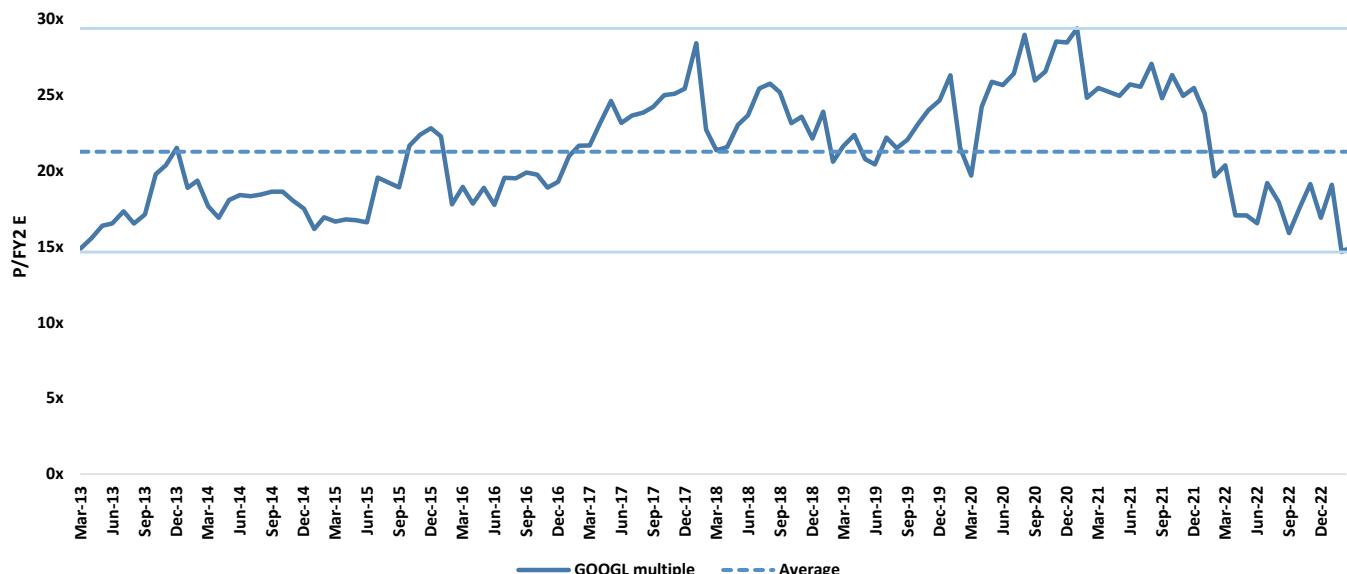
Impact on EPS assuming 10x compute cost intensity for GAI fulfilled searches						EPS % impact vs. current '24 consensus at 10x compute costs					
% of searches fulfilled by GAI	GOOGL % share loss to Bing					% of searches fulfilled by GAI	GOOGL % share loss to Bing				
	1.0%	2.5%	5.0%	7.5%	10.0%		1.0%	2.5%	5.0%	7.5%	10.0%
	5.0%	\$4.91	\$4.88	\$4.85	\$4.82	\$4.78	-15.5%	-15.9%	-16.5%	-17.1%	-17.6%
	7.5%	\$4.46	\$4.44	\$4.41	\$4.38	\$4.34	-23.1%	-23.5%	-24.0%	-24.6%	-25.2%
	10.0%	\$4.02	\$4.00	\$3.97	\$3.94	\$3.91	-30.8%	-31.1%	-31.6%	-32.2%	-32.7%
	12.5%	\$3.58	\$3.56	\$3.53	\$3.50	\$3.47	-38.4%	-38.7%	-39.2%	-39.7%	-40.2%
	15.0%	\$3.13	\$3.12	\$3.09	\$3.06	\$3.03	-46.0%	-46.3%	-46.8%	-47.3%	-47.7%

Source: Company Reports, Factset, RBC Capital Markets. Note: we assume % of searches Bing gains that are monetizable and % of monetizable search use cases fulfilled by GOOGL GAI are both 15%

### Our base case implies ~13% downside to '24 EPS

Leveraging our base case above which assumes Google loses 5% market share to Bing and compute costs for GAI runs 4x vs. traditional searches implies an estimate ~13% downside to '24 EPS. Given the stock's valuation is trading near trough levels over the past decade and 30% below the mean/median, it would appear the market would have to bake in more draconian assumptions to warrant more than ~10% further downside, in our view.

[Figure 41 - GOOGL is trading near historical trough P/E multiple and 30% below historical average](#)



Source: Factset, RBC Capital Markets

[Figure 42 - GOOGL is trading near trough P/E levels](#)

	Value	Current multiple delta
Current multiple	14.9x	N/A
Peak	29.4x	-49.4%
Trough	14.6x	1.5%
Mean	21.2x	-30.1%
Median	21.3x	-30.4%

Source: Factset, RBC Capital Markets



## Implications for software companies

As we think across the broader software landscape, we see several puts and takes behind the impact of generative AI and ChatGPT on enterprise software companies. To a certain extent, we have to separate the impact of ChatGPT into the back end (how companies build software) and the front end (how companies utilize ChatGPT in their products). In other words, how does ChatGPT benefit the company and how does it benefit the actual software?

On the back end, ChatGPT can speed up development of new products and features by helping write and debug code and help companies deal with the shortage of talented developers. To a certain extent, this can even be a margin tailwind, reducing the amount of R&D spend necessary, but we would prefer that companies reinvest those savings in further innovation. These companies can respond to customer needs faster and the time between customers demanding new features and bringing those features to market could decrease.

We expect this trend to be a tailwind for innovative challengers – for example, we believe this can help HubSpot narrow the gap versus Salesforce on enterprise-grade functionality in Sales Hub (while also acknowledging that Salesforce has a major data advantage) and a headwind for complacent market leaders that already underinvest in innovation. We would also highlight some impressive use cases we've seen with OpenAI integrations with private companies, including Coda, where customers can use OpenAI to create personalized emails for sales prospects and tweet ideas, and Notion, where customers can use OpenAI to draft up blog posts.

We also see a potential tailwind for market-leading vertical software companies (e.g. Guidewire, Veeva) to leverage the data from their market leadership position to build more differentiated and customized products, which would increase the separation between them and their competitors. In addition, this could help reduce the services attach rate, as customization could become easier with generative AI.

On the front end, broadly speaking, we believe generative AI will be a net positive for enterprise software companies that embrace the technology. This technology can make enterprise software applications easier to use and navigate, more bespoke (since the experience can be easily customized to the specific needs of the enterprise), and “smarter”, in that the software will adapt over time. For example, we can imagine generative AI underlying CRM marketing campaigns and helping marketers iterate so each campaign is more targeted and effective than the last. Or ChatGPT making HR software easier to navigate so that all employees can more easily log their time cards and find resources for specific questions (instead of a canned FAQ section), generating meaningful time and cost savings.

On the other hand, we feel generative AI will be a net negative for two categories of enterprise software.

The first is those companies that don't quickly embrace generative AI, as it becomes a competitive disadvantage against those companies that do. If two companies are selling competing data warehousing solutions and one embeds ChatGPT, making it easier for users to find and analyze specific data sets, while the other doesn't, the former is more likely to win out. We arguably may see this when comparing Microsoft's GitHub, which has GitHub Copilot, making it easier for developers to write and debug code, versus GitLab, which currently has no such capabilities (although we can imagine GitLab embracing generative AI sooner than later to narrow that gap).

The second is companies whose entire value proposition is selling solutions that offer AI-like capabilities or where the “secret sauce” is their own proprietary AI, especially if these companies are benefiting from enterprises with AI mandates. We believe generative AI has



leapfrogged many of these technologies, such as offerings from Palantir, and Alteryx. We would have particular caution on Palantir, as those technologies require so much manual customization (and Palantir collects meaningful revenue from professional services, per our estimates) and ChatGPT can make that level of manual customization unnecessary. In addition, solutions utilizing generative AI are more likely to gain share of budget associated with AI mandates versus companies selling AI-like solutions.



## Software company-specific impacts

In this section, we weigh the tailwinds and headwinds for select companies in our software coverage universe.

### Adobe (ADBE) — Covered by Matt Swanson

**Adobe's current product set:** Adobe's most recent Max event demonstrated its advancements within the generative AI space with both AI and ML being major parts of the creative cloud roadmap. On its first quarter call, Adobe highlighted generative AI as a focal point of its Summit user event starting 3/20 noting that they are excited to unveil a differentiated product set with a "creative co-pilot". Previous demonstrations of utilizing AI within photo shop focuses both on generative capabilities but also enhancing the variety of tools utilized to edit images, enhancing the potential of creativity not replacing it. In other areas like Adobe Express, AI helps users with less experience move beyond pre-made templates to create something more unique to them. Express is another area where we expect a product announcement from Summit where AI and generative AI could be major components. While currently the company has focused on generative AI within images, investments are currently being made for video and 3D design. Within video, Sensei already has the ability to help edit video, with Substance 3D bringing AI to the 3D design space. While Adobe should benefit on a standalone basis, being a central hub of enterprise creativity should also create an opportunity for Adobe to partner with point solutions that will need work flows built around their tools for use in the enterprise. We feel Adobe should benefit from an expanded partner eco-system around generative.

#### Tailwinds:

- **Creativity for the people:** Expanding the total addressable market for creativity has been a focal point for Adobe as well as newer entrants to the market including Canva and Figma. The idea of democratizing creativity has historically come from simplifying user interface, growing detail and prevalence of templates, more drag and drop features and of course entry level price points. Generative AI is the next iteration of opening up the creative market, building of products like Adobe Express that make basic tools accessible to consumers to democratizing visually professional content.
- **Market sizing:** At the company's 2022 analyst day, Adobe sized its market as 68 million creative professionals, 900 million communicators and 4 billion consumers. The ability to expand this market over time will depend on expanding these groups but also bringing current users up the curve. Within enterprises, this is a license expansion opportunity. Much in the way that Tableau opened up the business intelligence market to knowledge workers, the thought process was those who have the questions should be able to find the answers. We feel in creative, those who have the ideas, should be able to create the content.
- **Augmented intelligence:** The new age, augmented intelligence is the idea of meshing the strengths of humans and machines to see compounding value. Within creativity, the idea is not to replace creative professionals but to emphasize them. Making sure the work they are doing is worthy of their skill set, allowing AI to help with drafts not just for their own work but to be able to receive drafts from non-creative professionals reducing reworks. Generative AI editing will speed the iteration process and allow workers to create more content and more expansive content.

#### Potential headwinds:

- **Image issues:** Presenting generative AI within creative has come with some challenges, attending user events Adobe customers generally seem excited, with products demos for things like Sensei getting large ovations but also apprehension. A tale as old as technology, the fear of being replaced by robots is real, personally we would not be overly excited about an



AI industry around writing equity research. Working with and not against change, disrupting to not be disrupted, is not new and concerns will pass. Much as low-code, no-code has not reduced the need for developers, data scientists lived through the democratization of business intelligence and security architects now couldn't live without AI for threat detection. The digital environment continues to expand at faster rate than the workforce with shortages creating a choke point in digital transformation. Concerns around alienating the creative community we feel will ultimately be short-lived. Adobe has also taken proactive steps working as a leader of the Content Authenticity Initiative or CAI which has standards to help creators maintain control over their work.

- **Market impact:** The impact on the creative market could be massive, in our view. As we mentioned above, we don't see this as a disruptive force to displace creative professionals, but it should increase the efficiency of creatives allowing for work to be done faster with fewer iterations. Where we do see changes are on the low-end of the market. In the consumer segment, generative AI opens up a new user base of non-creatives to do more on their own with the ability to create professional quality images. We feel this could fragment the low-end of the market with easier entry for application based solutions to the consumer market which may have a high bar for quality but lower for specificity. For example, using DALL-E, we tried to make a cover for this report. With a prompt of "Royal Bank of Canada robot lion writing a research report" this was the result. While the result looks professional, particularly given the speed from ideation to the result, it is not professional in the sense that it does not match our company brand or image. This would serve as a good jumping off point if we were trying to explain to someone what we wanted the cover to look like, but at the same time, it is not fine-tuned to meet specific parameters particularly trying to reflect an existing brand. In Adobe's view, unlocking this creativity in non-creative workers could end up as a top-of-funnel marketing tool.



Figure 43 - DALL-E Generative Image



Source: DALL-E, RBC Capital Markets

**Net/net:** Adobe is well positioned to be a beneficiary of generative AI within the digital media landscape, but more importantly we believe the investments will de-risk and future proof the model against disruption from players within the space. The greatest areas of risk come from the potential fragmentation of the consumer market, which could also work as a top-of-funnel entry point to broader platforms like Adobe, while the greatest areas of upside are likely to come from expanding the total addressable market for creativity including expanded enterprise seat counts, as well as premium tools to deal with the challenges of more expansive digital environments, such as the metaverse, increasing the efficiency of limited creative professionals.

#### Autodesk (ADSK) — Covered by Matt Hedberg

**Tailwinds:** We think Autodesk is in a good position to leverage AI capabilities, initially through generative design capabilities, which is used to provide engineers the ability to quickly explore, optimize, and make informed decisions to complex design problems. To an engineer, generative design software is like an assistant that helps with creating, testing, and evaluating design options. However, we found it interesting that Microsoft and Satya Nadella demoed a natural language processing tool for generating Maya scripts for both direct-to-Maya and for Bifrost.



Over time, we think doing real-time training on customer data is where the real innovation and tailwinds to Autodesk is likely to emerge.

**Headwinds:** We don't see any real headwinds to generative AI for Autodesk at the moment.

**Bottom line:** With a growing portfolio of cloud-based design tools, we believe Autodesk is in a good position to leverage large customer data sets and generative AI models to give users a better design experience.

#### Akamai (AKAM) — Covered by Rishi Jaluria

**Tailwinds:** Generative AI does pose increasing security risks, which could be a tailwind for Akamai's security business. We could also see a potential tailwind for the delivery business, although we do not believe OpenAI is a meaningful Akamai customer today. We would also note one of OpenAI's co-founders, Jack Hughes, was also a co-founder of Akamai. Finally, we could see OpenAI (and other competitors) utilize Akamai for delivery and performance acceleration as the volume of traffic grows exponentially (we note Microsoft will be OpenAI's exclusive cloud provider going forward and Akamai is one of Azure CDN's partners).

**Headwinds:** We note OpenAI utilizes Cloudflare, an Akamai competitor, as a security vendor today. If Cloudflare meaningfully benefits, it could worsen Akamai's competitive positioning against Cloudflare.

**Bottom line:** We don't see many meaningful tailwinds or headwinds for Akamai from ChatGPT.

#### Asana (ASAN) — Covered by Rishi Jaluria

**Tailwinds:** As generative AI becomes more embedded in business processes, we believe there will be a greater focus on collaboration, as human-to-human collaboration becomes a more differentiated component of work (while siloed tasks like data entry get outsourced to ChatGPT). This could serve as a tailwind for Asana, which helps manage collaborative work and projects.

**Headwinds:** We expect ChatGPT to be able to replace some of the basic task management capabilities of Asana. Our due diligence suggests there are paid users utilizing Asana for basic assigning and following up of tasks and if that use case can be automated and replaced by ChatGPT, this could be a meaningful headwind.

**Bottom line:** We see generative AI as being neither a strong tailwind, nor a strong headwind for Asana, as we believe the headwind to basic use cases can be balanced out by tailwinds towards adoption of collaboration software.

#### Couchbase (BASE) — Covered by Matt Hedberg

**Tailwinds:** We think generative AI could ultimately become a bit of a tailwind to Couchbase. The company has spent a lot of time thinking about AI and ways that it could be useful to help developers expedite the application build process. More broadly, efforts continue around leveraging AI and ML as a core part of the value proposition. Additionally, we believe there could be a tailwind around AI as far as helping customers store massive amounts of data to train AI and ML models built on the Couchbase platform.

**Headwinds:** The headwind could be that Couchbase is small relative to other database peers and could easily be outspent regarding generative AI.

**Bottom line:** Overall we see generative AI as more neutral to Couchbase today, but over time, it could become a tailwind.

#### Box (BOX) — Covered by Rishi Jaluria

**Tailwinds:** Generative AI could lead to exponential growth in the volume of content (including

images and videos), serving as a tailwind for Box to serve as a system of record or repository for all this content. In addition, given the vast volumes of data Box has, the company could figure out how to leverage ChatGPT as a monetization vector (e.g. deeper analytics on all the user's content).

**Headwinds:** We don't see any major headwinds for Box in the near-term from generative AI.

**Bottom line:** We see generative AI as generating slight tailwinds for Box.

#### **Coursera (COUR) — Covered by Rishi Jaluria**

**Tailwinds:** With generative AI becoming a new skill for people to learn, this can serve as a tailwind for the Consumer business, as learners take courses around generative AI and ChatGPT (we can imagine OpenAI partnering for ChatGPT certifications). In addition, if there is, in fact, meaningful disruption to many careers as a result, this could serve as a tailwind for all three businesses (Consumer as people look to upskill/reskill, Degrees as people look to make a pivot in their careers with graduate degrees, and Enterprise, especially on the government side, as governments look to reskill/upskill their citizenry). In addition, we can see Coursera leverage ChatGPT technology in its courses to help provide more "hands-on" education to learners.

**Headwinds:** ChatGPT can itself be used as an educational tool and lead to commoditization for some of Coursera's more basic offerings. For example, instead of a learner taking a course in financial modeling on Coursera, ChatGPT could serve as the instructor and teach how to build a DCF model in an interactive manner.

**Bottom line:** While ChatGPT can disrupt learning for single course offerings, we note Coursera offers a greater breadth of materials than others in the edtech space and, importantly, the Consumer business comes with professional certifications (which can be used on resumes or LinkedIn profiles) that ChatGPT cannot offer. Ultimately, while we understand investor concerns around the impact of ChatGPT on edtech – ChatGPT certainly makes it harder for edtech companies focused on helping students cheat on exams – we see more tailwinds than headwinds and view Coursera as a net beneficiary of ChatGPT.

#### **Salesforce (CRM) — Covered by Rishi Jaluria**

**Tailwinds:** For a business as diversified as Salesforce, we have to think of a few different angles. From an overarching perspective, however, we believe Salesforce has vast volumes of data over time, which can be a major competitive advantage, if utilized properly.

Within the core sales, service, and marketing offerings, we see a number of tailwinds that can make Salesforce's products better. Across these portfolios, ChatGPT can reduce the amount of customization required and even reduce the need for Salesforce Administrators. This can help reduce the TCO for Salesforce solutions, which remains one of the biggest sources of pushback, based on our due diligence.

Service Cloud is likely the biggest beneficiary, as integrating ChatGPT makes the product more effective for end users and reduces the reliance on human intervention to tackle customer service issues. For example, if customers submit support tickets through Service Cloud, ChatGPT can bring immediate resolution to the problem based on customer data and behavior, without any human intervention required. In addition, allowing Service Cloud customers to offer a white labeled, integrated ChatGPT would allow real-time interactions before having to engage with a contact center, resulting in major cost savings.

Sales Cloud can also benefit from ChatGPT making the CRM smarter. This can be used to help users more intelligently target sales prospects with higher propensity to spend and analyze behavior of salespeople to help determine the most appropriate channel, depending on the



type of customers they're going after. In addition, ChatGPT could be used to verify contacts in the database and ensure there's less stale contact information (we note the public version of ChatGPT refuses to find contact information for specific people, even business email addresses). We wouldn't be surprised if some Sales Cloud users try to use ChatGPT to automate the outreach process and draft emails to prospects, although we could caution that, as intelligent as ChatGPT is, its content (so far) can be distinguished from human-generated content and recipients of automated emails that pretend to be human-generated may push back.

Marketing Cloud can see benefits from helping users create more intelligent marketing campaigns and better tweak language to drive better outcomes. In addition, AI can go back and analyze prior marketing campaigns and suggest improvements for future campaigns.

Even in recently-acquired parts of the business, we see tailwinds. Adding AI on top of Tableau (along with all the new data being generated by generative AI) can make the product and its analytics more effective. Even Slack can benefit from ChatGPT bringing about better search capabilities (Slack's weak spot, based on our conversations, has been its weak search – ironic for a company whose name stands for Searchable Library of All Conversation and Knowledge).

We note that Salesforce has already made some major announcements around generative AI, which we view rather positively. The first is Einstein GPT to create personalized content across Salesforce clouds, including Sales, Service, and Marketing Clouds (which incorporates data from Salesforce Data Cloud). The second is a ChatGPT app for Slack for conversation summaries, research tools, and writing assistance. The third is Salesforce Ventures launching a \$250MM Generative AI Fund. While Einstein GPT is currently in closed pilot, we are encouraged to see Salesforce moving quickly.

**Headwinds:** On the flip side, we do see numerous potential headwinds throughout Salesforce's portfolio. From an overarching company perspective, we do note Salesforce is a direct competitor with Microsoft and has historically had a somewhat contentious relationship with the company, which only got worse with the purchase of Slack, even though the companies try to play nice publicly (witness Microsoft CEO Satya Nadella on stage with Salesforce CEO Marc Benioff at Dreamforce 2015). Salesforce embracing OpenAI and ChatGPT may be a tough pill for management to swallow, as it directly benefits Microsoft, which is seen as a meaningful competitor.

In addition, as Microsoft more rapidly embraces OpenAI and integrates the technology throughout its suite of products, Dynamics could become a more significant threat to Salesforce on the core CRM side of the equation. We expect this impact to be even worse with Slack. Microsoft Teams has already been a major competitive threat to Slack and is already embedding ChatGPT in Teams Premium, which may increase the competitive advantages versus Slack and further hurt that business.

Finally, while Salesforce does have the advantage of its vast amount of data, we also believe that competitors utilizing ChatGPT for product development can help narrow the gap in features and functionality. For example, we've spoken with users who find HubSpot's Marketing Hub superior to Salesforce's Marketing Cloud, but stay with Salesforce because Marketing Hub is lacking certain enterprise-grade features. ChatGPT can allow HubSpot to narrow that gap and make its product suite more competitive against Salesforce at the mid-market and even the enterprise level sooner than expected.

**Bottom line:** It's difficult to make a call right now, given the diversity of Salesforce's portfolio and the competitive dynamics with Microsoft. As things stand right now, we see a number of tailwinds and are encouraged by Salesforce launching offerings around generative AI so quickly. On the flip side, we do believe the competitive environment could get tougher from both



Microsoft and HubSpot. Putting this all together, we think Salesforce will ultimately see more tailwinds than headwinds from generative AI.

### Crowdstrike (CRWD) — Covered by Matt Hedberg

**Tailwinds:** We think generative AI will give hackers new ways to write and deliver malicious code. As such, we think there are several potential tailwinds AI can provide to CrowdStrike to help customers prevent AI-based attacks. CrowdStrike was built with AI and ML at its core as their models are trained on 2 trillion data points collected every day by the CrowdStrike Security Cloud. What this translates to is that the Falcon platform achieves 100% ransomware prevention with zero false positives. Recently the company launched ExPRT.AI for Falcon Spotlight. ExPRT.AI or the Expert Prediction Rating artificial intelligence model leverage vulnerability and threat-based telemetry provide a dynamic, responsive ExPRT Rating within Falcon Spotlight's console which has shown a 3x improvement in proactive vulnerability prioritization over other methods. With the importance of SecOps, the company also introduced AI-powered Indicators of Attack (IoAs), a new innovation for fileless attack prevention. In the future, we believe the company is in a good position to leverage its large and growing data lake to stay ahead of hackers that also are in a position to leverage generative AI.

**Headwinds:** We don't see any immediate headwinds to CrowdStrike from generative AI.

**Bottom line:** We see AI as a positive for CrowdStrike given all their customer data is cloud-based and not on premise. Ultimately we believe AI will work best with large data sets, something CrowdStrike is in a good position to leverage.

### Clearwater Analytics (CWAN) — Covered by Rishi Jaluria

**Tailwinds:** One of Clearwater's competitive advantages is the amount of data it has, especially related to the pricing of assets. Clearwater could integrate that data into ChatGPT and use it to further its competitive advantage. In addition, Clearwater could leverage generative AI to provide faster insights, improving its value proposition.

**Headwinds:** ChatGPT may potentially put pressure on the investment management industry (in ways that so-called "robo advisors" like Betterment and Wealthfront could not), creating fee pressure and limiting budget for Clearwater's solutions.

**Bottom line:** We see a slight benefit for Clearwater from generative AI.

### Dropbox (DBX) — Covered by Rishi Jaluria

**Tailwinds:** Generative AI could lead to exponential growth in the volume of content (including images and videos), serving as a tailwind for Dropbox to serve as a system of record or repository for all this content. In addition, given the vast volumes of data Dropbox has, the company could figure out how to leverage ChatGPT as a monetization vector (e.g. deeper analytics on all the user's content).

**Headwinds:** We don't see any major headwinds for Dropbox in the near-term from generative AI.

**Bottom line:** We see generative AI as generating slight tailwinds for Dropbox.

### Datadog (DDOG) — Covered by Matt Hedberg

**Tailwinds:** Modern applications are constantly in flux, cycling through ephemeral cloud and container infrastructure as they scale up and down in response to usage. Datadog provides built-in AI and ML logic to simplify the complexity of managing and monitoring environments. With anomaly detection, forecasting, outlier detection, and automatic metric correlation, engineers can leverage AI and ML to intelligently monitor larger numbers of objects more effectively. Watchdog is a great example of how the company is helping customers in areas such as anomaly



detection, root cause analysis and enhanced forecasting to prevent application performance bottlenecks. As such, we believe AI and ML could increasingly act as tailwinds to Datadog as it integrates additional features such as natural language query processing that could help customers uncover trends faster and more intuitively.

**Headwinds:** We don't see any immediate headwinds for generative AI for Datadog but believe they have to continue to invest beyond AI/ML into GAI.

**Bottom line:** We see AI becoming increasingly relevant for observability and given Datadog's cloud-based model, we believe it will be in a good position to leverage advanced generative AI capabilities in the future.

#### **DocuSign (DOCU) — Covered by Rishi Jaluria**

**Tailwinds:** While we don't see any major tailwinds on the core e-signature side, we could see generative AI benefiting the broader agreement cloud, especially CLM. ChatGPT can improve search capabilities in finding historical contracts (building on the Seal Software acquisition). In addition, we could see ChatGPT helping with negotiations of contracts and helping users better understand what is embedded in contracts.

**Headwinds:** We don't see any meaningful headwinds in the near-term from generative AI.

**Bottom line:** We see generative AI as a slight tailwind for DocuSign.

#### **Dynatrace (DT) — Covered by Matt Hedberg**

**Tailwinds:** Dynatrace could be in a good position to leverage AI through Davis, their underlying AI engine. Davis uses deterministic AI which we believe is a different approach to traditional ML techniques that focuses on causation not correlation. With data being a differentiator, the platform analyzes over 368 billion dependencies per second and pulls data from mainframes, core infrastructure, cloud platforms, and CI/CD pipelines. What this translates to is better, more intuitive monitoring for use cases such as AIOps, anomaly detection and application security. As such, we believe AI and ML could increasingly act as tailwinds to Dynatrace as it integrates additional features such as natural language query processing that could help customers uncover trends faster and more intuitively.

**Headwinds:** We don't see any immediate headwinds for generative AI for Dynatrace but believe they have to continue to invest beyond AI/ML into GAI.

**Bottom line:** We see AI becoming increasingly relevant for observability and given Dynatrace's platform with AI built into the core, we believe it will be in a good position to leverage advanced AI capabilities in the future.

#### **Elastic (ESTC) — Covered by Matt Hedberg**

**Tailwinds:** Elastic is a search engine, so intuitively we believe generative AI could be a nice tailwind for Elastic. Over the past 18 months, the company has made investments to enable running large language models directly on its platform with Vector Search. With large transformer models like ChatGPT coming up, management believes this opens up many possibilities for customers to build search centric applications on Elastic given it would be cost prohibitive to run these models on its own infrastructure. Additionally, we think the company is in a good position to leverage generative AI in its enterprise and site search products to provide a more intuitive search process based on natural language processing. We also think Elastic could benefit from AI increasingly built into its security offerings to provide real-time threat intelligence. Finally, we think its observability platform could also benefit from AI to help uncover anomalies faster with less human interaction. That said, management believes it remains in the early innings of the opportunity.



**Headwinds:** At the moment, we don't see any immediate headwinds for generative AI for Elastic. That said, we do worry they can be outspent by larger peers including hyperscalers. As such, a potential headwind could emerge if Elastic isn't able to properly integrate generative AI features or that it sees pressure from ChatGPT search capabilities.

**Bottom line:** While still early, we believe Elastic is in a good position to leverage generative AI and advanced ML capabilities across the entire platform including enterprise search, site search, observability and security. Over time, we wouldn't be surprised to see them as one of the bigger beneficiaries within our coverage.

#### **Fastly (FSLY) — Covered by Rishi Jaluria**

**Tailwinds:** While we do not believe OpenAI is a current Fastly customer, we could see other companies use Fastly for delivery and performance, as companies need to utilize CDN and edge cloud to drive faster response times, as traffic continues to grow exponentially.

**Headwinds:** We note OpenAI utilizes Cloudflare, a Fastly competitor, as a security vendor today. If Cloudflare meaningfully benefits, it could worsen Fastly's competitive positioning against Cloudflare.

**Bottom line:** We don't see any major headwinds or tailwinds for Fastly from generative AI.

#### **GitLab (GTLB) — Covered by Matt Hedberg**

**Tailwinds:** We believe generative AI could transform the GitLab platform. The obvious alternative in the space is GitHub Copilot, but we believe GitLab is in a good position to harness generative AI in several ways beyond code suggestions (in closed beta currently and expected to go GA soon) to areas such as how to classify issues, summarize suggestions, hand off and automate work as well as tangential areas such as observability, security and search. The company has focused on AI for years including internal development as well as a March 2022 partnerships with Tabnine, an alternative to Copilot that uses AI to improve code development. That said, the code suggestion functionality in closed beta was developed organically by GitLab. Essentially management sees peers that focus on AI relative to DevOps and code suggestions while it believes GitLab is taking a more holistic and extensive view for DevSecOps. Over time, we believe future internal development and API integrations make a lot of sense given the open source nature of GitLab. That said, we think it will take time to integrate features and positively impact growth.

**Headwinds:** The obvious potential headwind is Microsoft GitHub Copilot and if GitLab can't keep up with innovation or large cloud data sets.

**Bottom line:** We believe that GitLab could be one of the better positioned companies in our coverage to benefit from generative AI given its platform approach to DevSecOps and the ability to consolidate spend vs point-based vendors.

#### **Guidewire (GWRE) — Covered by Rishi Jaluria**

**Tailwinds:** We could see Guidewire leverage generative AI to make its systems smarter and more customized (while also reducing the services attach rate). In addition, Guidewire's large volume of data and insights on customer behavior can serve as a major competitive advantage versus others in the P&C insurance software space. In addition, we could see insurance companies leveraging ChatGPT to better serve customers, which frees up budget for Guidewire's solutions and accelerates digital transformation.

**Headwinds:** We don't see any meaningful headwinds for Guidewire from generative AI.

**Bottom line:** We see generative AI as a real potential tailwind for Guidewire.



### HubSpot (HUBS) — Covered by Rishi Jaluria

**Tailwinds:** We see numerous tailwinds for each of HubSpot's core products. HubSpot has already demonstrated some of the use cases we highlight below in the Alpha version of ChatSpot.ai, which is a conversational UX powered by ChatGPT and DALL-E 2 and fine-tuned to operate within HubSpot CRM.

Marketing Hub can benefit from utilizing ChatGPT to generate content to drive inbound marketing or to insert in outbound email marketing campaigns, doing research on potential prospects, and helping to build target customer segments.

Sales Hub can benefit from bringing ChatGPT to automate entry of new contacts, as well as automatically verify contact information. In addition, we can see salespeople use ChatGPT to generate drafts for outbound messages, although we would caution against automating the reach out altogether, as ChatGPT content can be discerned from human-generated content. In addition, ChatGPT could be used to analyze the behavior of salespeople and identify prospects with the highest potential conversion rate or highest propensity to spend.

Service Hub can benefit from having ChatGPT as a “front-end” for customers to interact with service and help lead to resolution of issues without requiring human customer service agents, which generates meaningful cost savings.

Very importantly, if HubSpot embraces generative AI for writing code, we could see HubSpot begin to narrow the gap with its enterprise competitors at the CRM level, most notably Salesforce and Adobe. In our conversations, we find plenty of customers who want to switch from Salesforce or Adobe to HubSpot, but find HubSpot lacks certain enterprise-grade features. Generative AI can make it easier for HubSpot to come up with these features quickly.

**Tailwinds:** If ChatGPT replaces some of the work of marketers, salespeople, or support/service, it could lead to reduction in potential seats for HubSpot.

**Bottom line:** We see real potential benefits to HubSpot from generative AI, especially given how quickly the company is moving.

### MongoDB (MDB) — Covered by Rishi Jaluria

**Tailwinds:** We see the massive amount of new content being generated with generative AI as being a tailwind for MongoDB, especially if a meaningful portion of that content contains unstructured data, as MongoDB is built to work with unstructured data (in contrast to traditional relational systems). In addition, as MongoDB is already a tool well-adopted by developers, the use of generative AI for coding can make it easier and faster to build new applications on MongoDB, serving as a tailwind for workloads. Finally, we can see developers using generative AI with MongoDB to automate much of the maintenance and updating of the database (fulfilling the “autonomous database” vision that others have suggested).

**Headwinds:** We could see a possibility of the rise of generative AI bringing about a brand new category of next-generation database systems that are optimized for generative AI, creating some longer-term competition for MongoDB. We believe it is important that MongoDB moves quickly to optimize its systems for generative AI to defend against potential future competitive threats.

**Bottom line:** We believe MongoDB will see meaningful tailwinds from generative AI.

### Microsoft (MSFT) — Covered by Rishi Jaluria

Please see the dedicated deep dive on Microsoft on pages 17-28.



### Cloudflare (NET) — Covered by Matt Hedberg

**Tailwinds:** We believe generative AI could be a tailwind for Cloudflare for several reasons. OpenAI runs a portion of its network on Cloudflare and leverage technology such as CDN, DDoS, Bot Management and Gateway DNS with future opportunities that could include Workers. So one reason Cloudflare could benefit from generative AI is by hosting other providers of AI technology on the Cloudflare platform. Cloudflare is building out an extensive edge network layer of infrastructure, compute, storage and database as we believe it could see generative AI momentum similar to the hyperscalers. The other way we think Cloudflare could benefit from GAI is through cyber-security solutions that leverage advanced AI capabilities for stopping zero-day threats to more intelligent chatbots. While these trends will likely take time to show up in results, we believe Cloudflare is in a good position to leverage long-term GAI trends.

**Headwinds:** The headwind could be hyperscalers with larger networks and deeper R&D budgets. The other headwind from a security perspective is competition from larger platform vendors.

**Bottom line:** Overall we think Cloudflare could be one of the best positioned names in our coverage to benefit from generative AI.

### New Relic (NEWR) — Covered by Rishi Jaluria

**Tailwinds:** If generative AI is, in fact, a tailwind for new application development and cloud workloads, then New Relic, as a player in observability, can benefit. In addition, integration of ChatGPT can make monitoring more effective and easier for users to deploy and analyze underlying data. We note New Relic has announced MLOps capabilities to monitor applications built with OpenAI GPT APIs, with the goal of “instant observability.”

**Headwinds:** We don’t see any meaningful headwinds from generative AI.

**Bottom line:** We see slight tailwinds from generative AI for New Relic.

### NICE (NICE) — Covered by Rishi Jaluria

**Tailwinds:** AI is already a big part of NICE’s value proposition, selling IVAs and conversational chatbots alongside the CXone CCaaS platform. NICE has already announced integration of CXone Expert with ChatGPT to create conversational customer experience software. In our view, this creates a major market opportunity for NICE (and other CCaaS market leaders) for several reasons. First, customers already have existing spend on chatbots, most of which have technology that is inferior (from an AI perspective) to ChatGPT, so NICE doesn’t have to generate new spending. Second, the use of IVAs (interactive virtual agents) and chatbots can generate meaningful cost savings for contact centers – for example, an IVA responding to a customer inquiry checking a bank balance is significantly cheaper than having a human agent answer that same question (naturally, the customer checking the bank balance online is the cheapest). Third, NICE has a major data advantage, given it is the market leader in CCaaS and can derive insights from its operational history and customer base to make ChatGPT more effective for the contact center use case, whereas customers using ChatGPT on their own wouldn’t). Finally, given the moving off legacy contact center solutions (e.g. Cisco, Avaya) is a heavy lift, we believe generative AI can help make that move and the customization of CCaaS solutions easier, potentially accelerating migrations to CCaaS.

Outside of the core CCaaS, we also believe generative AI can benefit the financial crime and compliance business, making tasks like AML (anti money laundering) more effective.

**Headwinds:** To a certain extent, ChatGPT does compete against NICE’s own chatbots and there could be some cannibalization. In addition, some customers could choose to build their own chatbots with ChatGPT, bypassing NICE altogether.



**Bottom line:** We believe generative AI and especially ChatGPT will be a meaningful tailwind for NICE within the contact center business and further increase its value proposition.

### ServiceNow (NOW) — Covered by Matt Hedberg

**Tailwinds:** We believe generative AI could be a significant tailwind to ServiceNow. We see potential tailwinds including AIOps, advanced chatbots through ServiceNow's customer service solutions, low-code/no-code application development on the ServiceNow platform and general workflow and employee productivity enhancements. ServiceNow has focused on AI for many years including helping customers deliver better self-service, detect incidents, route and prioritize work, discover hidden patterns, optimize knowledge bases, quickly identify workflow that can be automated, recommend action and allow for a natural search experience. In the future we think there are additional areas of expansion opportunities through machine learning frameworks, natural language processing, search and automation. As a cloud-based platform build for workflow, we think the company is in a good position to further leverage generative AI in the future.

**Headwinds:** We don't see any real headwinds to generative AI for ServiceNow unless other platforms such as Salesforce leapfrog it from a technology perspective.

**Bottom line:** We believe that ServiceNow could see some of the strongest tailwinds from generative AI over time as we think it could provide a nice benefit to growth for years.

### UiPath (PATH) — Covered by Matt Hedberg

**Tailwinds:** We believe generative AI could represent several tailwinds for UiPath in the form of new use cases customers can utilize. For example, we believe there are several business applications for ChatGPT when combined with a UiPath automation robot including 1) analyzing customer feedback, 2) creating a custom response email, 3) prescreening resumes, 4) creating job interview questions and 5) evaluating customer service conversations. Over time, we think other use cases could emerge for the use of both attended and unattended bots combined with a ChatGPT application. In the near-term, the company plans to release a preview of its GPT connector to help users leverage GPT to generate content in automation as management believes generative AI can be applied to many other use cases. Additionally, the company currently leverages a combination of its own AI models as well as Microsoft/GPT, Google, and Amazon to help accelerate productivity. Overall, management remains bullish on GAI as they believe it can both accelerate the adoption of its platform and democratize access for automation.

**Headwinds:** One potential headwind that could emerge is if generative AI moves in and replaces the traditional RPA market. We also worry that with a lot of UiPath customer data on premise, it could limit their ability to leverage GAI trends.

**Bottom line:** Overall we believe the jury is still out on UiPath's ability to leverage GAI as we see it as more of a neutral at this point that could turn into either a bigger headwind or tailwind.

### PagerDuty (PD) — Covered by Matt Hedberg

**Tailwinds:** We believe AI could become a tailwind for PagerDuty over time as they have spent a lot of time talking about foundational AI. AI for IT operations or AIOps is a broad category that comprises the use of big data, ML, and AI to automate and accelerate the identification and resolution of IT issues. In a cloud based world, customers generate millions of events per day. At this scale, it is not viable for IT to manually parse through all that data to detect and remediate issues. As such, we believe customers are increasingly leveraging PagerDuty's AIOps capabilities to help make sense of massive amounts of hybrid-cloud data. Primary products that could see increased customer interest in our view include PagerDuty Event Intelligence and PagerDuty Automation Actions. And while GAI use are interesting from a consumerization perspective, we



believe it would be nearly impossible to leverage internet data for what PagerDuty solves for enterprise customers.

**Headwinds:** The biggest potential headwind in our view is that PagerDuty could be outspent by larger tech peers.

**Bottom line:** We see AI as a tailwind for PagerDuty given their focus on enterprise AIOps as well as overall workflow as we believe the company could increasingly leverage aspects of generative AI for additional search capabilities.

#### Palo Alto Networks (PANW) — Covered by Matt Hedberg

**Tailwinds:** We think generative AI will give hackers new ways to write and deliver malicious code. As such, we think there are several potential tailwinds AI can provide to Palo Alto Networks to help customers prevent AI-based attacks. From a product perspective, the company launched autonomous digital experience management in FY/22 followed by AIOps and SaaS Security Posture Management this year as management believes AI has the power to transform SASE. Its integrated security services are now all powered by AI to detect and prevent zero-day attacks, and they'll soon be introducing additional AI-driven capabilities. Fundamentally management believes AI is a data problem, which requires clean and comprehensive data sets. Unlike consumer-based AI, we believe the enterprise AI market is more complex and needs to be real-time, especially when it comes to cyber-attacks. Within newer products, we believe AI can also benefit Cortex and XSIAM as well as Prisma Cloud and overall SOC transformations.

**Headwinds:** We don't see any real headwinds other than some of its customer data is on premise vs in the cloud which makes it more of a challenge to harness customer data sets vs a pure cloud platform.

**Bottom line:** Overall we think Palo Alto could be one of the biggest benefits of GAI within the cyber-security market given its platform approach that captures petabytes of data.

#### Pegasystems (PEGA) — Covered by Rishi Jaluria

**Tailwinds:** On the DPA (digital process automation) side, we can see generative AI helping further automate these processes and integrating systems more intelligently. In addition, Pega does require a high level of customization and generative AI can help reduce services attach. On the CRM side, we can see generative AI making the systems smarter and ChatGPT helping out in contact center use cases. Finally, we expect Pega to utilize generative AI to make its developers more effective. We expect further announcements at Pega's user conference, PegaWorld iNspire, in June (noting the tagline for the event is "The AI landscape is complex. Unravel it here").

**Headwinds:** We have concerns that some of Pega's automation could be replaced with generative AI, especially for more basic automation use cases.

**Bottom line:** We believe generative AI can be a slight tailwind to Pega's business, but are closely monitoring the landscape to see if the headwinds are bigger than we expect.

#### Palantir (PLTR) — Covered by Rishi Jaluria

**Tailwinds:** Generative AI can make Palantir's solutions smarter and more effective, especially for advanced analytics use cases. In addition, given the high services attach rate, generative AI can make it easier for Palantir to customize software for customers.

**Headwinds:** We believe Palantir has been benefiting from positioning itself as an AI company and benefiting from AI mandates at companies. We also believe the insights from generative AI can replace the need for some of Palantir's solutions, especially within the commercial segment.



**Bottom line:** We see more headwinds than tailwinds and, as such, believe generative AI will be net negative for Palantir.

#### **Smartsheet (SMAR) — Covered by Rishi Jaluria**

**Tailwinds:** As generative AI becomes more embedded in business processes, we believe there will be a greater focus on collaboration, as human-to-human collaboration becomes a more differentiated component of work (while siloed tasks like data entry get outsourced to ChatGPT). This could serve as a tailwind for Smartsheet, which helps manage collaborative work and projects. In addition, with Smartsheet's focus on advanced functionality and workflow capabilities, we could see integration of ChatGPT with Smartsheet to make the systems more effective and easier to use. Finally, ChatGPT can serve as an accelerator on its own, providing custom templates depending on specific use cases (e.g. sales pipeline forecasting).

**Headwinds:** We expect ChatGPT to be able to replace some of the basic task management capabilities of Smartsheet. Having said that, we don't see many paying users using Smartsheet for basic task management and find limited shelfware.

**Bottom line:** We see generative AI as a slight tailwind for Smartsheet.

#### **Splunk (SPLK) — Covered by Matt Hedberg**

**Tailwinds:** The power of AI resides in data. Splunk customers have a lot of data within the platform. The issue is that most of this data sits on premise and isn't open to large scale data processing models that reside in the cloud. Over time and as Splunk Cloud gains more traction, we think Splunk could be in a better position to leverage AI, but we think others could be better positioned as of now.

**Headwinds:** The biggest issue is that a majority of Splunk data sits on premise, which in our view prevents GAI scale.

**Bottom line:** Over time, we could see Splunk in a better position to see GAI tailwinds, but at the moment, we think other cloud-based security and monitoring vendors are in a better position.

#### **Twilio (TWLO) — Covered by Rishi Jaluria**

**Tailwinds:** Twilio is already leveraging OpenAI technology and offers users the ability to build a chatbot using OpenAI technology (along with Twilio Programmable Messaging). In other words, Twilio can help users have a ChatGPT-like experience, but over SMS, which could be helpful for customer service type use cases. In addition, the ability of generative AI to write code can make it easier for companies to adopt Twilio, especially non-digitally native companies. We have fielded investor questions if a ChatGPT mobile application would use Twilio for 2FA, but we believe it would be more likely to use Microsoft for 2FA, given OpenAI's deep partnership with Microsoft.

Outside of the core messaging platform, we believe generative AI can enhance Segment by making a true AI-based CDP. On the flip side, given the limited traction that Twilio has seen with Flex, its CCaaS solution, we don't see meaningful tailwinds for ChatGPT within the Flex business.

**Headwinds:** Given the limited traction that Flex has seen, we actually believe ChatGPT will increase the gap between the CCaaS market leaders (NICE, Five9, Genesys) and Flex.

**Bottom line:** We see generative AI as a slight tailwind for Twilio.

#### **Veeva (VEEV) — Covered by Rishi Jaluria**

**Tailwinds:** We see a number of meaningful potential tailwinds for Veeva.

On the R&D side, we believe generative AI has meaningful potential to change the way drugs are designed and brought to market. For example, we note there are a number of start-ups



focused on designing new drugs with generative AI and, in fact, Insilico Medicine is beginning clinical trials on a COVID-19 drug (ISM3312) designed entirely by generative AI. If companies begin to use generative AI to help design drugs, this could be a meaningful tailwind for Veeva's R&D business with higher volume of drugs going through the R&D and regulatory processes. In addition, Veeva can use generative AI within its own R&D products to make them more effective (e.g. digital trials). Finally, given the vast volumes of data Veeva has from its market leadership position, Veeva can utilize generative AI to give unique insights (which can also extend to the commercial business).

On the commercial side, Veeva can utilize ChatGPT to make its CRM more effective, from updating and testing contact information to helping pharmaceutical reps better target the right healthcare professionals. We also expect ChatGPT to be a tailwind for some of the alternative communication channels, such as Approved Email and for improving marketing campaigns utilizing Crossix's data set. Finally, we can see generative AI improving the Data Cloud business, with greater insights derived from the data, as well as helping Veeva potentially catch up faster with IQVIA (wherever the products are competitive).

**Headwinds:** We could see ChatGPT making pharmaceutical reps more effective and, as a result, leading to further cuts to pharma reps, creating a headwind for Veeva's CRM business.

**Bottom line:** On balance, while there could be some challenges for the core CRM offering, we see more tailwinds, especially on the R&D business, and believe Veeva will be a net beneficiary from generative AI.

#### Ziff-Davis (ZD) — Covered by Rishi Jaluria

**Tailwinds:** We could potentially see Ziff-Davis utilizing ChatGPT for its Internet properties to more efficiently generate content, serving as a tailwind to the digital advertising business (and improving margins). In addition, given Ziff-Davis is a programmatic acquirer, generative AI could help better identify targets that would be a fit within the Ziff-Davis portfolio.

On the software side, we believe it is mixed for marketing (Moz group). If the nature of search does, in fact, change, as we posit throughout this whitepaper, it could create headwinds for SEO solutions. Generative AI, however, can also help accelerate the need for SEO software, as well as help with marketing campaigns. Within security, we could see a tailwind as cyber-attacks become more complex, although we don't expect this to be a meaningful tailwind, given the more downstream and commoditized nature of Ziff-Davis' security solutions.

**Headwinds:** We could see headwinds to the digital media business from traffic going directly to ChatGPT for "expert answers" instead of Ziff-Davis properties. For example, instead of researching a health topic on Everyday Health, users may instead ask ChatGPT for answers to a topic. Similarly, we could see users asking ChatGPT for a comparison between different smartphones, versus navigating to one of Ziff-Davis' tech properties.

**Bottom line:** We see several puts and takes here, but do ultimately believe Ziff-Davis will face a slight headwind from ChatGPT as things stand now. Having said that, if Ziff-Davis is able to utilize ChatGPT in ways we can't imagine right now, that headwind could be overcome.

#### ZoomInfo (ZI) — Covered by Rishi Jaluria

**Tailwinds:** We believe most users utilize ZoomInfo for the core data, not the up-the-stack offerings, but ChatGPT can certainly change that. For example, ChatGPT can help salespeople automate outreach, so salespeople can spend more time engaging with customers and prospects, versus manually drafting cold outreach. In addition, generative AI can help better identify context and run testing on prior outreach to create better email templates over time. We would caution against outright using ChatGPT to automatically send emails to targets as



communication generated from ChatGPT is distinguishable from human generated content today.

**Headwinds:** While ChatGPT today refuses to answer questions as to business emails or phone numbers today, other generative AI systems may be willing to serve up that information. Over time, generative AI may be able to provide the same data that ZoomInfo customers pay for today (e.g. “what is the contact information for the head of infrastructure at company xx and who is their boss?”), which would put pressure on paying users.

**Bottom line:** Given the puts and take, it's hard to gauge a net impact, but we believe generative AI could be a slight negative for ZoomInfo, if the company is not able to expand beyond the core data offering fast enough.

#### **Zoom Video Communications (ZM) — Covered by Rishi Jaluria**

**Tailwinds:** We see a number of potential tailwinds for Zoom from generative AI and note that CEO Eric Yuan has spoken publicly about Zoom becoming an “AI-first company”.

Zoom is currently utilizing generative AI (including GPT3) throughout the portfolio of solutions. For example, Zoom offers Zoom Smart, which summarizes meetings. Zoom will also use generative AI alongside Zoom IQ for sales.

We see room for Zoom to further expand the use of generative AI, including improving the video technology, search, and chatbots, which can enhance capabilities within chat, as well as offering a cross-sell opportunity within the nascent contact center business (although we would caution that we were skeptical on Zoom’s ambitions within contact center, beyond the low end of the market).

**Headwinds:** Given Microsoft is a major competitor with Teams and has already incorporated ChatGPT in Teams Premium, the competitive environment could remain intense against Zoom (and perhaps Zoom is already playing catch-up on AI).

**Bottom line:** We see numerous puts and takes and have concerns around competition from Microsoft, but also note Zoom is willing to embrace the technology and is willing to work with Microsoft (in contrast to Slack). As a result, we believe generative AI can be a slight tailwind for Zoom.



## Internet & internet company-specific takeaways

### Primary GAI implications/themes across internet

**Software engineering efficiency.** We see GAI as having potential to super-charge the underlying engineering output for product development as well as adding meaningful automation to maintenance engineering that is a part of the fabric of every company in our coverage universe. With R&D typically running anywhere from the HSD to mid-teens of revenue, we see there being opportunities to recapture at least a few points of fixed cost leverage over and above what's already generally occurring across the space as a function of revenue growth & generally higher opex discipline.

**Not all guns are right for this war.** The common characteristic in calling out Cloud and Search as likely being outsized beneficiaries of GAI is that both are providing the foundational tools for virtually all companies to leverage (guns for the war so to speak) as opposed to leveraging GAI for more specific customer-facing tools (though social media and certain types of professional services might be the exceptions to this rule). Much in the same way that there's been enormous profit in making chips for smartphones (ie multiple chip players garnering solid profits vs. Apple being the only hardware maker with real operating profit), we believe the majority of the incremental value creation from GAI will accrue to these GAI arms dealers where a lack of competitive differentiation over the longer-term could erode much of the profit pool for those players.

**Innovation/disruption could come from unexpected places - admittedly, search seems the most exposed though it could also largely represent TAM expansion vs. risk to Google.** With the potential to re-create others' capabilities by using 3p LLM's for a cost and with GAI tools technically having to provide generally unbiased information in order to maintain relevance, it's especially hard to think of certain, better-resourced players in a box and say they couldn't innovate their way into disrupting an entirely different company or even industry. Just brainstorming but some examples would include Apple implementing GAI into its core iOS UI which would then bypass Google entirely. Amazon implements consumer-facing GAI on its site that places more pressure on search but also risks displacing demand as results could well reflect superior responses & content which drive users off Amazon's platform.

**Regulatory risk seems highly likely.** Within the first few months of its rollout, ChatGPT has already altered its operating & business model to reflect many different negatively-bent manipulations of the service which we view as a harbinger given we're only scratching the surface on users discovering all the ways GAI can be leveraged. Historically, regulators have taken issue with basic search algorithms in particular where user data & the internet's content drove a virtually uncontrollable level of discovery and underlying ability of the provider (Google primarily) to steer results in its own best interests. We'd view the underlying LLM's which power GAI as exponentially more complex and difficult to unpack vs. Google's organic search algorithms for example and as such, are likely to invite both significant regulatory scrutiny along with a complete lack of ability to ultimately control or regulate it short of shutting it down completely. As such, we see Google's more measured approach to rolling it out as trying to demonstrate prudence around user safety whereas MSFT seems more bent on going as fast as possible which we'd view as carrying much more reputational and regulatory risk going forward.

### How internet companies are using AI today

*Note: All Internet companies are covered by Brad Erickson*

#### Airbnb (ABNB)

AI and machine learning have been incorporated in ABNB since the early days of the business, and they employ it across a number of different parts of the business. ABNB utilizes AI for ranking



properties, predictive search, predictive pricing, user profile personalization, customer service, and analyzing guest behavior all to create a platform that gives both guests and hosts a better experience so they come back more frequently.

### **Amazon (AMZN)**

AMZN uses AI and machine learning not only to improve the customer experience, but also to improve operational efficiency. They employ AI broadly for customer product recommendations, search relevancy, supply chain management, cloud tools, fraud detection, personalization, Amazon Go stores, image/voice recognition, and customer service.

### **Angi (ANGI)**

ANGI to date has not been very public about their AI efforts. Presumably, they are using AI tools to assist in their search and user recommendations. On the Q4 2022 earnings call, CEO Joseph Levin said regarding AI, "Every new technology is a threat and an opportunity. And we certainly think about them in both ways." Besides that, there has been very little discussion publicly.

### **Booking (BKNG)**

BKNG deploys AI across almost every part of the business. For customer service, they have AI chatbots for English speakers that are able to handle 60%+ of all requests. Marketing decisions are driven by models built with learning algorithms to optimize spend. BKNG also uses AI throughout the purchasing funnel, making personalized and connected trip recommendations for users. Within the company, there is also a task force for generative AI which is testing a variety of products to improve the user experience.

### **Bumble (BMLB)**

AI and machine learning are a backbone of BMLB's business. AI is built into the recommendation engine, used in safety, and customer service. In the future, BMLB is hoping AI will help users portray their best self on their profiles and ultimately create the best matches. The company also plans to use AI's predictive capabilities to detect bad actors, making the platform safer. The CEO, Whitney Wolfe Heard, has emphasized focusing on deeper integration of AI moving forward.

### **CarGurus (CARG)**

As an online car platform, CARG has incorporated AI and machine learning into its core business. One of the products is called Lead AI, which analyzes how shoppers engage with the platform to rank them by quality of leads. Another product is Digital Deal, which allows customers to build their perfect deal and connect with dealers across the country. CARG also uses AI to support its supply chain and backend operations.

### **Carvana (CVNA)**

Similar to CARG, CVNA uses AI to streamline operations throughout the business. CVNA uses AI to determine real-time offers for customers from robust data on the automotive market, customer credit score, and financing. AI and other technology is also used for virtual inspections and other aspects of the buying experience. They deploy AI for customer support throughout the purchasing process as well.

### **DoorDash (DASH)**

DASH leverages AI and machine learning to create a more efficient marketplace while also supporting customer service. Their AI capabilities allow them to predict when an order will be ready, picked up, and delivered, so they can optimize each step of the process. Within the delivery process, DASH even tries to predict minute details like how long it will take a dasher to park their car, deliver the item to the doorstep, and the likelihood a dasher will accept an upcoming order. Further, AI is also incorporated into batching, where a single dasher will pickup multiple orders at one time. DASH also uses AI for purchase recommendations and customer service requests.



### **Expedia (EXPE)**

EXPE is deploying AI-driven solutions to create a great customer experience and better personalization to drive high LTV per customer. It's important to callout, Sam Altman, the CEO of OpenAI, is on the board of EXPE. The company uses AI to improve the search experience for consumers in recommendations and discovery, and ranking properties on the platform based off massive data sets. For example, EXPE is able to adjust pictures it displays to users of a specific property based on their interests and prior experiences to increase conversion. EXPE also offers an AI price prediction tool, predicting the best time to book and sending alerts on price drops. They use it for support requests as well. Further, the company uses AI to improve the experience for users in other languages.

### **Meta (META)**

While META rebranded in the fall of 2021 to focus on bringing the metaverse to life, AI has always been an important part of the business strategy. Further, following significant losses from the Reality Labs division, META has shifted some of its resources to AI and created a more centralized AI team to unlock the immense opportunity as it plays a key role in the advertising and social media businesses. AI has helped improved Facebook and Instagram's recommendation engines to increase the quantity of plays for Reels and drive further user engagement across multiple surfaces. Machine learning algorithms, automation, and better measurement have also helped create more relevant and timely advertising, increasing conversion for advertisers at lower CPAs. META has also been creating its own LLMs, like ILaMA and Galactica, to further assist in its business and to expand the customer base.

### **Fiverr (FVRR)**

While AI will likely disrupt the freelancing business, FVRR is committed to embracing the AI revolution. FVRR is offering freelancers a suite of AI tools to improve their efficiency and customer satisfaction. FVRR is also focused on offering businesses connections to AI professionals for a variety of tasks. On the website, FVRR offers AI services for AI Applications, AI Artists, AI Models, AI Music Videos, Fact Checking, AI Content Editing. Lastly, FVRR is using AI and machine learning to increase the quality of search, recommendations, and matching to improve the platform.

### **Google (GOOGL)**

While detailed above, Google has been focused on AI and machine learning for the larger part of a decade, and it is incorporated into almost every part of their business. For search, Google deploys RankBrain to understand the context of a specific search, helping to produce more relevant results. The advertising and cloud businesses have also seen significant increases in efficiency from AI tools. Further, the Transformer paper Google published in 2017 has served as a foundational resource for LLMs. They have utilized this research to develop and train several LLMs like BERT, MUM, and LaMDA to assist in numerous aspects of their business. Bard, which is still in a testing phase, is an AI chatbot powered by LaMDA which will be incorporated into search as well.

### **Lyft (LYFT)**

While LYFT has focused on providing a quality transportation experience, AI and machine learning is deeply integrated into the tech stack to improve the efficiency of the platform for a better experience for both riders and drivers. The company leverages data from over a billion rides for pricing and predictive algorithms. LYFT also deploys AI to improve matching capabilities and optimize driver engagement spend for better efficiency. Lastly, LYFT is using AI and other technology to develop autonomous driving capabilities.

### **Match (MTCH)**

Similarly to BMBL, AI and machine learning is key to MTCH's business. It is used to enhance



the overall user experience to create deeper engagement and higher paying users. Machine learning references data based on interests, prior matches, engagement, and positive outcomes to create higher quality recommendations and matches. It is also used to enhance safety and detect scammers on the platform. MTCH management has also spoken about AI's potential to "coach" users when creating their profiles or engaging with others for more positive outcomes.

### **Pinterest (PINS)**

PINS uses a variety of AI tools to enhance the experience on their platform. For image search, PINS deploys AI to more accurately categorize and rank photos, resulting in higher quality results given a specific search. Because many of the photos on the PINS platform are high resolution photos as opposed to selfies or mobile uploads, PINS is able to use representation learning, an algorithm related to neural networks, to categorize and easily extract billions of photos. Further, PINS uses AI and machine learning to power its recommendation system to drive engagement. The combination of sorting, ranking, and recommending given the robust dataset allows PINS to establish highly personalized user profiles.

### **Redfin (RDFN)**

For RDFN, AI and machine learning is a vital part of its mission to make the home buying and selling process more efficient. While many AI tools are built into RDFN's offering, the main aspects to highlight are estimate and recommendation. Redfin Estimate calculates the market value of a home leveraging datasets, taking into account over 500 data points. Within its recommendation engine, algorithms track user engagement like clicks, interests, and contacting real estate agents to understand individual user preferences. RDFN then employs this data to provide users a list of recommended houses and sends personalized messages and alerts about new listings or price drops.

### **Vivid Seats (SEAT)**

SEAT has discussed very little publicly about its utilization of AI and machine learning on its platform. Despite this, the website most likely utilizes algorithms to set ticket prices and adjusts them accordingly depending on timing and demand of the event. The company is also one of the few in the industry to offer a loyalty program, and they most likely use AI for ticket recommendations based on a user's past purchases or recent interest. Thirdly, SEAT boasts world-class customer service, which more than likely includes some aspect of a chatbot or AI-related care.

### **Snap (SNAP)**

SNAP employs AI to power many of the content creation capabilities users enjoy daily as well as to create a more powerful platform. SNAP creates filters using AI-powered lenses with the help of image processing. Further, the company is also using AI for scene understanding, scene interaction, and scene rendering so machine learning models can recognize names and shapes of objects. In advertisements, SNAP uses targeted ads with goal-based bidding to optimize advertisement conversion. Further, SNAP deploys AI to increase the safety on the platform and to detect unscrupulous actors or interactions. Lastly, in March 2023, SNAP released My AI for Snapchat Plus subscribers, which is a chatbot designed to answer everyday questions.

### **Squarespace (SQSP)**

SQSP has been following AI innovation for the last decade and views it as a tool to augment its core web design capabilities rather than totally replace it. SQSP's platform has Content Transformation Engine, which offers suggestions for content improvements. SQSP also has a customer service chatbot to decrease response times and improve customer satisfaction. Further, SQSP has a partnership with Grammarly, which is an AI-powered grammar checker. SQSP has also integrated Google images onto its platform. In the future, SQSP is focusing on assisting customers in creating content like text and pictures, so they can create websites faster.



### **Uber (UBER)**

UBER deploys AI across many aspects of its platform to enhance the user experience, increase efficiency, and create higher retention. The company uses machine learning to optimize pricing as well as to power upfront pricing, one of the biggest changes to UBER's business, which decouples rider price and driver pay. UBER also leverages its platform data to cross-sell product offerings. Further, UBER employs AI for better matching between riders and drivers and predictive capabilities for a more efficient platform. AI also helps detect fraud and improve customer support. Lastly, like LYFT, UBER is using AI to test autonomous vehicles.

### **Upwork (UPWK)**

UPWK has not revealed much publicly surrounding its AI capabilities and while they recognize the potential headwinds, they are bullish on AI for their business. UPWK is likely deploying AI in search and recommendations to power better matches. UPWK has freelancers in over 90 categories of work and has acknowledged AI and machine learning tools can enhance and increase the efficiency of work, which will make the platform more appealing to current and potential clients. UPWK also expects the AI revolution to increase the need for technical skills for development, training, and support, which is currently one of the biggest use cases for the platform, increasing the overall TAM.

### **Wix.com (WIX)**

WIX employs AI and machine learning in several aspects of its business. WIX offers Wix Artificial Design Intelligence, which is a custom website builder using algorithms based on user's inputs and preferences without requiring code or detailed design. In February 2023, WIX also announced an AI Text Creator tool utilizing GPT-3 to generate human-like content for websites in English with more languages rolling out later on. Further, WIX has an AI-powered logo maker tool with customization capabilities. In 2023, management has highlighted an AI product pipeline simplifying user creation of websites.

### **Zillow (ZG)**

Zillow started testing AI and machine learning in the tech's nascent days and now deploys it in several aspects of their business. Zillow offers Zestimates for real time home valuation based off current market information, listing date, and pictures, among other data. In January 2023, Zillow announced a new AI-powered natural language search for real estate instead of traditionally starting the home search with location or bed/bath count. Further, Zillow's 3D Home app also allows users to create estimated floor plans and virtual tours based on upload photos or scans. Zillow also leverages their datasets and algorithms to send alerts and prospective houses to users.



## Implications for internet companies by sub-vertical

**Best positioned companies:** GOOGL, META, AMZN, PINS, SNAP, and to a lesser degree, BKNG, EXPE and ABNB.

**Companies with mixed exposure or at risk:** GOOGL, FVRR, WIX, SQSP, UPWK, BKNG, EXPE, MTCH, BMBL

### Cloud and Associated Infrastructure: GOOGL, AMZN & MSFT

The one vertical where it is most difficult to build an argument of being negatively impacted aside from competitive concerns. Higher compute intensity driving higher consumption, new revenue models driving TAM expansion and lastly, all sorts of hardware & software opportunities to drive cost & performance efficiencies over time which should drive structural profitability improvements from initial levels barring new, more aggressive competitive entrants. On the infrastructure front, generative AI represents a material, multi-year demand driver for third-party datacenter developers with a focus on hyperscale campus deployments. This includes most notably DLR amongst the listed providers, given its global scale and solid relationships with the major U.S. and Asian players, as well as numerous unlisted operators that are active across the globe. See our most recent [Global Datacenter Review from December 2022](#).

### Search Advertising: GOOGL, AMZN

**Positively**, we see GAI as a likely TAM expander for search in particular, and potentially for social as well for those with the best enabling tools. We believe GAI will likely induce incremental search activity as users become aware of its greater functionality and for many types of enterprise or super-users, there should be incremental revenue opportunities given the cost of compute for many types of these use-cases would be prohibitive. Further, given the likely coming tighter integration with GAI will product more user inputs alongside improving AI being used for targeting and measurement, we'd expect search's ability to target users should also incrementally improve which could drive structural higher CPM's. Further, we think SEM conversion could also improve as a function of potentially smaller ad load driven by scarcity which would also be a positive offset to CPMs. Lastly, we think the content creation efficiencies (fleshed out more fully in social media section below) could create significant incremental dollars that could be spent incrementally just as well on search vs. social in the event that search's marginal ROAS is higher (which we think it often is).

**Negatively**, the biggest risk is that GAI replaces many types of queries which are currently fulfilled through regular search and in some cases, searches that are monetizable - particularly across categories like travel, education, professional services etc. Further, to the degree that vertical specific companies of a size with adequate resources are able to leverage their own proprietary/vertical-specific data on top of 3p foundation models, this could create a superior search experience in that vertical which could drive some portion of top-of-funnel activity away from traditional search, or even GAI within search.

### Social media advertising: META, GOOGL, PINS, SNAP

**Positively**, the content creation & overall advertising creative industry could arguably see the most disruption amongst industries aside from software engineering & education with the advent of GAI. We believe this could free up significantly more dollars to be plugged back into social media spend (also search given in many cases depending on where a particular advertisers' marginal dollar is producing the highest ROAS). Content creation costs is not only a significant expense for companies and agencies (estimate as much as a third of total ad spend in some cases) but given the relatively recent rise of short-form video engagement, we can make a compelling case that the combination stands to structurally increase over time in the absence of any tailwinds from GAI. In our channel checks with SMB ad agencies, we're already hearing



evidence that advertisers are leveraging tools like ChatGPT to create copy that is approaching the brand messaging intent that human content creation would produce. Further, with yesterday's introduction of several new, larger LLM's (ChatGPT4, PaLM etc), which can increasingly work with text to images, video & audio, this exponentially expands the toolkit for advertisers to add significant efficiencies to content creation costs. We think this is especially positive for META which we believe possesses superior AI-related tools and has greater resources vs. smaller competitors to invest in GAI tools likely enabling differentiated content creation efficiency.

**Negatively**, to the degree that GAI does somehow enable advertisers to shift spending to other channels due to capturing more users given GAI's other functionality, this could become a source of lead gen diversification. Further, to the degree that social media platforms begin leveraging GAI solutions without significant oversight, we'd have to think that bad actors would almost immediately begin using it for such things as bullying, fraud, phishing and any nefarious output stemming from impersonation.

#### Ecommerce: AMZN

**Positively**, we'd think the greater interactivity of GAI could drive more effective discoverability, faster & more accurate price discovery and an overall better shopping experience. Further, we'd think these tools would likely benefit horizontal/3p marketplaces given by definition, a supposedly-unbiased GAI solution would have to be objectively producing responses reflecting the core tenets of any usual organic search algorithm vs. favoring one particular site or brand's products.

**Negatively**, any Ecommerce platform with significant competition from a large number of players could actually be disincentivized to leverage a GAI tool as it could drive business off-platform in the event that more relevance was elevated from elsewhere. It poses quite the paradox whereby if AMZN for example, were to implement a GAI solution for shopping, how could it drive its recommend-only products on AMZN if the tool is a truly objective GAI solution that is searching across the entire internet. The easy solve there would seem that in our example, AMZN's GAI would only reflect content from within its own ecosystem but isn't that simply what already exists today and therefore, the GAI's value add would only be to make discovery and shopping more conversational - not exactly revolutionary or as significant of a value when considering humans can already read, and the whole point of GAI is to aggregate content from the entire internet, not just one company's viewpoint.

#### Online travel: ABNB, BKNG, EXPE

**Positively**, we think the OTAs in particular (including ABNB) could develop a significantly better booking process within their own sites around not only planning the nodes of a trip (flight, hotel, rental car etc) but also planning a more comprehensive itinerary while simultaneously leveraging ratings, reviews and other types of user-generated content from which a GAI tool should be able to provide differentiated color and guidance for a trip that would be difficult if not impossible to obtain anywhere else besides word-of-mouth. Further, we think the OTA's would be best situated (vs. the hotels themselves) to capture incremental content regarding individual travel suppliers to improve the trip planning process. This could not only create higher SEM & SEO relevance and conversion but also could further enhance the on-site shopping experience beyond what any non-chain hotel could produce (which drives most of the profit for EXPE & BKNG, in particular).

**Negatively**, the OTAs (BKNG, EXPE mostly, less so ABNB) are heavily exposed to search where we estimate travel may represent as much as 10-15% of Google's search revenue in any given qtr. One of the most well-publicized speculations on how GAI could change industries has been travel with the over-arching view that discovery, shopping and maybe even booking could be upended and done within a GAI UI in a way that search could never fulfill. While there are a variety of reasons why this is likely not the case (which are a function of structural industry



nuances vs. the GAI technology itself), the big risk, in our view, is around the long-tail of travel bidders in SEM as well as SEO. Based on screenshots we generated & analyzed (later in the note), we believe there's a decent probability that for a portion of travel related, discovery/shopping type of searches, the GAI could fully circumvent a typical search or at least severely limit the ad load. Overall, we'd think this could be a net headwind, though an important offset/minimization to the ad load headwind would be that a) the OTA's would almost certainly appear higher than most independent hotels or smaller OTA's and b) OTA's tend to have very little SEO exposure (we estimate LSD/MSD as % of room nights for BKNG & EXPE, likely lower for ABNB).

#### **Professional services marketplaces - FVRR, UPWK**

Positively, we think we're entering into a veritable wild west of GAI discovery where all companies, particularly SBMs, are largely not equipped to even begin exploring how they could leverage GAI for their businesses on their own. As such, we see a huge opportunity for a new or at least migratory category of what will essentially be GAI consultants to help businesses of all sizes more quickly understand how to leverage these tools in hopes of new capabilities and/or competitive advantages. Certainly for areas around education, content creation, digital marketing & health, just to name a few. Further, we think opportunities for horizontal customer acquisition tools & techniques should also arise as more and more content can be automated where a whole new level of SEO consulting is likely to arise along with the potential to conduct deeper GAI analysis based on SEM performance where companies can more quickly learn what's driving conversion off of the most critical customer acquisition channels.

Negatively, once the initial phases of exploration, digestion and implementation occur, we think it's entirely possible that various industries, particularly information-centric ones, could start to realize benefits that would actually reduce their reliance on outside professional services. In our space, this would likely affect FVRR & UPWK mostly where categories like content creation, copy writing and digital marketing represent a significant portion of the company's business. In the near-term, FVRR in particular has talked about leaning into the GAI secular trend as it created many new categories for freelancers to fulfill demand which FVRR saw spike after the rollout of ChatGPT. With that said, given the tools make these freelancers exponentially more productive, at some level, we'd think there could be a long-term dilution dynamic that plays out there given the skill-set for achieving those efficiencies is highly replicable once the learning curve becomes less steep.

#### **Web design - WIX, SQSP**

**Positively**, we'd expect web design companies to implement GAI tools (WIX has already implemented a ChatGPT API into its workflow) and certainly when we think about all the associated content-related marketing tools associated with website building, we'd expected fully-integrated GAI capabilities to rapidly become table stakes for any of the major players like WIX, SQSP, GDDY (NC), Weebly, Webflow. Further, given the underlying technology that exists with website building, we'd think this also raises the odds of M&A given bringing together an existing builder with tighter integration with the most powerful models would be a compelling integration for MSFT's or GOOGL's corporate customers in particular (just as an example).

**Negatively**, between text to text as well as text to image, there's already evidence that GAI's ramping capability can all but replace the functionality for creating a website for someone who has no skillset to do so. Pragmatically, there's all kinds of reasons why this wouldn't necessarily be widely adopted like there's still more friction to that, maintaining is not easy, Ecommerce is very difficult vs. static sites as it's been demonstrated and finally, security. With that said, when we think about logo design as a likely top-of-funnel hook that often grabs new customers in the web design space, the availability of text to visual tools could pose funnel headwinds for these customers. Further, all these companies offer a la carte services (or add-ons to existing subscriptions) related to more intensive types of content creation which could



become marginalized by GAI.

#### Digital real estate - ZG, RDFN

**Positively**, we think companies with the largest data sets, much of which is often not publicly available, should be able to put more distance between themselves and smaller competitors to provide richer content related to shopping for real estate. With that said, we've no reason to think one would have significant differentiation over the much longer-term given all have enough scale to reasonably invest in GAI tools.

**Negatively**, to the degree that GAI allowed traditional top-of-funnel players (primarily search) to shift some real estate shopping over from a site (find me houses on a quiet street not near railroad tracks in a particular city, for example), this would obviously be a headwind for traffic & impressions. We'd think this is low likelihood.

#### Online car retail - CARG, CVNA

**Positively**, we'd think the recommendation engines and customer interaction could increase relevance and thus the quality of the experience substantially. Further, the shopping websites working with GAI would prompt capturing more information around vehicle inventory for example, which would raise discoverability and conversion. Inspections will of course, never go away in the industry, but given the holy grail in B&M car retail is to run a totally seamless omnichannel experience, we'd think GAI could significantly reduce friction that exists today while also increasing consumer confidence in buying such a large item online.

**Negatively**, we believe the segment has meaningful SEO exposure where to the degree that search habits in the sector see more of a pronounced mix shift towards GAI vs. traditional search, that could pose more significant traffic headwinds. In 2019, when Google introduced some of the most SEO algo changes in years, CARG, CARS and TRUE all experienced significant slowdowns in traffic which resulted in margin compression for the space as all had to increase paid marketing channels.

#### Ride-hailing/delivery: UBER, LYFT, DASH

Positively, we see very little if any disruption potential for ride-hailing, while for delivery, we think improving recommendation engines would be the primary benefit. While we don't find what Instacart is doing with its early implementation of ChatGPT as being all that innovative (basically the same as Google today with a smaller set of vendors & options to choose from), over time, we'd think this could provide a differentiated and for some a more palatable (pun intended) user experience.

#### Online dating: MTCH, BMBL

**Positively**, we see the potential to increase a user's proverbial shots on goal with the ability to automate content and recommendation engines improving to the degree that the companies capture more information from users with the pitch being that more information is likely to find better matches. Along these lines, we'd think there'd be meaningful payer penetration/monetization opportunities here as a portion of users would likely find outsized value add from this capability.

**Negatively**, anything that reduces authenticity on a dating site/app generally has a souring effect on the experience and certainly GAI does exactly that. To the degree that companies over-enable GAI tools for user conversations for example, we'd think a stigma around trust would quickly emerge and could become a headwind for a particular brand which would be difficult to come back from.



## Implications for the cloud wars

**Top-down thesis:** We believe the hyperscalers will each bring their own proprietary or exclusively-partnered GAI/chatbot solution to market as a Trojan horse intended to drive user adoption leading to enterprise API usage which is a conduit to locking in cloud services & effective competitive share gains over time.

**GAI massive opportunity for the hyperscale cloud vendors.** We believe AI is reaching an inflection point as a market opportunity, analogous to public cloud infrastructure five to ten years ago driven by the market acceptance and accelerating innovation around generative AI. Amazon Web Services, Microsoft Azure, and Google Cloud Platform all stand to benefit from widespread adoption of AI. There will likely be millions of applications built on top of these AI platforms, reaching billions of end users — for example, Spotify announced Spotify DJ using OpenAI technology and Snap announced My AI and these two companies alone reach close to a billion consumers. More importantly, the compute intensity of AI workloads and training AI models is several times larger than a normal workload, therefore given the scale elasticity required for AI, these workloads not only necessitate cloud adoption but also likely carry a larger revenue per workload.

**Microsoft.** We do subscribe to the viewpoint generative AI is likely to be a rising tide lifts all boats type of situation. Having said that, we believe Microsoft is looking to leverage a first-mover advantage to become the de facto cloud platform for AI workloads. ChatGPT is already a household name at this point, providing Microsoft not only with a first-mover advantage but also significant mindshare, though still early. As noted earlier, many companies, such as Spotify and Snap, are not only experimenting with OpenAI but releasing OpenAI-powered applications into production. We believe competitors do have the technology to compete and will soon launch competitive commercialized solutions, but likely need to showcase convincing differentiation in order to attract enterprises that are already experimenting with OpenAI. Furthermore, OpenAI and Microsoft have already done pre-emptive price cuts to establish a large ecosystem of partners and customers as quickly as possible, as well as to limit competitors differentiating on price alone. All in all, while still early days, we do feel like Microsoft Azure has strong competitive positioning at this point and is making the right moves to try and sustain it.



Figure 44 - Small snapshot of Microsoft's AI/ML solutions (not an exhaustive list)

Product	Description
Personalizer	AI service that your applications make smarter decisions at scale using reinforcement learning
Computer Vision	API/SDK providing developers with access to advanced algos for processing images and returning information
Speaker Recognition	API/SDK providing developers with access to AI algorithms that can help determine who is speaking in an audio clip
Content Moderator	API/SDK providing developers with access to AI algorithms that check text, image, and video content for material that is potentially offensive, risky, or otherwise undesirable
Face	API/SDK providing developers with access to AI algorithms that detect, recognize, and analyze human faces in images
Keyword Recognition	API/SDK providing developers with access to AI algorithms that detects a word or short phrase within a stream of audio
Text To Speech	API/SDK providing developers with access to AI algorithms that enable your applications, tools, or devices to convert text into humanlike synthesized speech
Image Analysis	API/SDK providing developers with access to AI algorithms that extract visual features from images, like adult content, brands or objects, or human faces
Speech Translation	API/SDK providing developers with access to AI algorithms that give your applications, tools, and devices access to source transcriptions and translation outputs for the provided audio
Intent Recognition	API/SDK providing developers with access to AI algorithms that perform pattern matching and conversational language understanding
Speech To Text	API/SDK providing developers with access to AI algorithms that perform real-time or offline transcription of audio streams into text
Spatial Analysis	API/SDK providing developers with access to AI algorithms that turn detect the presence and movements of people in video
Azure Form Recognizer	API/SDK providing developers with access to AI algorithms that turn documents into usable data
Anomaly Detector	API/SDK providing developers with access to AI algorithms to easily add anomaly detection into apps
Custom Vision	Build, deploy, and improve owned image classifiers, applying content labels based on visual characteristics
Azure Bot Service	Create bots and connect them across channels
Open Datasets	Curated and cleansed data - including weather, census, and holidays - that you can use with minimal preparation to enrich ML models
Kinect Dk	Developer kit with advanced AI sensors that provide sophisticated computer vision and speech models
Azure Cognitive Search	Infrastructure, API/SDKs, and tools for building AI-powered cloud search into mobile and web apps
Health Bot	Platform for healthcare orgs to build and deploy compliant, AI-powered virtual health assistants
Azure Machine Learning	Platform managing the machine learning project lifecycle, including training, deploying, and managing ML models
Azure OpenAI Service	See sub-section in Microsoft section on this topic
Metrics Advisor	Solution using AI to perform data monitoring and anomaly detection in time series data
Video Indexer	Solutions to extract insights from videos and audio
Immersive Reader	Tool that implements proven techniques to improve reading comprehension for new readers, language learners, and people with learning differences such as dyslexia
Data Science Vms	Virtual machine with pre-loaded data science and machine learning tools
Azure Databricks	Apache Spark-based analytics platform

Source: Company website, RBC Capital Markets

**Google.** While GOOGL has been playing catch up to MSFT/OpenAI since the release of ChatGPT, the company's deep experience with AI and increasing internal focus on rolling out GAI tools into their suite of products may narrow the gap. Despite the seemingly rushed Bard announcement in February, we think future GAI announcements will be more frequent and could change the narrative for the positive. Just recently (on 3/14), GOOGL announced a new GAI app builder and GAI tools within Google Workspace to write emails and documents, create presentations, take meeting notes, summarize email threads, etc. within Gmail, Documents, Sheets, Meet, etc.

Beyond Workspace, Search is the obvious channel to highlight their GAI capabilities to the largest audience possible. While a Search/GAI integration is not there yet today, an eventual release could be a tailwind to GOOGL in terms of mindshare/marketing. And it's worth noting that the current state of GAI chatbots is far from perfect. While we expect them to improve significantly going forward with the release of newer & larger models, the public's (and potential Cloud customers) confidence in the quality of outputs likely has room to the upside. Lastly, it's worth noting that GOOGL develops their own custom TPUs which drive significantly lower relative compute costs for both model training & utilization.



Figure 45 - GOOGL has an extensive array of AI/ML Cloud API/capabilities which we expect them to build upon going forward

Use Case	Product	Description
Scientists	Vertex AI	Centralized UI to manage all ML workflows. Pretrained APIs to quickly develop GAI applications
Scientists	Vertex AI Workbench	Development environment to manage the entire application/model workflow. Allows for faster building and training, better scale and data analysis
Scientists	Vertex Explainable AI	Set of tools/frameworks to better understand ML outputs to debug and improve model performance.
Developers	AutoML	Simplified ML development for less experienced developers across image, text, video, translation, etc applications
Developers	Natural Language AI	Analyzes unstructured text to provide better insights including sentiment analysis, content classification, syntax analysis, etc
Developers	Dialogflow	Customer service chatbots/voicebots
Developers	Media Translation	Real-time audio translation
Developers	Speech-to-Text	Converts audio to text in 125+ languages. Available on-premise or via cloud.
Developers	Text-to-Speech	Converts text to speech at near human quality levels in 40+ languages in 220+ voices. Ability to train custom voice models via customer audio recordings.
Developers	Recommendations AI	Analyzes customer data to maximize metric business is optimizing for at scale to improve conversions and ROAS
Developers	Translation AI	Translate text in 100+ languages
Developers	Video AI	Automatically recognizes 20k+ objects/places/actions. Generates video metadata. Builds video apps.
Developers	Vision AI	ML models to analyze videos and images. Detects objects and handwriting. Pretrained APIs to extract metadata.
Infrastructure	Deep Learning Containers	Environment to develop, test and deploy AI applications
Infrastructure	Deep Learning VM Image	Access to VMs with pre-installed applications
Infrastructure	Cloud GPUs	Access to GPUs to improve job speed with a wide range of performance and prices
Infrastructure	Cloud TPUs	Access to TPUs for larger workloads and ML model training/interating
Infrastructure	TensorFlow Enterprise	Enterprise-grade CPU, GPU, TPU resources
Solutions	Contact Center AI	Human-like AI for customer service
Solutions	Document AI	Provides structured data from documents
Solutions	Intelligent Products	Customer insights to develop and monetize new products
Solutions	Product Discovery	Implement Google-quality search on websites

Source: Google, RBC Capital Markets



**Amazon.** While AWS may appear to be at a relative disadvantage at the moment, we think they have the potential to be a fast follower in GAI workloads. Relative to OpenAI/MSFT and GOOGL it's not entirely clear that AMZN has developed its own foundational models similar to the scale of GPT or LaMDA/PaLM. While the partnership with Hugging Face (which is also used by MSFT and GOOGL) gives AMZN access to the models which can be trained and deployed via SageMaker, it could be viewed as a relative disadvantage to GOOGL/MSFT by not owning the models themselves. Additionally, beyond Alexa devices, it's not clear they have an intuitive means of distributing a GAI to get in front of users in a more visible way (we think it's unlikely AMZN would implement GAI functionality into amazon.com's search similar to ChatGPT/Bing).

That said, we think AWS has likely been developing cloud AI capabilities longer than any and have a lot of the same functionality as GCP and Azure, if not more advanced. And while they haven't publicly announced a direct competitor to GPT/LaMDA CEO Andy Jassy recently noted they've been working on large GAI models for a long time and the company does have some GAI they offer to clients (Lex and Polly). Additionally, with the Hugging Face partnership, AWS has access to foundational models which can be trained by AWS's Tranium for half the price of comparable GPUs, like the ones used by OpenAI & MSFT. Finally, given their vast developer relationships, they may not need a consumer distribution model to drive appropriate capture of workloads going forward, though may face some NT headwinds given the rapid pace of ChatGPT's more aggressive marketing & both MSFT & GOOGL's likely GAI innovation/implementation.



Figure 46 - AMZN has an extensive array of AI/ML Cloud API/capabilities which we expect them to build upon going forward

Use Case	Product	Description
Computer Vision	Rekognition	ML to automate image recognition and video analysis
Computer Vision	Lookout for Vision	Identify product defects in real time, automating quality inspection
Computer Vision	Panorama	Process and analyze video at the edge to improve logistics
Automated data extraction and analysis	Textract	Extracts text from scanned documents for finance, healthcare and gov't applications. Understands data forms and structures.
Automated data extraction and analysis	Comprehend	Analyze document text and provide insights
Automated data extraction and analysis	A2I	Human review of ML models/systems to ensure quality/precision
Language AI	Lex	Conversational AI for customer service. Chatbots and voice assistants.
Language AI	Transcribe	Speech-to-text transcription
Language AI	Polly	Text-to-speech transcription
Improve customer experience	Kendra	ML powered enterprise search
Improve customer experience	Personalize	Powers personalized customer experiences. Days to implement. Real-time recommendation updates based on new information.
Improve customer experience	Translate	Batch and real-time translation. Incorporated into chat/email/helpdesk applications.
Business metrics	Forecast	ML business prediction model. Retail/inventory, workforce, travel demand, etc. use cases.
Business metrics	Fraud Detector	Custom fraud detection model. Build without any ML experience. Immediate deployment.
Business metrics	Lookout for Metrics	Identify and attribute outlier datapoints. Automated alerts.
Code and DevOps	DevOps Guru	Insights on application behavior to identify anomalies and recommend necessary action. Identify operational issues early.
Code and DevOps	CodeGuru Reviewer and Profiler	Identify security vulnerabilities. Code cost and efficiency analysis.
Industrial AI	Lookout for Equipment	ML model to process data from machinery sensors to minimize downtime
Industrial AI	Monitron	Monitor machine status. Predict maintenance needs.
Healthcare	Healthlake	Securely analyze unstructured data. Make health predictions. Reduce costs on imaging.
Healthcare	Comprehend Medical	Process and analyze unstructured medical text .

Source: AWS, RBC Capital Markets

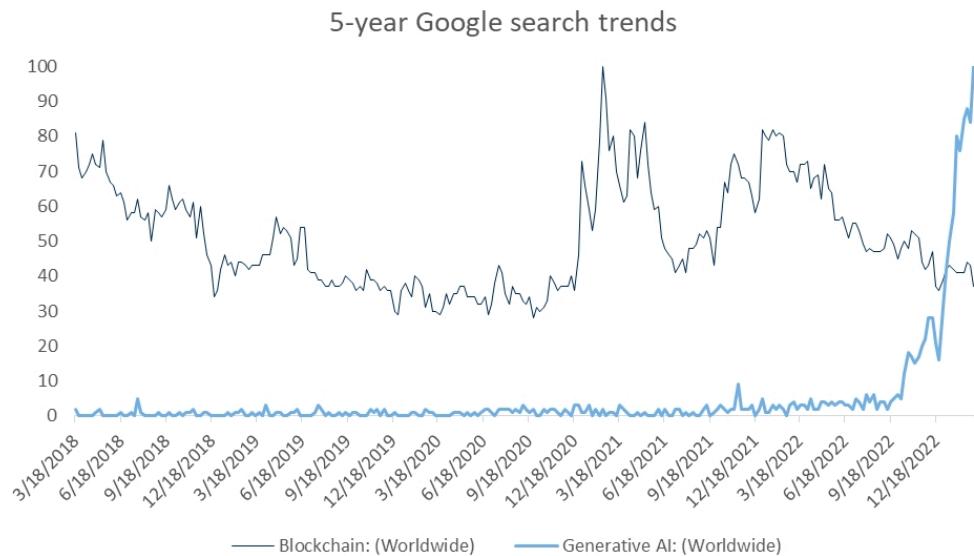
## Broad vertical impacts from AI & ML adoption

### All aboard the hype train

We feel generative AI is a transformative advancement in technology that will have broad implications across verticals and sectors with applications for a wide range of technology vendors. That said, it has also become a common theme in transcripts across our space as management teams attach themselves to the topic. A focus of this report has been to separate the companies we feel are most likely to have a material impact from the technology and to help investors sort through the noise that is currently being generated. We saw a similar dynamic emerge around blockchain in Q1 2021, and while we feel generative AI has broader applications, we see similarities in the level of investor interest correlating with the number of companies looking to show themselves as well-positioned in the space.

Below, we show Google Search trends for the two topics over the past five years. We can see the peak in blockchain and the drop off afterwards as the hype around the technology transitioned toward the more pragmatic view of applicable use cases. Generative AI has seen a much steeper increase in interest, which has gained the attention of investors and consumers as the accessibility of the technology through applications like ChatGPT and DALL-E has demonstrated the consumerization of tech making the theme much more tangible.

**Figure 47 - Google Search trends**



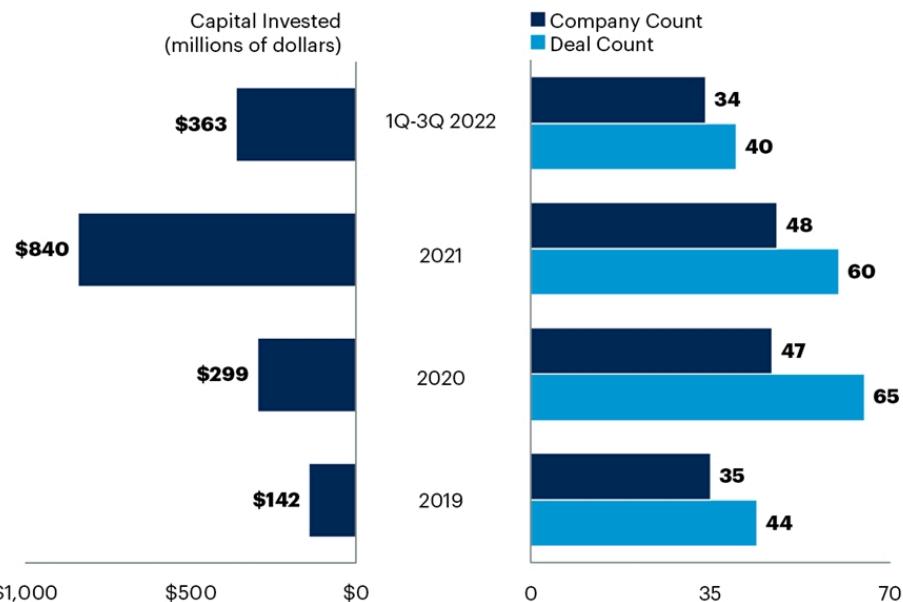
Source: Google Trends

### Following the money

According to Gartner, over \$1.7B has been invested into generative AI solutions by VC firms over the last 5-years across 255 deals. As seen below, Gartner lays out the investments, number of deals and number of companies receiving VC investments from 2019 until Q3 of 2022.

Figure 48 - Generative AI VC Investment

### Generative AI VC Investment by Number of Deals and Companies, 2019-3Q22



Source: adapted from PitchBook investment data.  
776430\_C

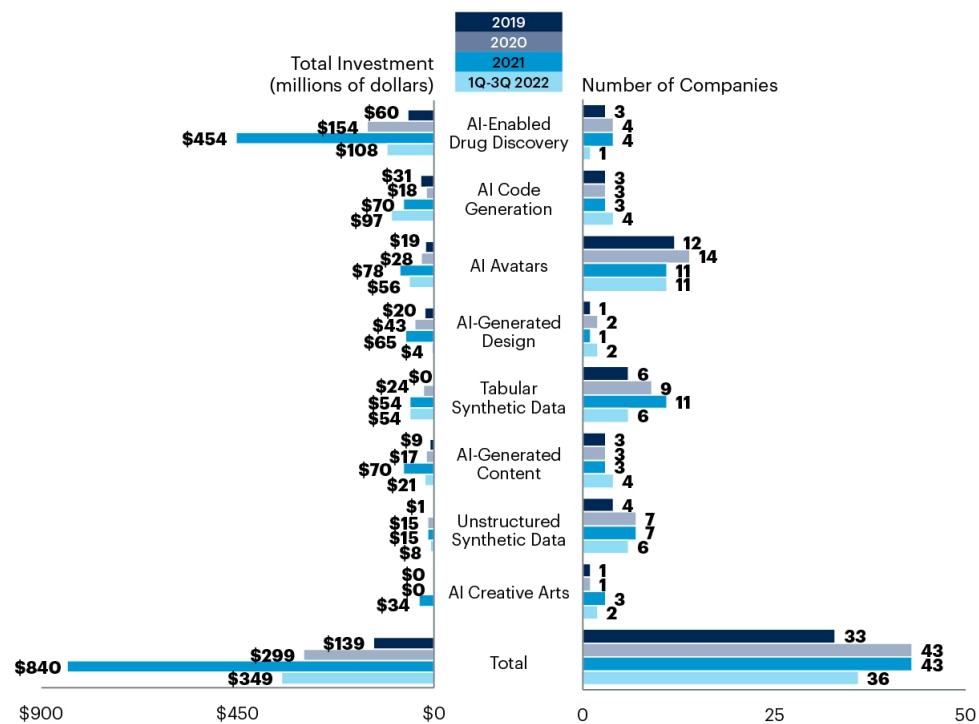
**Gartner**

Source: Gartner "Emerging Tech: Venture Capital Growth Insights for Generative AI" By Annette Jump, Vibha Chitkara, Aly Woodward on December 2, 2022

Within those deals, we can see the largest dollar amounts have gone to AI-enabled drug discovery while the AI Avatars have seen the largest number of companies receiving VC investments. From a tech sector perspective, AI Code Generation is the only segment that saw increased funding in 2022 compared to 2021.

Figure 49 - Generative AI VC Investment by Segment

### Generative AI VC Investment by Segment, 2019-3Q22



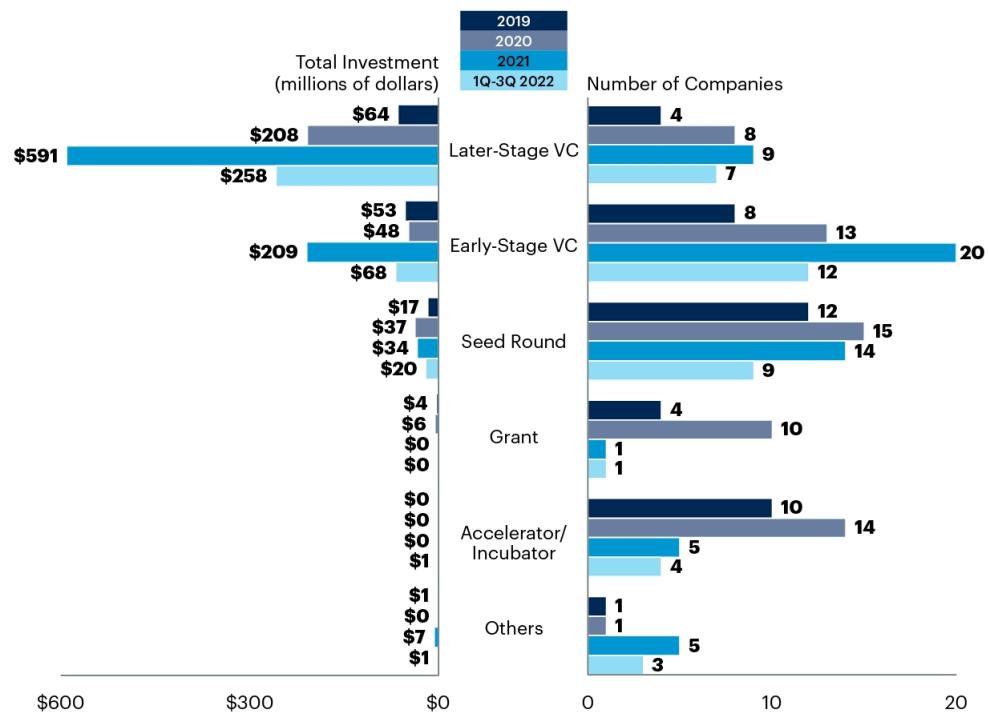
Source: adapted from PitchBook investment data.

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**Gartner**

Source: Gartner "Emerging Tech: Venture Capital Growth Insights for Generative AI" By Annette Jump, Vibha Chitkara, Aly Woodward on December 2, 2022

Breaking these deals down further, later stage startups have seen the most funding while early stage has seen the largest number of companies receiving VC funding.

Figure 50 - Generative AI VC Investment by Stage
**Generative AI VC Investment by Stage, 2019-3Q22**


Source: adapted from PitchBook investment data.  
776430\_C

**Gartner**

Source: Gartner "Emerging Tech: Venture Capital Growth Insights for Generative AI" By Annette Jump, Vibha Cithara, Alys Woodward on December 2, 2022

**Robot revolution**

Generative AI is likely to have an impact across a wide range of industries both by enhancing the quantitative skills that computers have always excelled at, which will be an advancement of existing AI and ML technology, but also flowing into new areas like writing and creative processes which have typically seen less machine intervention.

We continue to believe in the long-run augmented intelligence will be the end-result of most of these changes. As seen below Gartner has laid out uses cases for generative AI as well as the industries they are most likely applicable in. Through this we can see more real-world examples of how generative AI is likely to reshape aspects of work across verticals.

[Figure 51 - Generative AI Use Cases by Industry](#)

### Use Cases by Industry/Capability

	Automotive and Vehicle Manufacturing	Media	Architecture and Engineering	Industries					Business Capabilities			
				Energy and Utilities	Healthcare Providers	Electronic Product Manufacturing	Manufacturing	Pharmaceutical	Human Resources Management	Information Technology Management	Marketing and Sales	Research and Development
Drug Design								●				
Material Design	●			●		●						●
Chip Design					●							
Synthetic Data	●		●	●	●	●	●	●		●	●	●
Generative Design (Parts)	●		●				●					●
Generative Design (Architecture)			●									
Code Generation										●		
Text Generation		●									●	
Image Generation		●									●	
Video Generation		●						●			●	
Audio Generation		●									●	
Media Content Improvement		●									●	

Source: Gartner  
778501\_C

**Gartner**

Source: Gartner "Innovation Insight for Generative AI" By Brian Burke, Arun Chandrasekaran and Svetlana Sicilar on December 15, 2022

### How the market may develop

While generative AI will likely impact most verticals in one way or another, as we often see with emerging technology, there will likely be a lag between early adopters and when the technology becomes more pervasive. Investments made within generative AI do not only pertain to the technology companies developing them, but for the customers who use them. Industries will need to retrain employees in many cases to realize the full efficiency gains of generative AI with forward-looking enterprises likely to see the earliest benefits.

Strategic planning assumptions from Gartner's "Top Strategic Technology Trends for 2022: Generative AI":

- By 2025, generative AI will account for 10% of all data produced, up from less than 1% today.
- By 2027, 30% of manufacturers will be using generative AI to increase product development efficiency.
- By 2025, 50% of drug development initiatives will use generative AI.
- By 2024, 50% of the largest low-code/no-code development platforms will provide "text to code" functionality in their AI suites.
- By 2025, 20% of all test data for consumer-facing use cases will be synthetically generated.
- By 2025, 30% of outbound marketing messages from large organizations will be synthetically generated.
- By 2025, 90% of the material in quarterly reports will be synthetically generated.

- By 2024, the European Union will pass legislation to mandate the “watermarking” of AI-generated artifacts.
- By 2025, 20% of procedural code professionals will have retrained because generative AI will have cannibalized their core skill set and market value.
- By 2025, stunt doubles in the entertainment industry will no longer need to look like the stars they imitate.

### Finding a balance

The largest concern around AI and more particularly generative AI has been around the impact on employees and the potential for jobs being replaced by machines. As seen in the survey results from Gartner below, employees are not opposed to AI assistance, but only AI replacement. The key for successful implementation will be finding the balance that maximizes productivity without alienating employees, maximizing the potential of human capital.

Traditional AI use cases have been widely accepted focusing on automating manual and repetitive tasks and streamlining processes as seen below in the strong preference for AI assistance in data processing. Additionally, most employees are also comfortable with measures for mistake reduction utilizing AI - we are all familiar with tools like spell-check.

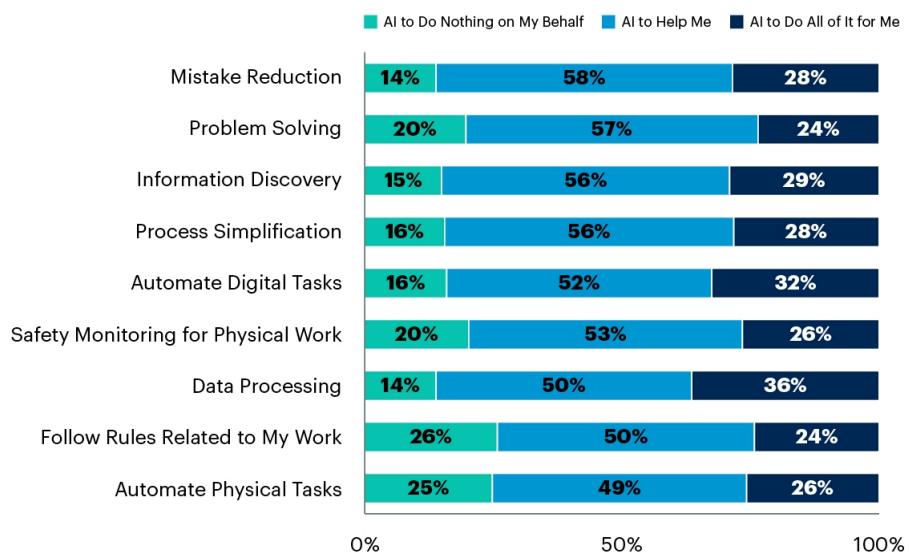
The areas people are less comfortable with are when they move away from machines and into the physical workplace which in our view continues to show a lack of trust in artificial intelligence more generally. Areas where workers stated they wanted the least AI intervention included “automate physical tasks” and “follow rules related to my work” as well as “safety monitoring for physical work”.

The answer that we feel relates the most closely to generative AI is in problem solving. 20% of respondents want AI intervention, 24% want AI to “do it all for me”, while 57% want AI help. This latter segment which has the highest proportion of respondents falls squarely in the realm of augmented intelligence. We feel this is the long-tail of generative AI, with the human role adapting to the changing dynamics within the workplace focusing on areas where their domain specific expertise can enhance the automated processes within their workplace.

Figure 52 - Gartner Survey Results on the Extent Workers Would Like AI to Help

### Extent of Help

Percentage of U.S. Workers



n = 1,424 Base: U.S. workers, excludes "not applicable"

Q: To what extent would you like AI to help you achieve the following on your behalf?

Source: 2021 Gartner Worker-Consumer AI Attitudes Survey

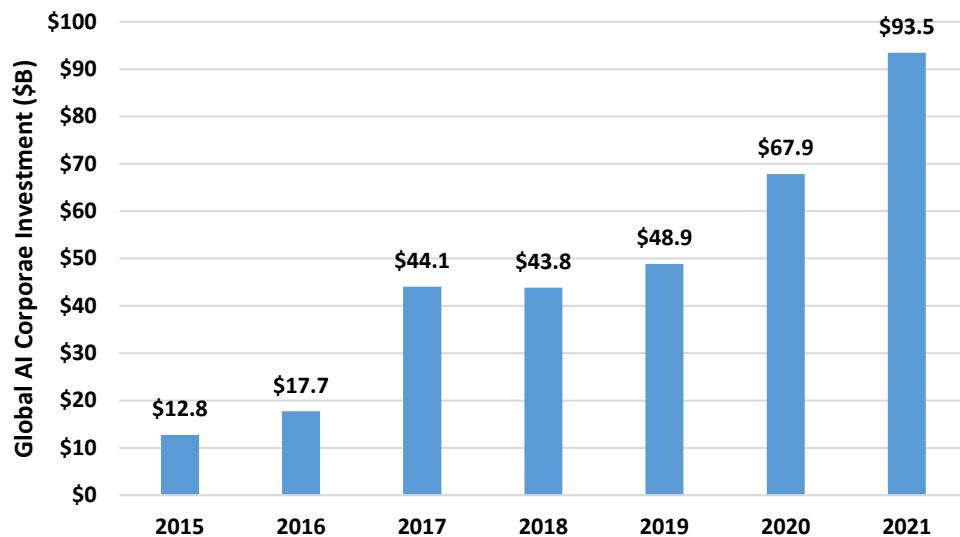
767371\_C

**Gartner**

Source: Gartner “How to Convince Your CEO to Use AI to Augment, Not Replace, Workers” By Leigh McMullen, Whit Andrews, Svetlana Sicular, Dave Aron on May 16, 2022

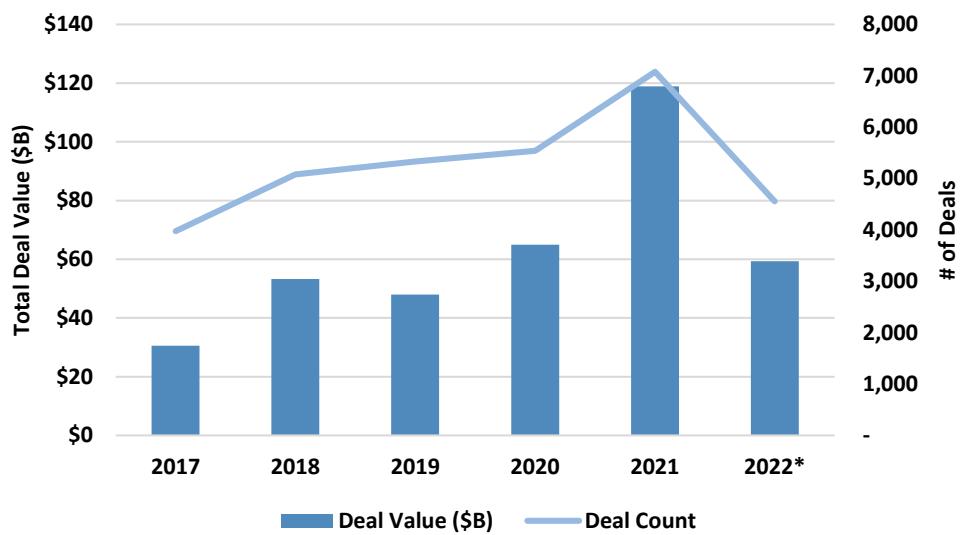
While still in its nascent days and yet to see true mass adoption, AI and machine learning will disrupt many industries and sectors moving forward, especially given the massive funding it has and will continue to receive. As seen in the two charts below, corporations and venture capital firms have been pouring money into AI and machine learning at an accelerating rate.

Figure 53 - Global AI investment continues to ramp



Source: Statista, RBC Capital Markets

Figure 54 - Venture Capital AI & ML Deal Value and Deal Count



Source: Pitchbook, \* Only through Q3 2022



## Large language model (LLM) tech underpinnings

### What is a large language model?

A large language model is a machine learning model that is trained on a massive amount of data in order to perform natural language processing tasks. Some of the most well-known LLMs are GPT and BERT. LLMs can be used for a variety of natural language processing tasks, including answering questions, language translation, sentiment analysis, and text summarization. They are also used to generate text in applications like chatbots, virtual assistants, and content creation tools.

LLMs are trained on a massive amount of text or a subset of the data which is first cleaned and processed. GPT-3, for example, has 175 billion parameters and is one of the most powerful LLMs to date. LLMs have neural networks, consisting of many layers of interconnected nodes, designed to learn and recognize patterns in the text. LLMs like GPT-3 and LaMDA are transformer neural networks which are very effective at language tasks.

One of the training methods uses self-supervised learning, which teaches the model to predict missing words or phrases after being given a sequence of words. It involves feeding the model many examples of texts with certain words masked or adjusting the weights of the neural network, so it becomes better at predicting the missing words. The process is repeated iteratively until the model reaches an acceptable level of accuracy. One advantage of this training method is that it trains the model on the statistical nature of language, leading to more natural and fluent language responses. On the flip side, because the model is trained to predict the next word, it is not necessarily learning the higher level representation of meaning that humans rely on, creating the need for reinforcement learning from human feedback.

OpenAI and Anthropic are known for pioneering "instruction tuning", which is the method of fine-tuning self-supervised machine-learning models with human feedback. This practice has enabled much smaller models to perform on-par, if not better, than models that are much larger in parameter size.

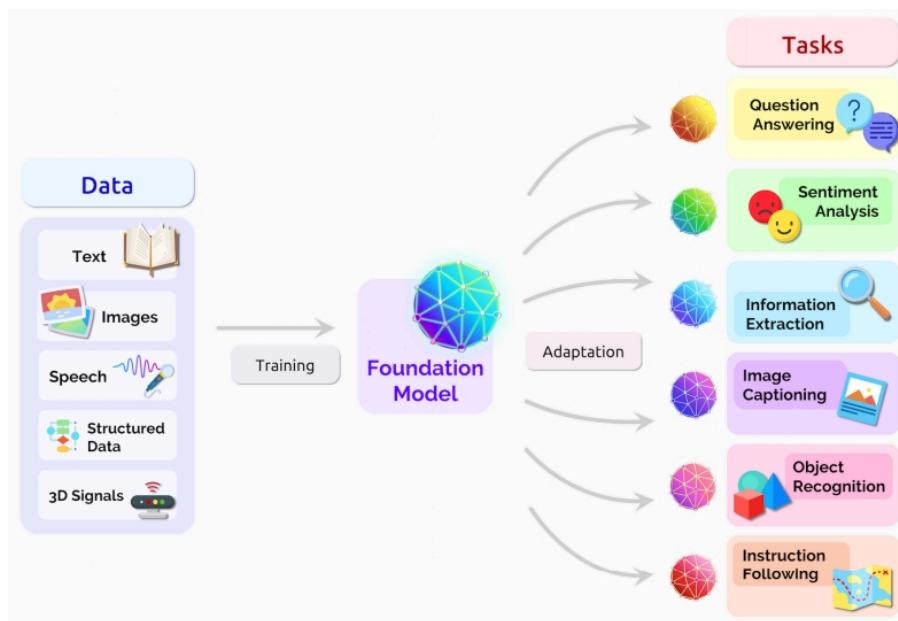
As the model becomes better at predicting the next word or phrase, it also becomes better at generating natural and coherent language. The model then utilizes the patterns it has learned from training and can be fine-tuned to generate outputs based on the desired goal. This allows the model to be tailored for specific requirements.

In terms of training costs for LLMs, a rough estimate is ~\$1/1000 parameters, depending on the operating costs, model complexity, and type of training data. Extrapolating that out, it costs ~100k-\$1.5M to train 1.5B parameters. GPT-3, for example, was built on 175B parameters and is estimated to have cost several million dollars to train according to Capgemini. As these models increase in size and complexity, the training costs will continue to rise.

### What is a foundation model?

While large language models as the name suggests refer to machine-learning models that can understand language, foundation model refers to the broader umbrella of models that can understand language, vision, robotics, or reasoning and search. Foundation models as a term was popularized by Stanford's Center for Research on Foundation Models (CRFM). A good example of a non-language foundation model is OpenAI's DALL-E 2, which would be considered a large vision model, as the algorithm not only understands and recognizes images, but generates them too (in response to human prompts, much like ChatGPT works with language).

Figure 55 - Foundational Models



Source: Center for Research on Foundation Models

### Google Transformer Paper

Google published a paper in 2017 titled “Attention is All You Need” introducing the Transformer, a novel neural network that was groundbreaking for understanding and completing tasks like question answering, machine translation, and language modeling. Instead of processing sequential inputted data, the algorithm processes the entire input all at once. The paper detailed the Transformer’s outperformance vs. prior models and demonstrated how it required fewer steps compared to prior models, less computation to train, and is an overall better match for machine learning hardware.

In the past, recurrent neural networks (RNN) were the most prominent approaches to language understanding. In general, neural networks process and understand language by creating fixed or variable length vector space representations. They start with single words, or even pieces of words, and they collect data from adjacent words to determine meaning. RNNs process words and language in left to right or vice versa manner, reading one word at a time. This forces RNN to perform multiple steps, like an iterative process, before it can accurately understand the words or phrases. Research has shown, the higher the number of steps a network requires, the harder it is for a network to understand and then ultimately make a decision. Based off the left-to-right or right-to-left nature of RNNs, they are not the best suited for advanced computing hardware like TPUs and GPUs.

Compared to RNNs, the Transformer is a novel neural network and performs a small but constant number of steps to understand language. The Transformer is able to directly model relationships between all the words in the sentence by comparing an individual word to all the other words in the sentence at the same time, regardless of position, severely cutting down the number of steps and allowing for faster computing.

This paper has served as the foundation for many of the AI tools and capabilities that Google has released in the past six years. The current versions of LaMDA, PaLM, and other features would not have been possible without the Transformer research.



## ChatGPT vs. Google Search across internet verticals

### Travel

Restaurants in a big city produces a very similar type of output vs. traditional Google and judging by ChatGPT's UI, we think there are likely similar opportunities to apply a similar set of recommendations while changing the taxonomy of the page to reduce the organic results and increasing the paid results. Further, in terms of research, ChatGPT's nicely laid out initial screen, just like Google's, is totally insufficient for showing a menu, reading reviews and providing at least some, merchant-specific information which would be somewhat necessary for going deeper in the funnel (calling, emailing, booking etc).

Figure 56 - Google Search vs. ChatGPT - Restaurants

The screenshot shows two side-by-side search results for "What are the best restaurants in New York City?"

**Google Search Results:**

- Header: "Places" with filters: 4.0+ rating, Cuisine, Price, Hours.
- Results:
  - L'Apertit (4.7 stars) - Fine Dining
  - P.J. Clarke's On The Hudson (4.3 stars) - American
  - El Vez and Burrito Bar (4.3 stars) - Mexican
- Map: A map of Lower Manhattan showing restaurant locations.
- Footer: "More places →" and links to Time Out and New York magazine.

**ChatGPT Response:**

- Header: "W" icon and question: "What are the best restaurants in New York City?"
- Text: "New York City is one of the best food cities in the world, with an incredibly diverse range of restaurants serving cuisine from every corner of the globe. The following are some of the best restaurants in the city:"
- List:
  - Eleven Madison Park: This award-winning restaurant, located in the heart of Manhattan, offers an elegant dining experience with a focus on seasonal, locally-sourced ingredients.
  - Le Bernardin: Widely regarded as one of the best seafood restaurants in the world, Le Bernardin serves up impeccably prepared dishes in a luxurious, sophisticated setting.
  - Per Se: This acclaimed restaurant, helmed by Chef Thomas Keller, offers a refined, contemporary take on classic French cuisine, served in an elegant dining room overlooking Central Park.
  - Blue Hill at Stone Barns: Situated on a working farm just outside the city, Blue Hill at Stone Barns offers a unique farm-to-table dining experience, with an ever-changing menu based on what's in season.
  - Momofuku Ko: This small, intimate restaurant in the East Village is known for its inventive, Asian-inspired cuisine and its chef's counter seating, which allows diners to watch the chefs at work.
- Footer: "Regenerate response" button and a note: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve."

Source: Google Search, ChatGPT, RBC Capital Markets



Figure 57 - Bing - Restaurants

The screenshot shows a Microsoft Bing search interface. At the top, there are buttons for 'SEARCH' and 'CHAT'. A blue button on the right says 'What is the best restaurant in New York City?'. Below the search bar, there are three green checkmarks: 'Searching for: best restaurant New York City', 'Searching for: best restaurant New York City criteria', and 'Generating answers for you...'. The main content area contains text about the search query and a map of New York City showing the locations of various restaurants. At the bottom, there are buttons for 'New topic' and 'Ask me anything...'.

What is the best restaurant in New York City?

✓ Searching for: best restaurant New York City

✓ Searching for: best restaurant New York City criteria

✓ Generating answers for you...

There are many great restaurants in New York City, but the best one depends on your preferences and criteria. Some factors that you might consider are cuisine, location, price, ratings, reviews, awards and atmosphere.

According to some sources <sup>1</sup> <sup>2</sup>, some of the top-ranked restaurants in New York City are **Le Bernardin**, **Eleven Madison Park**, **Daniel**, **Per Se** and **Jean-Georges**. These restaurants have received high praise from critics and customers alike, and have earned multiple Michelin stars and James Beard Awards.

However, there are also many other excellent restaurants that offer different styles of food and ambience. For example, if you are looking for a casual pizza place with a cult following, you might want to try **Bleecker Street Pizza** <sup>3</sup>. If you are looking for a stunning view of the city skyline along with fine dining, you might want to check out **The River Cafe** <sup>4</sup>. If you are looking for a taste of Africa with a social mission, you might want to visit **Teranga** <sup>5</sup>.

What kind of restaurant are you looking for?

Learn more: 1. [10best.com](#) 2. [elitetraveler.com](#) 3. [tripadvisor.com](#) +8 more

1 of 15

New topic Ask me anything...

Source: Bing, RBC Capital Markets

Boutique hotels near the river in Chicago yields some helpful detail and in this case, the simply constructed explanations feel similar to hearing a recommendation from a friend who'd stayed there which is superior to anything search could yield. With that said, hotels are one category where for discoverability, research & even booking, text is likely not sufficient to drive down-funnel conversion as we believe visual shopping this case seems somewhat of a critical component both within the search experience and on the hotel's website if a user is going to go further or all the way down the funnel to conversion.



Figure 58 - Google Search vs. ChatGPT - Hotel

The figure shows two side-by-side search results for "boutique hotels near the river in Chicago".

**Google Search Results:**

- Search bar: "What are boutique hotels near the river in Chicago?"
- Results:
  - Pendry Chicago: \$242, 4.6 stars, 256 reviews. High-end hotel offering French dining.
  - Hotel EMC2, Autograph Collection: \$182, 4.7 stars, 1.1K reviews. Stylish lodging with a fitness room.
  - LondonHouse Chicago, Curio Collection by Hilton: \$179, 4.5 stars, 4.8K reviews. Eco-certified, spa, push hotel with rooftop dining & a spa.
- Map: A map of Chicago showing various neighborhoods and landmarks like the Loop, River North, Magnificent Mile, and Streeterville.
- Footer links: "View 121 hotels →" and "https://www.myboutiquehotels.com ... Chicago | 11 Boutique Hotels in Chicago River North U.S.A. Hotels by area: River North | 11 Boutique hotels | 21c Museum Hotel Chicago - The Chicago Hotel Collection | River North Mag Mile | Found Hotel Chicago River North ..."
- People also ask section:

  - Where is the best area to stay when visiting Chicago?
  - What is the difference between boutique hotel and hotel?
  - What makes a hotel a boutique hotel?
  - What is an example for boutique hotel?

**ChatGPT Response:**

- Search bar: "What are boutique hotels near the river in Chicago?"
- Text: "There are several boutique hotels located near the river in Chicago. Here are some options:"
- List of 5 options:
  1. The Langham, Chicago: Located in the landmark 52-story riverfront tower, this luxury boutique hotel offers stunning views of the river and city skyline. It features a full-service spa, an indoor swimming pool, and an award-winning restaurant.
  2. The Godfrey Hotel Chicago: This trendy boutique hotel is located in the River North neighborhood, just a short walk from the Chicago River. It features a rooftop lounge, a fitness center, and contemporary guest rooms with city or river views.
  3. Hotel Monaco Chicago: This historic boutique hotel is located in the Loop district, just steps from the Chicago River. It features eclectic decor, a 24-hour fitness center, and an on-site restaurant and bar.
  4. The Kimpton Gray Hotel: This sleek boutique hotel is housed in a historic 1894 building and is located in the heart of the Loop district, near the Chicago River. It features a rooftop bar, a fitness center, and stylish guest rooms.
  5. LondonHouse Chicago: This luxury boutique hotel offers stunning views of the Chicago River and Lake Michigan. It features a rooftop bar, a fitness center, and elegant guest rooms with mod ⚡ Regenerate response
- Text at the bottom: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve." with a feedback icon.

Source: Google Search, ChatGPT, RBC Capital Markets



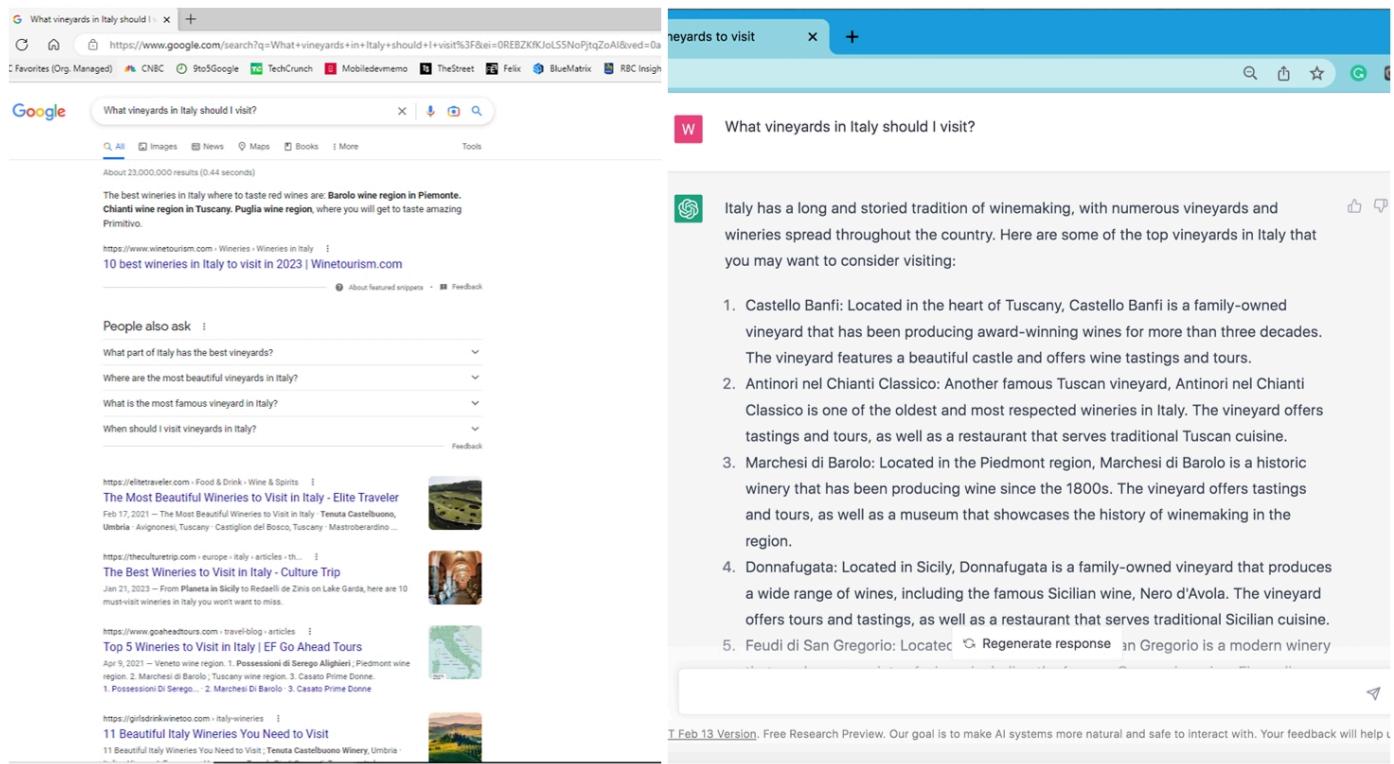
Figure 59 - Bing - Hotel

The screenshot shows the Microsoft Bing search interface. At the top, there are buttons for "Microsoft Bing", "SEARCH", and "CHAT". A blue button at the top right contains the query: "What are boutique hotels near the river in Chicago?". Below this, two green checkmarks indicate the search process: "Searching for: boutique hotels near the river in Chicago" and "Generating answers for you...". The main content area displays a snippet of text about boutique hotels in Chicago, mentioning Hotel Felix Chicago, Kimpton Hotel Palomar Chicago, LondonHouse Chicago, and Kimpton Hotel Monaco Chicago. It also provides a link to compare prices and availability. A sub-section titled "Hotels | The River, Orleans, MA" shows a map of Cape Cod Bay and Barnstable Town, with price markers for different hotel locations: \$295, \$274, \$414, and \$535. Below the map are date and guest selection fields: "Sun, Apr, 30, 2023", "Mon, May, 1, 2023", and "2 guests". At the bottom of the search results, there is a "Learn more" section with links to 1. hotelfelixchicago.com, 2. myboutiquehotel.com, 3. tripadvisor.com, and "+3 more". A progress indicator shows "2 of 15".

Source: Bing, RBC Capital Markets

**(No ad impact):** Vineyards in Italy to visit yields a solid overview in GAI and then its usual list in rank order. Interestingly, in search, it gives the beginning of a similar list which came from a single organic site which apparently ranked best in its quality/intent/relevance score. Lastly, there were no ads here which seemed interesting given a competitive wine industry (though more rational given its history and cultural institutionalization relative to American wineries).

**Figure 60 - Google Search vs. ChatGPT - Italian Vineyard**



The figure shows a side-by-side comparison of search results for "What vineyards in Italy should I visit?" on Google and a ChatGPT interface.

**Google Search Results:**

- Query: What vineyards in Italy should I visit?
- Results:
  - About 23,000,000 results (0.44 seconds)
  - The best wineries in Italy where to taste red wines are: Barolo wine region in Piemonte, Chianti wine region in Tuscany, Puglia wine region, where you will get to taste amazing Primitivo.
  - [https://www.winetourism.com/Wineeries/Wineeries\\_in\\_Italy](https://www.winetourism.com/Wineeries/Wineeries_in_Italy)
  - 10 best wineries in Italy to visit in 2023 | Winetourism.com
  - People also ask:
    - What part of Italy has the best vineyards?
    - Where are the most beautiful vineyards in Italy?
    - What is the most famous vineyard in Italy?
    - When should I visit vineyards in Italy?
  - Related links:
    - [The Most Beautiful Wineries to Visit in Italy - Elite Traveler](https://elitetraveler.com/Food-&Drink/Wine-&Spirits)
    - [The Best Wineries to Visit in Italy - Culture Trip](https://theculturetrip.com/europe/italy/articles/the-best-wineries-to-visit-in-italy-culture-trip)
    - [Top 5 Wineries to Visit in Italy | EF Go Ahead Tours](https://goaheadtours.com/travel-blog/articles/top-5-wine-tours-in-italy)
    - [11 Beautiful Italy Wineries You Need to Visit](https://girldrinkwino.com/italy-wine/)

**ChatGPT Response:**

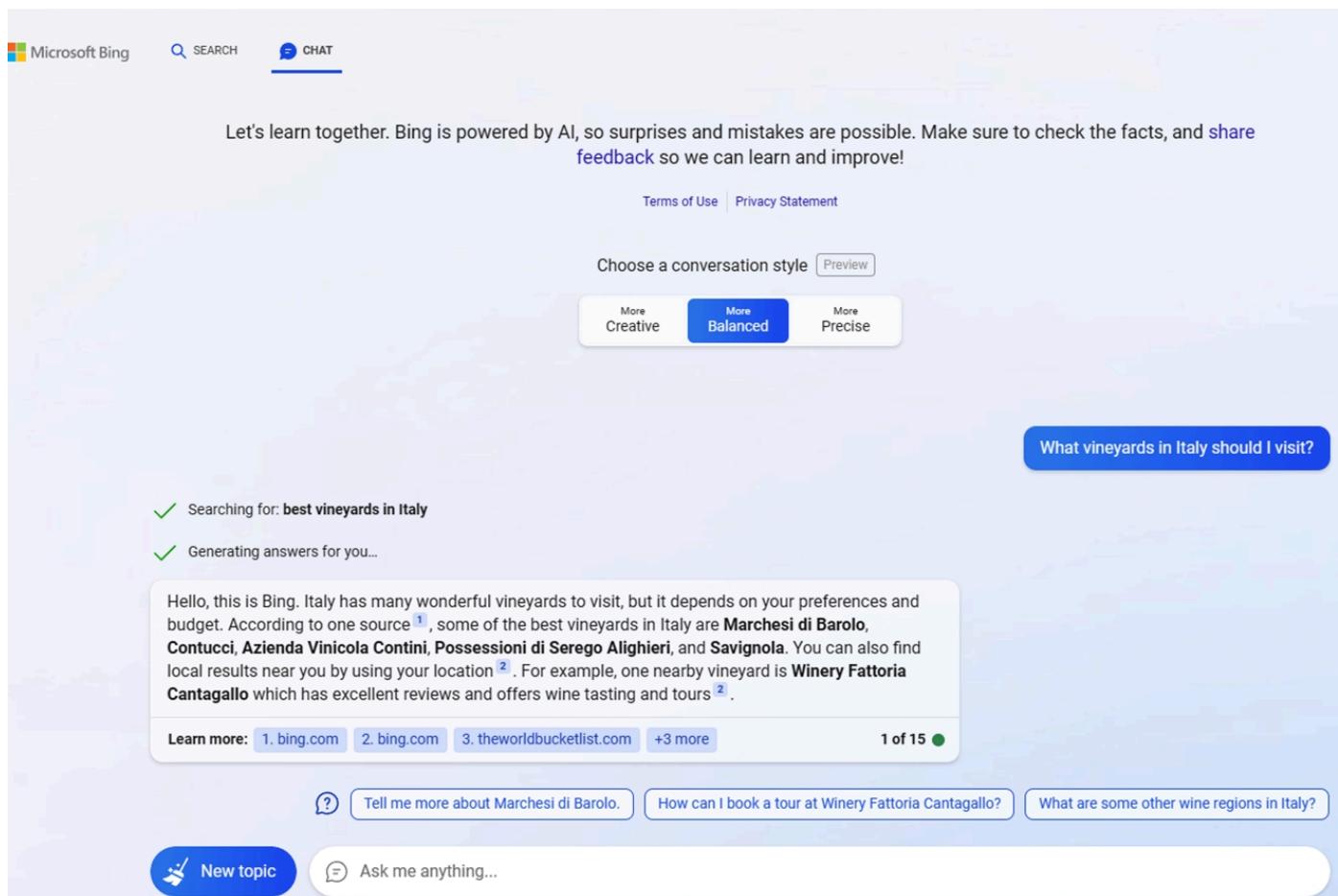
- Query: What vineyards in Italy should I visit?
- Response:
 

Italy has a long and storied tradition of winemaking, with numerous vineyards and wineries spread throughout the country. Here are some of the top vineyards in Italy that you may want to consider visiting:

  1. Castello Banfi: Located in the heart of Tuscany, Castello Banfi is a family-owned vineyard that has been producing award-winning wines for more than three decades. The vineyard features a beautiful castle and offers wine tastings and tours.
  2. Antinori nel Chianti Classico: Another famous Tuscan vineyard, Antinori nel Chianti Classico is one of the oldest and most respected wineries in Italy. The vineyard offers tastings and tours, as well as a restaurant that serves traditional Tuscan cuisine.
  3. Marchesi di Barolo: Located in the Piedmont region, Marchesi di Barolo is a historic winery that has been producing wine since the 1800s. The vineyard offers tastings and tours, as well as a museum that showcases the history of winemaking in the region.
  4. Donnafugata: Located in Sicily, Donnafugata is a family-owned vineyard that produces a wide range of wines, including the famous Sicilian wine, Nero d'Avola. The vineyard offers tours and tastings, as well as a restaurant that serves traditional Sicilian cuisine.
  5. Feudi di San Gregorio: Located in the Campania region, Feudi di San Gregorio is a modern winery

Source: Google Search, ChatGPT, RBC Capital Markets

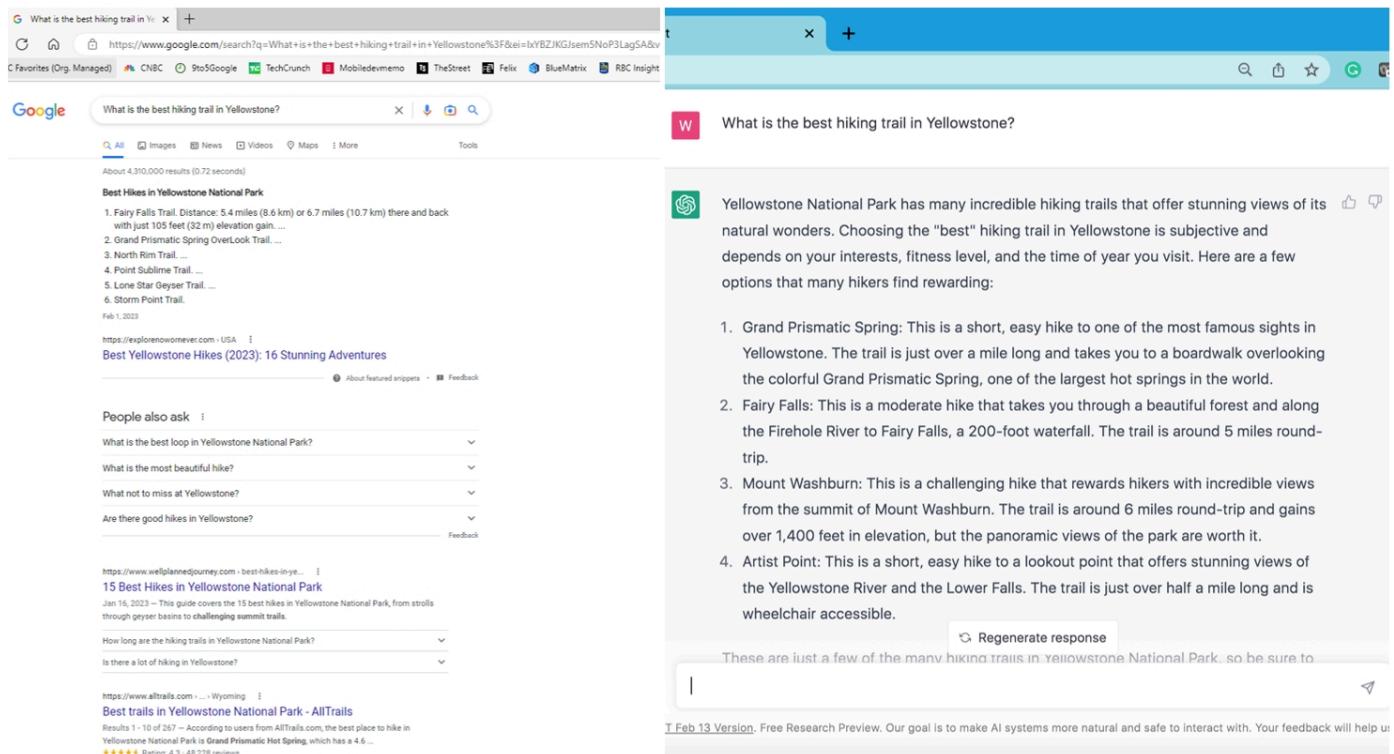
Figure 61 - Bing - Italian Vineyard



The screenshot shows the Microsoft Bing search interface. At the top, there are links for "SEARCH" and "CHAT". A message from Bing states: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" Below this are links for "Terms of Use" and "Privacy Statement". A section titled "Choose a conversation style" offers options: "More Creative" (selected), "More Balanced", and "More Precise". In the main search area, a question is asked: "What vineyards in Italy should I visit?". Below the question, a list of search results begins with: "Searching for: best vineyards in Italy" and "Generating answers for you...". The results section contains text about Italy's vineyards, mentioning Marchesi di Barolo, Contucci, Azienda Vinicola Contini, Possessioni di Serego Alighieri, and Savignola. It also mentions Winery Fattoria Cantagallo. At the bottom of the results, there are links for "Learn more: 1. bing.com 2. bing.com 3. theworldbucketlist.com +3 more" and a page number "1 of 15". Below the results, there are three buttons: "Tell me more about Marchesi di Barolo.", "How can I book a tour at Winery Fattoria Cantagallo?", and "What are some other wine regions in Italy?". At the very bottom, there are two buttons: "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets

Figure 62 - Google Search vs. ChatGPT - Hiking in Yellowstone



The figure shows two side-by-side browser windows. The left window is a Google search results page for the query "What is the best hiking trail in Yellowstone?". The right window is a ChatGPT interface with the same query.

**Google Search Results:**

- Query: What is the best hiking trail in Yellowstone?
- Results count: About 4,310,000 results (0.72 seconds)
- Section: Best Hikes in Yellowstone National Park
  - 1. Fairy Falls Trail. Distance: 5.4 miles (8.6 km) or 6.7 miles (10.7 km) there and back with just 105 feet (32 m) elevation gain. ...
  - 2. Grand Prismatic Spring OverLook Trail. ...
  - 3. North Rim Trail. ...
  - 4. Point Sublime Trail. ...
  - 5. Lone Star Geyser Trail. ...
  - 6. Storm Point Trail. ...
- Date: Feb 1, 2023
- Source: https://exploreyellowstonenever.com - USA
- Section: Best Yellowstone Hikes (2023): 16 Stunning Adventures
- Section: People also ask:
  - What is the best loop in Yellowstone National Park?
  - What is the most beautiful hike?
  - What not to miss at Yellowstone?
  - Are there good hikes in Yellowstone?
- Related links:
  - https://www.wellplannedjourney.com - best-hikes-in-y... | 15 Best Hikes in Yellowstone National Park | Jan 16, 2023 - This guide covers the 15 best hikes in Yellowstone National Park, from strolls through geyser basins to challenging summit trails.
  - How long are the hiking trails in Yellowstone National Park?
  - Is there a lot of hiking in Yellowstone?
  - https://www.alltrails.com - Wyoming | Best trails in Yellowstone National Park - AllTrails | Results 1 - 10 of 257 - According to users from AllTrails.com, the best place to hike in Yellowstone National Park is Grand Prismatic Hot Spring, which has a 4.6 ... | 4.6 Rating: 4.3 - 48,228 reviews

**ChatGPT Response:**

What is the best hiking trail in Yellowstone?

Yellowstone National Park has many incredible hiking trails that offer stunning views of its natural wonders. Choosing the "best" hiking trail in Yellowstone is subjective and depends on your interests, fitness level, and the time of year you visit. Here are a few options that many hikers find rewarding:

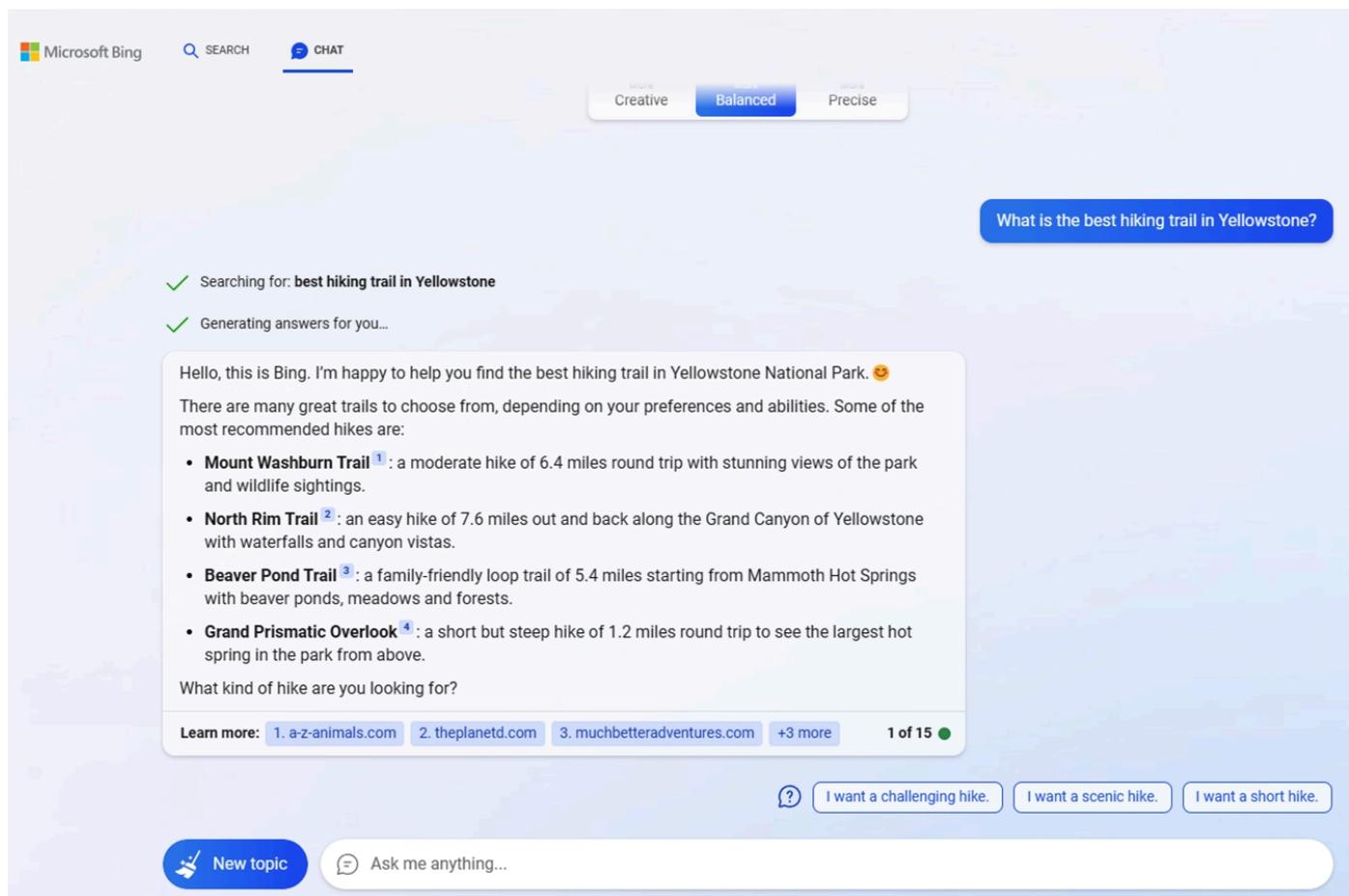
1. Grand Prismatic Spring: This is a short, easy hike to one of the most famous sights in Yellowstone. The trail is just over a mile long and takes you to a boardwalk overlooking the colorful Grand Prismatic Spring, one of the largest hot springs in the world.
2. Fairy Falls: This is a moderate hike that takes you through a beautiful forest and along the Firehole River to Fairy Falls, a 200-foot waterfall. The trail is around 5 miles round-trip.
3. Mount Washburn: This is a challenging hike that rewards hikers with incredible views from the summit of Mount Washburn. The trail is around 6 miles round-trip and gains over 1,400 feet in elevation, but the panoramic views of the park are worth it.
4. Artist Point: This is a short, easy hike to a lookout point that offers stunning views of the Yellowstone River and the Lower Falls. The trail is just over half a mile long and is wheelchair accessible.

These are just a few of the many hiking trails in Yellowstone National Park... so be sure to Regenerate response

Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 63 - Bing - Hiking in Yellowstone



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "What is the best hiking trail in Yellowstone?". Below the search bar, there are three tabs: "Creative", "Balanced" (which is selected), and "Precise". In the main content area, there is a message from Bing: "Hello, this is Bing. I'm happy to help you find the best hiking trail in Yellowstone National Park. 😊". Below this message, there is a list of recommended hikes:

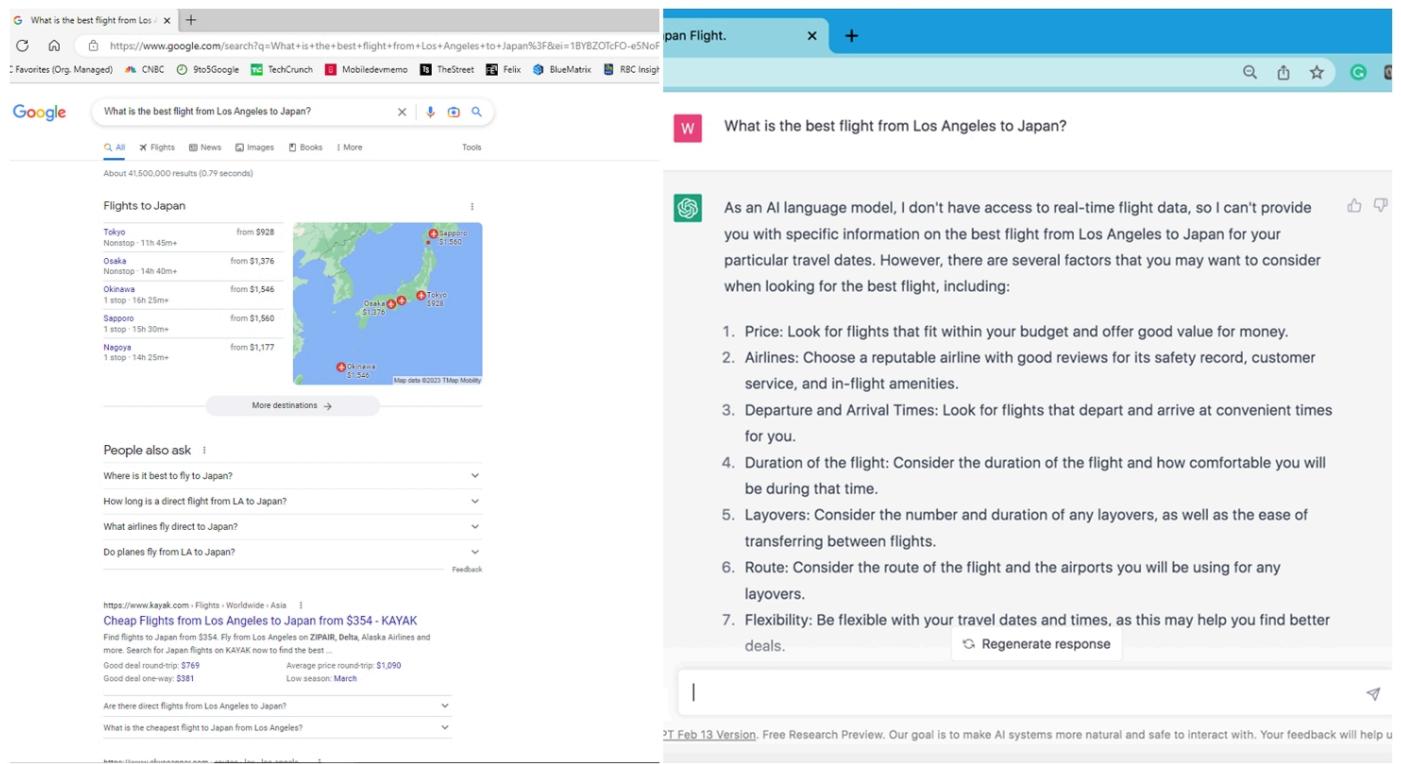
- Mount Washburn Trail <sup>1</sup>: a moderate hike of 6.4 miles round trip with stunning views of the park and wildlife sightings.
- North Rim Trail <sup>2</sup>: an easy hike of 7.6 miles out and back along the Grand Canyon of Yellowstone with waterfalls and canyon vistas.
- Beaver Pond Trail <sup>3</sup>: a family-friendly loop trail of 5.4 miles starting from Mammoth Hot Springs with beaver ponds, meadows and forests.
- Grand Prismatic Overlook <sup>4</sup>: a short but steep hike of 1.2 miles round trip to see the largest hot spring in the park from above.

Below the list, there is a question: "What kind of hike are you looking for?". Underneath this question, there is a "Learn more:" section with links: 1. [a-z-animals.com](#), 2. [theplanetd.com](#), 3. [muchbetteradventures.com](#), +3 more, and 1 of 15.

At the bottom of the interface, there are several buttons: "New topic", "Ask me anything...", "?", "I want a challenging hike.", "I want a scenic hike.", and "I want a short hike."

Source: Bing, RBC Capital Markets

Figure 64 - Google Search vs. ChatGPT - Flights



The figure shows two side-by-side search results for the query "What is the best flight from Los Angeles to Japan?"

**Google Search Results:**

- Search bar: "What is the best flight from Los Angeles to Japan?"
- Page title: "Flights to Japan" - Pan Flight.
- Map: A map of Japan showing flight routes from Los Angeles to major cities like Tokyo, Sapporo, and Osaka.
- Table: A table of flight options from Los Angeles to Japan:
 

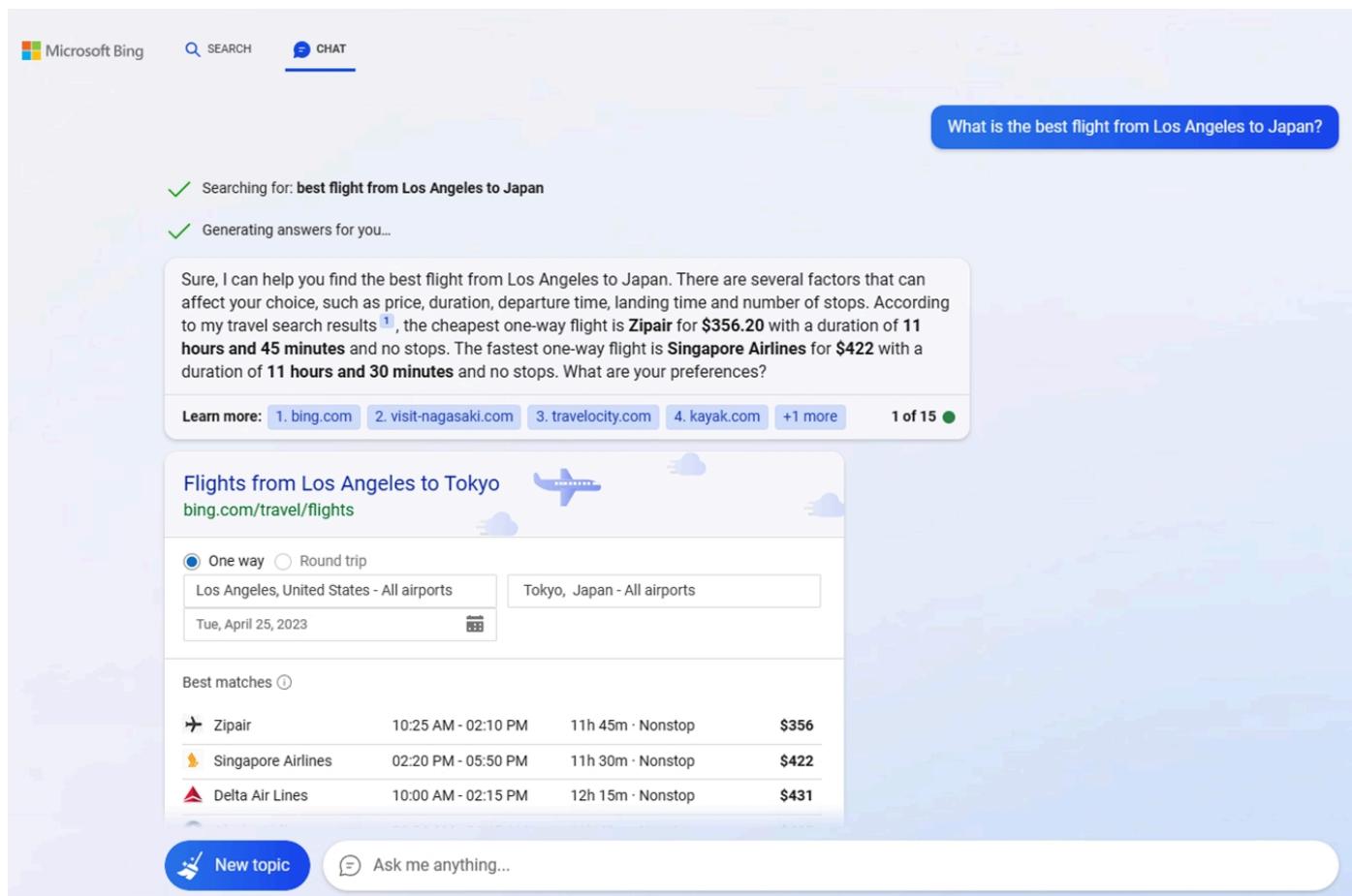
Destination	Flight Type	Flight Duration	Price
Tokyo	Nonstop	11h 45m+	\$928
Osaka	Nonstop	14h 40m+	\$1,376
Okinawa	1 stop	16h 25m+	\$1,546
Sapporo	1 stop	15h 30m+	\$1,560
Nagoya	1 stop	14h 25m+	\$1,177
- Section: "People also ask" with questions like "Where is it best to fly to Japan?", "How long is a direct flight from LA to Japan?", etc.
- Link: "Cheap Flights from Los Angeles to Japan from \$354 - KAYAK"

**ChatGPT Response:**

- Search bar: "What is the best flight from Los Angeles to Japan?"
- Text: "As an AI language model, I don't have access to real-time flight data, so I can't provide you with specific information on the best flight from Los Angeles to Japan for your particular travel dates. However, there are several factors that you may want to consider when looking for the best flight, including:
  1. Price: Look for flights that fit within your budget and offer good value for money.
  2. Airlines: Choose a reputable airline with good reviews for its safety record, customer service, and in-flight amenities.
  3. Departure and Arrival Times: Look for flights that depart and arrive at convenient times for you.
  4. Duration of the flight: Consider the duration of the flight and how comfortable you will be during that time.
  5. Layovers: Consider the number and duration of any layovers, as well as the ease of transferring between flights.
  6. Route: Consider the route of the flight and the airports you will be using for any layovers.
  7. Flexibility: Be flexible with your travel dates and times, as this may help you find better deals.
- Text: "Regenerate response"
- Text: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve."

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 65 - Bing - Flights



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the query "What is the best flight from Los Angeles to Japan?". Below the search bar, there are two green checkmarks indicating the search is underway: "Searching for: best flight from Los Angeles to Japan" and "Generating answers for you...". A text box contains a response from a generative AI: "Sure, I can help you find the best flight from Los Angeles to Japan. There are several factors that can affect your choice, such as price, duration, departure time, landing time and number of stops. According to my travel search results <sup>1</sup>, the cheapest one-way flight is Zipair for \$356.20 with a duration of 11 hours and 45 minutes and no stops. The fastest one-way flight is Singapore Airlines for \$422 with a duration of 11 hours and 30 minutes and no stops. What are your preferences?" Below this, a "Learn more" section lists links: 1. bing.com, 2. visit-nagasaki.com, 3. travevelocity.com, 4. kayak.com, +1 more. A page number "1 of 15" is also present.

**Flights from Los Angeles to Tokyo**  
[bing.com/travel/flights](http://bing.com/travel/flights)

One way  Round trip

Los Angeles, United States - All airports	Tokyo, Japan - All airports
Tue, April 25, 2023	

Best matches

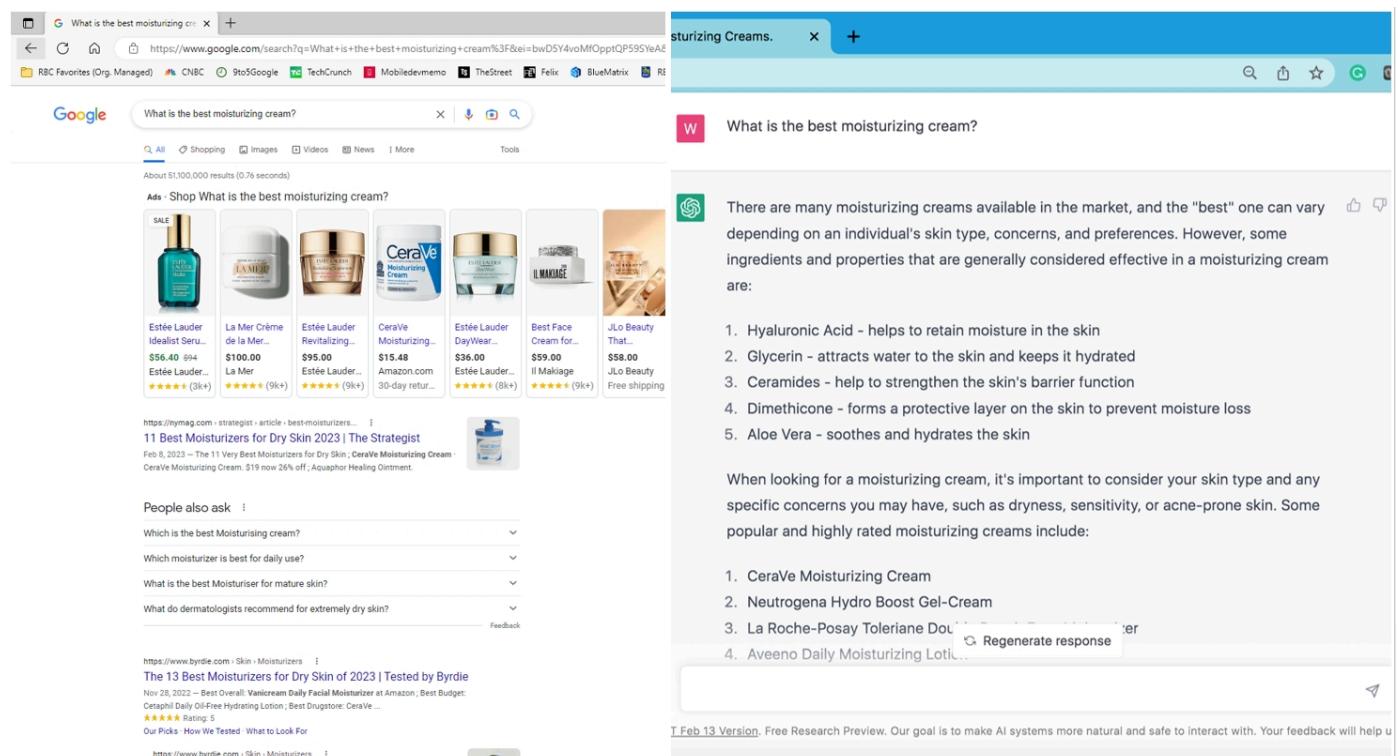
Airline	Flight Details	Duration	Price
Zipair	10:25 AM - 02:10 PM	11h 45m · Nonstop	\$356
Singapore Airlines	02:20 PM - 05:50 PM	11h 30m · Nonstop	\$422
Delta Air Lines	10:00 AM - 02:15 PM	12h 15m · Nonstop	\$431

New topic Ask me anything...

Source: Bing, RBC Capital Markets

## Ecommerce

Figure 66 - Google Search vs. ChatGPT - Skincare Product Recommendation



The figure shows a side-by-side comparison of search results for "What is the best moisturizing cream?" on Google and ChatGPT.

**Google Search Results:**

- Search Bar:** What is the best moisturizing cream?
- Ads:** Shop What is the best moisturizing cream?
  - Estée Lauder Idealist Serum \$56.40
  - La Mer Crème de la Mer \$100.00
  - Estée Lauder Revitalizing... \$95.00
  - CeraVe Moisturizing Cream \$15.48
  - Estée Lauder Daywear... \$36.00
  - Best Face Cream for... \$59.00
  - JL Beauty That... \$58.00
  - Il Makigae
  - JL Beauty Free shipping
- Organic Results:**
  - [11 Best Moisturizers for Dry Skin 2023 | The Strategist](https://nymag.com)
  - [The 13 Best Moisturizers for Dry Skin of 2023 | Tested by Byrdie](https://www.byrdie.com)
- People also ask:**
  - Which is the best Moisturising cream?
  - Which moisturizer is best for daily use?
  - What is the best Moisturiser for mature skin?
  - What do dermatologists recommend for extremely dry skin?

**ChatGPT Response:**

There are many moisturizing creams available in the market, and the "best" one can vary depending on an individual's skin type, concerns, and preferences. However, some ingredients and properties that are generally considered effective in a moisturizing cream are:

1. Hyaluronic Acid - helps to retain moisture in the skin
2. Glycerin - attracts water to the skin and keeps it hydrated
3. Ceramides - help to strengthen the skin's barrier function
4. Dimethicone - forms a protective layer on the skin to prevent moisture loss
5. Aloe Vera - soothes and hydrates the skin

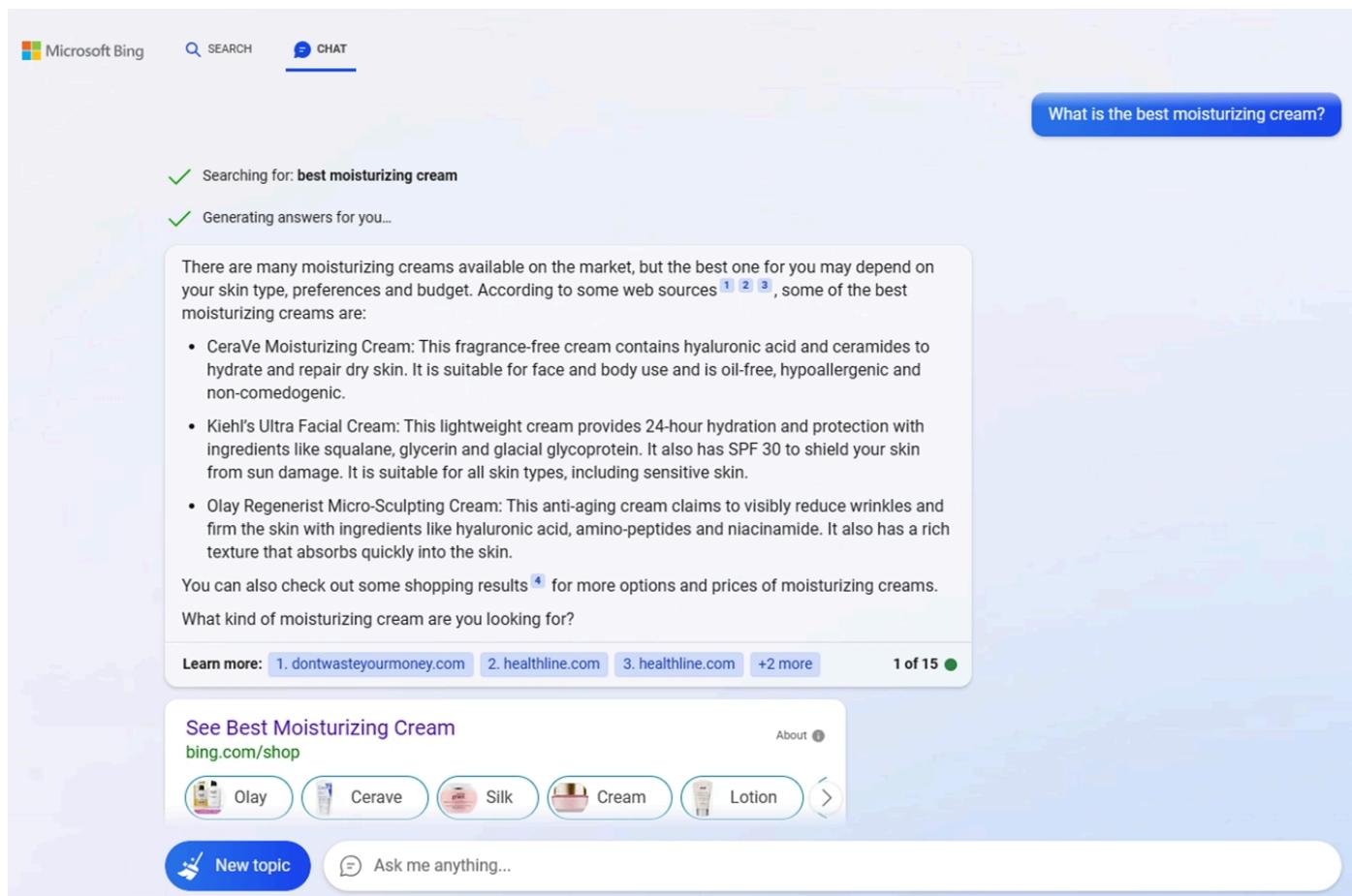
When looking for a moisturizing cream, it's important to consider your skin type and any specific concerns you may have, such as dryness, sensitivity, or acne-prone skin. Some popular and highly rated moisturizing creams include:

1. CeraVe Moisturizing Cream
2. Neutrogena Hydro Boost Gel-Cream
3. La Roche-Posay Toleriane Douceur
4. Aveeno Daily Moisturizing Lotion

Regenerate response

Source: Google Search, ChatGPT, RBC Capital Markets

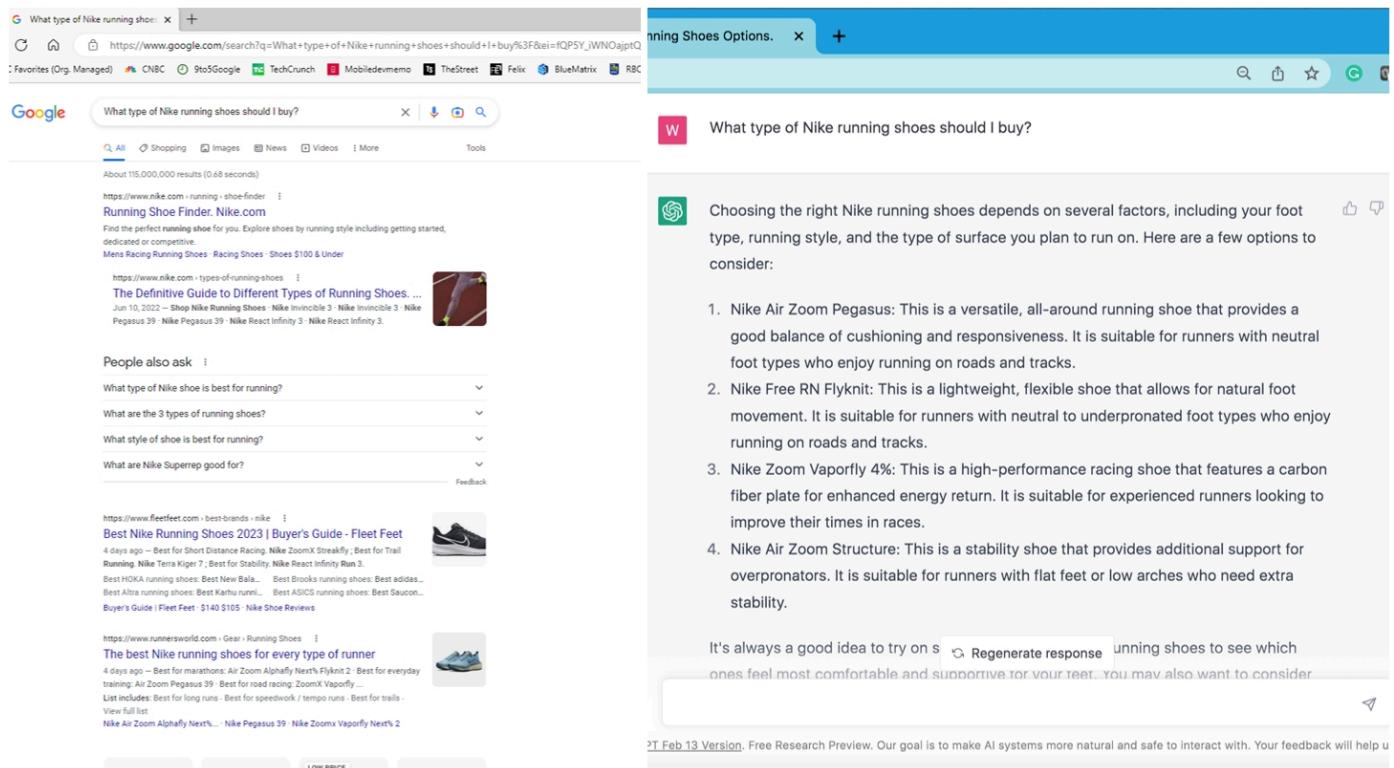
Figure 67 - Bing - Skincare Product Recommendation



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the query "What is the best moisturizing cream?". Below the search bar, there are two green checkmarks indicating the search process: "Searching for: best moisturizing cream" and "Generating answers for you...". The main content area displays a paragraph about moisturizing creams, mentioning that the best one depends on skin type, preferences, and budget. It lists three recommended products: CeraVe Moisturizing Cream, Kiehl's Ultra Facial Cream, and Olay Regenerist Micro-Sculpting Cream. Below this, there is a note about shopping results and a question about the type of moisturizing cream being looked for. At the bottom, there is a "Learn more" section with links to [1. dontwasteyourmoney.com](#), [2. healthline.com](#), [3. healthline.com](#), and "+2 more". A page number "1 of 15" is also present. Below the main content, there is a "See Best Moisturizing Cream" section with a link to [bing.com/shop](#). This section includes icons for Olay, Cerave, Silk, Cream, and Lotion, along with a "New topic" button and an "Ask me anything..." input field.

Source: Bing, RBC Capital Markets

Figure 68 - Google Search vs. ChatGPT - Shoe Recommendation



The figure shows two side-by-side search results for the query "What type of Nike running shoes should I buy?"

**Google Search Results:**

- Page 1:** Shows search filters (All, Shopping, Images, News, Videos, More) and tools. It lists results from Nike.com, Fleet Feet, and RunnersWorld.com, each with a small image of a shoe.
- Page 2:** Shows a "People also ask" section with links like "What type of Nike shoe is best for running?", "What are the 3 types of running shoes?", etc.

**ChatGPT Response:**

What type of Nike running shoes should I buy?

Choosing the right Nike running shoes depends on several factors, including your foot type, running style, and the type of surface you plan to run on. Here are a few options to consider:

1. Nike Air Zoom Pegasus: This is a versatile, all-around running shoe that provides a good balance of cushioning and responsiveness. It is suitable for runners with neutral foot types who enjoy running on roads and tracks.
2. Nike Free RN Flyknit: This is a lightweight, flexible shoe that allows for natural foot movement. It is suitable for runners with neutral to underpronated foot types who enjoy running on roads and tracks.
3. Nike Zoom Vapormax 4%: This is a high-performance racing shoe that features a carbon fiber plate for enhanced energy return. It is suitable for experienced runners looking to improve their times in races.
4. Nike Air Zoom Structure: This is a stability shoe that provides additional support for overpronators. It is suitable for runners with flat feet or low arches who need extra stability.

It's always a good idea to try on some running shoes to see which ones feel most comfortable and supportive for your feet. You may also want to consider

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Source: Google Search, ChatGPT, RBC Capital Markets

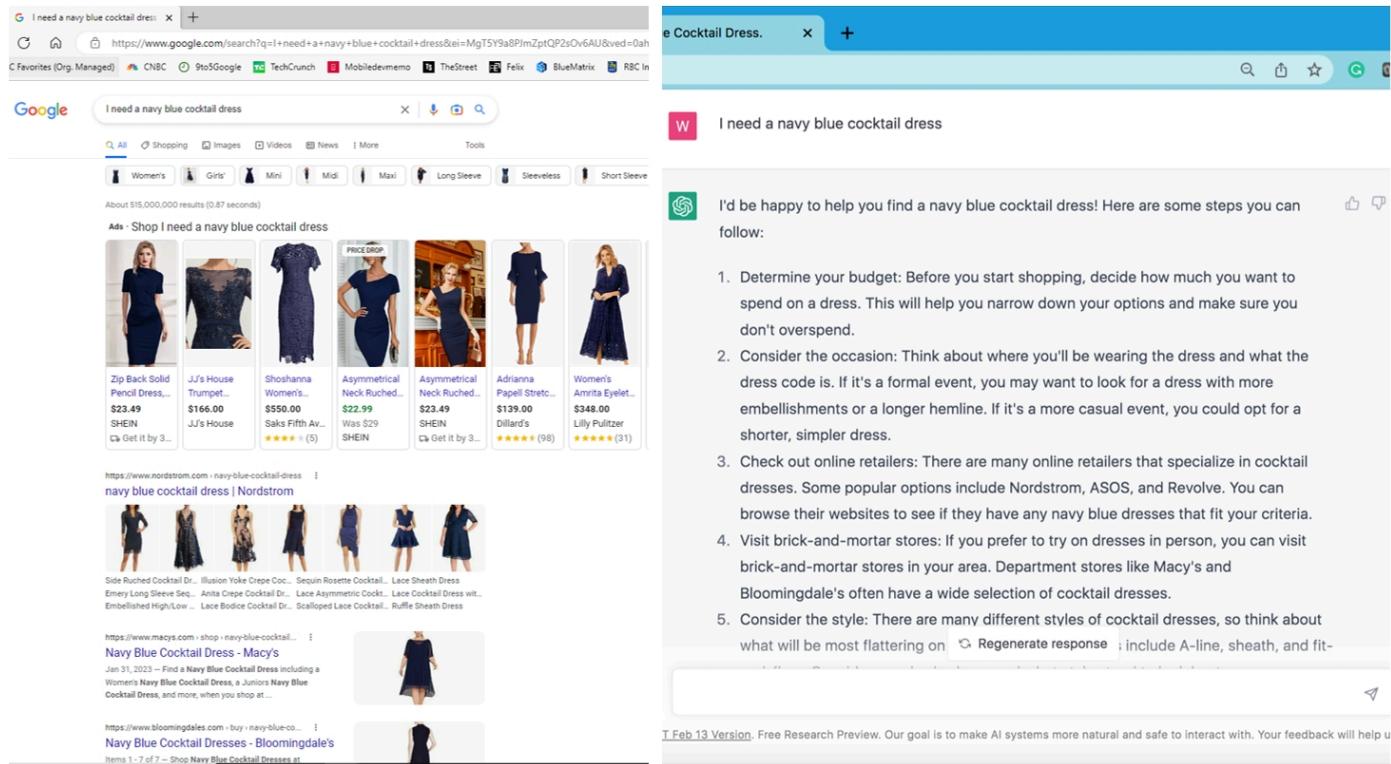


Figure 69 - Bing - Shoe Recommendation

The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the text "What type of Nike running shoes should I buy?". Below the search bar, there are two green checkmarks indicating the search process: "Searching for: Nike running shoes" and "Generating answers for you...". A text box contains advice: "There are many types of Nike running shoes to choose from, depending on your preferences and needs. Some factors to consider are:" followed by a bulleted list: "The surface you run on: road, trail, track or treadmill", "The distance you run: short, medium or long", "The cushioning level you prefer: soft, medium or firm", and "The fit and feel you like: snug, roomy or adaptive". Another section discusses the best Nike running shoes of 2022, mentioning the Nike Pegasus Turbo Next Nature, Nike Quest 4, and Nike Zegama. It also suggests browsing shopping results to compare prices, features, and reviews. At the bottom, there are links to learn more: 1. runnersworld.com, 2. bing.com, 3. gq.com, +3 more, and a page indicator "1 of 15". There are also buttons for "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets

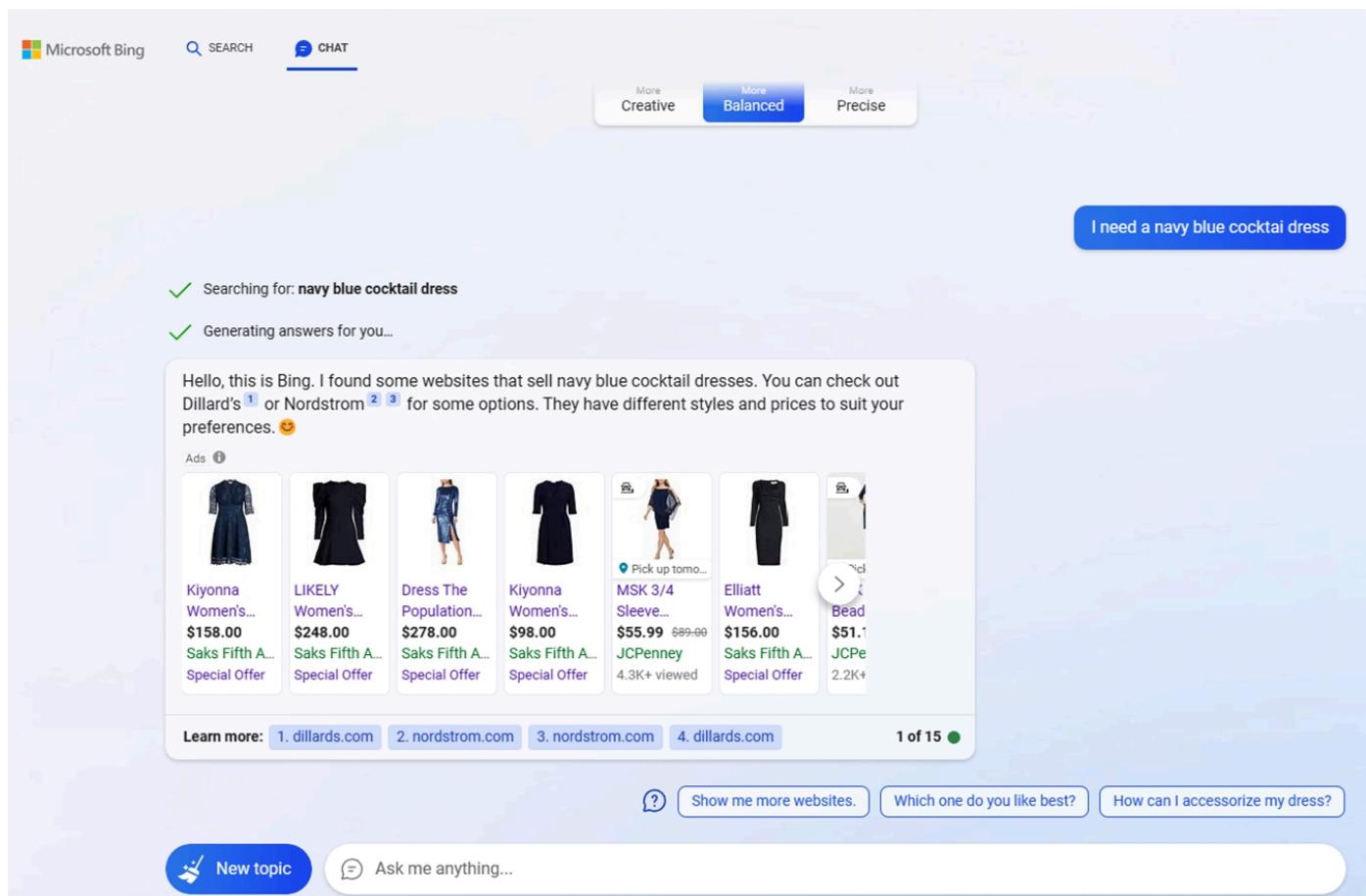
Figure 70 - Google Search vs. ChatGPT - Dress Recommendation



The figure shows two side-by-side search results. On the left is a Google search result for "I need a navy blue cocktail dress". It includes a search bar, a navigation bar with links like 'All', 'Shopping', 'Images', etc., and a grid of eight navy blue cocktail dresses from various brands like SHEIN, JJ's House, Shoshanna, and Adrianna Papell. Below the grid is a snippet from Nordstrom's website. Further down are results from Macy's and Bloomingdale's. On the right is a ChatGPT interface with the same search query. ChatGPT responds with a message: "I'd be happy to help you find a navy blue cocktail dress! Here are some steps you can follow:" followed by five numbered tips. At the bottom of the ChatGPT window, there is a note: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve." A "Regenerate response" button is also visible.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 71 - Bing - Dress Recommendation



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the text "I need a navy blue cocktail dress". Below the search bar, there are three buttons: "More Creative", "More Balanced" (which is highlighted in blue), and "More Precise".

On the left, there is a sidebar with two green checkmarks: "Searching for: navy blue cocktail dress" and "Generating answers for you...".

The main content area displays a message from Bing: "Hello, this is Bing. I found some websites that sell navy blue cocktail dresses. You can check out Dillard's <sup>1</sup> or Nordstrom <sup>2</sup> <sup>3</sup> for some options. They have different styles and prices to suit your preferences. 😊".

Below this message, there is a section titled "Ads" with a count of 7. It shows seven product cards for navy blue cocktail dresses:

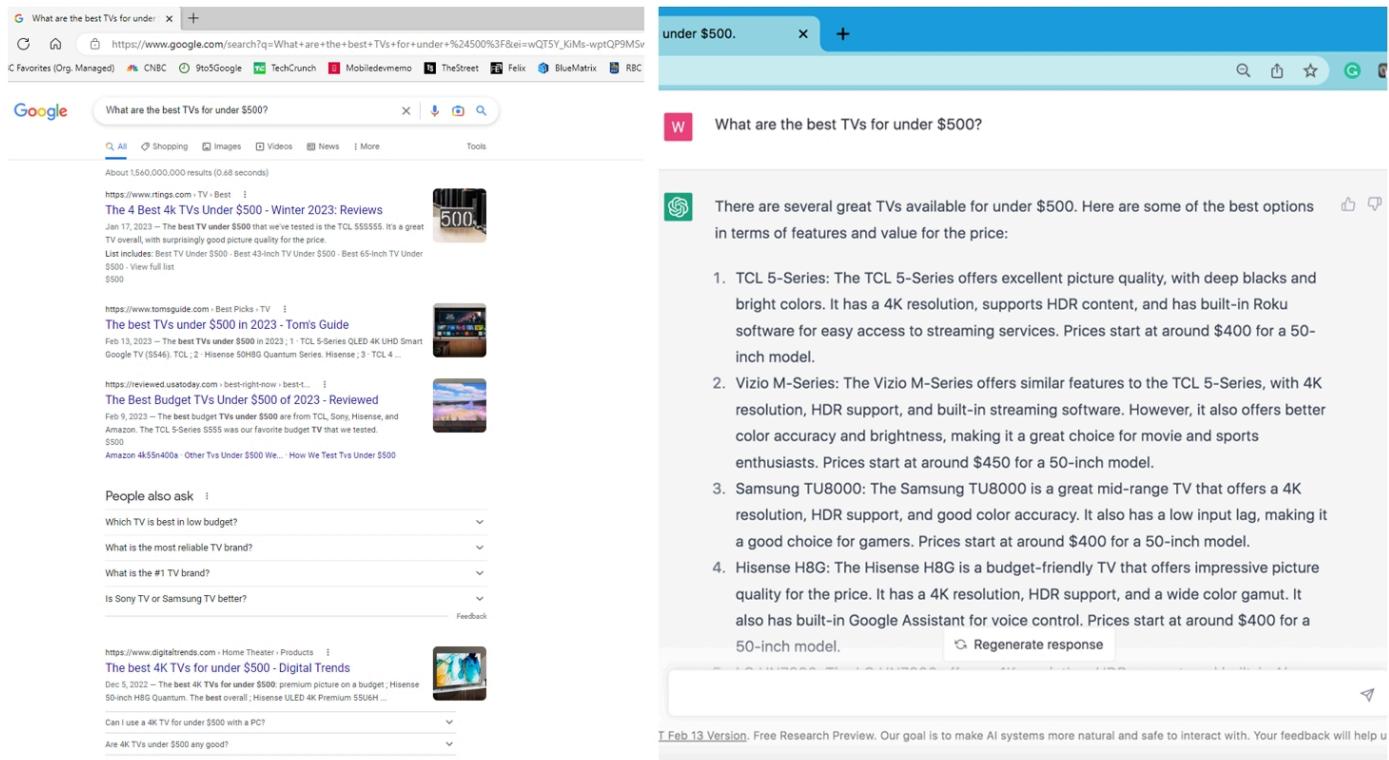
- Kiyonna Women's... \$158.00
- LIKELY Women's... \$248.00
- Dress The Population... \$278.00
- Kiyonna Women's... \$98.00
- Pick up tomo... MSK 3/4 Sleeve... \$55.99
- Elliatt Women's... \$156.00
- Saks Fifth A... Saks Fifth A... \$51.11
- Saks Fifth A... Special Offer JCPenney 4.3K+ viewed
- Bead Bead 2.2K+

Below the ads, there are links to learn more: [1. dillards.com](https://www.dillards.com), [2. nordstrom.com](https://www.nordstrom.com), [3. nordstrom.com](https://www.nordstrom.com), and [4. dillards.com](https://www.dillards.com). There is also a page indicator "1 of 15".

At the bottom, there are several buttons: "New topic", "Ask me anything...", "? Show me more websites.", "Which one do you like best?", and "How can I accessorize my dress?".

Source: Bing, RBC Capital Markets

**Figure 72 - Google Search vs. ChatGPT - Affordable TV Recommendation**



The figure shows a side-by-side comparison of search results for "What are the best TVs for under \$500?" on Google and a response from ChatGPT.

**Google Search Results:**

- Search Bar:** What are the best TVs for under \$500?
- Results:**
  - [The 4 Best 4K TVs Under \\$500 - Winter 2023: Reviews](https://www.rtings.com/TV-Best-4K-TVs-Under-$500-Winter-2023-Reviews) (Jan 17, 2023)
  - [The best TVs under \\$500 in 2023 - Tom's Guide](https://www.tomeguide.com/The-best-TVs-under-$500-in-2023---Tom's-Guide) (Feb 13, 2023)
  - [The Best Budget TVs Under \\$500 of 2023 - Reviewed](https://reviewed.usatoday.com/best-budget-tvs-under-$500-reviewed) (Feb 9, 2023)
  - [The best 4K TVs for under \\$500 - Digital Trends](https://www.digitaltrends.com/home-theater-products/the-best-4k-tvs-for-under-$500-digital-trends) (Dec 5, 2022)
- People also ask:**
  - Which TV is best in low budget?
  - What is the most reliable TV brand?
  - What is the #1 TV brand?
  - Is Sony TV or Samsung TV better?

**ChatGPT Response:**

There are several great TVs available for under \$500. Here are some of the best options in terms of features and value for the price:

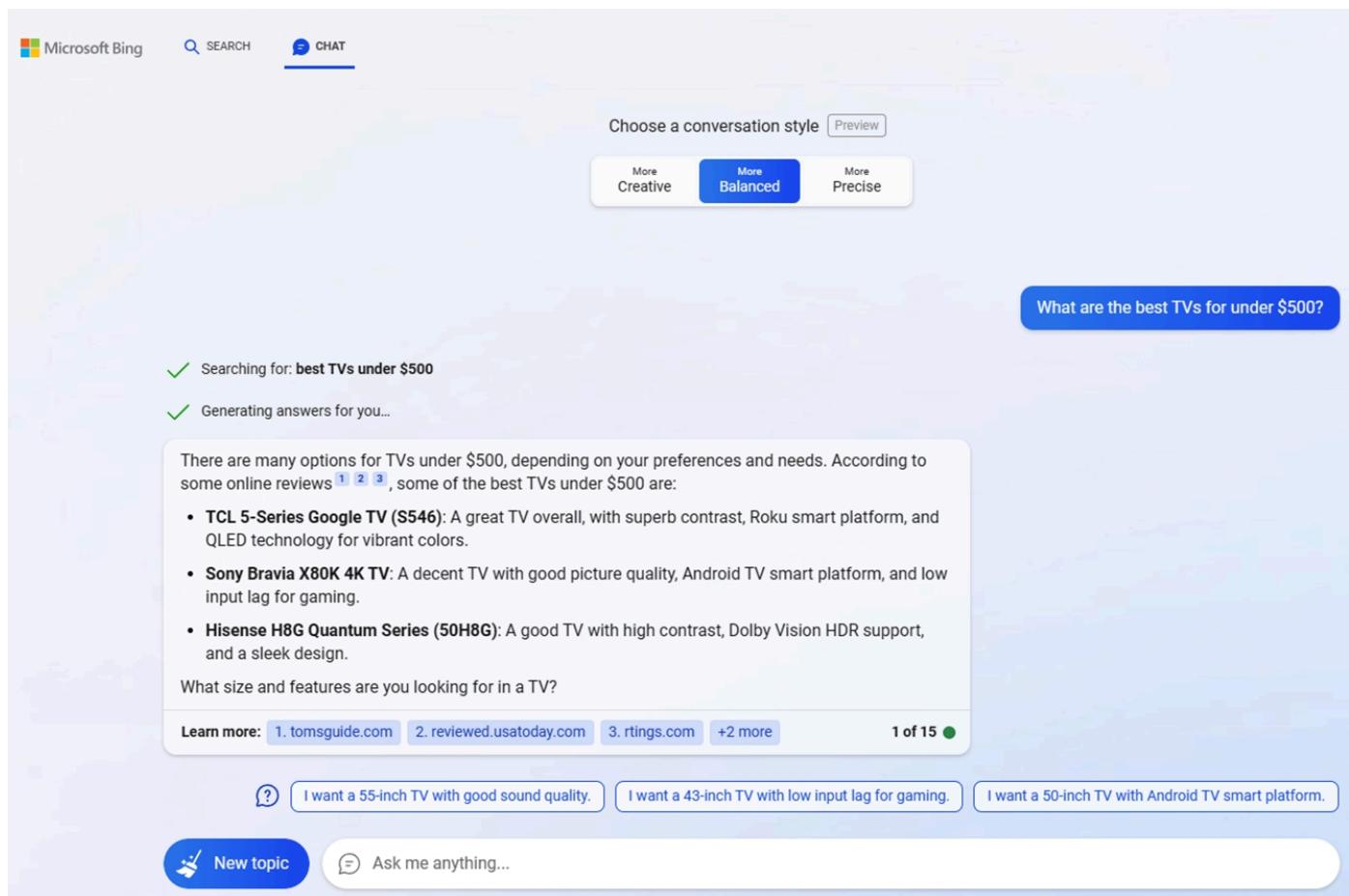
1. **TCL 5-Series:** The TCL 5-Series offers excellent picture quality, with deep blacks and bright colors. It has a 4K resolution, supports HDR content, and has built-in Roku software for easy access to streaming services. Prices start at around \$400 for a 50-inch model.
2. **Vizio M-Series:** The Vizio M-Series offers similar features to the TCL 5-Series, with 4K resolution, HDR support, and built-in streaming software. However, it also offers better color accuracy and brightness, making it a great choice for movie and sports enthusiasts. Prices start at around \$450 for a 50-inch model.
3. **Samsung TU8000:** The Samsung TU8000 is a great mid-range TV that offers a 4K resolution, HDR support, and good color accuracy. It also has a low input lag, making it a good choice for gamers. Prices start at around \$400 for a 50-inch model.
4. **Hisense H8G:** The Hisense H8G is a budget-friendly TV that offers impressive picture quality for the price. It has a 4K resolution, HDR support, and a wide color gamut. It also has built-in Google Assistant for voice control. Prices start at around \$400 for a 50-inch model.

**Feedback:** Regenerate response

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Source: Google Search, ChatGPT, RBC Capital Markets

Figure 73 - Bing - Affordable TV Recommendation



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "What are the best TVs for under \$500?". Below the search bar, there is a "Choose a conversation style" section with three options: "More Creative", "More Balanced" (which is selected), and "More Precise".

In the main content area, there is a progress indicator: "Searching for: best TVs under \$500" and "Generating answers for you...". The text below states: "There are many options for TVs under \$500, depending on your preferences and needs. According to some online reviews 1 2 3, some of the best TVs under \$500 are:" followed by a bulleted list of three TV models: TCL 5-Series Google TV (S546), Sony Bravia X80K 4K TV, and Hisense H8G Quantum Series (50H8G). There is also a question "What size and features are you looking for in a TV?" and a "Learn more" section with links to tom'sguide.com, reviewed.usatoday.com, rttings.com, and +2 more.

At the bottom, there are three suggestions: "I want a 55-inch TV with good sound quality.", "I want a 43-inch TV with low input lag for gaming.", and "I want a 50-inch TV with Android TV smart platform.". There are also "New topic" and "Ask me anything..." buttons.

Source: Bing, RBC Capital Markets



Figure 74 - Google Search vs. ChatGPT - iPhone Case Recommendation

The figure shows two side-by-side search results for "Best red iPhone 12 cases".

**Google Search Results:** This section displays a grid of 14 red iPhone 12 cases from various brands like OTOFLY, OtterBox, FLAUNT, iPhone, Spigen, and Caseology. Each item includes a small image, the brand name, model, price, and a link to the product page.

**ChatGPT Recommendation:** This section starts with a heading: "There are many great red iPhone 12 cases available on the market, and the best one for you will depend on your individual preferences and needs. However, here are some highly-rated options to consider:" followed by a numbered list of four cases. Below the list is a "Regenerate response" button and a note about the AI system's goal.

Rank	Case Type	Brand	Color	Material	Price	Rating
1	Leather Case	(PRODUCT)RED	Red	Leather	\$14.99	4.5
2	Tough Armor Case	Spigen	Red	Polycarbonate and TPU	\$14.99	4.5
3	Defender Series Case	OtterBox	Red	Polycarbonate	\$59.95	4.5
4	Parallax Case	Caseology	Burgundy	Polycarbonate	\$29.99	4.5

Source: Google Search, ChatGPT, RBC Capital Markets



Figure 75 - Bing - iPhone Case Recommendation

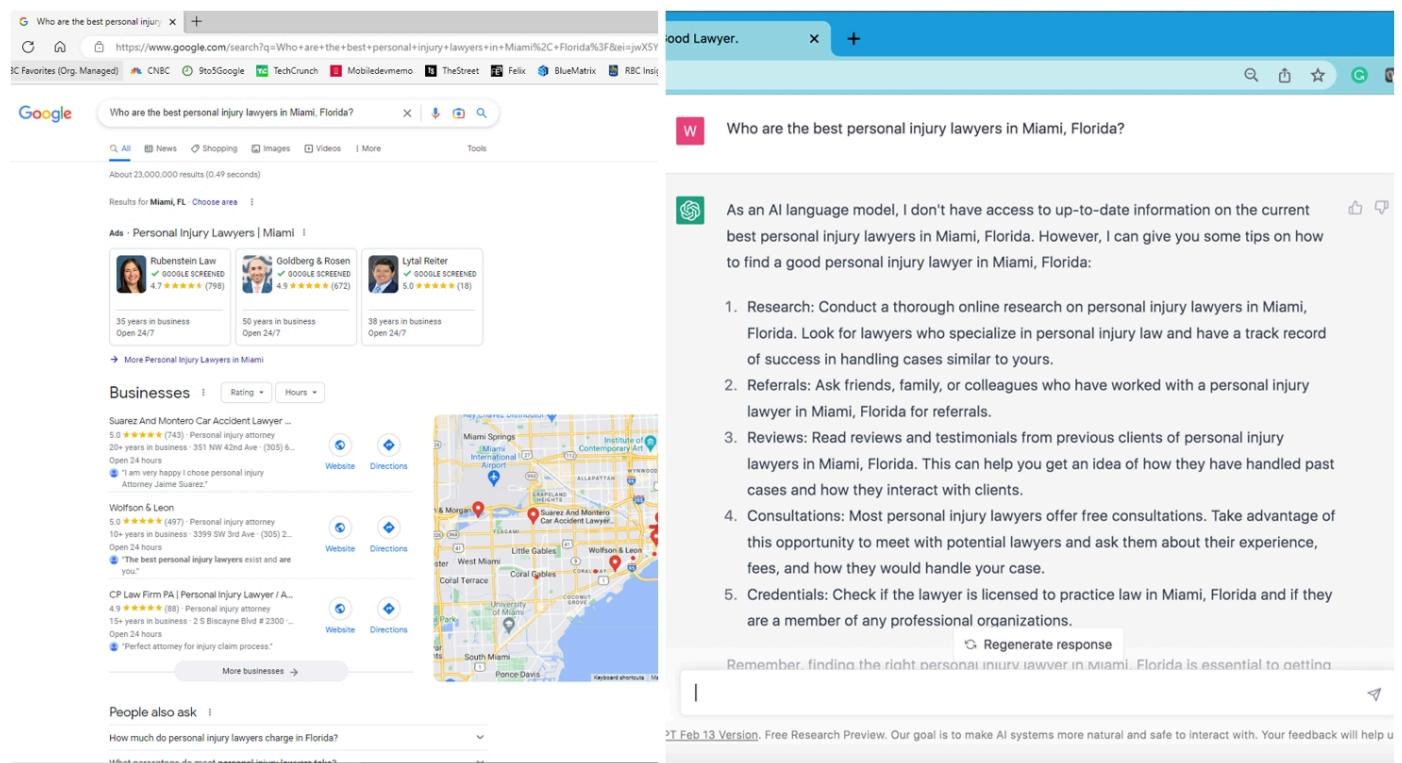
The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the query "Best red iPhone 12 cases?" and buttons for "SEARCH" and "CHAT". Below the search bar, there are two green checkmarks indicating the process: "Searching for: best red iPhone 12 cases" and "Generating answers for you...". A message from Bing states: "Hello, this is Bing. I found some web pages that list some of the best red iPhone 12 cases you can buy. Here are some of them:" followed by a bulleted list of case brands. Below this, a question asks: "What kind of case are you looking for? Do you want a wallet case, a clear case, a protective case or something else?". A section titled "Ads" displays eight product cards for various iPhone 12 cases, each with a small image, the product name, price, seller, and shipping information. At the bottom, there are buttons for "New topic" and "Ask me anything...".

Product	Seller	Price	Shipping
iPhone 12 Mini Case	Ekster	\$25.00	Free shipping
Premium PU Leather...	Storevon	\$32.00	Free shipping
Casely iPhone 12...	Casely	\$17.50	Web access...
Premium PU Leather...	Storevon	\$32.00	Free shipping
Casebus iPhone 12...	Casebus	\$29.99	Free shipping
Casebus iPhone 12...	Casebus	\$34.99	Free shipping
iPhor Case	Case	\$34.99	Free s

Source: Bing, RBC Capital Markets

## Services

Figure 76 - Google Search vs. ChatGPT - Finding an Attorney



The figure shows two side-by-side search results for the query "Who are the best personal injury lawyers in Miami, Florida?"

**Google Search Results:**

- Search Bar:** Who are the best personal injury lawyers in Miami, Florida?
- Results:**
  - Ads:** Personal Injury Lawyers | Miami
    - Rubenstein Law (4.7 stars, 798 reviews)
    - Goldberg & Rosen (4.9 stars, 672 reviews)
    - Lytal Reiter (5.0 stars, 18 reviews)
  - Businesses:**
    - Suarez And Montero Car Accident Lawyer (5.0 stars, 743 reviews)
    - Wolfson & Leon (5.0 stars, 497 reviews)
    - CP Law Firm PA | Personal Injury Lawyer / A... (4.9 stars, 88 reviews)
  - Map:** A map of Miami showing various neighborhoods and business locations.
  - People also ask:**
    - How much do personal injury lawyers charge in Florida?

**ChatGPT Response:**

- Search Bar:** Who are the best personal injury lawyers in Miami, Florida?
- Response:**

As an AI language model, I don't have access to up-to-date information on the current best personal injury lawyers in Miami, Florida. However, I can give you some tips on how to find a good personal injury lawyer in Miami, Florida:

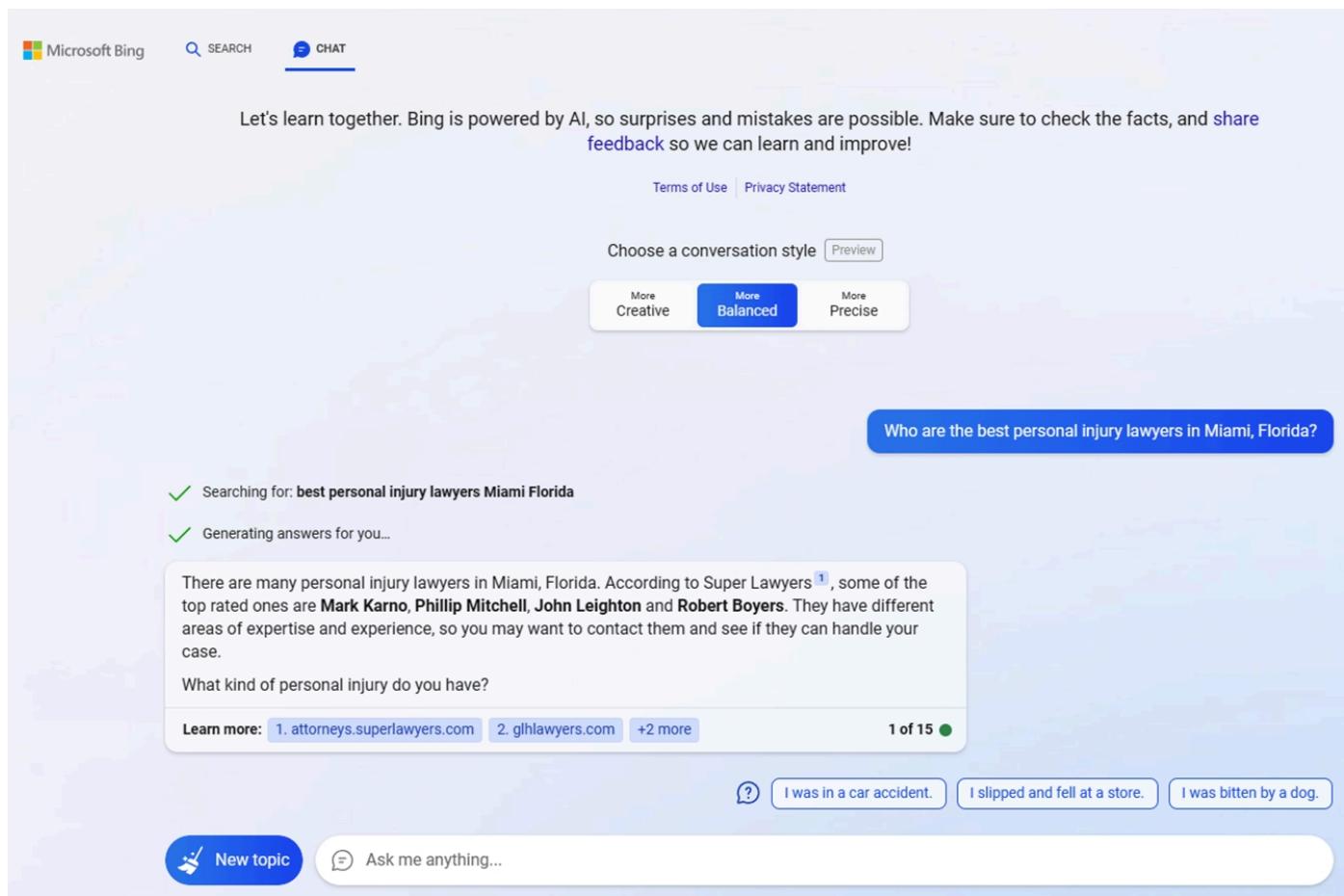
  1. Research: Conduct a thorough online research on personal injury lawyers in Miami, Florida. Look for lawyers who specialize in personal injury law and have a track record of success in handling cases similar to yours.
  2. Referrals: Ask friends, family, or colleagues who have worked with a personal injury lawyer in Miami, Florida for referrals.
  3. Reviews: Read reviews and testimonials from previous clients of personal injury lawyers in Miami, Florida. This can help you get an idea of how they have handled past cases and how they interact with clients.
  4. Consultations: Most personal injury lawyers offer free consultations. Take advantage of this opportunity to meet with potential lawyers and ask them about their experience, fees, and how they would handle your case.
  5. Credentials: Check if the lawyer is licensed to practice law in Miami, Florida and if they are a member of any professional organizations.

[Regenerate response](#)

Remember, finding the right personal injury lawyer in Miami, Florida is essential to getting the best outcome for your case.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 77 - Bing - Finding an Attorney



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the navigation bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and [share feedback](#) so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". Below this, there is a section titled "Choose a conversation style" with three options: "More Creative" (grayed out), "More Balanced" (selected and highlighted in blue), and "More Precise".

In the main search area, a question is asked: "Who are the best personal injury lawyers in Miami, Florida?". Below the question, two green checkmarks indicate the process: "Searching for: **best personal injury lawyers Miami Florida**" and "Generating answers for you...". A text box contains the response: "There are many personal injury lawyers in Miami, Florida. According to Super Lawyers <sup>1</sup>, some of the top rated ones are **Mark Karno, Phillip Mitchell, John Leighton** and **Robert Boyers**. They have different areas of expertise and experience, so you may want to contact them and see if they can handle your case." Below this, a sub-question asks, "What kind of personal injury do you have?". At the bottom of the search results, there are links for "Learn more: 1. [attorneys.superlawyers.com](#) 2. [ghlawyers.com](#) +2 more" and a page number "1 of 15".

At the bottom of the interface, there are several buttons: a question mark icon, "I was in a car accident.", "I slipped and fell at a store.", "I was bitten by a dog.", a "New topic" button with a speech bubble icon, and an "Ask me anything..." button with a speech bubble icon.

Source: Bing, RBC Capital Markets



Figure 78 - Google Search vs. ChatGPT - Haircut Recommendation

The figure shows two side-by-side browser windows. The left window is a Google search for 'Where should I go for a haircut in Boston, Massachusetts?'. It displays a map of Boston with several red pins indicating salon locations. Below the map is a list of businesses, including 'Street Salon & Barber Shop' and 'WorkShop82'. The right window is a ChatGPT interface with the same search query. ChatGPT responds by stating it cannot provide real-time information and instead suggests popular salons like James Joseph Salon, Jeffrey Lyle Salon, G20 Spa + Salon, Safar Boston, and Mizu Boston.

Google search results for "Where should I go for a haircut in Boston, Massachusetts?"

Businesses listed:

- Street Salon & Barber Shop
- WorkShop82
- Louie's Hair Cuts

ChatGPT response:

As an AI language model, I don't have access to real-time information on current conditions or recommendations, so I cannot provide up-to-date information on specific hair salons in Boston. However, I can suggest some popular hair salons in the area for you to research further:

1. James Joseph Salon: Located in Back Bay, this salon offers a range of hair services, including haircuts, coloring, and styling.
2. Jeffrey Lyle Salon: This salon, located in the South End, offers a variety of hair services, including haircuts, coloring, and extensions.
3. G20 Spa + Salon: Located in the North End, this salon offers a range of services, including haircuts, coloring, and styling.
4. Safar Boston: This salon, located in the Financial District, offers a range of hair services, including haircuts, coloring, and styling.
5. Mizu Boston: Located in the Back Bay, this salon offers a range of hair services, including haircuts, coloring, and styling.

It's always a good idea to read reviews and check the salon's website for information on their services, pricing, and availability.

Source: Google Search, ChatGPT, RBC Capital Markets

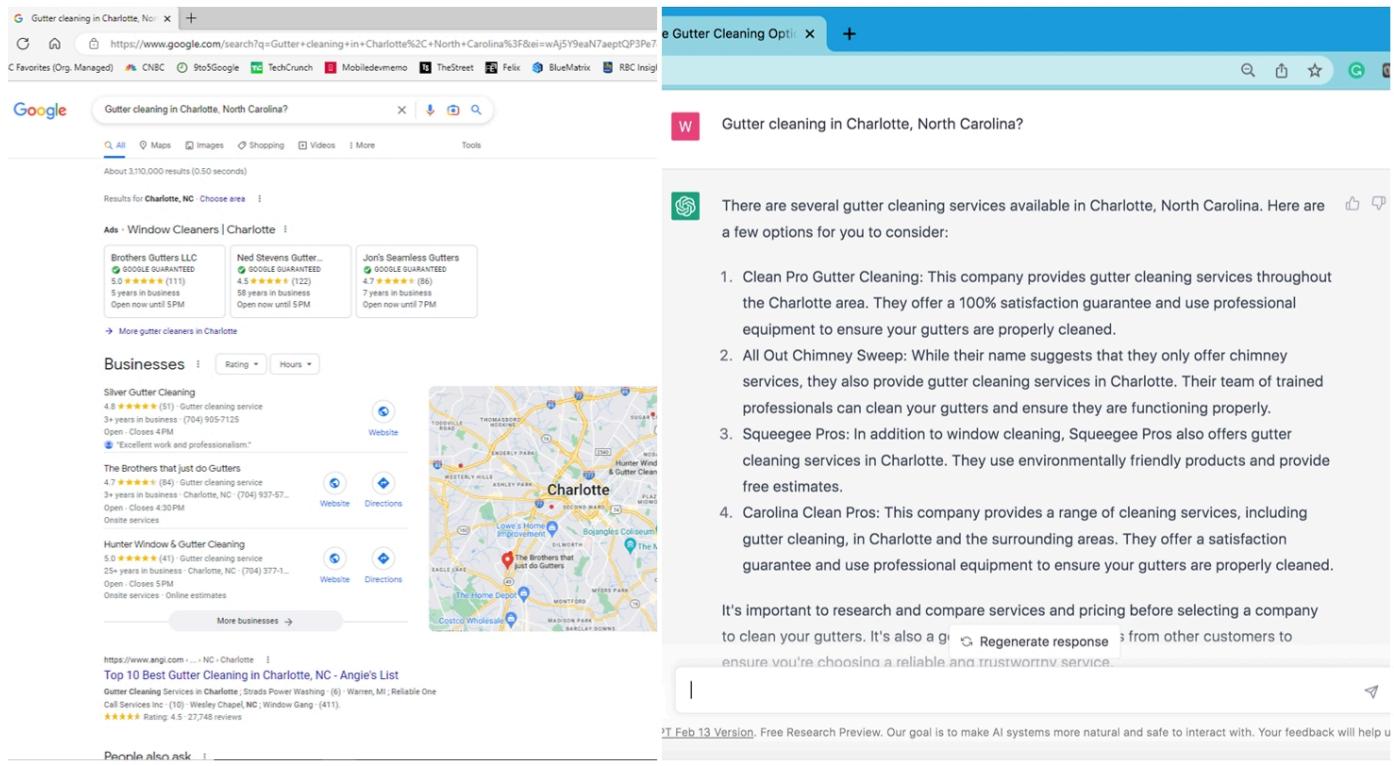


Figure 79 - Bing - Haircut Recommendation

The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder text "Where should I go for a haircut in Boston, Massachusetts?". Below the search bar, there are two green checkmark icons: "Searching for: best haircut in Boston, Massachusetts" and "Generating answers for you...". A large text box contains the generated response from Bing. It starts with "Hello, this is Bing. I can help you find a good place for a haircut in Boston, Massachusetts. 😊". It then recommends Viselli Salon, which has a 4.4 rating and 314 reviews, located at 297 Newbury St. It also mentions Zoe Hair Studio, which has a 5-star rating and 90 reviews, located at 3 Tyler St. Another recommendation is Boston Barber & Tattoo Co., which has a 4-star rating and 302 reviews, located at 113 Salem St. The response concludes by saying there are many more options to explore online. At the bottom of the text box, there are links to learn more: 1. bing.com, 2. yelp.com, 3. bostonmagazine.com, +3 more. To the right, it says "1 of 15". Below the text box, there are four buttons: "?", "I want a short bob.", "I want a fade with a beard trim.", and "I want some highlights.". At the very bottom, there are two buttons: "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets

Figure 80 - Google Search vs. ChatGPT - Home Services



The figure shows a side-by-side comparison of search results for "Gutter cleaning in Charlotte, North Carolina".

**Google Search Results:**

- Search Bar:** Gutter cleaning in Charlotte, North Carolina?
- Header:** Google | Gutter cleaning in Charlotte, North Carolina? | +
- Results:**
  - Ads:** Window Cleaners | Charlotte
  - Businesses:**
    - Silver Gutter Cleaning: 4.8 stars (51) - Gutter cleaning service, 3+ years in business, Open - Closes 4PM
    - The Brothers that Just do Gutters: 4.7 stars (64) - Gutter Cleaning service, 3+ years in business, Charlotte, NC, Open - Closes 4:30PM
    - Hunter Window & Gutter Cleaning: 5.0 stars (41) - Gutter cleaning service, 25+ years in business, Charlotte, NC, Open - Closes 5PM
  - Map:** A map of Charlotte, NC showing various neighborhoods and landmarks.
  - Footer:** More businesses →
- ChatGPT Response:**

Gutter cleaning in Charlotte, North Carolina?

There are several gutter cleaning services available in Charlotte, North Carolina. Here are a few options for you to consider:

  1. Clean Pro Gutter Cleaning: This company provides gutter cleaning services throughout the Charlotte area. They offer a 100% satisfaction guarantee and use professional equipment to ensure your gutters are properly cleaned.
  2. All Out Chimney Sweep: While their name suggests that they only offer chimney services, they also provide gutter cleaning services in Charlotte. Their team of trained professionals can clean your gutters and ensure they are functioning properly.
  3. Squeegee Pros: In addition to window cleaning, Squeegee Pros also offers gutter cleaning services in Charlotte. They use environmentally friendly products and provide free estimates.
  4. Carolina Clean Pros: This company provides a range of cleaning services, including gutter cleaning, in Charlotte and the surrounding areas. They offer a satisfaction guarantee and use professional equipment to ensure your gutters are properly cleaned.

It's important to research and compare services and pricing before selecting a company to clean your gutters. It's also a good idea to read reviews from other customers to ensure you're choosing a reliable and trustworthy service.

Source: Google Search, ChatGPT, RBC Capital Markets

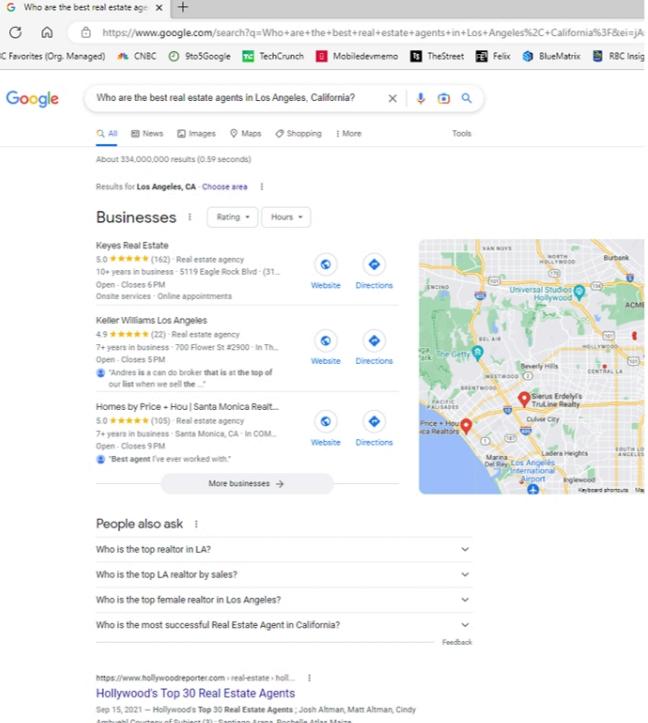


Figure 81 - Bing - Home Services

The screenshot shows the Microsoft Bing search interface. At the top, there are buttons for "Microsoft Bing", "SEARCH", and "CHAT". A blue button on the right says "Gutter cleaning in Charlotte, North Carolina?". Below the search bar, there are two green checkmarks: "Searching for: gutter cleaning in Charlotte, North Carolina" and "Generating answers for you...". A message from Bing asks if the user wants to see top local or web results. Below this, a map shows several service locations in Charlotte, North Carolina, including "Charlotte Gutters Quick", "H & S Roofing & Gu...", and "The Brothers that just...". Each location has a red pin and a small icon. Below the map, there are two service cards: one for "The Brothers that just do Gutters" and another for "H & S Roofing & Gutter Company". Each card includes a star rating, address, phone number, and links to "WEBSITE" and "DIRECTIONS". At the bottom, there are buttons for "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets

Figure 82 - Google Search vs. ChatGPT - Real Estate Agent



**Estate Agents**

Who are the best real estate agents in Los Angeles, California?

As an AI language model, I don't have access to up-to-date information about the current top real estate agents in Los Angeles. However, I can suggest a few resources that can help you find the best real estate agents in Los Angeles:

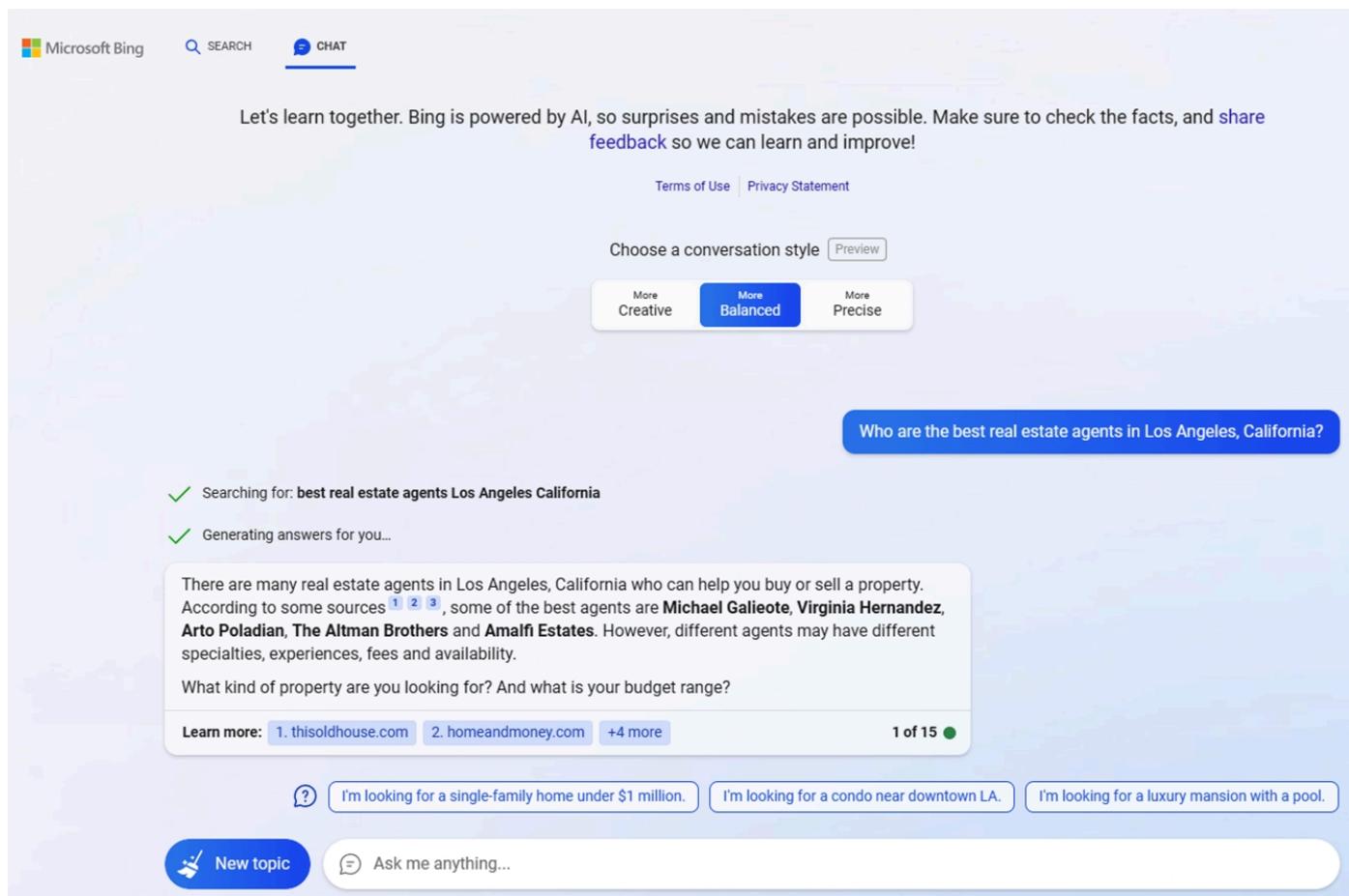
1. Zillow: Zillow is a popular online real estate marketplace that allows you to search for homes and connect with local real estate agents in Los Angeles. You can use Zillow's agent finder tool to browse agent profiles, read reviews from past clients, and choose the right agent for your needs.
2. Yelp: Yelp is a review website that allows users to rate and review businesses, including real estate agents in Los Angeles. You can use Yelp to read reviews from past clients and get an idea of an agent's reputation and level of service.
3. Realtor.com: Realtor.com is another online real estate marketplace that allows you to search for homes and connect with local real estate agents in Los Angeles. You can use Realtor.com's agent finder tool to browse agent profiles, read reviews from past clients, and choose the right agent for your needs.
4. Referrals: Word-of-mouth referrals from friends, family, and colleagues can be a great way to find a top real estate agent in Los Angeles. Ask people you know who have recently bought or sold a home.

[Regenerate response](#)

| Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us.

Source: Google Search, ChatGPT, RBC Capital Markets

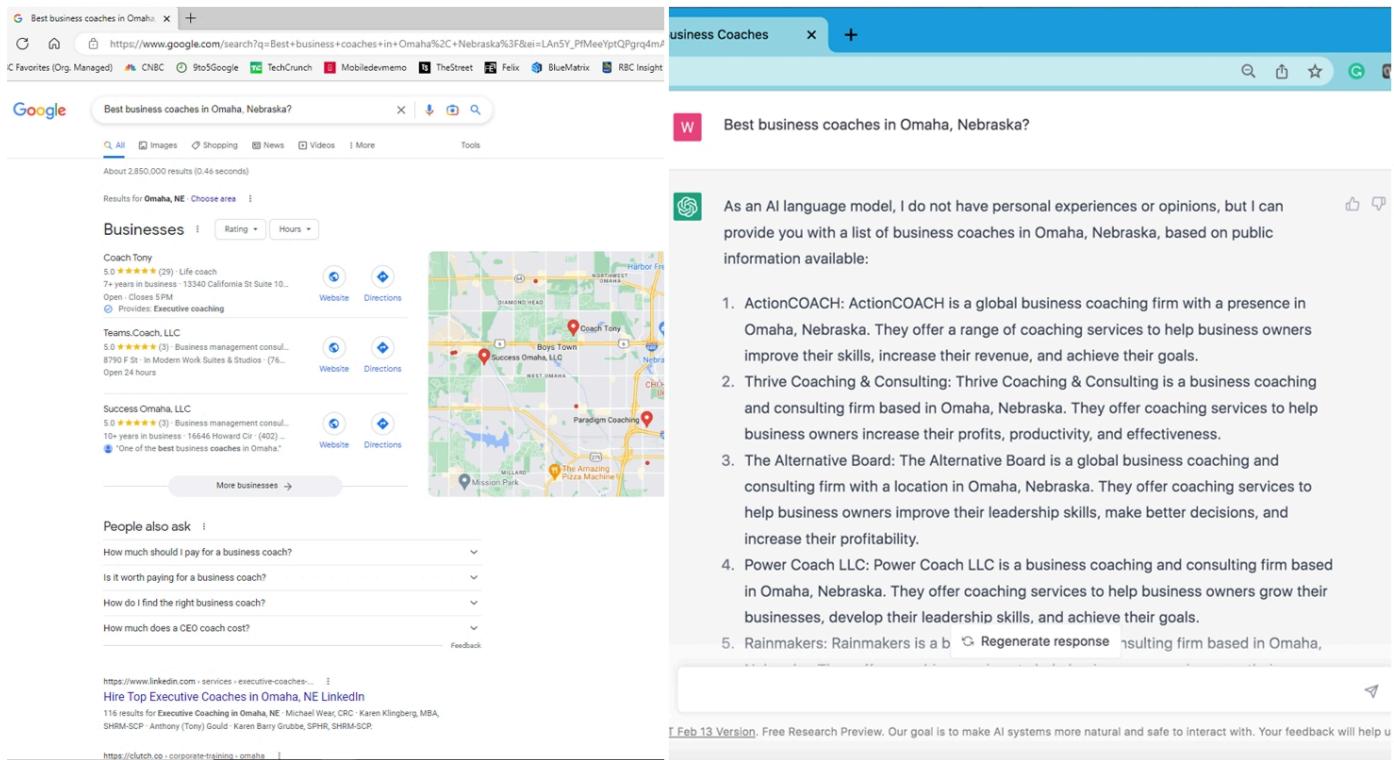
Figure 83 - Bing - Real Estate Agent



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "What would you like to know today?". Below the search bar are three buttons: "SEARCH", "CHAT", and a microphone icon for voice search. A message from Bing encourages users to "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" Below this message are links for "Terms of Use" and "Privacy Statement". A "Choose a conversation style" section offers three options: "More Creative" (white button), "More Balanced" (blue button), and "More Precise" (white button). The main search results area contains a question "Who are the best real estate agents in Los Angeles, California?" followed by a bulleted list: "✓ Searching for: **best real estate agents Los Angeles California**" and "✓ Generating answers for you...". Below this, a text box states: "There are many real estate agents in Los Angeles, California who can help you buy or sell a property. According to some sources [1](#) [2](#) [3](#), some of the best agents are **Michael Galieote, Virginia Hernandez, Arto Poladian, The Altman Brothers and Amalfi Estates**. However, different agents may have different specialties, experiences, fees and availability." It also asks, "What kind of property are you looking for? And what is your budget range?". Below this are links to "Learn more: 1. [thisoldhouse.com](#) 2. [homeandmoney.com](#) +4 more" and a page number "1 of 15". At the bottom, there are three buttons: "I'm looking for a single-family home under \$1 million.", "I'm looking for a condo near downtown LA.", and "I'm looking for a luxury mansion with a pool.". There are also "New topic" and "Ask me anything..." buttons.

Source: Bing, RBC Capital Markets

Figure 84 - Google Search vs. ChatGPT - Business Coach



The figure displays two side-by-side search results for "Best business coaches in Omaha, Nebraska".

**Google Search Results:**

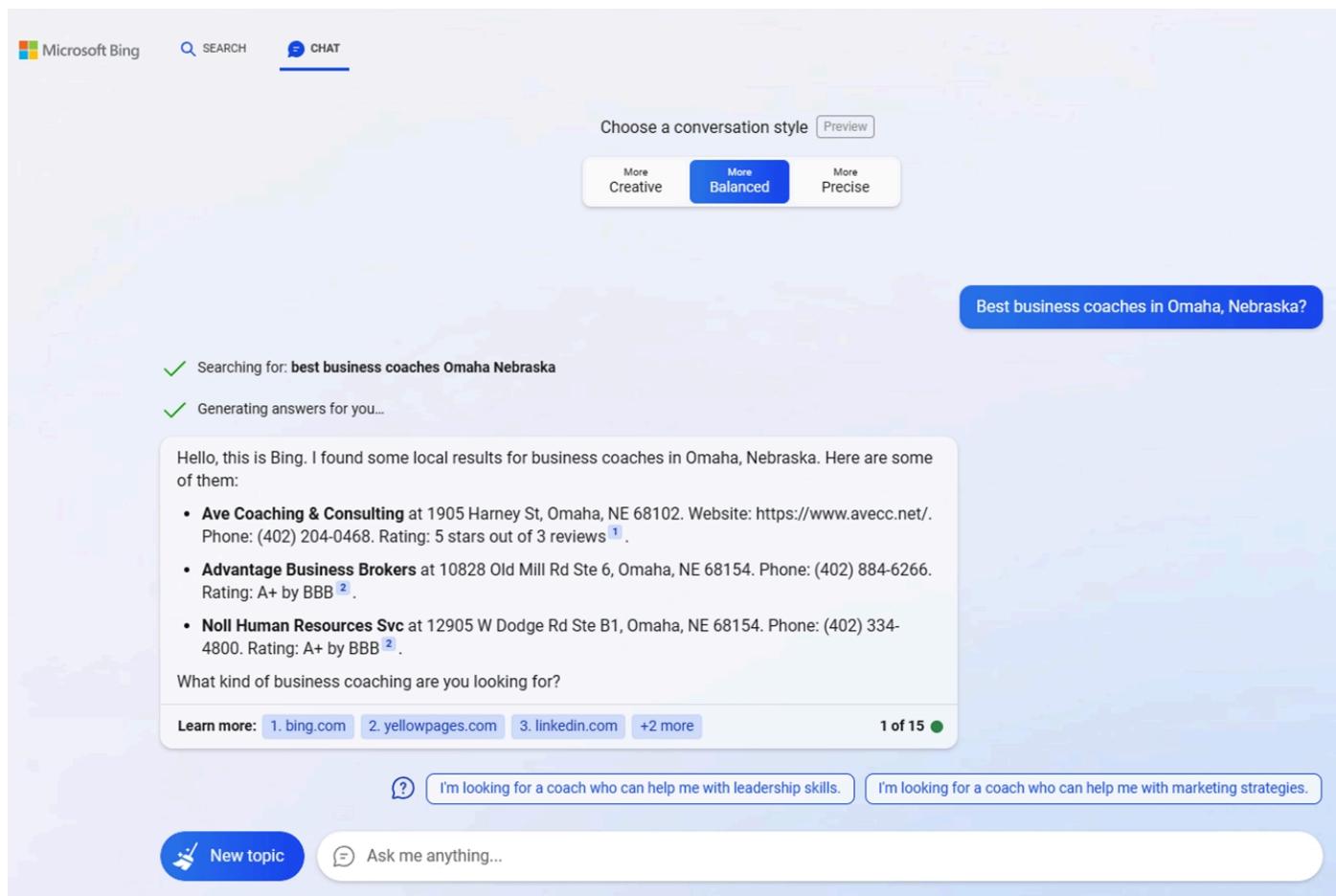
- Query:** Best business coaches in Omaha, Nebraska?
- Results:** Shows three business listings with ratings and links to websites and directions. A map of Omaha highlights several coaching locations.
- People also ask:** Includes questions like "How much should I pay for a business coach?", "Is it worth paying for a business coach?", "How do I find the right business coach?", and "How much does a CEO coach cost?".
- Links:** Includes links to LinkedIn and Clutch.co.

**ChatGPT Response:**

- Query:** Best business coaches in Omaha, Nebraska?
- Response:** As an AI language model, I do not have personal experiences or opinions, but I can provide you with a list of business coaches in Omaha, Nebraska, based on public information available:
  - ActionCOACH: ActionCOACH is a global business coaching firm with a presence in Omaha, Nebraska. They offer a range of coaching services to help business owners improve their skills, increase their revenue, and achieve their goals.
  - Thrive Coaching & Consulting: Thrive Coaching & Consulting is a business coaching and consulting firm based in Omaha, Nebraska. They offer coaching services to help business owners increase their profits, productivity, and effectiveness.
  - The Alternative Board: The Alternative Board is a global business coaching and consulting firm with a location in Omaha, Nebraska. They offer coaching services to help business owners improve their leadership skills, make better decisions, and increase their profitability.
  - Power Coach LLC: Power Coach LLC is a business coaching and consulting firm based in Omaha, Nebraska. They offer coaching services to help business owners grow their businesses, develop their leadership skills, and achieve their goals.
  - Rainmakers: Rainmakers is a business coaching and consulting firm based in Omaha,
- Feedback:** Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 85 - Bing - Business Coach

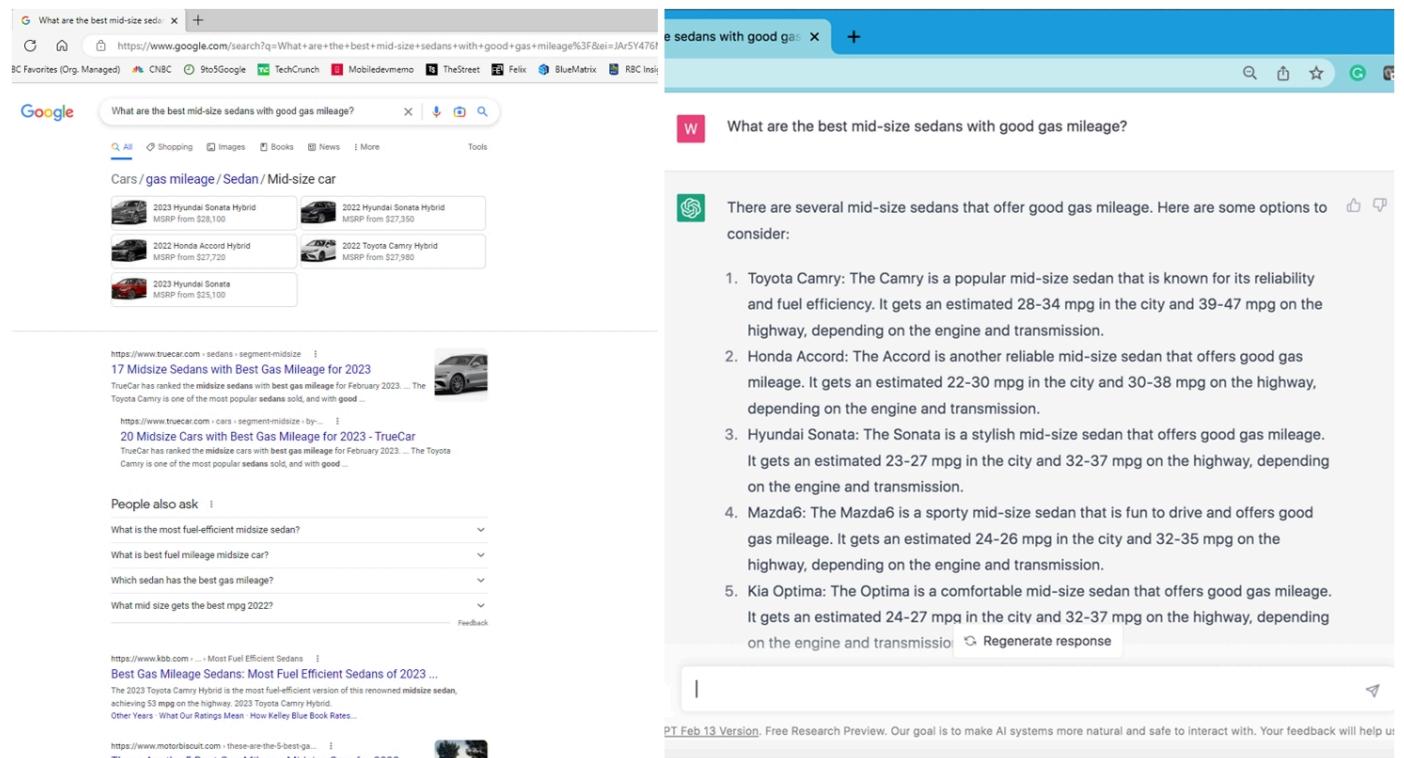


The screenshot shows the Microsoft Bing search interface with the "CHAT" tab selected. A sidebar on the left displays a profile picture of a person with the name "John Doe". At the top, there are buttons for "SEARCH" and "CHAT". Below the search bar, it says "Choose a conversation style" with options "More Creative", "More Balanced" (which is highlighted in blue), and "More Precise". A blue button at the bottom right of the sidebar says "Best business coaches in Omaha, Nebraska?". The main content area shows a progress message: "Searching for: best business coaches Omaha Nebraska" and "Generating answers for you...". It then displays a list of local results for business coaches in Omaha, Nebraska, including "Ave Coaching & Consulting", "Advantage Business Brokers", and "Noll Human Resources Svc". Below the results, a question "What kind of business coaching are you looking for?" is asked, followed by a "Learn more" section with links to bing.com, yellowpages.com, linkedin.com, and +2 more. At the bottom, there are two input fields: "I'm looking for a coach who can help me with leadership skills." and "I'm looking for a coach who can help me with marketing strategies.", along with "New topic" and "Ask me anything..." buttons.

Source: Bing, RBC Capital Markets

## Automotive

Figure 86 - Google Search vs. ChatGPT - Sedan with Good MPG



The figure shows two browser windows side-by-side.

**Google Search Results:**

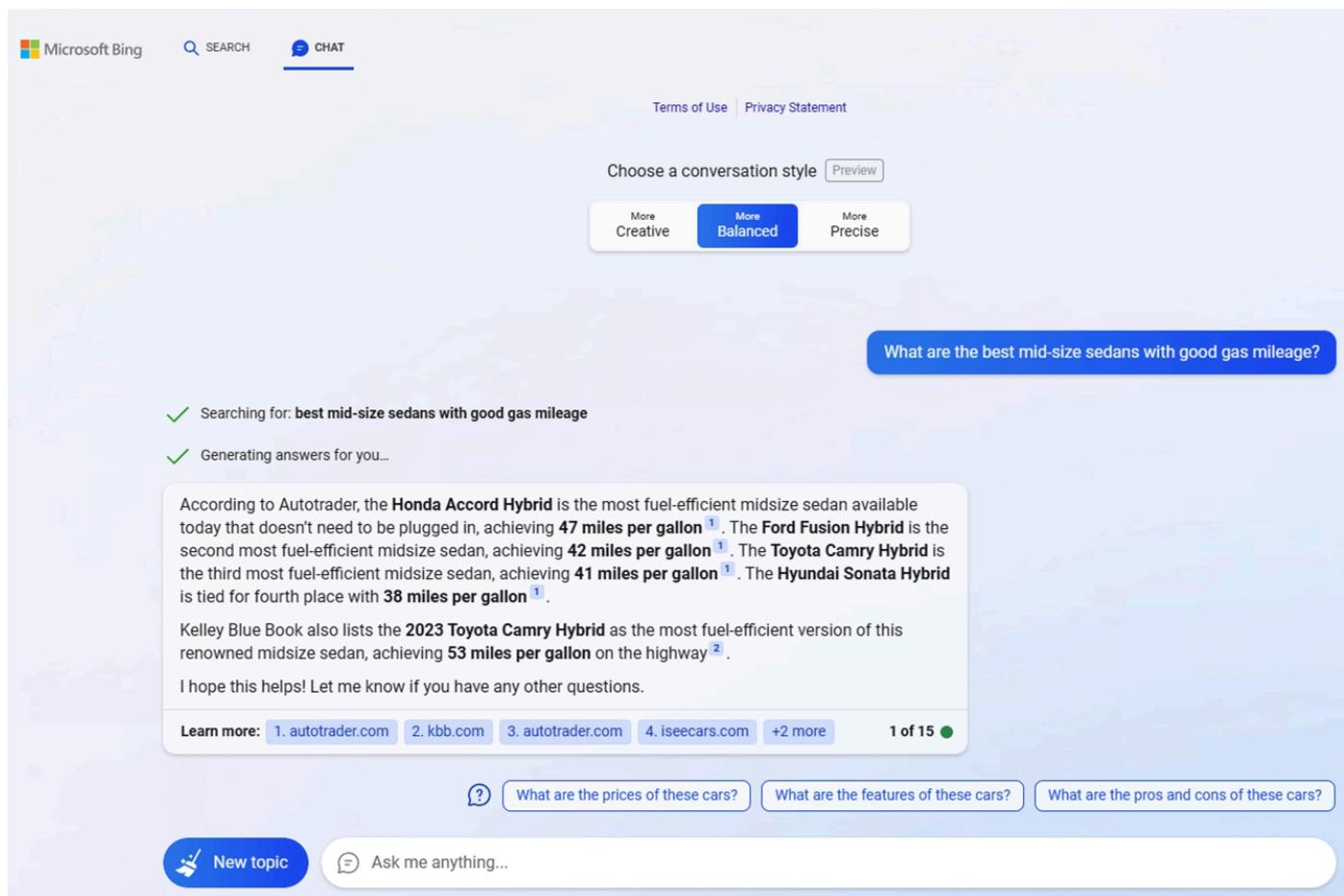
- Search query: "What are the best mid-size sedans with good gas mileage?"
- Results include links to TrueCar.com and Kelley Blue Book (KBB) websites, showing lists of sedans like the Toyota Camry, Honda Accord, and Hyundai Sonata.
- People also ask section includes questions like "What is the most fuel-efficient midsize sedan?", "What is best fuel mileage midsize car?", etc.
- Feedback link at the bottom right.

**ChatGPT Response:**

- Search query: "What are the best mid-size sedans with good gas mileage?"
- Response: "There are several mid-size sedans that offer good gas mileage. Here are some options to consider:
  1. Toyota Camry: The Camry is a popular mid-size sedan that is known for its reliability and fuel efficiency. It gets an estimated 28-34 mpg in the city and 39-47 mpg on the highway, depending on the engine and transmission.
  2. Honda Accord: The Accord is another reliable mid-size sedan that offers good gas mileage. It gets an estimated 22-30 mpg in the city and 30-38 mpg on the highway, depending on the engine and transmission.
  3. Hyundai Sonata: The Sonata is a stylish mid-size sedan that offers good gas mileage. It gets an estimated 23-27 mpg in the city and 32-37 mpg on the highway, depending on the engine and transmission.
  4. Mazda6: The Mazda6 is a sporty mid-size sedan that is fun to drive and offers good gas mileage. It gets an estimated 24-26 mpg in the city and 32-35 mpg on the highway, depending on the engine and transmission.
  5. Kia Optima: The Optima is a comfortable mid-size sedan that offers good gas mileage. It gets an estimated 24-27 mpg in the city and 32-37 mpg on the highway, depending on the engine and transmission.
- Regenerate response button at the bottom right.

Source: Google Search, ChatGPT, RBC Capital Markets

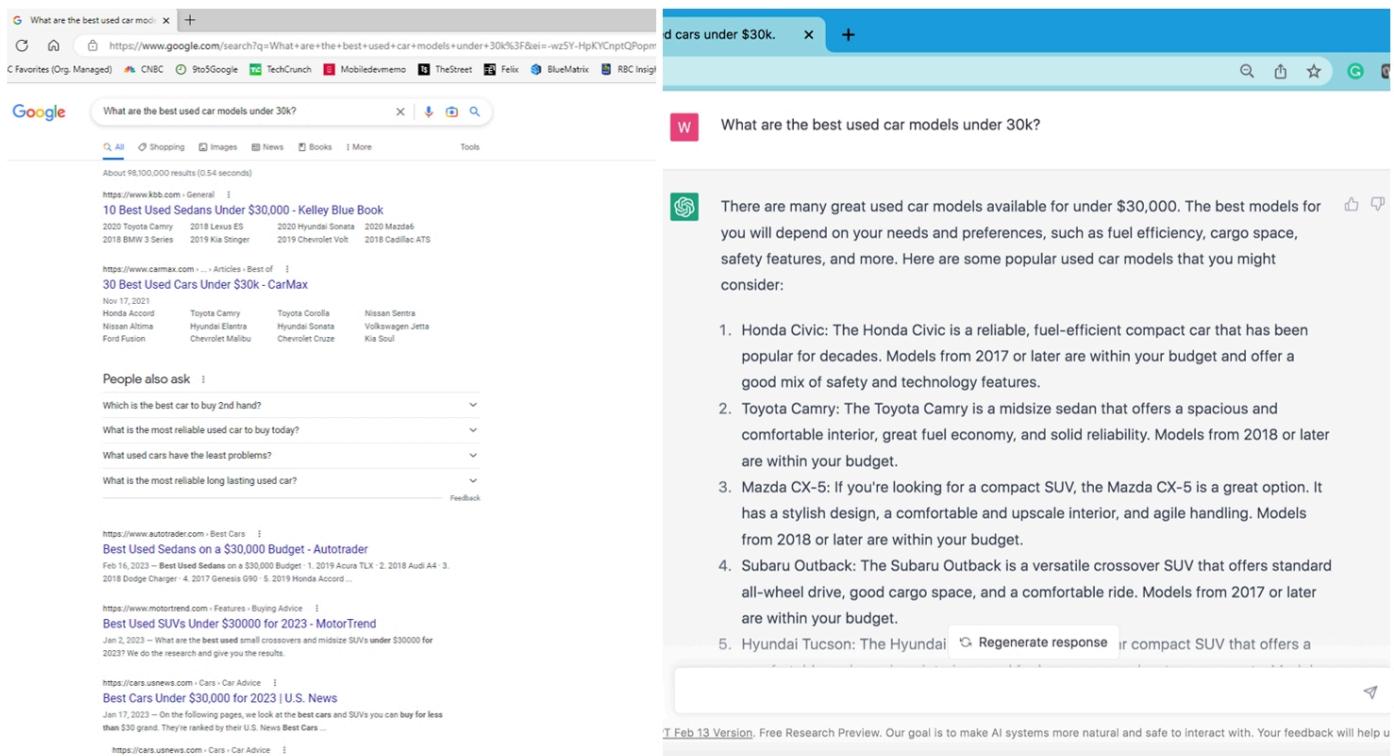
Figure 87 - Bing - Sedan with Good MPG



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a "CHAT" button. Below the navigation bar, there are links for "Terms of Use" and "Privacy Statement". A section titled "Choose a conversation style" offers three options: "More Creative", "More Balanced" (which is selected), and "More Precise". In the main search area, a question is asked: "What are the best mid-size sedans with good gas mileage?". Below the question, a green checkmark indicates that the search is underway: "Searching for: best mid-size sedans with good gas mileage". Another green checkmark indicates that answers are being generated: "Generating answers for you...". The response provided is: "According to Autotrader, the **Honda Accord Hybrid** is the most fuel-efficient midsize sedan available today that doesn't need to be plugged in, achieving **47 miles per gallon** <sup>1</sup>. The **Ford Fusion Hybrid** is the second most fuel-efficient midsize sedan, achieving **42 miles per gallon** <sup>1</sup>. The **Toyota Camry Hybrid** is the third most fuel-efficient midsize sedan, achieving **41 miles per gallon** <sup>1</sup>. The **Hyundai Sonata Hybrid** is tied for fourth place with **38 miles per gallon** <sup>1</sup>. Kelley Blue Book also lists the **2023 Toyota Camry Hybrid** as the most fuel-efficient version of this renowned midsize sedan, achieving **53 miles per gallon** on the highway <sup>2</sup>. I hope this helps! Let me know if you have any other questions." At the bottom of the response, there is a "Learn more:" link followed by five external links: 1. autotrader.com, 2. kbb.com, 3. autotrader.com, 4. iseecars.com, and "+2 more". The page number "1 of 15" is also visible. Below the response, there are three buttons: "What are the prices of these cars?", "What are the features of these cars?", and "What are the pros and cons of these cars?". At the very bottom, there are two buttons: "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets

Figure 88 - Google Search vs. ChatGPT - Used Vehicles Under \$30K



The figure shows two side-by-side browser windows. The left window is a Google search results page for the query "What are the best used car models under \$30K?". The right window is a ChatGPT interface with the same query.

**Google Search Results:**

- Search Bar:** What are the best used car models under \$30K?
- Results:**
  - [10 Best Used Sedans Under \\$30,000 - Kelley Blue Book](https://www.kbb.com/)
  - [30 Best Used Cars Under \\$30K - CarMax](https://www.carmax.com/)
  - [Best Used Sedans on a \\$30,000 Budget - Autotrader](https://www.autotrader.com/)
  - [Best Used SUVs Under \\$30000 for 2023 - MotorTrend](https://www.motortrend.com/)
  - [Cars Under \\$30,000 for 2023 U.S. News](https://cars.usnews.com/)
- People also ask:**
  - Which is the best car to buy 2nd hand?
  - What is the most reliable used car to buy today?
  - What used cars have the least problems?
  - What is the most reliable long lasting used car?

**ChatGPT Response:**

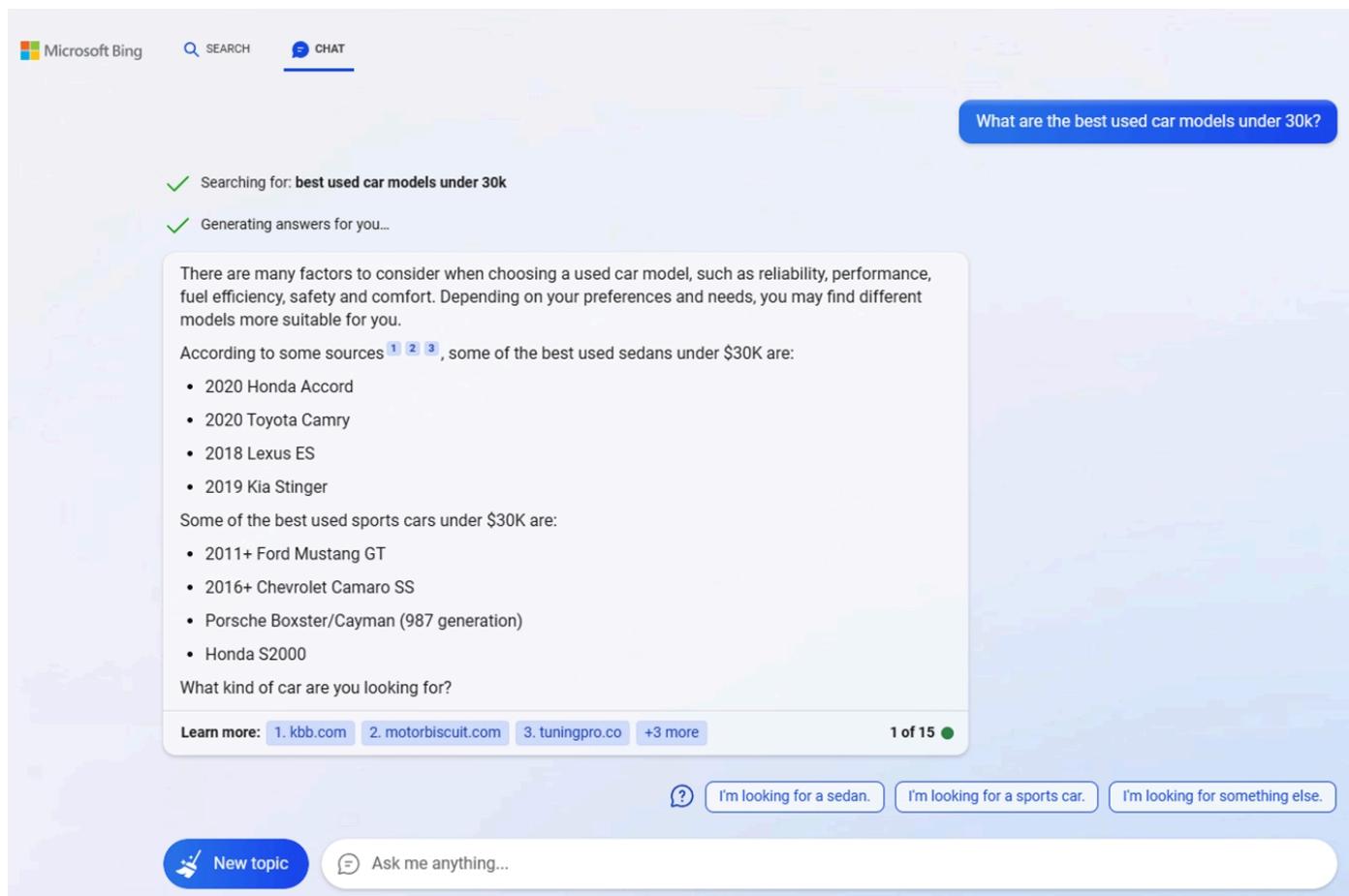
There are many great used car models available for under \$30,000. The best models for you will depend on your needs and preferences, such as fuel efficiency, cargo space, safety features, and more. Here are some popular used car models that you might consider:

1. Honda Civic: The Honda Civic is a reliable, fuel-efficient compact car that has been popular for decades. Models from 2017 or later are within your budget and offer a good mix of safety and technology features.
2. Toyota Camry: The Toyota Camry is a midsize sedan that offers a spacious and comfortable interior, great fuel economy, and solid reliability. Models from 2018 or later are within your budget.
3. Mazda CX-5: If you're looking for a compact SUV, the Mazda CX-5 is a great option. It has a stylish design, a comfortable and upscale interior, and agile handling. Models from 2018 or later are within your budget.
4. Subaru Outback: The Subaru Outback is a versatile crossover SUV that offers standard all-wheel drive, good cargo space, and a comfortable ride. Models from 2017 or later are within your budget.
5. Hyundai Tucson: The Hyundai Tucson is a compact SUV that offers a

Feb 13, 2023. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve.

Source: Google Search, ChatGPT, RBC Capital Markets

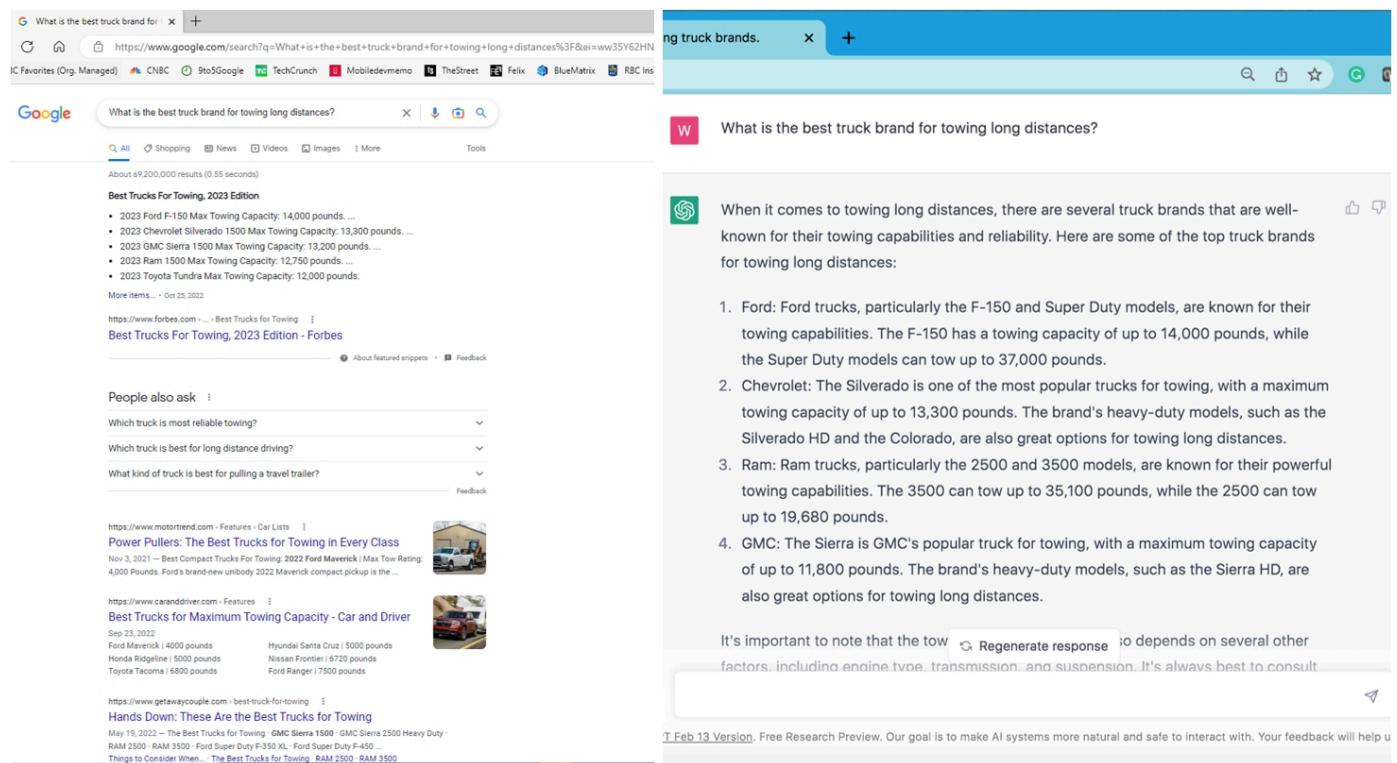
Figure 89 - Bing - Used Vehicles Under 30k



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the query "What are the best used car models under 30k?". Below the search bar, there are two green checkmarks indicating the process: "Searching for: best used car models under 30k" and "Generating answers for you...". A text box contains the following text: "There are many factors to consider when choosing a used car model, such as reliability, performance, fuel efficiency, safety and comfort. Depending on your preferences and needs, you may find different models more suitable for you." Below this, a list of sedans under \$30K is provided: • 2020 Honda Accord • 2020 Toyota Camry • 2018 Lexus ES • 2019 Kia Stinger. Another section lists sports cars under \$30K: • 2011+ Ford Mustang GT • 2016+ Chevrolet Camaro SS • Porsche Boxster/Cayman (987 generation) • Honda S2000. A question "What kind of car are you looking for?" is followed by a "Learn more" button with links to kbb.com, motorbiscuit.com, tuningpro.co, and +3 more. The page is labeled "1 of 15". At the bottom, there are four buttons: "I'm looking for a sedan.", "I'm looking for a sports car.", and "I'm looking for something else." Additionally, there are "New topic" and "Ask me anything..." buttons.

Source: Bing, RBC Capital Markets

Figure 90 - Google Search vs. ChatGPT - Truck with Towing Power



The figure shows two side-by-side search results for the query "What is the best truck brand for towing long distances?"

**Google Search Results:**

- Search Bar:** What is the best truck brand for towing long distances?
- Results:**
  - Best Trucks For Towing, 2023 Edition** (from Forbes)
    - 2023 Ford F-150 Max Towing Capacity: 14,000 pounds...
    - 2023 Chevrolet Silverado 1500 Max Towing Capacity: 13,300 pounds...
    - 2023 GMC Sierra 1500 Max Towing Capacity: 13,200 pounds...
    - 2023 Ram 1500 Max Towing Capacity: 12,750 pounds...
    - 2023 Toyota Tundra Max Towing Capacity: 12,000 pounds.
  - More Items... • Oct 25, 2022**
  - <https://www.forbes.com> ... Best Trucks for Towing
  - Best Trucks For Towing, 2023 Edition - Forbes**
- People also ask:**
  - Which truck is most reliable towing?
  - Which truck is best for long distance driving?
  - What kind of truck is best for pulling a travel trailer?
- Feedback:** About featured snippets | Feedback

**ChatGPT Response:**

When it comes to towing long distances, there are several truck brands that are well-known for their towing capabilities and reliability. Here are some of the top truck brands for towing long distances:

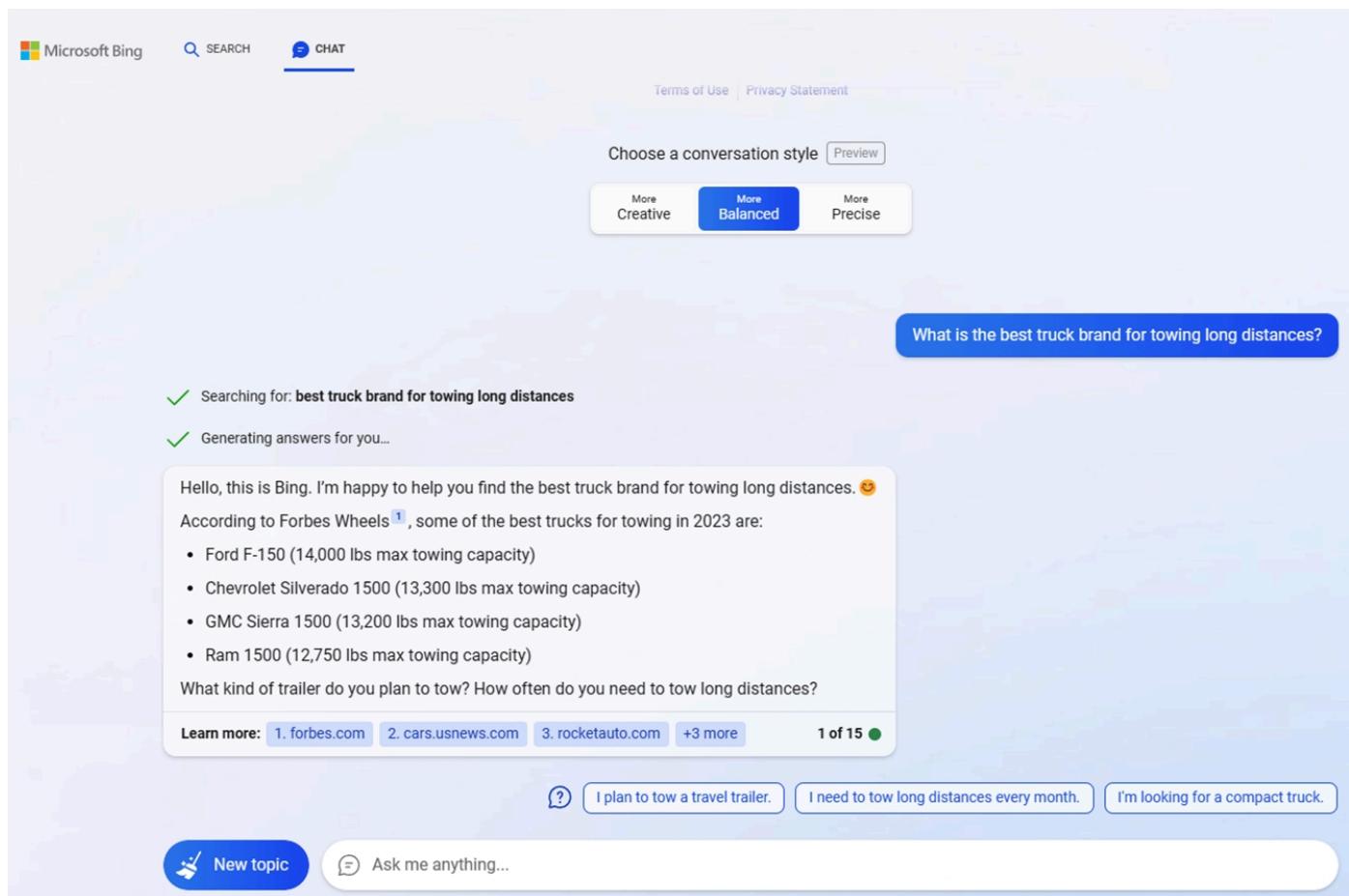
1. Ford: Ford trucks, particularly the F-150 and Super Duty models, are known for their towing capabilities. The F-150 has a towing capacity of up to 14,000 pounds, while the Super Duty models can tow up to 37,000 pounds.
2. Chevrolet: The Silverado is one of the most popular trucks for towing, with a maximum towing capacity of up to 13,300 pounds. The brand's heavy-duty models, such as the Silverado HD and the Colorado, are also great options for towing long distances.
3. Ram: Ram trucks, particularly the 2500 and 3500 models, are known for their powerful towing capabilities. The 3500 can tow up to 35,100 pounds, while the 2500 can tow up to 19,680 pounds.
4. GMC: The Sierra is GMC's popular truck for towing, with a maximum towing capacity of up to 11,800 pounds. The brand's heavy-duty models, such as the Sierra HD, are also great options for towing long distances.

It's important to note that the tow depends on several other factors, including engine type, transmission, and suspension. It's always best to consult a professional for specific towing recommendations.

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Source: Google Search, ChatGPT, RBC Capital Markets

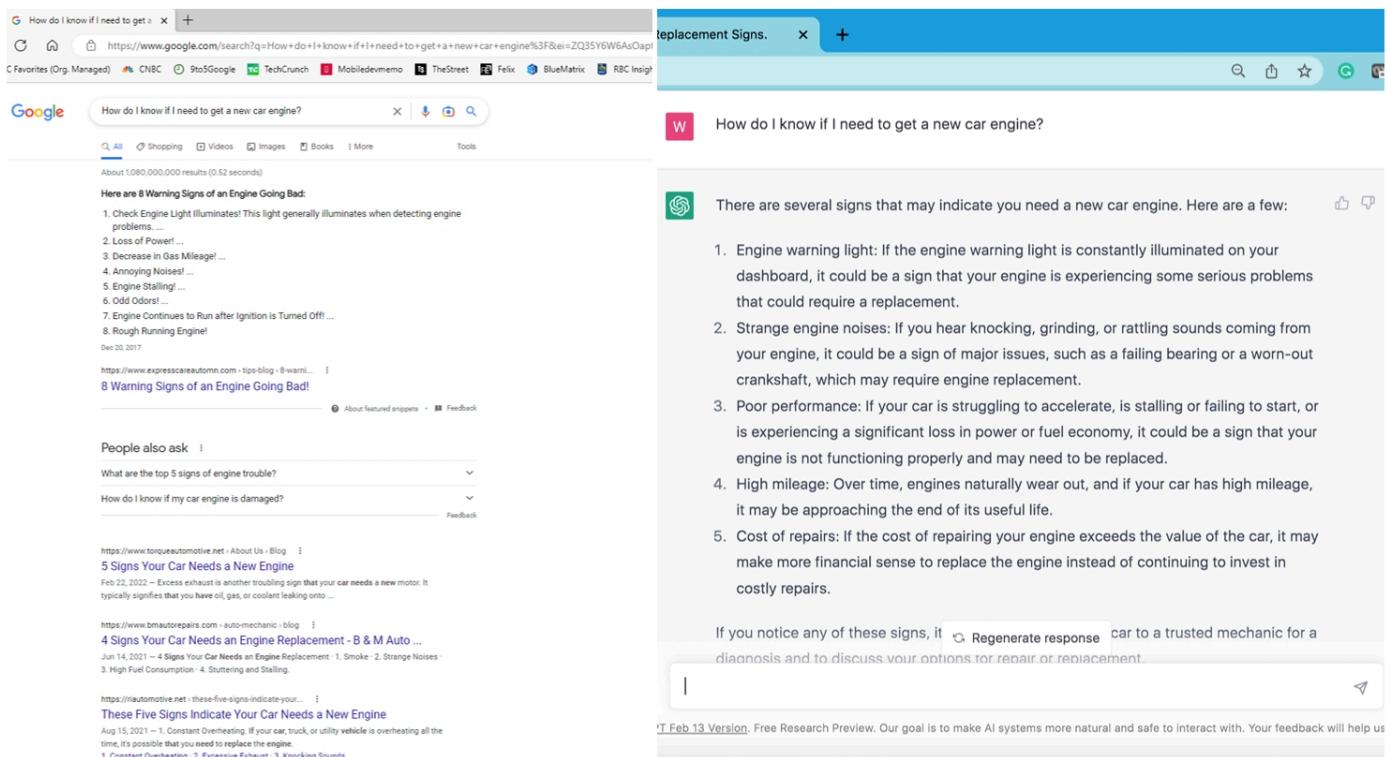
Figure 91 - Bing - Truck with Towing Power



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the navigation bar, there are links for 'Terms of Use' and 'Privacy Statement'. A 'Choose a conversation style' section offers three options: 'More Creative' (gray), 'More Balanced' (blue, selected), and 'More Precise' (gray). The main query input field contains the question: 'What is the best truck brand for towing long distances?'. Below the input field, a progress message says: 'Searching for: best truck brand for towing long distances' and 'Generating answers for you...'. The AI response starts with a greeting: 'Hello, this is Bing. I'm happy to help you find the best truck brand for towing long distances.' followed by a smiling emoji. It then provides a list of recommended trucks based on Forbes Wheels: Ford F-150 (14,000 lbs max towing capacity), Chevrolet Silverado 1500 (13,300 lbs max towing capacity), GMC Sierra 1500 (13,200 lbs max towing capacity), and Ram 1500 (12,750 lbs max towing capacity). The AI asks follow-up questions: 'What kind of trailer do you plan to tow? How often do you need to tow long distances?'. Below the AI's responses, there is a 'Learn more:' section with links to 1. forbes.com, 2. cars.usnews.com, 3. rocketauto.com, and '+3 more'. A '1 of 15' indicator is shown. At the bottom, there are several buttons for further interaction: 'New topic', 'Ask me anything...', and three options for the user's needs: 'I plan to tow a travel trailer.', 'I need to tow long distances every month.', and 'I'm looking for a compact truck.'

Source: Bing, RBC Capital Markets

**Figure 92 - Google Search vs. ChatGPT - Automotive Maintenance**



The figure shows a side-by-side comparison of search results for "How do I know if I need to get a new car engine?" on Google and a ChatGPT interface.

**Google Search Results:**

- Search bar: How do I know if I need to get a new car engine?
- Results count: About 1,080,000,000 results (0.52 seconds)
- Headline: Here are 8 Warning Signs of an Engine Going Bad:
  1. Check Engine Light Illuminates! This light generally illuminates when detecting engine problems...
  2. Loss of Power!...
  3. Decrease in Gas Mileage!...
  4. Annoying Noises!...
  5. Engine Stalling!...
  6. Odd Odors!...
  7. Engine Continues to Run after Ignition is Turned Off!...
  8. Rough Running Engine!
- Source: Dec 20, 2017 | https://www.expresscarautomotive.com/tpe-blog/8-warning-signs-of-an-engine-going-bad/
- Feedback link: Feedback
- People also ask section:
  - What are the top 5 signs of engine trouble?
  - How do I know if my car engine is damaged?
- Related links:
  - https://www.torqueautomotive.net>About Us>Blog>5 Signs Your Car Needs a New Engine
  - 4 Signs Your Car Needs an Engine Replacement - B & M Auto ...
  - https://bmautorepairs.com/auto-mechanic/blog/4-signs-your-car-needs-an-engine-replacement
  - These Five Signs Indicate Your Car Needs a New Engine

**ChatGPT Response:**

W How do I know if I need to get a new car engine?

There are several signs that may indicate you need a new car engine. Here are a few:

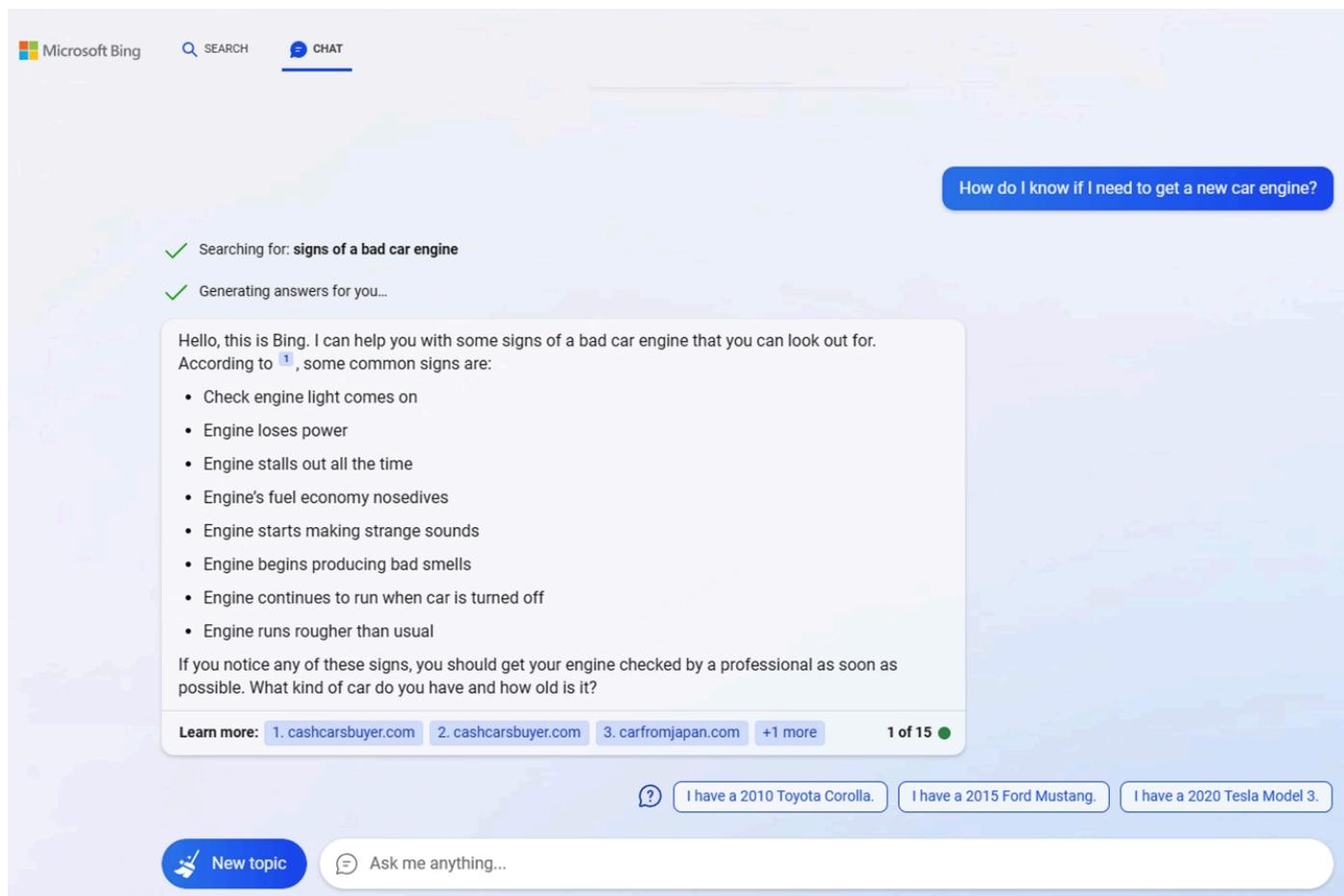
1. Engine warning light: If the engine warning light is constantly illuminated on your dashboard, it could be a sign that your engine is experiencing some serious problems that could require a replacement.
2. Strange engine noises: If you hear knocking, grinding, or rattling sounds coming from your engine, it could be a sign of major issues, such as a failing bearing or a worn-out crankshaft, which may require engine replacement.
3. Poor performance: If your car is struggling to accelerate, is stalling or failing to start, or is experiencing a significant loss in power or fuel economy, it could be a sign that your engine is not functioning properly and may need to be replaced.
4. High mileage: Over time, engines naturally wear out, and if your car has high mileage, it may be approaching the end of its useful life.
5. Cost of repairs: If the cost of repairing your engine exceeds the value of the car, it may make more financial sense to replace the engine instead of continuing to invest in costly repairs.

If you notice any of these signs, Regenerate response car to a trusted mechanic for a diagnosis and to discuss your options for repair or replacement.

Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us

Source: Google Search, ChatGPT, RBC Capital Markets

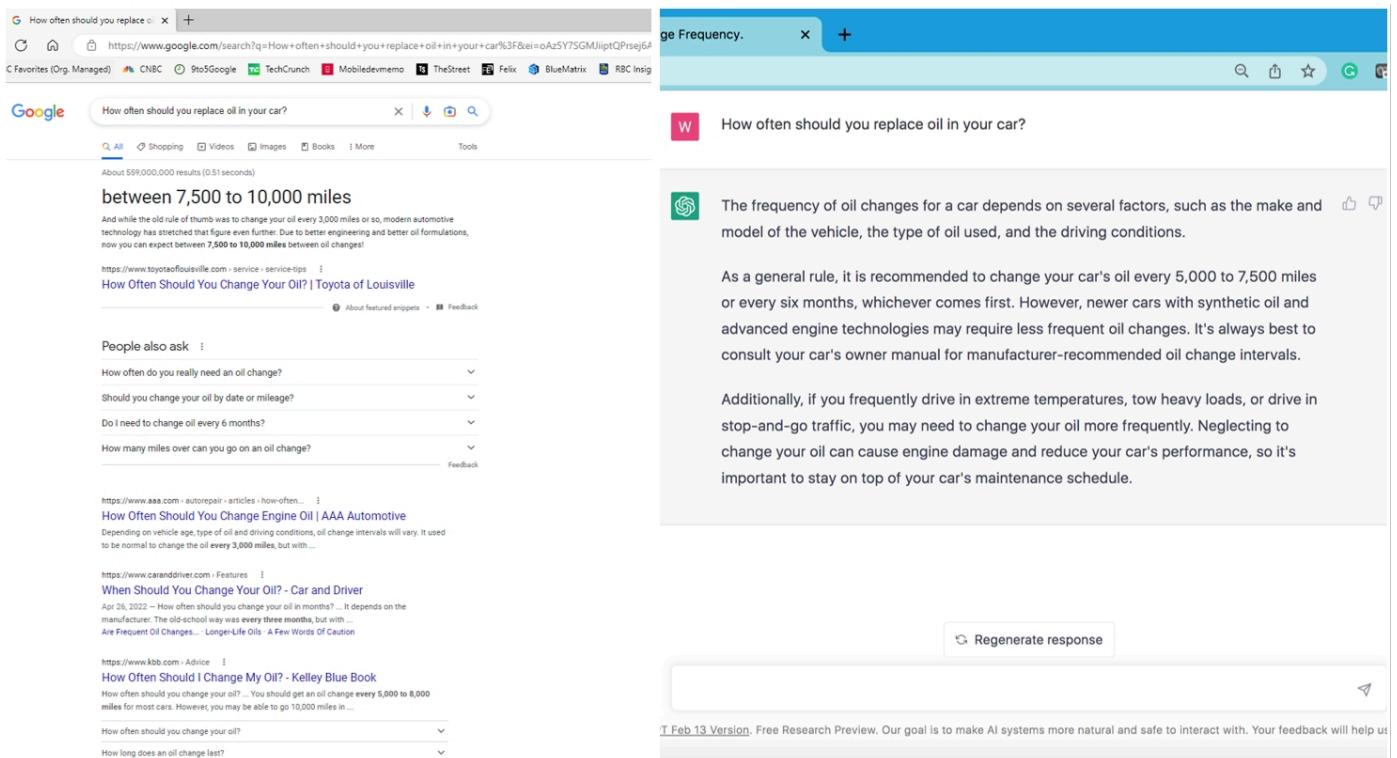
Figure 93 - Bing - Automotive Maintenance



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the text "How do I know if I need to get a new car engine?". Below the search bar, there are two green checkmarks indicating the process: "Searching for: signs of a bad car engine" and "Generating answers for you...". The main content area displays a response from Bing, which starts with "Hello, this is Bing. I can help you with some signs of a bad car engine that you can look out for. According to 1, some common signs are:" followed by a bulleted list of nine items. The list includes: Check engine light comes on, Engine loses power, Engine stalls out all the time, Engine's fuel economy nosedives, Engine starts making strange sounds, Engine begins producing bad smells, Engine continues to run when car is turned off, and Engine runs rougher than usual. Below this list, a note says "If you notice any of these signs, you should get your engine checked by a professional as soon as possible. What kind of car do you have and how old is it?". At the bottom of the main content area, there is a "Learn more:" section with links to "1. cashcarsbuyer.com", "2. cashcarsbuyer.com", "3. carfromjapan.com", "+1 more", and "1 of 15". Below the main content area, there are three buttons: "New topic", "Ask me anything...", and three options for car models: "I have a 2010 Toyota Corolla.", "I have a 2015 Ford Mustang.", and "I have a 2020 Tesla Model 3."

Source: Bing, RBC Capital Markets

**Figure 94 - Google Search vs. ChatGPT - Automotive Maintenance**



The figure shows a side-by-side comparison of search results from Google and a response from ChatGPT.

**Google Search Results:**

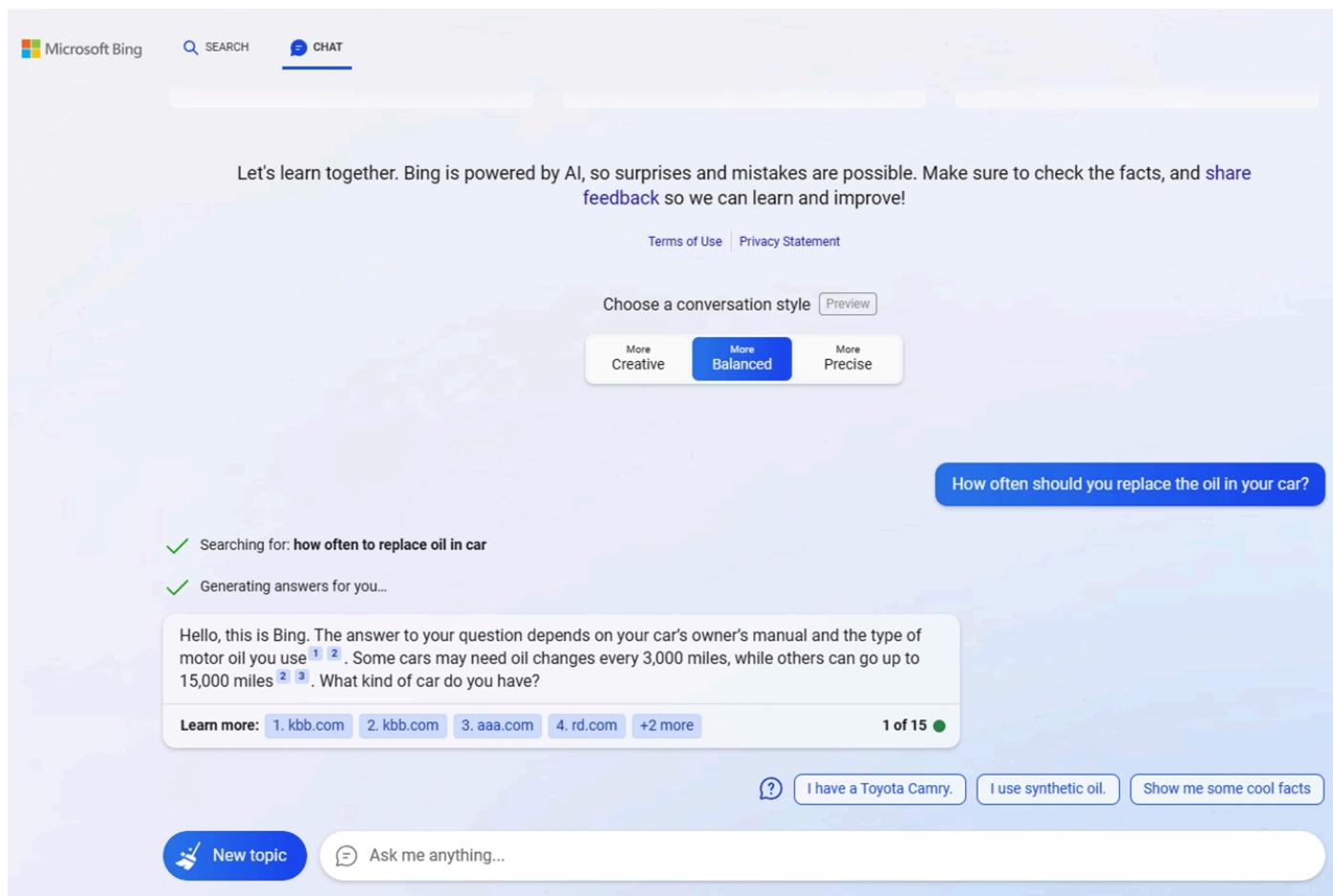
- Query: "How often should you replace oil in your car?"
- Results count: About 559,000 results (0.51 seconds).
- Top result snippet: "between 7,500 to 10,000 miles".
- Text: "And while the old rule of thumb was to change your oil every 3,000 miles or so, modern automotive technology has stretched that figure even further. Due to better engineering and better oil formulations, now you can expect between 7,500 to 10,000 miles between oil changes!"
- Link: [How Often Should You Change Your Oil? | Toyota of Louisville](https://www.toyotaflourville.com/service-service-tips/)
- People also ask section:
  - How often do you really need an oil change?
  - Should you change your oil by date or mileage?
  - Do I need to change oil every 6 months?
  - How many miles over can you go on an oil change?
- Other links listed:
  - [How Often Should You Change Engine Oil? | AAA Automotive](https://www.aaa.com/autorepair/articles/how-often...)
  - [When Should You Change Your Oil? - Car and Driver](https://www.carsanddriver.com/features/when-should-you-change-your-oil-car-and-driver)
  - [How Often Should I Change My Oil? - Kelley Blue Book](https://www.kbb.com/advice/how-often-should-i-change-my-oil-kelley-blue-book)

**ChatGPT Response:**

- Query: "How often should you replace oil in your car?"
- Text: "The frequency of oil changes for a car depends on several factors, such as the make and model of the vehicle, the type of oil used, and the driving conditions."
- Text: "As a general rule, it is recommended to change your car's oil every 5,000 to 7,500 miles or every six months, whichever comes first. However, newer cars with synthetic oil and advanced engine technologies may require less frequent oil changes. It's always best to consult your car's owner manual for manufacturer-recommended oil change intervals."
- Text: "Additionally, if you frequently drive in extreme temperatures, tow heavy loads, or drive in stop-and-go traffic, you may need to change your oil more frequently. Neglecting to change your oil can cause engine damage and reduce your car's performance, so it's important to stay on top of your car's maintenance schedule."
- Feedback button: "Regenerate response"
- Text at the bottom: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us."

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 95 - Bing - Automotive Maintenance



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the navigation bar, a message from Bing states: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and [share feedback](#) so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement".

In the center, there is a section titled "Choose a conversation style" with three options: "More Creative" (white button), "More Balanced" (blue button), and "More Precise" (white button). A blue callout box contains the question: "How often should you replace the oil in your car?"

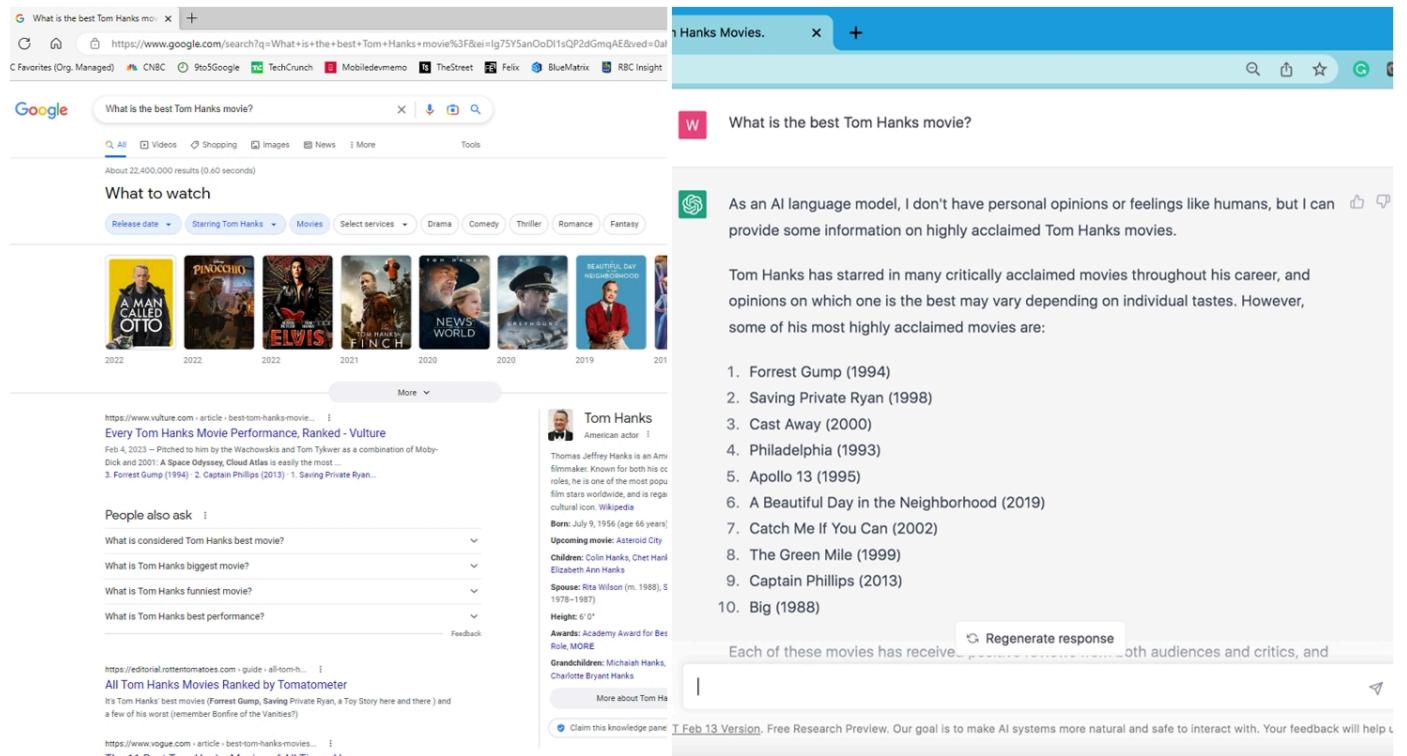
Below the question, a list of steps is shown: "✓ Searching for: how often to replace oil in car" and "✓ Generating answers for you...". A text box displays a response from Bing: "Hello, this is Bing. The answer to your question depends on your car's owner's manual and the type of motor oil you use <sup>1</sup> <sup>2</sup>. Some cars may need oil changes every 3,000 miles, while others can go up to 15,000 miles <sup>2</sup> <sup>3</sup>. What kind of car do you have?" Below the text box, there is a "Learn more:" link followed by a list of sources: "1. kbb.com", "2. kbb.com", "3. aaa.com", "4. rd.com", "+2 more". To the right, it says "1 of 15" with a green dot.

At the bottom, there are several buttons: a question mark icon, "I have a Toyota Camry.", "I use synthetic oil.", and "Show me some cool facts". There is also a "New topic" button with a microphone icon and an "Ask me anything..." input field.

Source: Bing, RBC Capital Markets

## Miscellaneous

Figure 96 - Google Search vs. ChatGPT - Movie Recommendation



The figure shows two side-by-side search results for "What is the best Tom Hanks movie?"

**Google Search Results:**

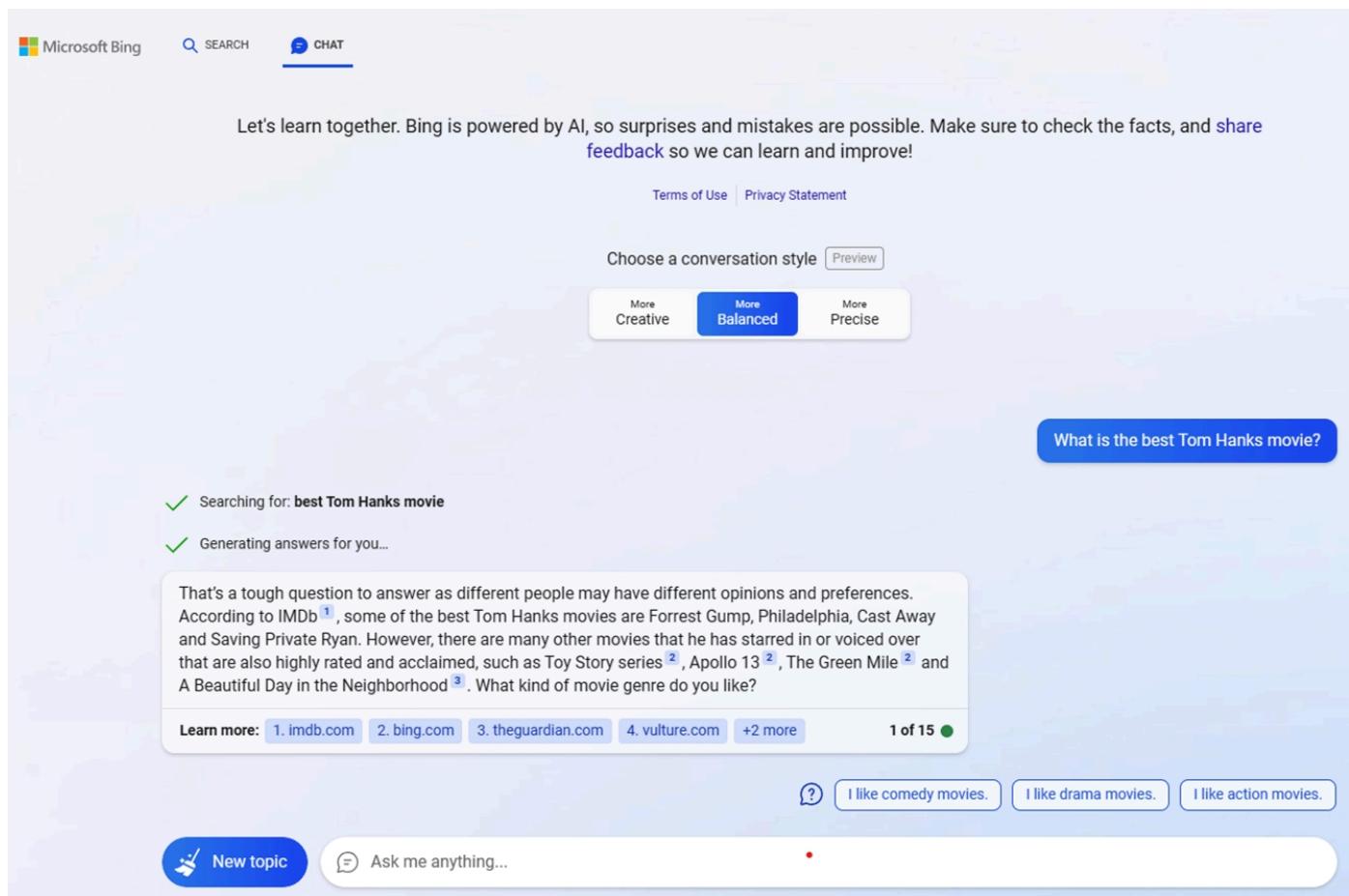
- Search bar: What is the best Tom Hanks movie?
- Results count: About 22,400,000 results (0.60 seconds)
- Section: What to watch
- Sub-section: Release date, Starring Tom Hanks, Movies, Select services, Drama, Comedy, Thriller, Romance, Fantasy
- Image grid: Shows movie posters for A Man Called Ove (2015), Pinocchio (2022), The King (2022), Elvis (2022), Finch (2021), News of the World (2020), and a thumbnail for Beautiful Day in the Neighborhood (2019).
- Link: https://www.vulture.com/article/best-tom-hanks-movie...
- Text: Every Tom Hanks Movie Performance, Ranked - Vulture
- Text: Feb 4, 2023 – Pitched to him by the Wachowskis and Tom Tykwer as a combination of Moby-Dick and 2001: A Space Odyssey, Cloud Atlas is easily the most...
- Text: 3. Forrest Gump (1994) 2. Captain Phillips (2013) 1. Saving Private Ryan...
- Section: People also ask
- List: What is considered Tom Hanks best movie?, What is Tom Hanks biggest movie?, What is Tom Hanks funniest movie?, What is Tom Hanks best performance?
- Link: https://editorial.rottentomatoes.com/guide/all-tom...
- Text: All Tom Hanks Movies Ranked by Tomatometer
- Text: In Tom Hank's best movies (Forrest Gump, Saving Private Ryan, a Toy Story here and there ) and a few of his worst (remember Bonfire of the Vanities?)
- Link: https://www.vogue.com/article/best-tom-hanks-movies...

**ChatGPT Response:**

- Search bar: What is the best Tom Hanks movie?
- Text: As an AI language model, I don't have personal opinions or feelings like humans, but I can provide some information on highly acclaimed Tom Hanks movies.
- Text: Tom Hanks has starred in many critically acclaimed movies throughout his career, and opinions on which one is the best may vary depending on individual tastes. However, some of his most highly acclaimed movies are:
- List: 1. Forrest Gump (1994), 2. Saving Private Ryan (1998), 3. Cast Away (2000), 4. Philadelphia (1993), 5. Apollo 13 (1995), 6. A Beautiful Day in the Neighborhood (2019), 7. Catch Me If You Can (2002), 8. The Green Mile (1999), 9. Captain Phillips (2013), 10. Big (1988)
- Text: Each of these movies has received positive audiences and critics, and
- Text: Regenerate response
- Text: T Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 97 - Bing - Movie Recommendation



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the RBC logo, the text "Microsoft Bing", a search bar, and a "CHAT" button. Below the navigation bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and [share feedback](#) so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". A section titled "Choose a conversation style" offers options: "More Creative" (selected), "More Balanced", and "More Precise". In the main search area, a question is asked: "What is the best Tom Hanks movie?". Below the question, a list of items starts with "Searching for: best Tom Hanks movie" and "Generating answers for you...". A text box contains: "That's a tough question to answer as different people may have different opinions and preferences. According to IMDb<sup>1</sup>, some of the best Tom Hanks movies are Forrest Gump, Philadelphia, Cast Away and Saving Private Ryan. However, there are many other movies that he has starred in or voiced over that are also highly rated and acclaimed, such as Toy Story series<sup>2</sup>, Apollo 13<sup>2</sup>, The Green Mile<sup>2</sup> and A Beautiful Day in the Neighborhood<sup>3</sup>. What kind of movie genre do you like?". Below this text, there is a "Learn more:" link followed by four numbered links: 1. [imdb.com](#), 2. [bing.com](#), 3. [theguardian.com](#), 4. [vulture.com](#), and "+2 more". To the right, it says "1 of 15". Below the text box, there are three buttons: "?", "I like comedy movies.", "I like drama movies.", and "I like action movies.". At the bottom, there are two buttons: "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets



Figure 98 - Google Search vs. ChatGPT - Snack Recommendation

The figure shows two side-by-side search results for "What are the best flavors of Lay's potato chips?".

**Google Search Results:**

- Search bar: What are the best flavors of Lay's potato chips?
- Results count: About 4,860,000 results (0.57 seconds)
- First result: [Our Favorite Lay's Potato Chip Flavors, Ranked - Thrillist](https://www.thrillist.com/eat/chips/our-favorite-lay-s-potato-chip-flavors-ranked)  
List of 27 flavors: Original Limón, Original Chile L., Wavy Ranch, Flamin' Hot, Original Sour Cr., Baked Original, Flamin' Hot Dill, Original Sour C., etc.
- People also ask:
  - What is the best flavor of Lays chips?
  - What is the number 1 selling potato chip?
  - What is the number 1 chips?
  - Which chips are most loved?
- Second result: [14 Best Lay's Potato Chip Flavors, Ranked by Popularity](https://www.restaurantclicks.com/best-lays-chip-flavors)  
List of 14 flavors: Classic, Salt & Vinegar, Sour Cream & Onion, Barbecue, Cheddar & Sour C., Chile Limón, Dill Pickle, etc.
- Third result: [Popular Lay's Potato Chip Flavors Ranked Worst To Best](https://www.mashed.com/popular-lays-potato-chip-flavors-ranked-worst-best)  
List of 10 flavors: 1. Lay's Sour Cream & Onion Flavored Potato Chips, 2. Lay's BBQ Flavored Potato..., 3. Lay's Grilled Pork Flavor Potato..., etc.
- Fourth result: [LOW PRICE](#)  
List of 4 chip bags: Lay's Grilled Pork Flavor Potato..., Lay's Herby Crush Flavour Potato..., Lay's Potato Chips Roasted Fish..., Lay's Sour Cream Onion Flavored...

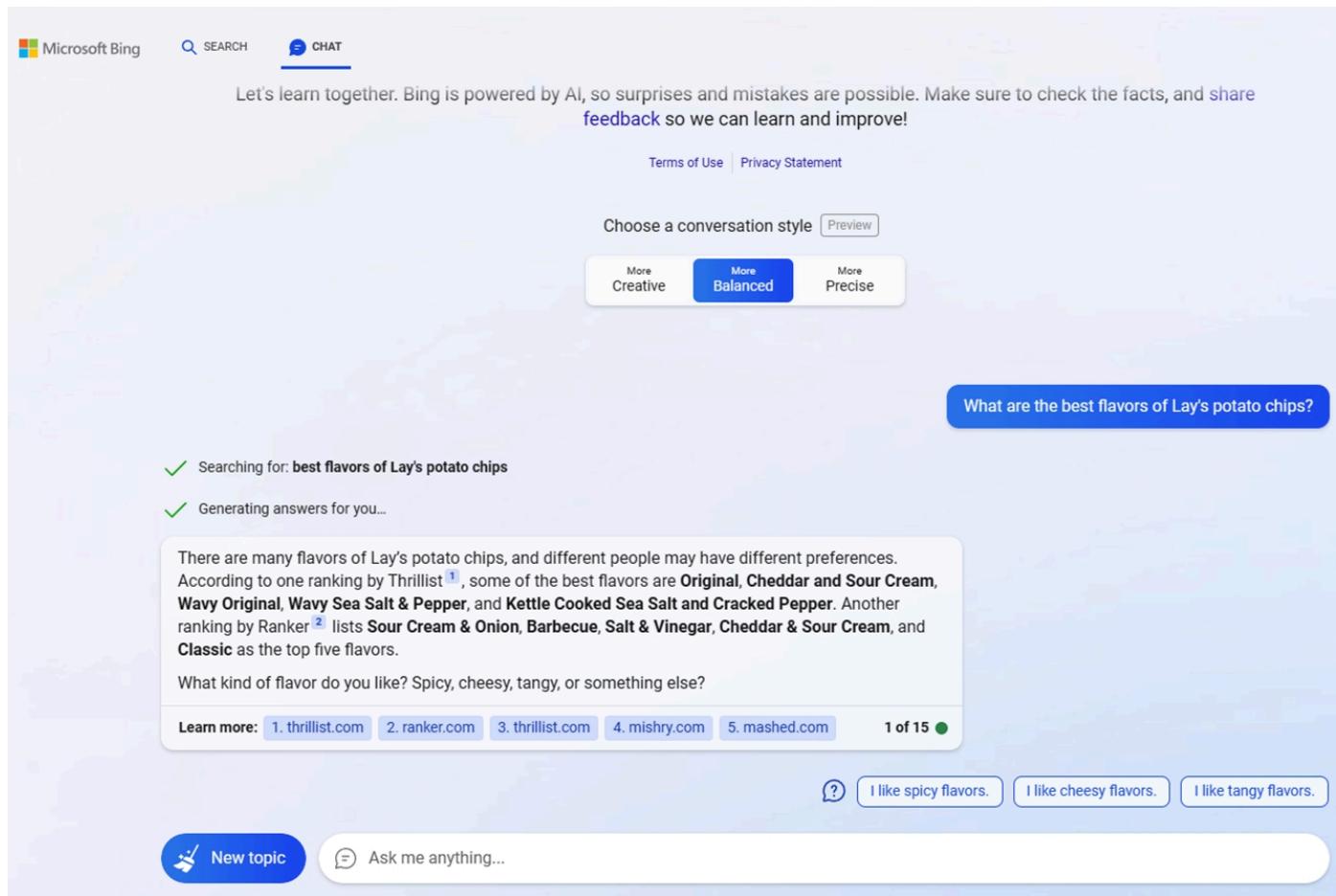
**ChatGPT Response:**

- Search bar: What are the best flavors of Lay's potato chips?
- Response: As an AI language model, I don't have personal preferences or tastes, but here are some of the most popular flavors of Lay's potato chips:
  - Classic/original: The original flavor of Lay's potato chips is a classic and simple flavor that many people enjoy.
  - Sour cream and onion: This flavor combines the tangy taste of sour cream with the savory flavor of onion, creating a tasty and addictive combination.
  - Barbecue: These chips have a smoky and sweet flavor that many people find irresistible.
  - Salt and vinegar: The tangy taste of vinegar combined with the salty flavor of Lay's potato chips makes for a unique and delicious snack.
  - Cheese and onion: This flavor combines the rich flavor of cheese with the savory taste of onion, creating a satisfying snack that many people love.
  - Cheddar and sour cream: The creamy flavor of cheddar cheese mixed with the tangy taste of sour cream creates a flavor that many people enjoy.
  - Dill pickle: These chips have a bold and tangy flavor that many people love, especially those who enjoy pickles.
  - Flamin' Hot: For those who like Flamin' Hot, Lay's potato chips provide a

At the bottom of the ChatGPT interface, there is a note: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve."

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 99 - Bing - Snack Recommendation



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the navigation bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". A section titled "Choose a conversation style" offers three options: "More Creative" (gray), "More Balanced" (blue, selected), and "More Precise" (gray). In the main search area, a question is asked: "What are the best flavors of Lay's potato chips?". Below the question, a green checkmark indicates: "Searching for: best flavors of Lay's potato chips" and "Generating answers for you...". The response section contains text about various Lay's chip flavors. At the bottom, there is a "Learn more:" link followed by five external links: 1. thrillist.com, 2. ranker.com, 3. thrillist.com, 4. mishry.com, 5. mashed.com. A page number "1 of 15" is shown. Below the search bar, there are three buttons: "New topic", "Ask me anything...", and a list of user preferences: "I like spicy flavors.", "I like cheesy flavors.", and "I like tangy flavors.".

Source: Bing, RBC Capital Markets



Figure 100 - Google Search vs. ChatGPT - Household Electronics

The figure shows a side-by-side comparison of search results from Google and a ChatGPT response.

**Google Search Results:**

- Search query: "What kind of batteries do I need for an Xbox controller?"
- Results count: About 35,400,000 results (0.58 seconds).
- Top result snippet:

You have two choices for batteries to use in your Xbox Wireless Controller: AA (LR6) batteries, and the rechargeable battery pack of the Xbox One Play & Charge Kit.


- Link: [Using batteries in your Xbox Wireless Controller](https://support.xbox.com/help/hardware-network/us...)
- Below the snippet, there are links to articles about replacing batteries in the Xbox 360 and a list of battery products available on Amazon:

  - Controller Battery Pack Replacement: \$16.99
  - Rocketfish Rechargeable: \$9.99
  - Venom Twin Rechargeable: \$23.99
  - Rechargeable Battery Packs for: \$26.99
  - Battery Pack for Xbox One Pickle: \$24.89
  - Smatree Controller Battery Compatibl: \$19.99
  - raphter 2800mAh Rechargeable: \$29.90
  - NYI 2800mAh Xbox Battery Pack with: \$29.89

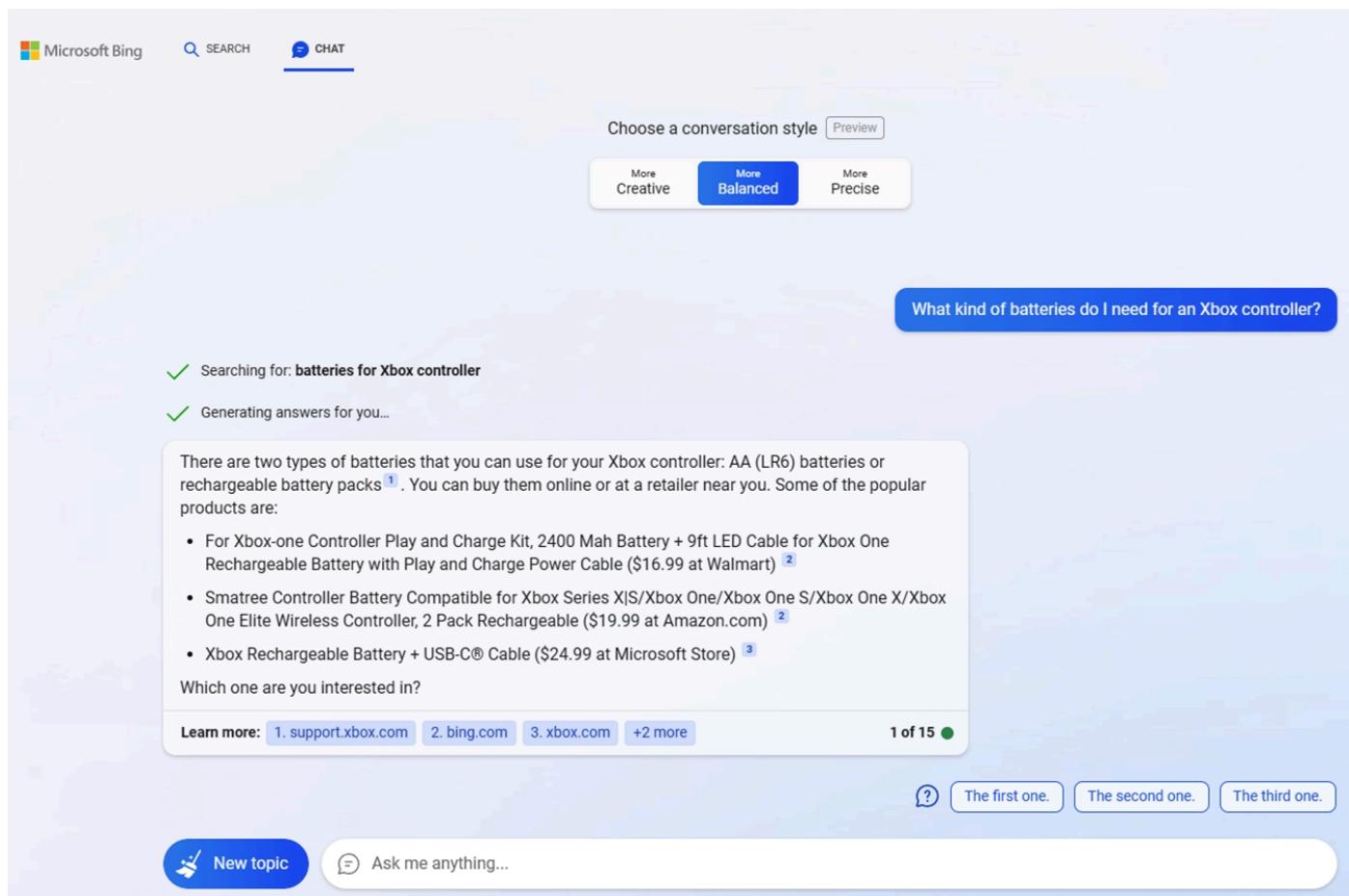
**ChatGPT Response:**

- Search query: "What kind of batteries do I need for an Xbox controller?"
- Response:

The Xbox controller typically uses two AA batteries. You can use either disposable or rechargeable AA batteries, depending on your preference. If you choose to use rechargeable batteries, make sure they are rechargeable AA batteries with a capacity of at least 1,200 mAh or higher for optimal performance.
- Feedback button: "Regenerate response"
- Footer: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us."

Source: Google Search, ChatGPT, RBC Capital Markets

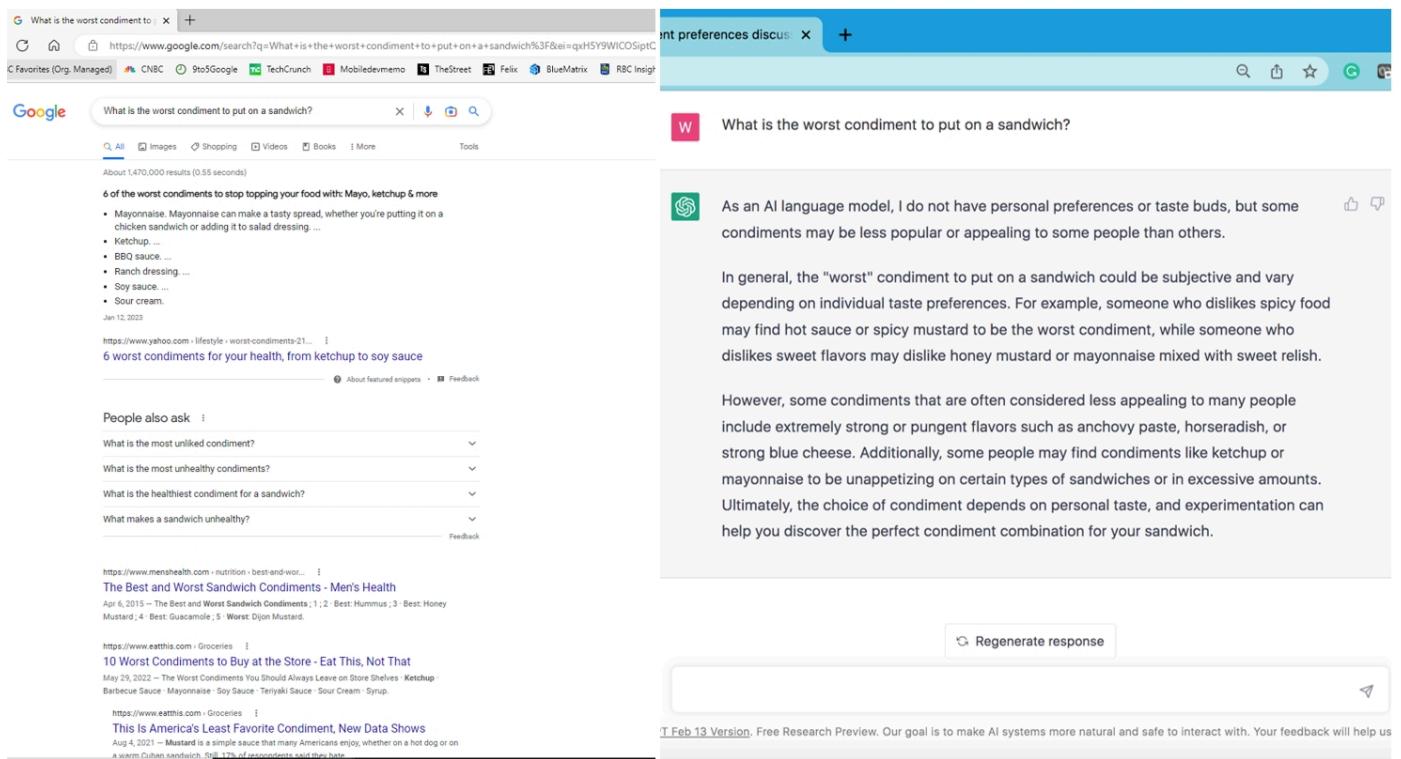
Figure 101 - Bing - Household Electronics



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the navigation bar, a message box displays the text: "Choose a conversation style [Preview]" with three options: "More Creative", "More Balanced" (which is selected), and "More Precise". In the main search area, a blue box contains the question: "What kind of batteries do I need for an Xbox controller?". Below the question, a progress bar indicates: "Searching for: batteries for Xbox controller" and "Generating answers for you...". A detailed response follows: "There are two types of batteries that you can use for your Xbox controller: AA (LR6) batteries or rechargeable battery packs <sup>1</sup>. You can buy them online or at a retailer near you. Some of the popular products are:" followed by a bulleted list of three items. At the bottom of the response, it asks "Which one are you interested in?" and provides a "Learn more" link with three sub-links: 1. support.xbox.com, 2. bing.com, 3. xbox.com, and "+2 more". To the right of the response, it says "1 of 15". Below the response, there are three buttons: "?", "The first one.", "The second one.", and "The third one.". At the very bottom, there are two buttons: "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets

**Figure 102 - Google Search vs. ChatGPT - Food Recommendation**



The figure shows two side-by-side search results. On the left is a Google search result from March 12, 2023, which lists several condiments as 'not good' toppings. On the right is a response from ChatGPT, which states it does not have personal preferences and provides a general overview of why certain condiments might be considered 'worst' based on individual taste.

**Google Search Results:**

- Query: What is the worst condiment to put on a sandwich?
- Results: About 1,470,000 results (0.55 seconds)
  - Top result: "6 of the worst condiments to stop topping your food with: Mayo, ketchup & more" (from Yahoo! News)
  - Second result: "Mayonnaise can make a tasty spread, whether you're putting it on a chicken sandwich or adding it to salad dressing. ..."
  - Third result: "Ketchup. ..."
  - Fourth result: "BBQ sauce. ..."
  - Fifth result: "Ranch dressing. ..."
  - Sixth result: "Soy sauce. ..."
  - Seventh result: "Sour cream."
- Feedback: "About featured snippets" and "Feedback".
- People also ask:
  - What is the most disliked condiment?
  - What is the most unhealthy condiments?
  - What is the healthiest condiment for a sandwich?
  - What makes a sandwich unhealthy?

**ChatGPT Response:**

What is the worst condiment to put on a sandwich?

As an AI language model, I do not have personal preferences or taste buds, but some condiments may be less popular or appealing to some people than others.

In general, the "worst" condiment to put on a sandwich could be subjective and vary depending on individual taste preferences. For example, someone who dislikes spicy food may find hot sauce or spicy mustard to be the worst condiment, while someone who dislikes sweet flavors may dislike honey mustard or mayonnaise mixed with sweet relish.

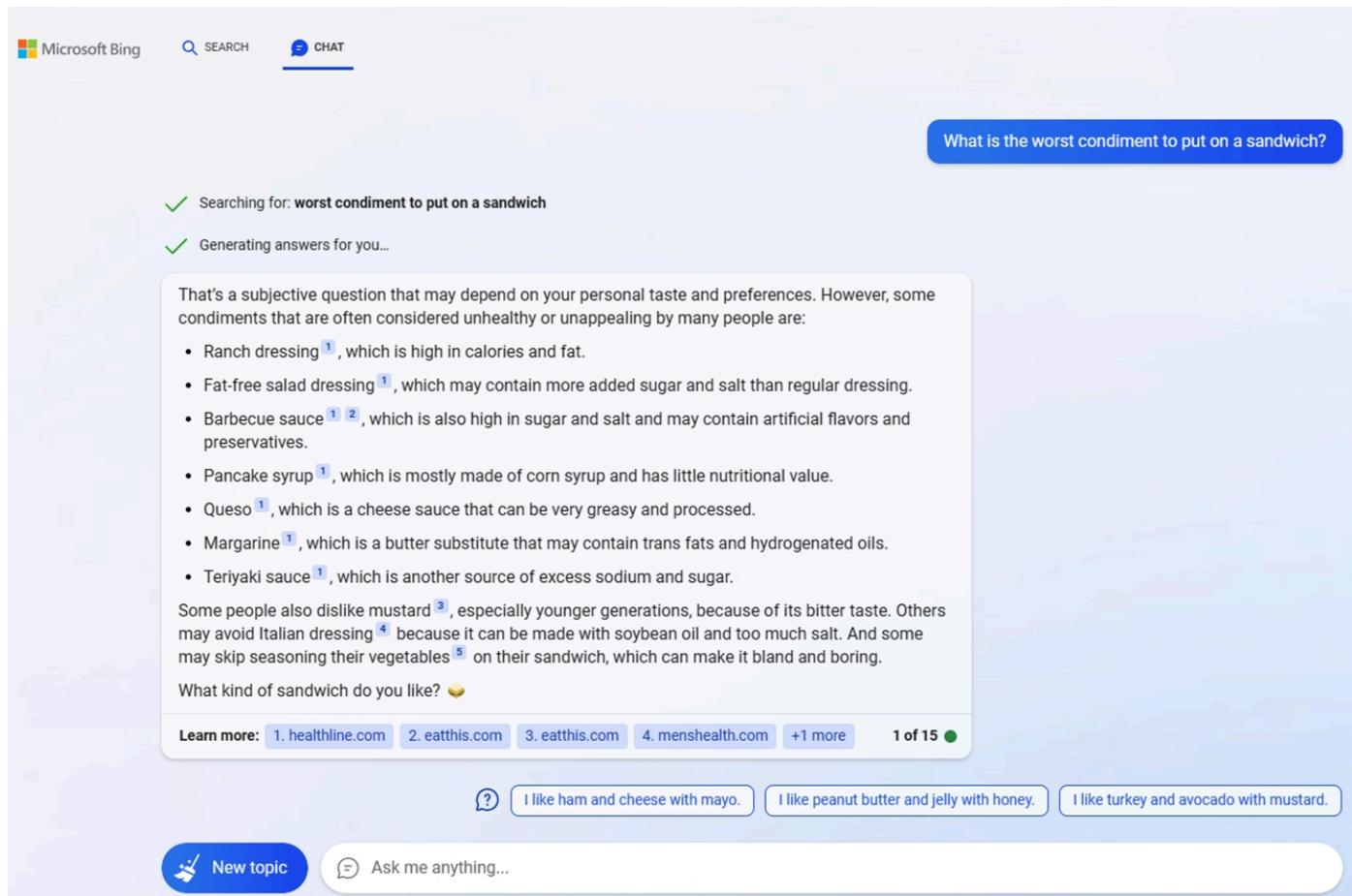
However, some condiments that are often considered less appealing to many people include extremely strong or pungent flavors such as anchovy paste, horseradish, or strong blue cheese. Additionally, some people may find condiments like ketchup or mayonnaise to be unappetizing on certain types of sandwiches or in excessive amounts. Ultimately, the choice of condiment depends on personal taste, and experimentation can help you discover the perfect condiment combination for your sandwich.

Regenerate response

Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 103 - Bing - Food Recommendation



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the query "What is the worst condiment to put on a sandwich?". Below the search bar, there are two green checkmarks indicating the process: "Searching for: worst condiment to put on a sandwich" and "Generating answers for you...". A text box contains the following content:

That's a subjective question that may depend on your personal taste and preferences. However, some condiments that are often considered unhealthy or unappealing by many people are:

- Ranch dressing <sup>1</sup>, which is high in calories and fat.
- Fat-free salad dressing <sup>1</sup>, which may contain more added sugar and salt than regular dressing.
- Barbecue sauce <sup>1 2</sup>, which is also high in sugar and salt and may contain artificial flavors and preservatives.
- Pancake syrup <sup>1</sup>, which is mostly made of corn syrup and has little nutritional value.
- Queso <sup>1</sup>, which is a cheese sauce that can be very greasy and processed.
- Margarine <sup>1</sup>, which is a butter substitute that may contain trans fats and hydrogenated oils.
- Teriyaki sauce <sup>1</sup>, which is another source of excess sodium and sugar.

Some people also dislike mustard <sup>3</sup>, especially younger generations, because of its bitter taste. Others may avoid Italian dressing <sup>4</sup> because it can be made with soybean oil and too much salt. And some may skip seasoning their vegetables <sup>5</sup> on their sandwich, which can make it bland and boring.

What kind of sandwich do you like? 😊

Learn more: [1. healthline.com](#) [2. eatthis.com](#) [3. eatthis.com](#) [4. menshealth.com](#) +1 more

1 of 15

At the bottom, there are three buttons: "New topic", "Ask me anything...", and a list of sandwich preferences: "I like ham and cheese with mayo.", "I like peanut butter and jelly with honey.", and "I like turkey and avocado with mustard."

Source: Bing, RBC Capital Markets



Figure 104 - Google Search vs. ChatGPT - Sports Facts

The screenshot shows two browser windows side-by-side. The left window is a Google search results page for the query "Who is the quarterback of the New York Giants?". The right window is a ChatGPT interface with the same query.

**Google Search Results:**

- Search bar: Who is the quarterback of the New York Giants?
- Results:
  - New York Giants / Quarterbacks
  - Thumbnail images of Daniel Jones and Tyrod Taylor.
  - Link: [Daniel Jones - Giants.com](https://www.giants.com/team/players-roster/daniel-jones)
  - Text: On Daniel Jones and WR Darius Slayton made the list put together by NFL Media analyst Daniel Jeremiah.
  - Text: Career: New York Giants logo - New York Giants Website - Splits
- People also ask:
  - Who is the New York Giants quarterback now?
  - What happened to New York Giants quarterback?
  - Is Daniel Jones better than Mac Jones?
  - Who will be the starting quarterback for the New York Giants in 2022?
- Links:
  - [Daniel Jones \(American football\) - Wikipedia](https://en.wikipedia.org/wiki/Daniel_Jones_(American_football))
  - [QB Daniel Jones: The Good, the Great and the Ugly](https://www.si.com/nfl/giants-ob-daniel-jones-2022-primer)
  - [New York Giants 2023 UFA Primer: QB Daniel Jones](https://www.si.com/nfl/giants-big-blue-plus-new-york-giants-2023-ufa-primer)

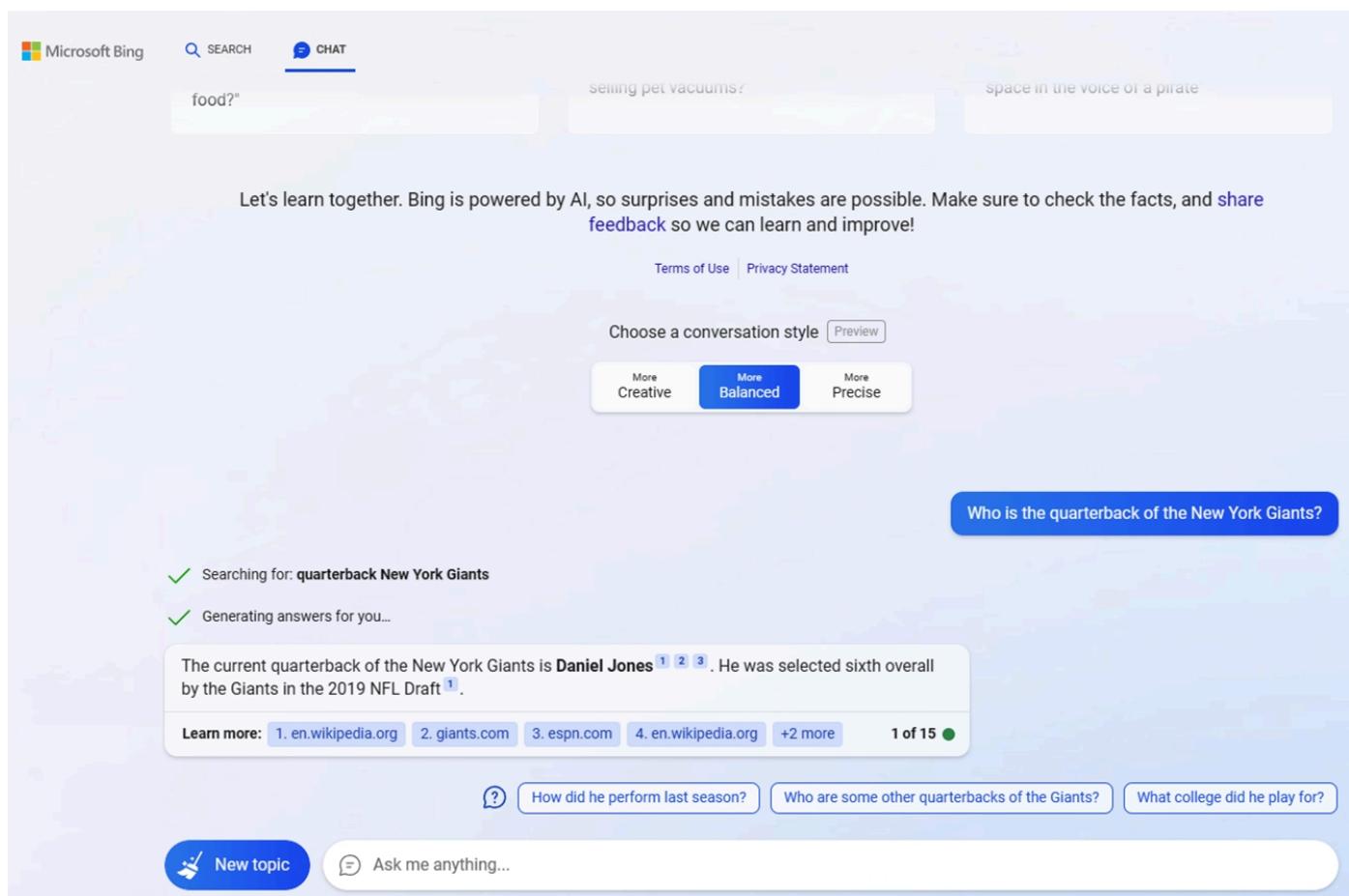
**ChatGPT Response:**

- Search bar: Who is the quarterback of the New York Giants?
- Response:

As of my knowledge cutoff date of September 2021, the starting quarterback for the New York Giants was Daniel Jones. However, please note that my responses are generated by artificial intelligence and may not reflect current information beyond my knowledge cutoff date.
- Image: A large thumbnail image of Daniel Jones in a New York Giants uniform.
- Text: New York Giants Football team
- Text: The New York Giants are a pro football team based in the New area. The Giants compete in the League as a member club of the Football Conference East division.
- Text: Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 105 - Bing - Sports Facts



The screenshot shows the Microsoft Bing search interface. At the top, there are search bars for "food?" and "space in the voice of a pirate". Below the search bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". A section titled "Choose a conversation style" offers options: "More Creative" (grayed out), "More Balanced" (selected and highlighted in blue), and "More Precise".

In the main search results area, a question is asked: "Who is the quarterback of the New York Giants?". Below it, a progress message says: "Searching for: quarterback New York Giants" and "Generating answers for you...". The result states: "The current quarterback of the New York Giants is **Daniel Jones** [1](#) [2](#) [3](#). He was selected sixth overall by the Giants in the 2019 NFL Draft [1](#)". Below the result are links: "Learn more: 1. en.wikipedia.org 2. giants.com 3. espn.com 4. en.wikipedia.org +2 more" and "1 of 15". At the bottom, there are buttons for "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets



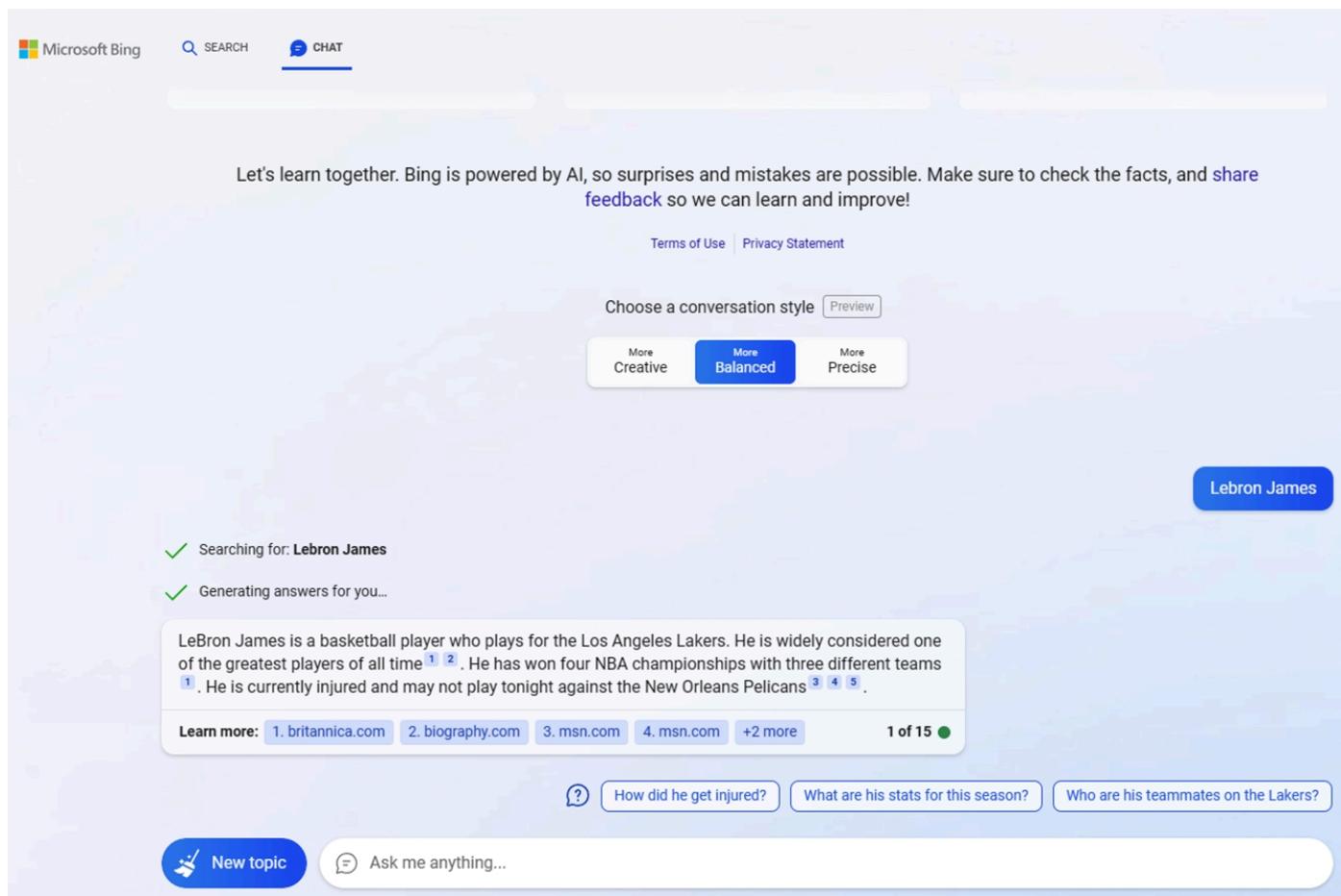
## People

Figure 106 - Google Search vs. ChatGPT - People

The figure shows two side-by-side browser windows. The left window is a Google search for 'Lebron James', displaying a standard search results page with news articles, images, and a 'About' section from Wikipedia. The right window is a ChatGPT interface with the query 'James: basketball super'. The ChatGPT response is a detailed biography of LeBron James, mentioning his birth date, family, career highlights, and philanthropy, followed by a 'Regenerate response' button.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 107 - Bing - People



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "Search people, places, things". Below the search bar are buttons for "SEARCH" and "CHAT". A message at the top of the page reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" Below this are links for "Terms of Use" and "Privacy Statement". A "Choose a conversation style" section offers options: "More Creative" (gray), "More Balanced" (blue, selected), and "More Precise" (gray). The search query "Lebron James" is entered in the search bar. In the search results, a summary states: "LeBron James is a basketball player who plays for the Los Angeles Lakers. He is widely considered one of the greatest players of all time [1] [2]. He has won four NBA championships with three different teams [1]. He is currently injured and may not play tonight against the New Orleans Pelicans [3] [4] [5].". Below the summary, there are "Learn more" links to various websites: 1. britannica.com, 2. biography.com, 3. msn.com, 4. msn.com, +2 more. A "1 of 15" indicator is shown. At the bottom, there are buttons for "New topic" (with a microphone icon) and "Ask me anything..." (with a speech bubble icon). There are also three suggested questions: "How did he get injured?", "What are his stats for this season?", and "Who are his teammates on the Lakers?".

Source: Bing, RBC Capital Markets



Figure 108 - Google Search vs. ChatGPT - People

The screenshot shows two side-by-side search results for "Queen Elizabeth".

**Google Search Results:**

- Header: Queen Elizabeth - Google Search
- Search bar: Queen Elizabeth
- Results:
  - [Elizabeth II - Wikipedia](https://en.wikipedia.org/wiki/Elizabeth_II): Elizabeth II (Elizabeth Alexandra Mary, 21 April 1926 – 8 September 2022) was Queen of the United Kingdom and other Commonwealth realms from 6 February 1952 ...
  - [Elizabeth I - Wikipedia](https://en.wikipedia.org/wiki/Elizabeth_I): Elizabeth I (7 September 1533 – 24 March 1603) was Queen of England and Ireland from 17 November 1558 until her death in 1603. Elizabeth was the last ...
- People also ask:
  - What disease did Queen Elizabeth have?
  - How old was Elizabeth Ist when she died?
  - Why was Queen Elizabeth not born?
  - When Queen Elizabeth dies who becomes queen?
- Top stories:
  - CTV News: Ottawa spent \$398K on hotel rooms for Queen Elizabeth II funeral (1 day ago)
  - The Washington Post: Did Jimmy Carter kiss the Queen Mother on the lips? Depends who you ask. (3 days ago)
  - CBS News: Lady Anne Glenconner discusses friendships with King Charles and late Queen Elizabeth II (2 days ago)
  - BBC NEWS: Woodland in Rotherham to be named after Queen Elizabeth II (1 day ago)

**ChatGPT Response:**

Queen Elizabeth usually refers to Queen Elizabeth II, who is the current Queen of the United Kingdom and the Commonwealth Realms. She was born on April 21, 1926, and became Queen on February 6, 1952, following the death of her father, King George VI.

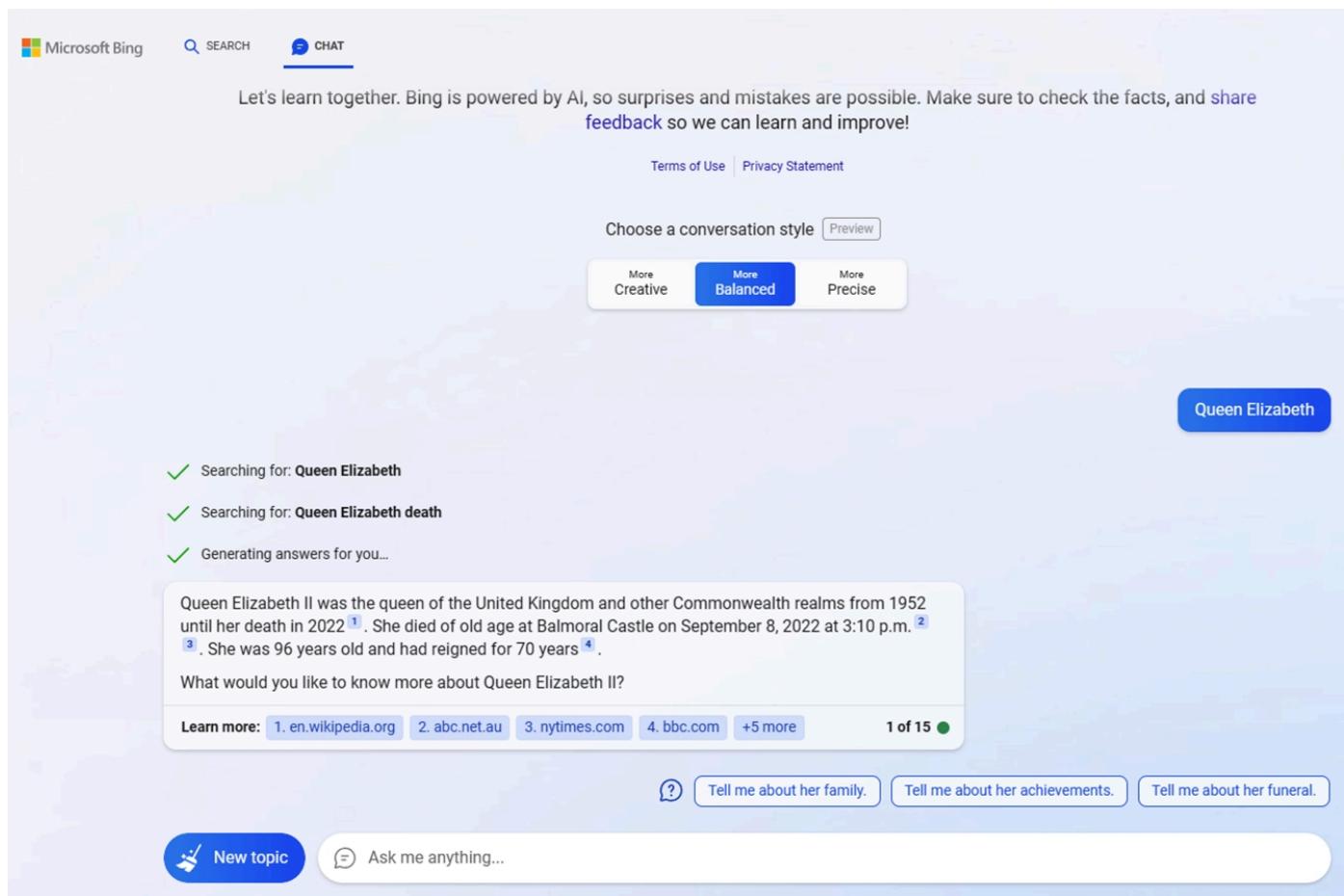
Queen Elizabeth II has been a prominent figure in British and international politics for more than six decades. During her reign, she has witnessed significant historical events such as the end of the British Empire, the Cold War, the rise of the European Union, and numerous changes in social and cultural norms.

As the Queen, she has a ceremonial and symbolic role in the government of the United Kingdom and the Commonwealth Realms, including Canada, Australia, and New Zealand. She performs various duties such as opening Parliament, receiving ambassadors, and awarding honors and medals. She is also the head of the Church of England and the patron of numerous charities and organizations.

Queen Elizabeth II is the longest-reigning monarch in British history and has become a beloved figure around the world. Her personal life, including her marriage to Prince Philip, Duke of Edinburgh, and her relatives and grandchildren, has been a subject of public interest and admiration.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 109 - Bing - People



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "What would you like to know?" and a "SEARCH" button. Below the search bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and [share feedback](#) so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". A "CHAT" button is also present.

In the center, there is a section titled "Choose a conversation style" with three options: "More Creative" (gray), "More Balanced" (blue), and "More Precise" (gray). To the right, a blue button says "Queen Elizabeth".

Below this, a list of search activities is shown with green checkmarks:

- ✓ Searching for: Queen Elizabeth
- ✓ Searching for: Queen Elizabeth death
- ✓ Generating answers for you...

A detailed search result for Queen Elizabeth II is displayed, stating: "Queen Elizabeth II was the queen of the United Kingdom and other Commonwealth realms from 1952 until her death in 2022 <sup>1</sup>. She died of old age at Balmoral Castle on September 8, 2022 at 3:10 p.m. <sup>2</sup> <sup>3</sup>. She was 96 years old and had reigned for 70 years <sup>4</sup>." Below the result, there are links to "Learn more" (including en.wikipedia.org, abc.net.au, nytimes.com, bbc.com) and a "1 of 15" indicator.

At the bottom, there are several buttons: a question mark icon, "Tell me about her family.", "Tell me about her achievements.", "Tell me about her funeral.", "New topic" (with a pencil icon), and "Ask me anything...".

Source: Bing, RBC Capital Markets



Figure 110 - Google Search vs. ChatGPT - People

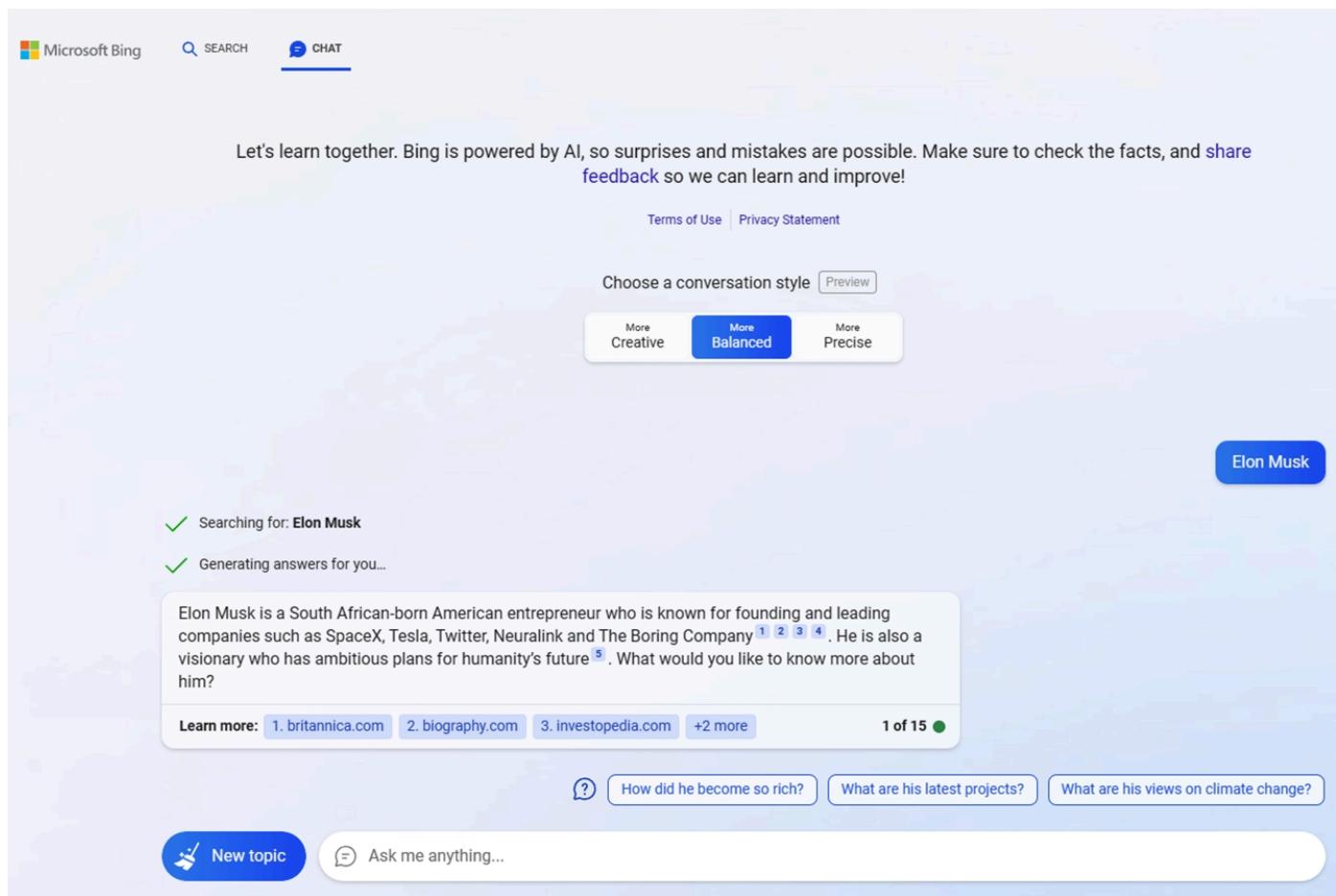
The figure shows a side-by-side comparison of search results for 'Elon Musk'.

**Google Search Results:** The left panel displays the standard Google search interface with a search bar containing 'Elon Musk'. Below it, a snippet of the Wikipedia page for Elon Musk is shown, followed by a section titled 'Top stories' with links to news articles from The Verge and Forbes.

**ChatGPT Response:** The right panel shows a detailed biography of Elon Musk generated by ChatGPT. It includes a summary, a 'Net worth' section (listing \$193.3 billion), and a 'About' section with biographical details like birth date (June 28, 1971), education (University of Pennsylvania), and family (parents Erol Musk and Maye Musk). A 'Regenerate response' button is at the bottom.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 111 - Bing - People



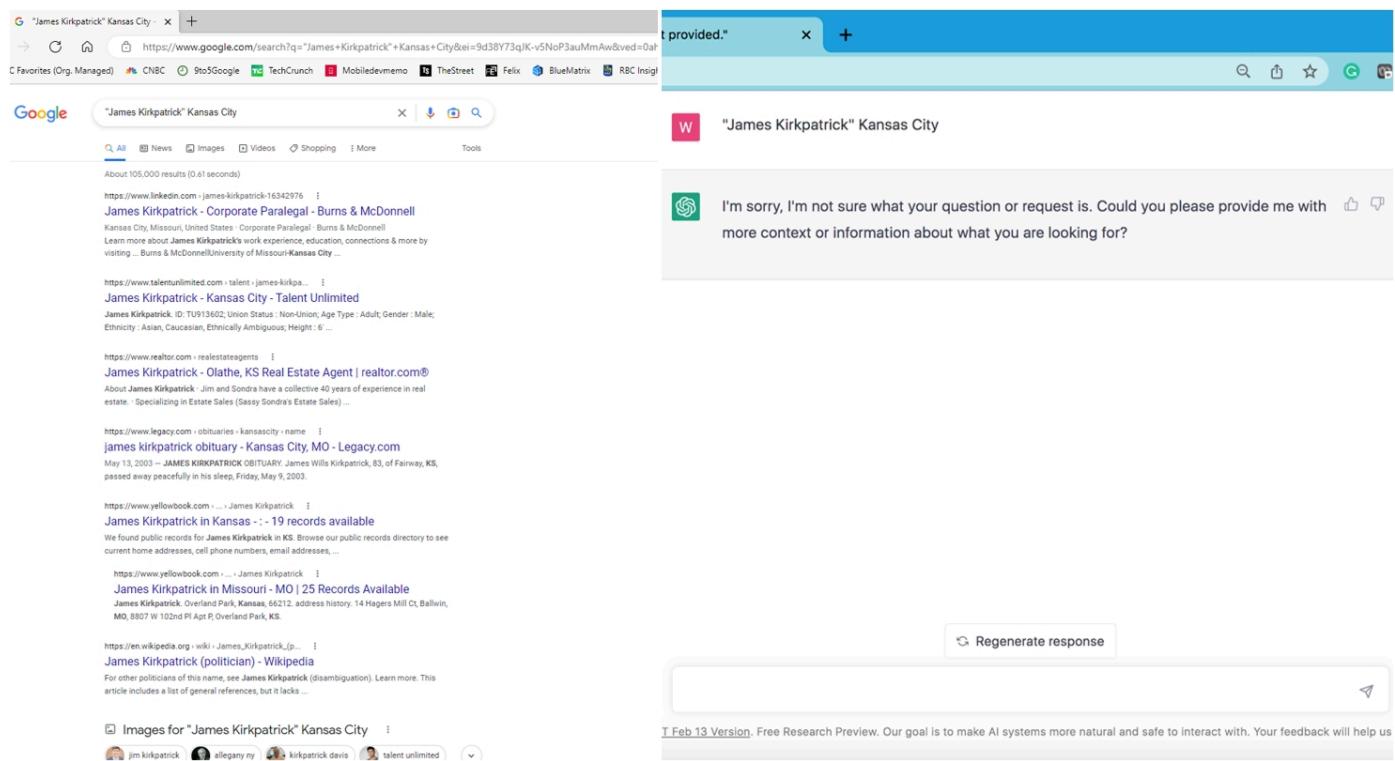
The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search input field labeled "SEARCH", and a "CHAT" button. Below the navigation bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and [share feedback](#) so we can learn and improve!" Below this message are links for "Terms of Use" and "Privacy Statement". A "Choose a conversation style" section offers three options: "More Creative", "More Balanced" (which is selected), and "More Precise".

In the main search results area, a blue button on the right says "Elon Musk". Below it, two green checkmarks indicate the search process: "Searching for: Elon Musk" and "Generating answers for you...". A detailed search result for "Elon Musk" is shown, stating he is a South African-born American entrepreneur known for founding SpaceX, Tesla, Twitter, Neuralink, and The Boring Company. It also mentions his ambitious plans for humanity's future. Below the result are links to learn more from Britannica.com, biography.com, investopedia.com, and others, along with a note that this is "1 of 15".

At the bottom of the search results, there are several interactive buttons: "New topic", "Ask me anything...", and three questions with icons: "How did he become so rich?", "What are his latest projects?", and "What are his views on climate change?".

Source: Bing, RBC Capital Markets

**Figure 112 - Google Search vs. ChatGPT - People**



The figure shows a side-by-side comparison of search results for "James Kirkpatrick" on Google and a response from ChatGPT.

**Google Search Results:**

- <https://www.linkedin.com/in/james-kirkpatrick-16342976> James Kirkpatrick - Corporate Paralegal - Burns & McDonnell
- <https://www.talenunlimited.com/talent-james-kirkpatrick> James Kirkpatrick - Kansas City - Talent Unlimited
- <https://www.realtor.com/realestagents/> James Kirkpatrick - Olathe, KS Real Estate Agent | realtor.com®
- <https://www.legacy.com/obituaries/kansas-city-name/james-kirkpatrick-obituary-Kansas-City-MO-Legacy.com>
- <https://www.yellowbook.com.../James-Kirkpatrick> James Kirkpatrick in Kansas - 19 records available
- [https://en.wikipedia.org/wiki/James\\_Kirkpatrick\\_\(politic](https://en.wikipedia.org/wiki/James_Kirkpatrick_(politic)

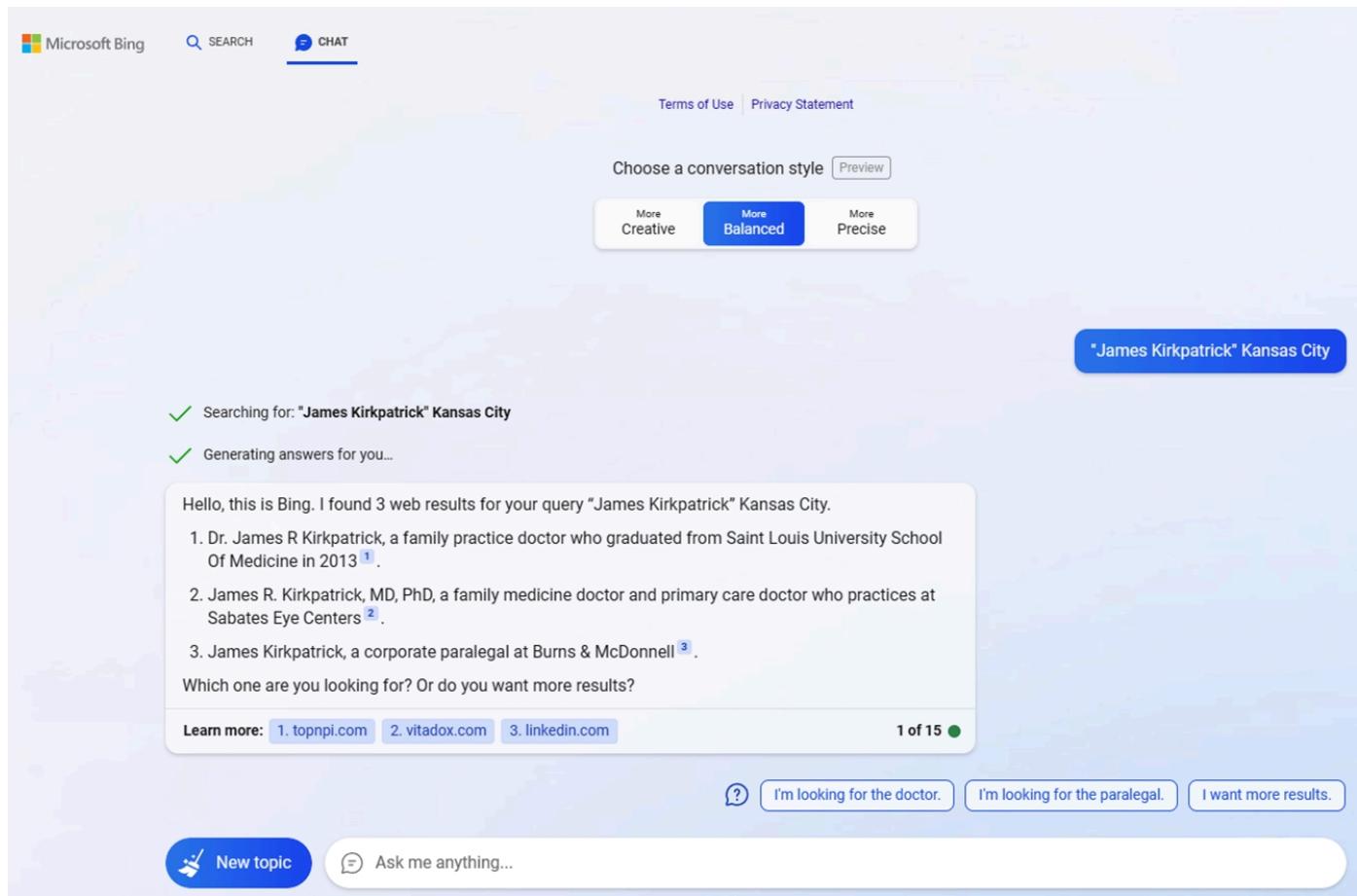
**ChatGPT Response:**

"I'm sorry, I'm not sure what your question or request is. Could you please provide me with more context or information about what you are looking for?"

**Feedback:** Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us.

Source: Google Search, ChatGPT, RBC Capital Markets

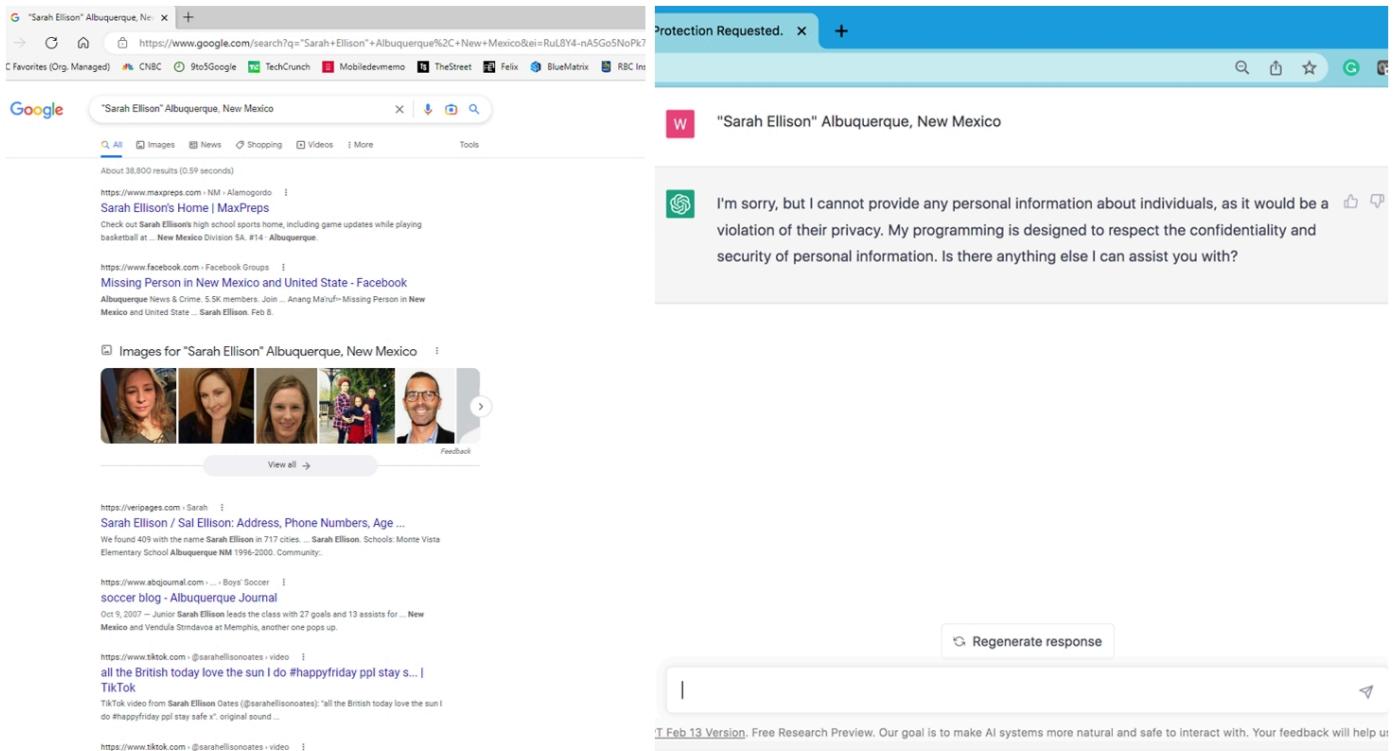
Figure 113 - Bing - People



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the navigation bar, there are links for 'Terms of Use' and 'Privacy Statement'. A section titled 'Choose a conversation style' offers options for 'More Creative', 'More Balanced' (which is selected), and 'More Precise'. In the main search area, a query 'James Kirkpatrick' Kansas City is entered. Below the query, a message says 'Hello, this is Bing. I found 3 web results for your query "James Kirkpatrick" Kansas City.' followed by a numbered list of three results. At the bottom of the search results, there are links to learn more about the results and a page number '1 of 15'. Below the search results, there are several interactive buttons: a question mark icon, 'I'm looking for the doctor.', 'I'm looking for the paralegal.', and 'I want more results.'. At the very bottom, there are two buttons: 'New topic' with a pencil icon and 'Ask me anything...' with a speech bubble icon.

Source: Bing, RBC Capital Markets

**Figure 114 - Google Search vs. ChatGPT - People**



The figure shows a side-by-side comparison of search results for "Sarah Ellison" in Albuquerque, New Mexico.

**Google Search Results:**

- Search bar: "Sarah Ellison" Albuquerque, New Mexico
- Results count: About 38,800 results (0.59 seconds)
- Links:
  - [MaxPreps](https://www.maxpreps.com): Sarah Ellison's Home | MaxPreps
  - [Facebook Groups](https://www.facebook.com): Missing Person in New Mexico and United State - Facebook
  - [Veripages](https://veripages.com): Sarah Ellison / Sal Ellison: Address, Phone Numbers, Age ...
  - [Abq Journal](https://www.abjournal.com): Soccer blog - Albuquerque Journal
  - [TikTok](https://www.tiktok.com): @sarahellisonates
- Image preview: A grid of five small profile pictures of different people, labeled "View all".

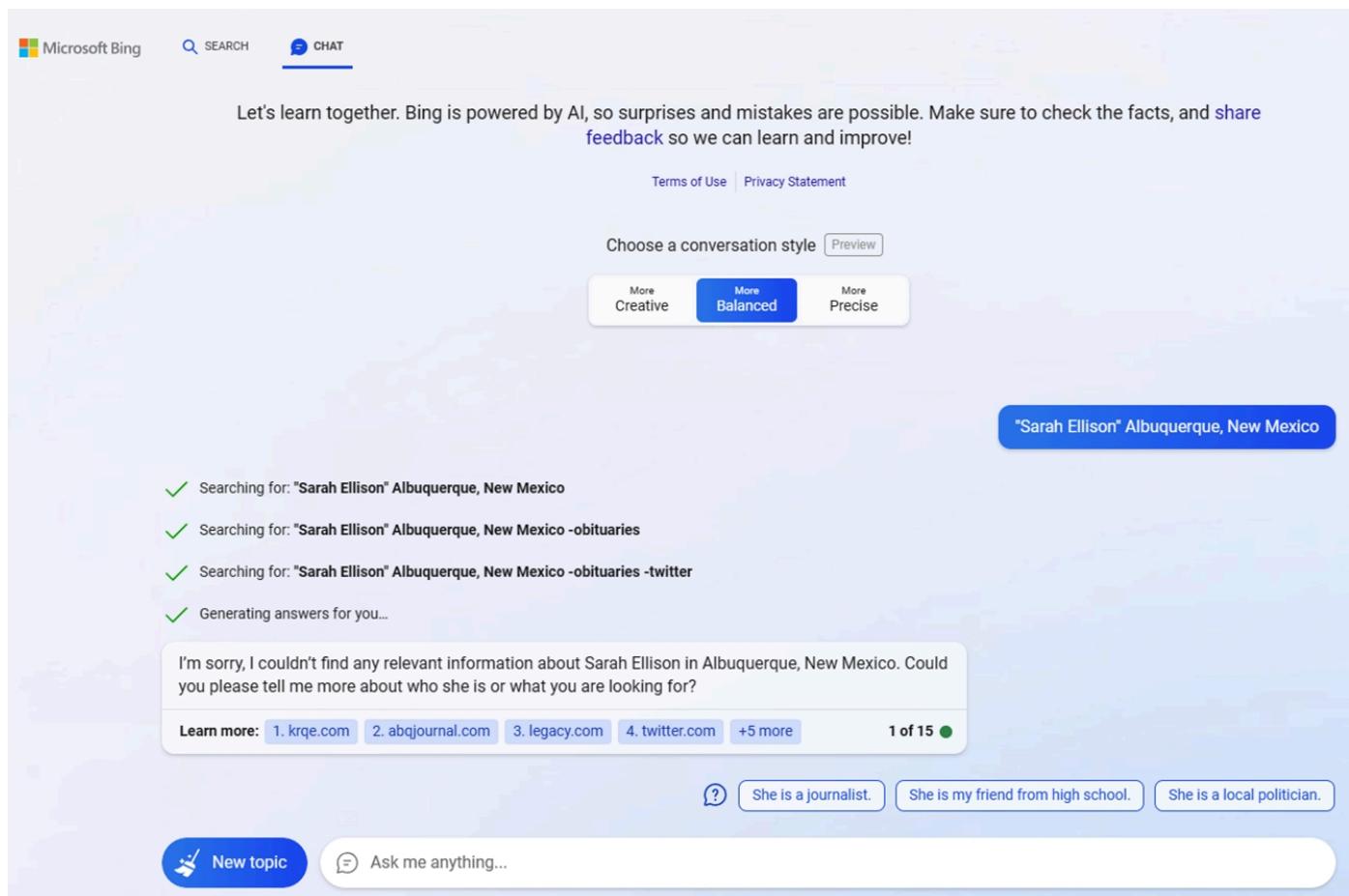
**ChatGPT Response:**

"Sarah Ellison" Albuquerque, New Mexico

I'm sorry, but I cannot provide any personal information about individuals, as it would be a violation of their privacy. My programming is designed to respect the confidentiality and security of personal information. Is there anything else I can assist you with?

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 115 - Bing - People



Microsoft Bing

SEARCH CHAT

Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and [share feedback](#) so we can learn and improve!

Terms of Use | Privacy Statement

Choose a conversation style [Preview](#)

More Creative More Balanced More Precise

"Sarah Ellison" Albuquerque, New Mexico

- ✓ Searching for: "Sarah Ellison" Albuquerque, New Mexico
- ✓ Searching for: "Sarah Ellison" Albuquerque, New Mexico -obituaries
- ✓ Searching for: "Sarah Ellison" Albuquerque, New Mexico -obituaries -twitter
- ✓ Generating answers for you...

I'm sorry, I couldn't find any relevant information about Sarah Ellison in Albuquerque, New Mexico. Could you please tell me more about who she is or what you are looking for?

Learn more: [1. krqe.com](#) [2. abqjournal.com](#) [3. legacy.com](#) [4. twitter.com](#) +5 more 1 of 15

?

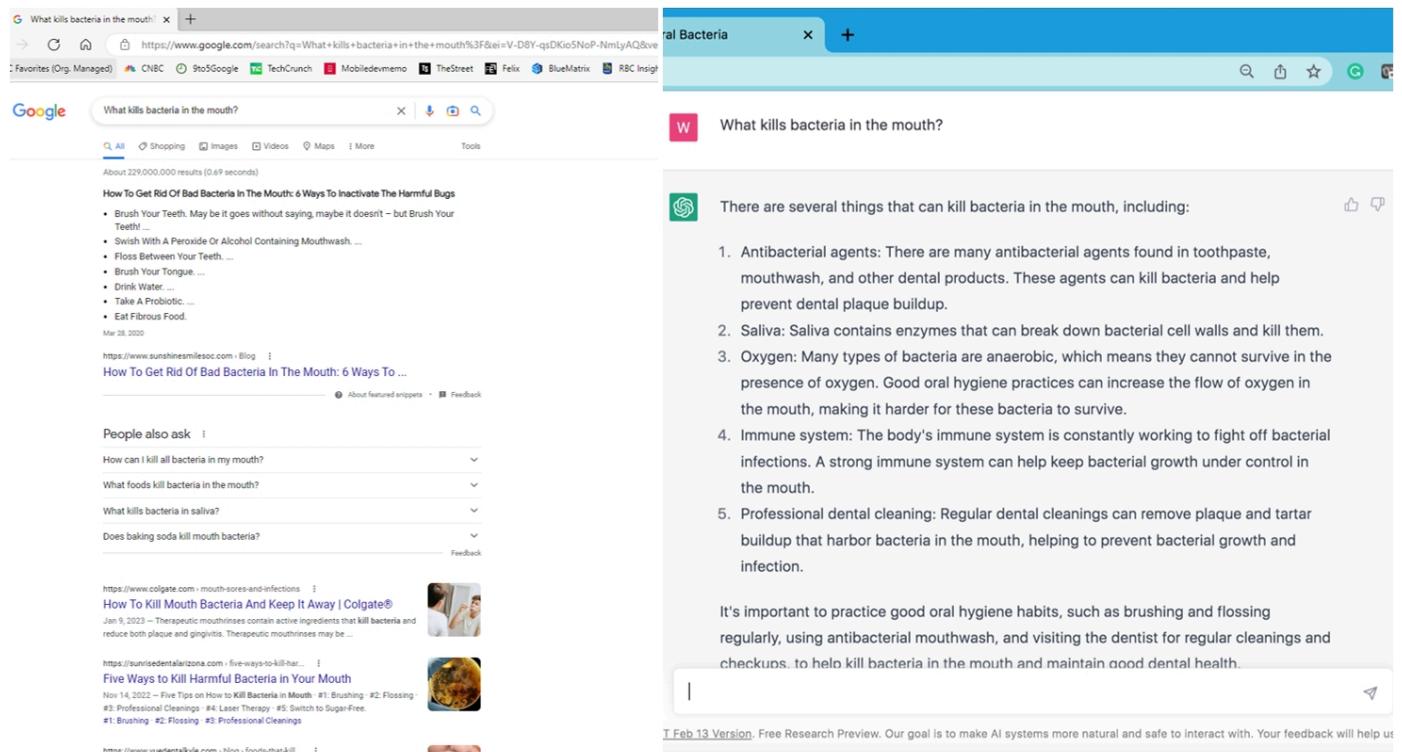
She is a journalist. She is my friend from high school. She is a local politician.

New topic Ask me anything...

Source: Bing, RBC Capital Markets

## Health

Figure 116 - Google Search vs. ChatGPT - Kills Bacteria



The figure shows two side-by-side browser windows. The left window is a Google search results page for the query "What kills bacteria in the mouth?". The right window is a ChatGPT interface with the same query.

**Google Search Results:**

- Page title: What kills bacteria in the mouth?
- Search bar: What kills bacteria in the mouth?
- Results count: About 229,000,000 results (0.69 seconds)
- First result: "How To Get Rid Of Bad Bacteria In The Mouth: 6 Ways To Inactivate The Harmful Bugs"
  - Summary: Brush Your Teeth, Swish With A Peroxide Or Alcohol Containing Mouthwash, Floss Between Your Teeth, Brush Your Tongue, Drink Water, Take A Probiotic, Eat Fibrous Food.
  - Date: Mar 28, 2020
  - Source: https://www.sunshinemilesoc.com/Blog/How To Get Rid Of Bad Bacteria In The Mouth: 6 Ways To ...
- People also ask:
  - How can I kill all bacteria in my mouth?
  - What foods kill bacteria in the mouth?
  - What kills bacteria in saliva?
  - Does baking soda kill mouth bacteria?
- Related links:
  - https://www.colgate.com/mouth-sores-and-infections/
  - How To Kill Mouth Bacteria And Keep It Away | Colgate®
  - Jan 9, 2023 — Therapeutic mouthrinses contain active ingredients that kill bacteria and reduce both plaque and gingivitis. Therapeutic mouthrinses may be ...
  - https://sunrisedentalaz.com/five-ways-to-kill-bac...
  - Five Ways To Kill Harmful Bacteria In Your Mouth
  - Nov 14, 2022 — Five Tips on How to Kill Bacteria in Mouth - #1: Brushing - #2: Flossing - #3: Professional Cleanings - #4: Laser Therapy - #5: Switch to Sugar-Free.
  - #1: Brushing - #2: Flossing - #3: Professional Cleanings
  - https://www.vuedentalkyle.com/blog/foods-that-kill...

**ChatGPT Response:**

There are several things that can kill bacteria in the mouth, including:

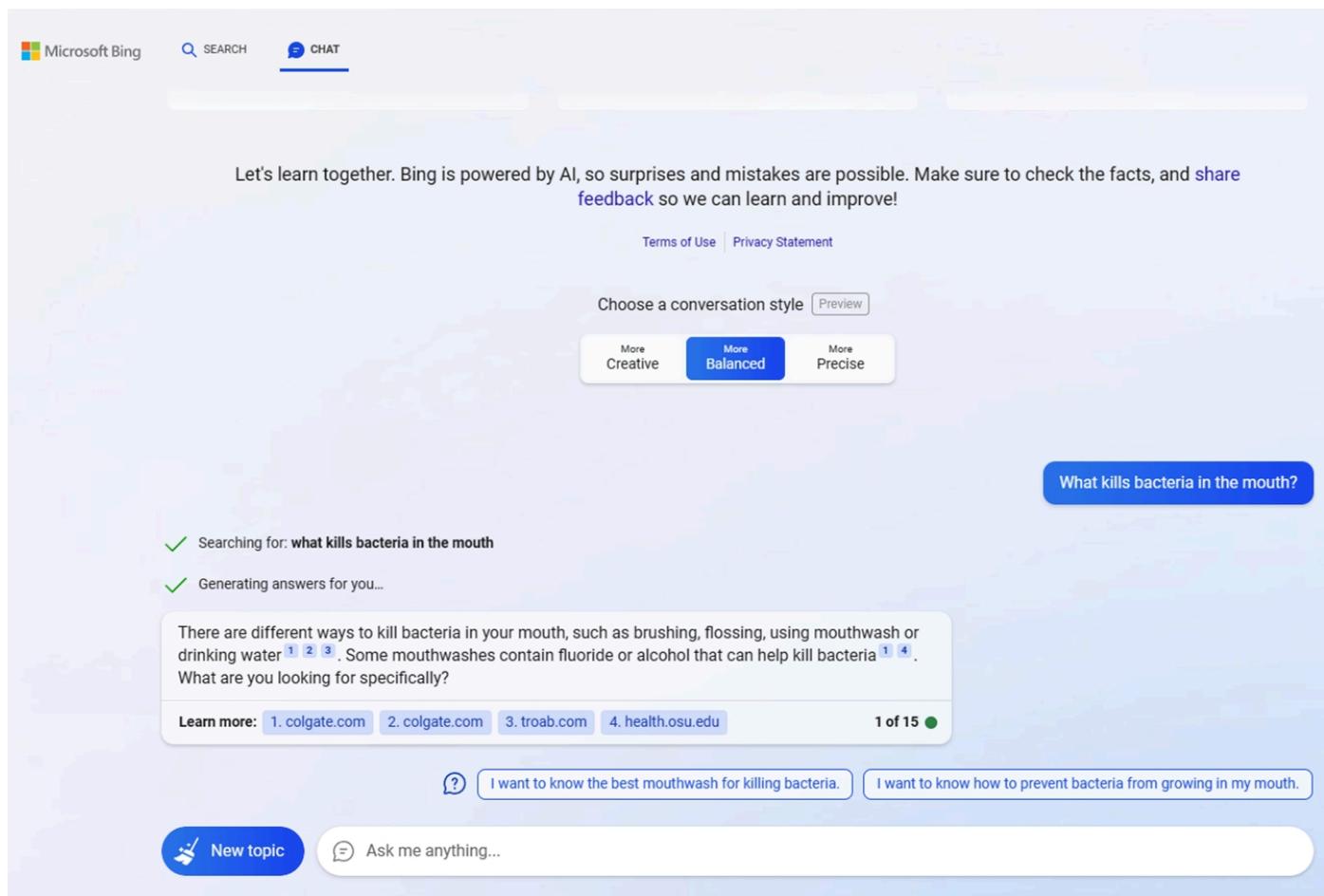
- Antibacterial agents: There are many antibacterial agents found in toothpaste, mouthwash, and other dental products. These agents can kill bacteria and help prevent dental plaque buildup.
- Saliva: Saliva contains enzymes that can break down bacterial cell walls and kill them.
- Oxygen: Many types of bacteria are anaerobic, which means they cannot survive in the presence of oxygen. Good oral hygiene practices can increase the flow of oxygen in the mouth, making it harder for these bacteria to survive.
- Immune system: The body's immune system is constantly working to fight off bacterial infections. A strong immune system can help keep bacterial growth under control in the mouth.
- Professional dental cleaning: Regular dental cleanings can remove plaque and tartar buildup that harbor bacteria in the mouth, helping to prevent bacterial growth and infection.

It's important to practice good oral hygiene habits, such as brushing and flossing regularly, using antibacterial mouthwash, and visiting the dentist for regular cleanings and checkups, to help kill bacteria in the mouth and maintain good dental health.

T Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us.

Source: Google Search, ChatGPT, RBC Capital Markets

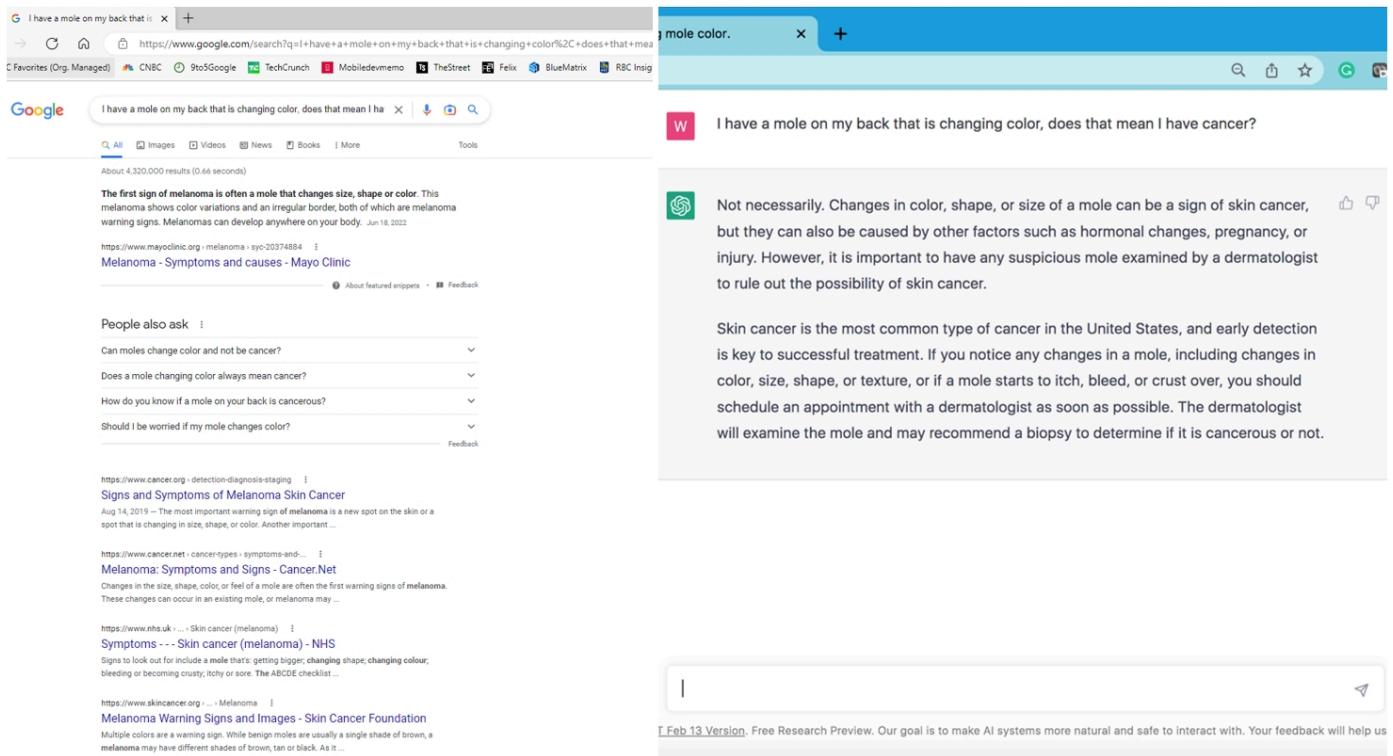
Figure 117 - Bing - Kills Bacteria



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the navigation bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". A section titled "Choose a conversation style" offers three options: "More Creative" (gray), "More Balanced" (blue, selected), and "More Precise" (gray). In the main search area, a blue button asks "What kills bacteria in the mouth?". Below this, a list of items starts with "Searching for: what kills bacteria in the mouth" and "Generating answers for you...". A text box contains the response: "There are different ways to kill bacteria in your mouth, such as brushing, flossing, using mouthwash or drinking water [1] [2] [3]. Some mouthwashes contain fluoride or alcohol that can help kill bacteria [1] [4]. What are you looking for specifically?" Below the response are four links: "Learn more: 1. colgate.com 2. colgate.com 3. troab.com 4. health.osu.edu". To the right, it says "1 of 15". At the bottom, there are two buttons: "Ask me anything..." and "New topic".

Source: Bing, RBC Capital Markets

**Figure 118 - Google Search vs. ChatGPT - Discolored Mole**



The figure shows two side-by-side search results. On the left is a Google search result for "I have a mole on my back that is changing color, does that mean I have cancer?". The results include links from Mayo Clinic, Cancer.org, and NHS, all stating that changes in a mole can be a sign of skin cancer. On the right is a ChatGPT response to the same query, which also links to Mayo Clinic and provides additional information about skin cancer symptoms and the importance of early detection.

**Google Search Results:**

- Query:** I have a mole on my back that is changing color, does that mean I have cancer?
- Results:**
  - About 4,320,000 results (0.66 seconds)
  - The first sign of melanoma is often a mole that changes size, shape or color. This melanoma shows color variations and an irregular border, both of which are melanoma warning signs. Melanomas can develop anywhere on your body. Jun 18, 2022
  - <https://www.mayoclinic.org/melanoma-symptoms-and-causes/MAY00034> | Mayo Clinic
  - People also ask:
    - Can moles change color and not be cancer?
    - Does a mole changing color always mean cancer?
    - How do you know if a mole on your back is cancerous?
    - Should I be worried if my mole changes color?
  - Feedback

**ChatGPT Response:**

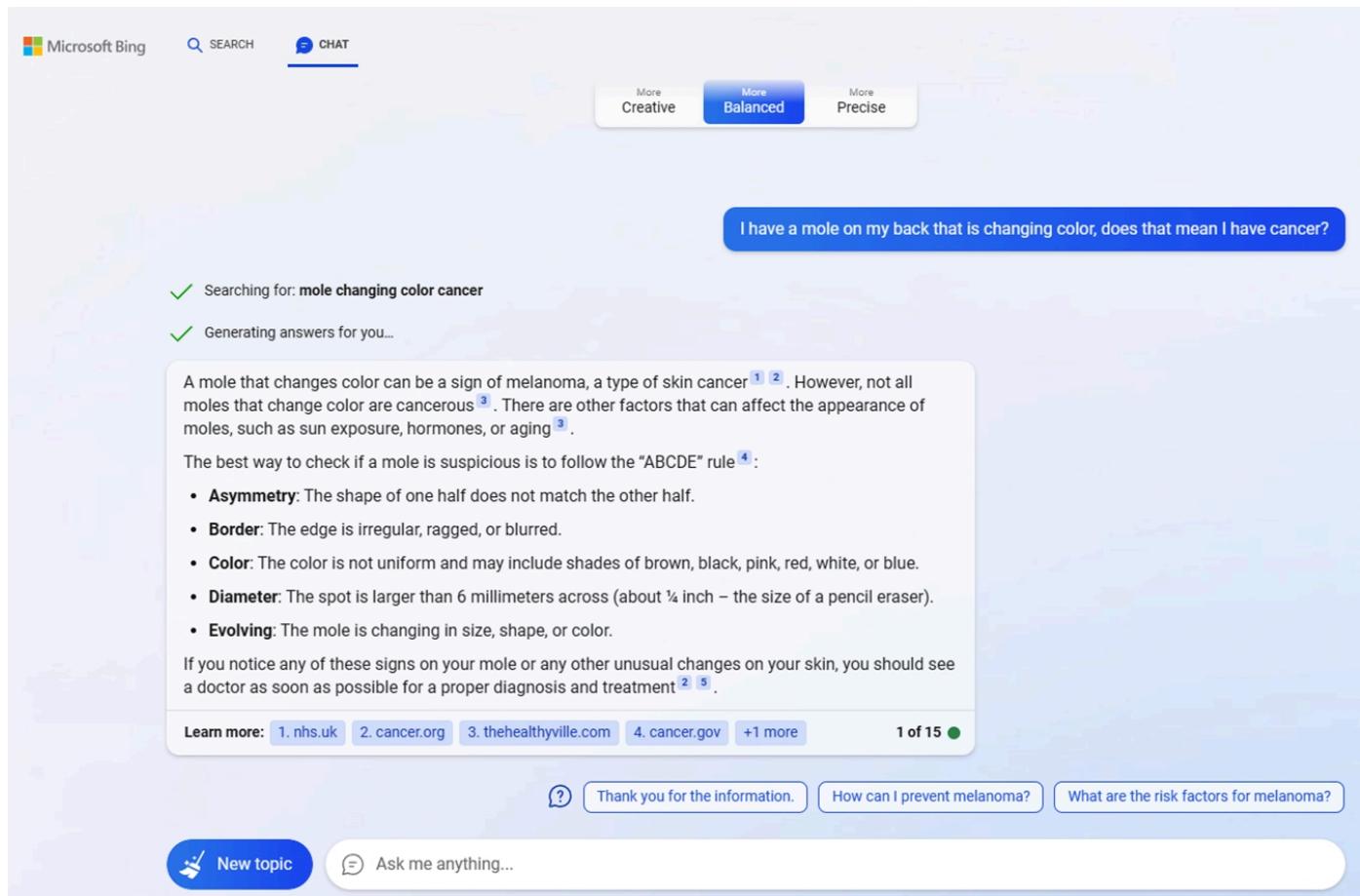
- Query:** I have a mole on my back that is changing color, does that mean I have cancer?
- Response:**

Not necessarily. Changes in color, shape, or size of a mole can be a sign of skin cancer, but they can also be caused by other factors such as hormonal changes, pregnancy, or injury. However, it is important to have any suspicious mole examined by a dermatologist to rule out the possibility of skin cancer.

Skin cancer is the most common type of cancer in the United States, and early detection is key to successful treatment. If you notice any changes in a mole, including changes in color, size, shape, or texture, or if a mole starts to itch, bleed, or crust over, you should schedule an appointment with a dermatologist as soon as possible. The dermatologist will examine the mole and may recommend a biopsy to determine if it is cancerous or not.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 119 - Bing - Discolored Mole



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the text "I have a mole on my back that is changing color, does that mean I have cancer?". Below the search bar, there are three buttons: "More Creative", "More Balanced" (which is highlighted in blue), and "More Precise".

Under the search bar, there are two green checkmarks indicating the process: "Searching for: mole changing color cancer" and "Generating answers for you...".

The main content area contains text about melanoma and the ABCDE rule:

A mole that changes color can be a sign of melanoma, a type of skin cancer <sup>1</sup> <sup>2</sup>. However, not all moles that change color are cancerous <sup>3</sup>. There are other factors that can affect the appearance of moles, such as sun exposure, hormones, or aging <sup>3</sup>.

The best way to check if a mole is suspicious is to follow the "ABCDE" rule <sup>4</sup>:

- **Asymmetry:** The shape of one half does not match the other half.
- **Border:** The edge is irregular, ragged, or blurred.
- **Color:** The color is not uniform and may include shades of brown, black, pink, red, white, or blue.
- **Diameter:** The spot is larger than 6 millimeters across (about  $\frac{1}{4}$  inch – the size of a pencil eraser).
- **Evolving:** The mole is changing in size, shape, or color.

If you notice any of these signs on your mole or any other unusual changes on your skin, you should see a doctor as soon as possible for a proper diagnosis and treatment <sup>2</sup> <sup>5</sup>.

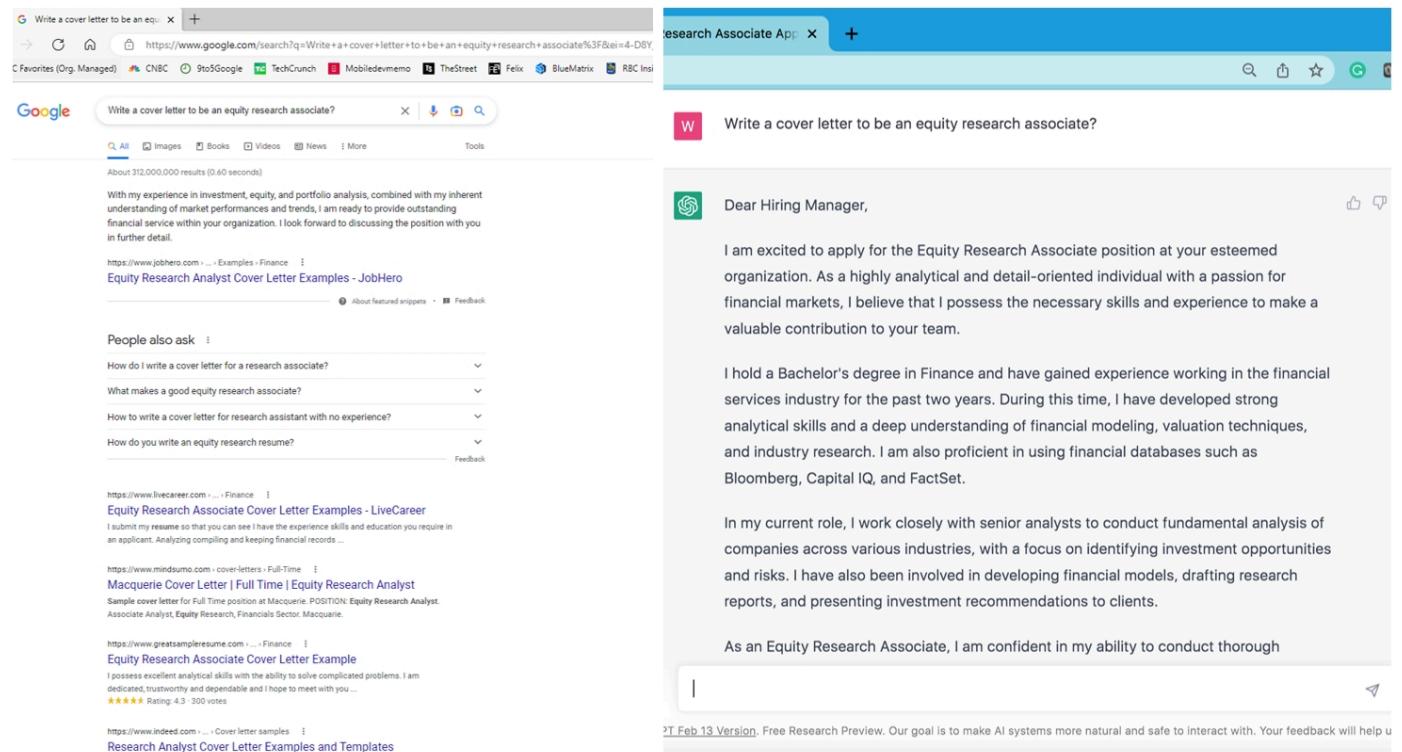
Below the text, there is a "Learn more:" section with links: 1. nhs.uk, 2. cancer.org, 3. thehealthyville.com, 4. cancer.gov, +1 more. To the right, it says "1 of 15".

At the bottom, there are several buttons: a question mark icon, "Thank you for the information.", "How can I prevent melanoma?", "What are the risk factors for melanoma?", a "New topic" button with a pencil icon, and an "Ask me anything..." button with a speech bubble icon.

Source: Bing, RBC Capital Markets

## Content Creation

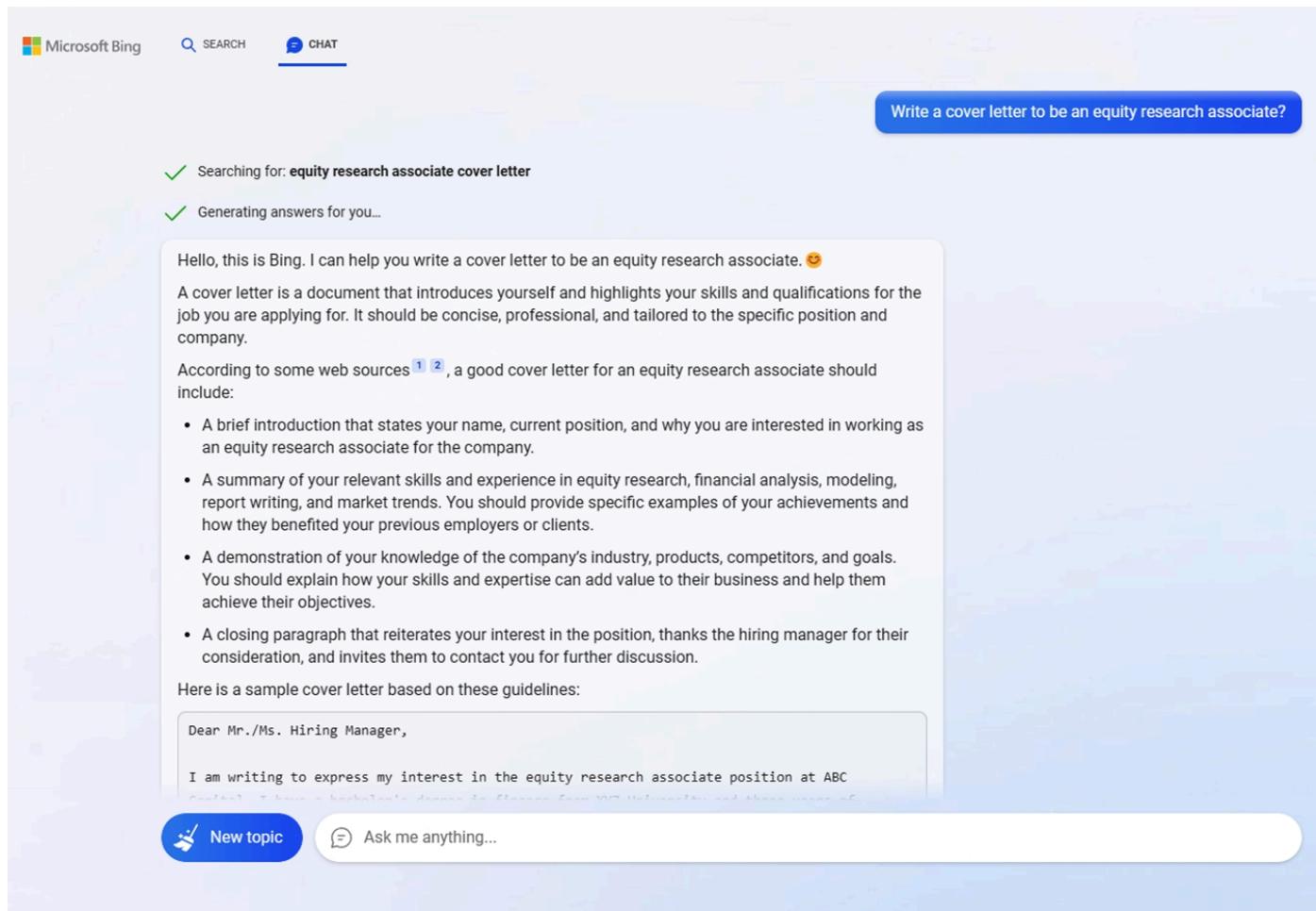
Figure 120 - Google Search vs. ChatGPT - Cover Letter



The figure shows two browser windows side-by-side. The left window is a Google search results page for the query "Write a cover letter to be an equity research associate". It displays several search results from websites like JobHero, LiveCareer, and Indeed, each providing examples of cover letters for the position. The right window is a screenshot of a ChatGPT interface, specifically the "Research Associate App" version. It shows a generated cover letter starting with "Dear Hiring Manager," followed by a paragraph about the applicant's education and experience in finance, and another paragraph detailing their current role and responsibilities at Macquarie. The ChatGPT interface includes a feedback section and a timestamp indicating the response was generated on Feb 13.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 121 - Bing - Cover Letter



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "Write a cover letter to be an equity research associate?". Below the search bar, there are two buttons: "SEARCH" and "CHAT". The "CHAT" button is highlighted with a blue underline.

On the left side of the main area, there are two green checkmarks with the following text:

- ✓ Searching for: **equity research associate cover letter**
- ✓ Generating answers for you...

In the center, a message from Bing starts with "Hello, this is Bing. I can help you write a cover letter to be an equity research associate. 😊". It then provides a definition of a cover letter and lists guidelines from web sources. Finally, it presents a sample cover letter template:

```

Dear Mr./Ms. Hiring Manager,  

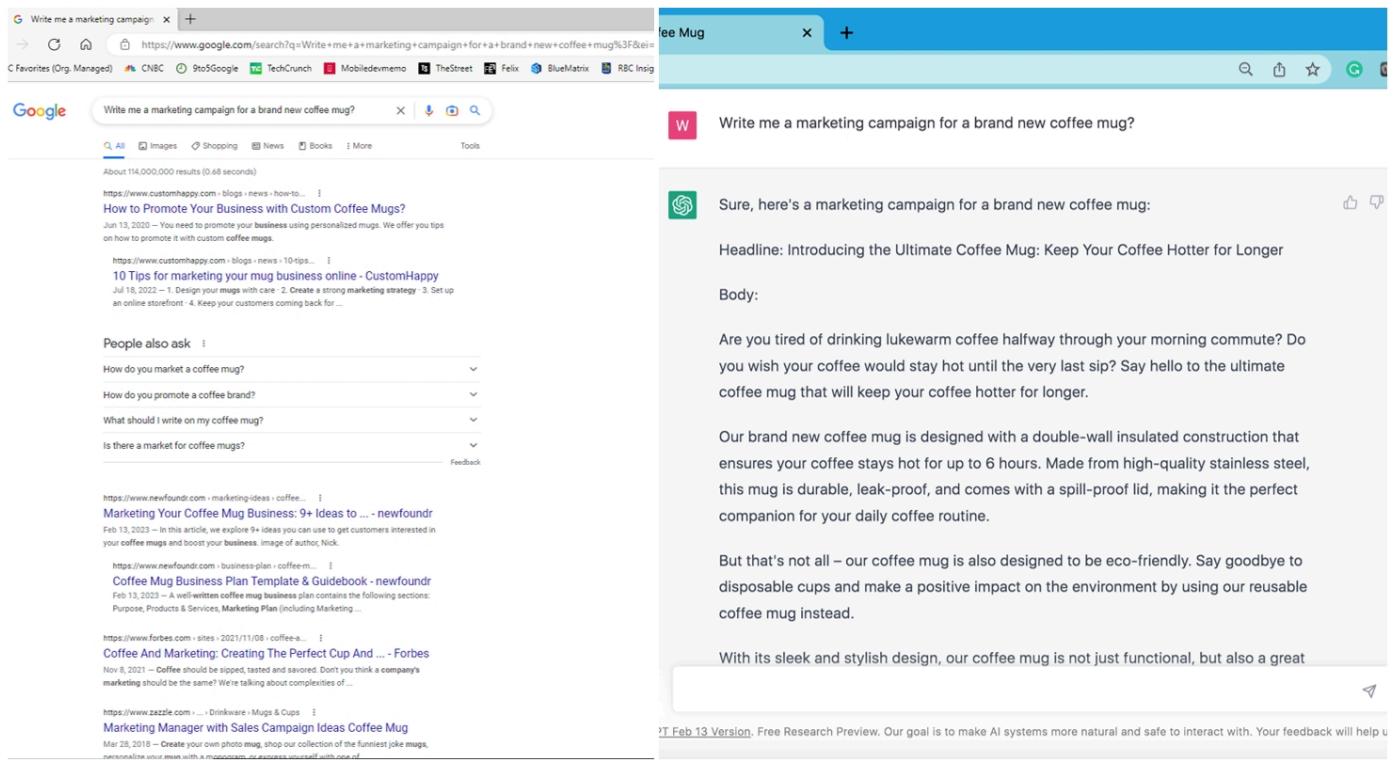
I am writing to express my interest in the equity research associate position at ABC

```

At the bottom of the interface, there are two buttons: "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets

**Figure 122 - Google Search vs. ChatGPT - Marketing Campaign**



The figure shows a side-by-side comparison between a Google search result and a ChatGPT-generated response to the query "Write me a marketing campaign for a brand new coffee mug".

**Google Search Results:**

- Search Query:** Write me a marketing campaign for a brand new coffee mug?
- Results:**
  - 1. How to Promote Your Business with Custom Coffee Mugs:** Jun 13, 2020 – Need to promote your business using personalized mugs. We offer tips on how to promote it with custom coffee mugs.
  - 2. 10 Tips for marketing your mug business online - CustomHappy:** Jul 18, 2022 – 1. Design your mugs with care. 2. Create a strong marketing strategy. 3. Set up an online storefront. 4. Keep your customers coming back for...
  - 3. People also ask:**
    - How do you market a coffee mug?
    - How do you promote a coffee brand?
    - What should I write on my coffee mug?
    - Is there a market for coffee mugs?
  - 4. Marketing Your Coffee Mug Business: 9+ Ideas to ... - newfoundr:** Feb 13, 2023 – In this article, we explore 9+ ideas you can use to get customers interested in your coffee mugs and boost your business. Image of author, Nick.
  - 5. Coffee Mug Business Plan Template & Guidebook - newfoundr:** Feb 13, 2023 – A well-written coffee mug business plan contains the following sections: Purpose, Products & Services, Marketing Plan (including Marketing ...)
  - 6. Coffee And Marketing: Creating The Perfect Cup And ... - Forbes:** Nov 8, 2021 – Coffee should be sipped, tasted and savored. Don't you think a company's marketing should be the same? We're talking about complexities of...
  - 7. Marketing Manager with Sales Campaign Ideas Coffee Mug - zazzle.com:** Mar 28, 2019 – Create your own photo mug, shop our collection of the funniest joke mugs, personalize your mug with a message, or express yourself with one of...

**ChatGPT Response:**

- Query:** Write me a marketing campaign for a brand new coffee mug?
- Response:**

Sure, here's a marketing campaign for a brand new coffee mug:

**Headline:** Introducing the Ultimate Coffee Mug: Keep Your Coffee Hotter for Longer

**Body:**

Are you tired of drinking lukewarm coffee halfway through your morning commute? Do you wish your coffee would stay hot until the very last sip? Say hello to the ultimate coffee mug that will keep your coffee hotter for longer.

Our brand new coffee mug is designed with a double-wall insulated construction that ensures your coffee stays hot for up to 6 hours. Made from high-quality stainless steel, this mug is durable, leak-proof, and comes with a spill-proof lid, making it the perfect companion for your daily coffee routine.

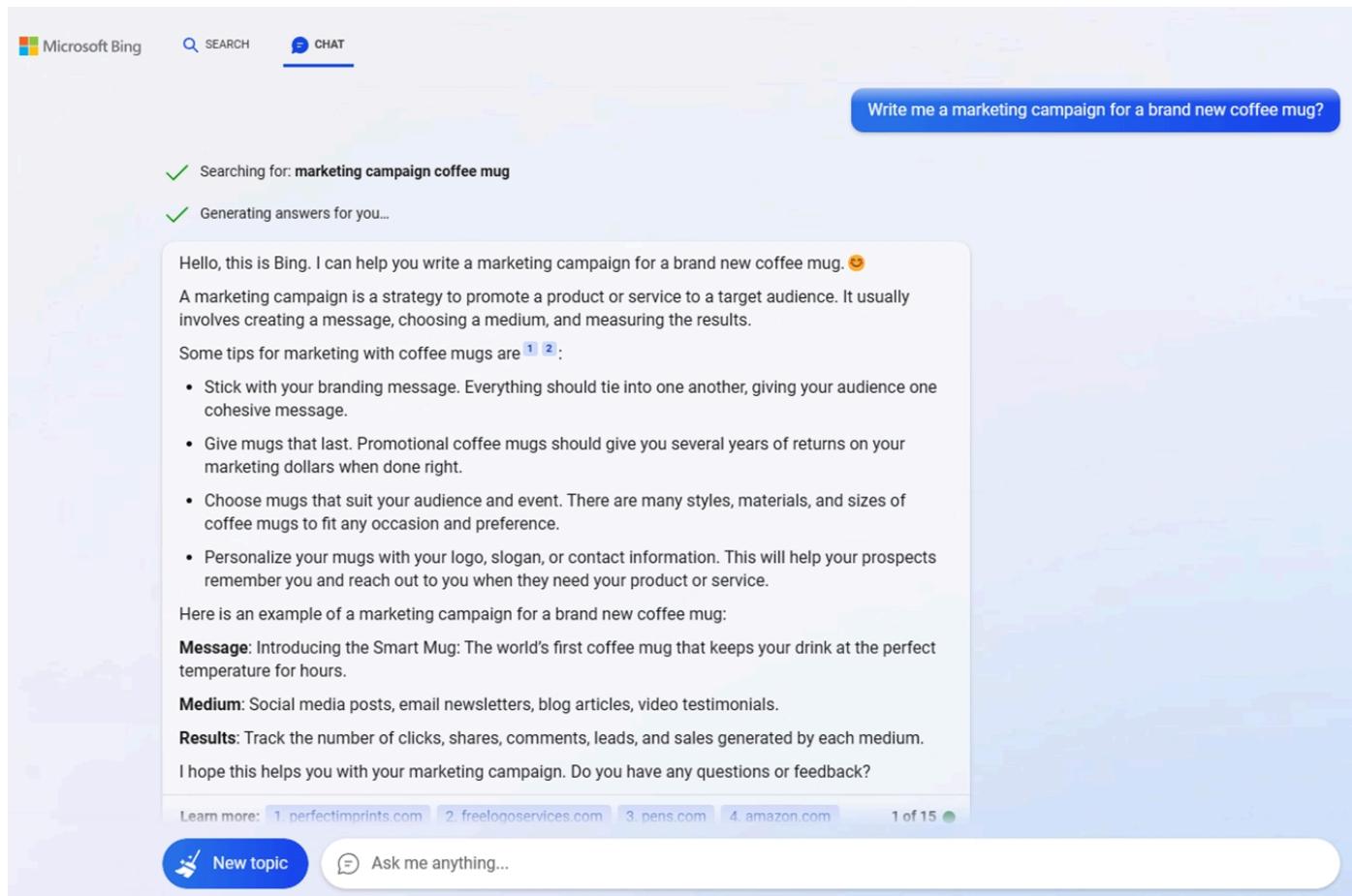
But that's not all – our coffee mug is also designed to be eco-friendly. Say goodbye to disposable cups and make a positive impact on the environment by using our reusable coffee mug instead.

With its sleek and stylish design, our coffee mug is not just functional, but also a great

Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 123 - Bing - Marketing Campaign



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "Write me a marketing campaign for a brand new coffee mug?". Below the search bar, there are two green checkmarks indicating the process: "Searching for: marketing campaign coffee mug" and "Generating answers for you...". A large white box contains the generated response from Bing. It starts with a greeting from Bing, followed by a definition of a marketing campaign, and then provides some tips for marketing with coffee mugs. The tips include: Stick with your branding message, Give mugs that last, Choose mugs that suit your audience and event, and Personalize your mugs with your logo, slogan, or contact information. Below the tips, there is an example of a marketing campaign for a coffee mug, which includes a message, medium, and results. The message is about the Smart Mug. The medium is social media posts, email newsletters, blog articles, and video testimonials. The results are tracked by the number of clicks, shares, comments, leads, and sales generated by each medium. The response concludes with a statement that it hopes this helps with the marketing campaign and asks if there are any questions or feedback. At the bottom of the response box, there are links to learn more: 1. perfectimprints.com, 2. freelogoservices.com, 3. pens.com, 4. amazon.com. To the right of these links, it says "1 of 15". At the very bottom of the interface, there are two buttons: "New topic" and "Ask me anything...".

Source: Bing, RBC Capital Markets



## DIY

Figure 124 - Google Search vs. ChatGPT - Filing Taxes

The figure shows a side-by-side comparison of search results for 'How do I file taxes in two separate states?' on Google and a ChatGPT interface.

**Google Search Results:**

- Search bar: How do I file taxes in two separate states?
- Page title: How do I file taxes in two separate states?
- Summary: If both states collect income taxes and don't have a reciprocity agreement, you'll have to pay taxes on your earnings in both states. First, file a nonresident return for the state where you work. You'll need information from this return to properly file your return in your home state.
- Link: <https://www.hrblock.com/.../Personal-tax-planning/>
- Section: What Do I Need to Know About Filing Taxes in Two States?
- Section: People also ask:

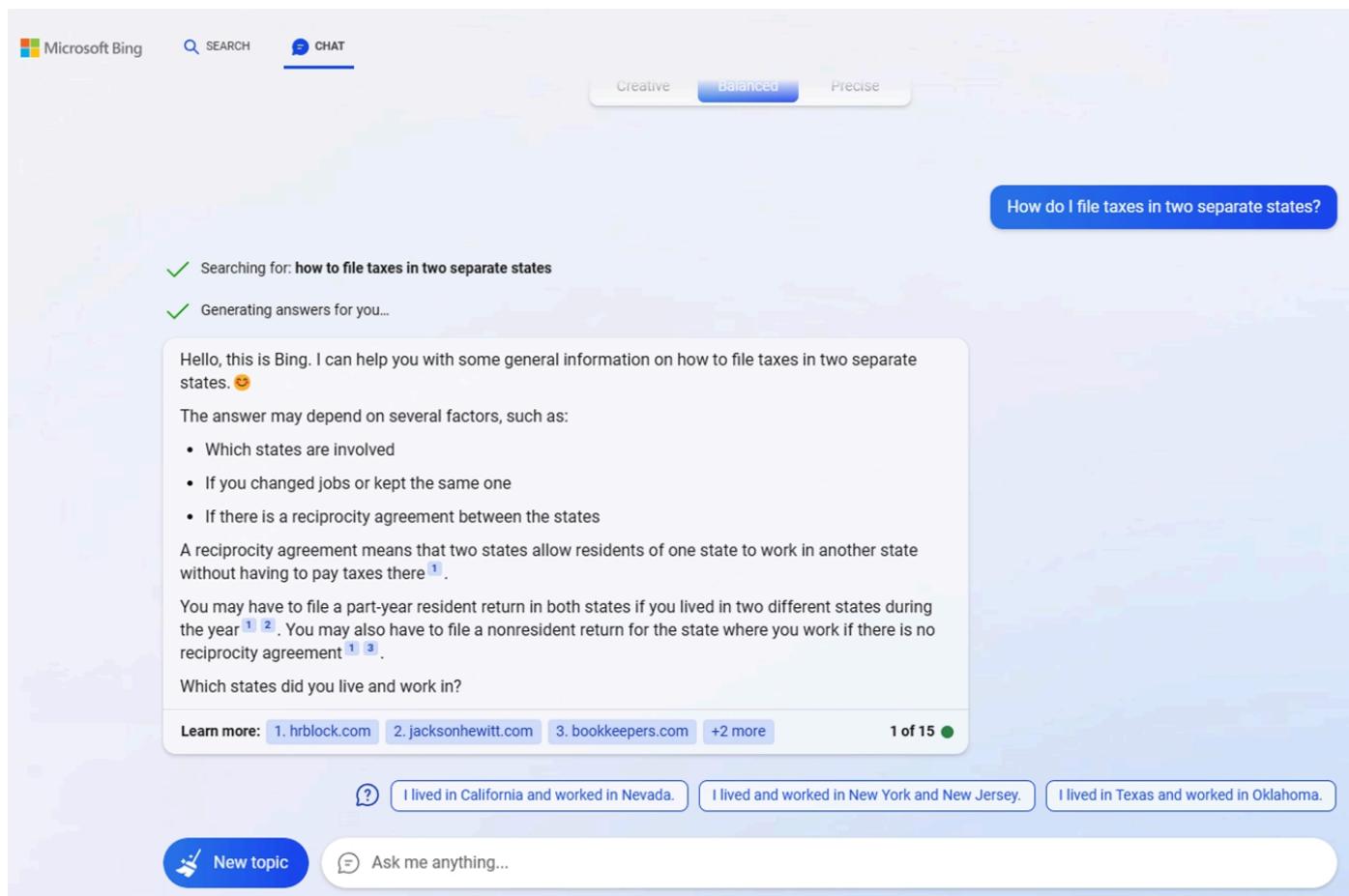
  - How to do taxes if you live and work in 2 different states?
  - How do I know which state to file my taxes?
  - Can TurboTax file in 2 states?
  - Can you file jointly in one state and separately in another?

**ChatGPT Response:**

- Search bar: How do I file taxes in two separate states?
- Summary: Filing taxes in two separate states can be a bit complicated, but here are the general steps you should follow:
- List of 6 steps:
  - Determine your residency status in each state: Your residency status will determine which state you owe taxes to. If you are a resident of both states, you will need to file a tax return in each state. If you are not a resident of one of the states but earned income there, you may still be required to file a tax return in that state.
  - Gather your income documents: Gather all the necessary income documents, such as W-2s, 1099s, and other tax forms, for both states.
  - Determine which state to file first: You may want to consider filing your taxes in the state where you earned the most income first. This can help you avoid potential penalties for filing late.
  - Fill out the state tax forms: Fill out the state tax forms for each state, making sure to accurately report all income earned in each state.
  - Determine your tax liability: Determine your tax liability in each state by following the instructions on the state tax forms. You may be able to claim a credit on one state tax return for taxes paid to the other state.
  - File your tax returns: File your tax returns for each state separately. You may be able to

Source: Google Search, ChatGPT, RBC Capital Markets

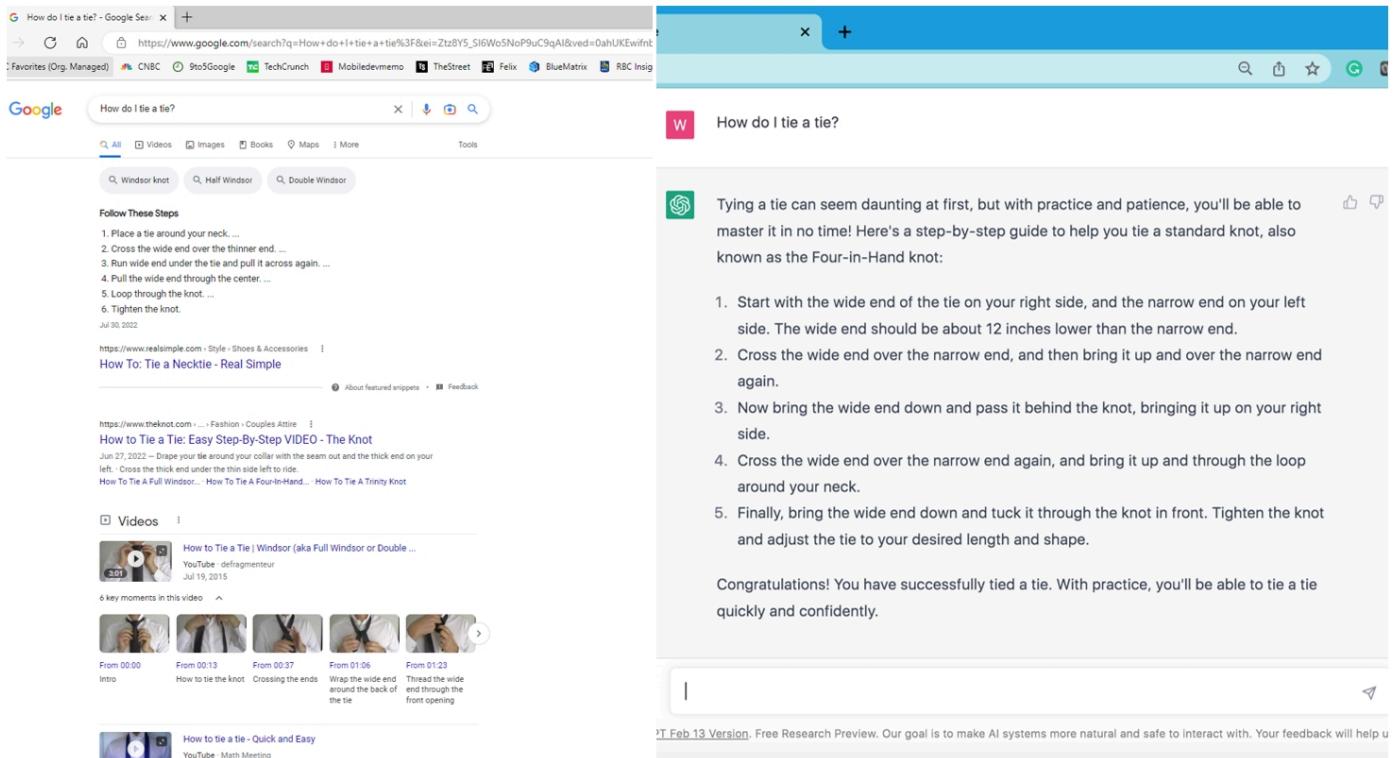
Figure 125 - Bing - Filing Taxes



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the text "How do I file taxes in two separate states?". Below the search bar, there are three tabs: "Creative", "Balanced" (which is selected), and "Precise". On the left side of the main content area, there is a sidebar with a green checkmark icon and the text: "Searching for: how to file taxes in two separate states" and "Generating answers for you...". The main content area starts with a greeting from Bing: "Hello, this is Bing. I can help you with some general information on how to file taxes in two separate states. 😊". It then asks, "The answer may depend on several factors, such as:" followed by a bulleted list: "• Which states are involved", "• If you changed jobs or kept the same one", and "• If there is a reciprocity agreement between the states". It continues with the definition of reciprocity: "A reciprocity agreement means that two states allow residents of one state to work in another state without having to pay taxes there 📈". It then discusses filing requirements: "You may have to file a part-year resident return in both states if you lived in two different states during the year 📈 2. You may also have to file a nonresident return for the state where you work if there is no reciprocity agreement 📈 3." Finally, it asks, "Which states did you live and work in?" Below this, there is a "Learn more" section with links to "1. hrblock.com", "2. jacksonhewitt.com", "3. bookkeepers.com", and "+2 more". A page number "1 of 15" is shown next to a green circular icon. At the bottom, there are three buttons: "I lived in California and worked in Nevada.", "I lived and worked in New York and New Jersey.", and "I lived in Texas and worked in Oklahoma.". There are also "New topic" and "Ask me anything..." buttons.

Source: Bing, RBC Capital Markets

Figure 126 - Google Search vs. ChatGPT - Tie a Tie



The figure shows two side-by-side browser windows. The left window is a Google search for "How do I tie a tie?". It displays a snippet from Real Simple with step-by-step instructions and a video thumbnail for "How to Tie a Tie | Windsor (aka Full Windsor or Double ...)" by YouTube user 'defragneur' from July 19, 2015. The right window is a ChatGPT interface with the same query. It provides a detailed, step-by-step text guide on tying a standard knot, followed by a numbered list of steps, and a congratulatory message.

**Google Search Results:**

- Query: How do I tie a tie?
- Snippet from Real Simple: Tying a tie can seem daunting at first, but with practice and patience, you'll be able to master it in no time! Here's a step-by-step guide to help you tie a standard knot, also known as the Four-in-Hand knot:
- Video thumbnail: How to Tie a Tie | Windsor (aka Full Windsor or Double ...)
- Video details: YouTube, defragneur, Jul 19, 2015
- Video preview: Shows six key moments in the video, labeled from 00:00 to 01:23, illustrating the knot-tying process.

**ChatGPT Response:**

How do I tie a tie?

Tying a tie can seem daunting at first, but with practice and patience, you'll be able to master it in no time! Here's a step-by-step guide to help you tie a standard knot, also known as the Four-in-Hand knot:

- Start with the wide end of the tie on your right side, and the narrow end on your left side. The wide end should be about 12 inches lower than the narrow end.
- Cross the wide end over the narrow end, and then bring it up and over the narrow end again.
- Now bring the wide end down and pass it behind the knot, bringing it up on your right side.
- Cross the wide end over the narrow end again, and bring it up and through the loop around your neck.
- Finally, bring the wide end down and tuck it through the knot in front. Tighten the knot and adjust the tie to your desired length and shape.

Congratulations! You have successfully tied a tie. With practice, you'll be able to tie a tie quickly and confidently.

Source: Google Search, ChatGPT, RBC Capital Markets

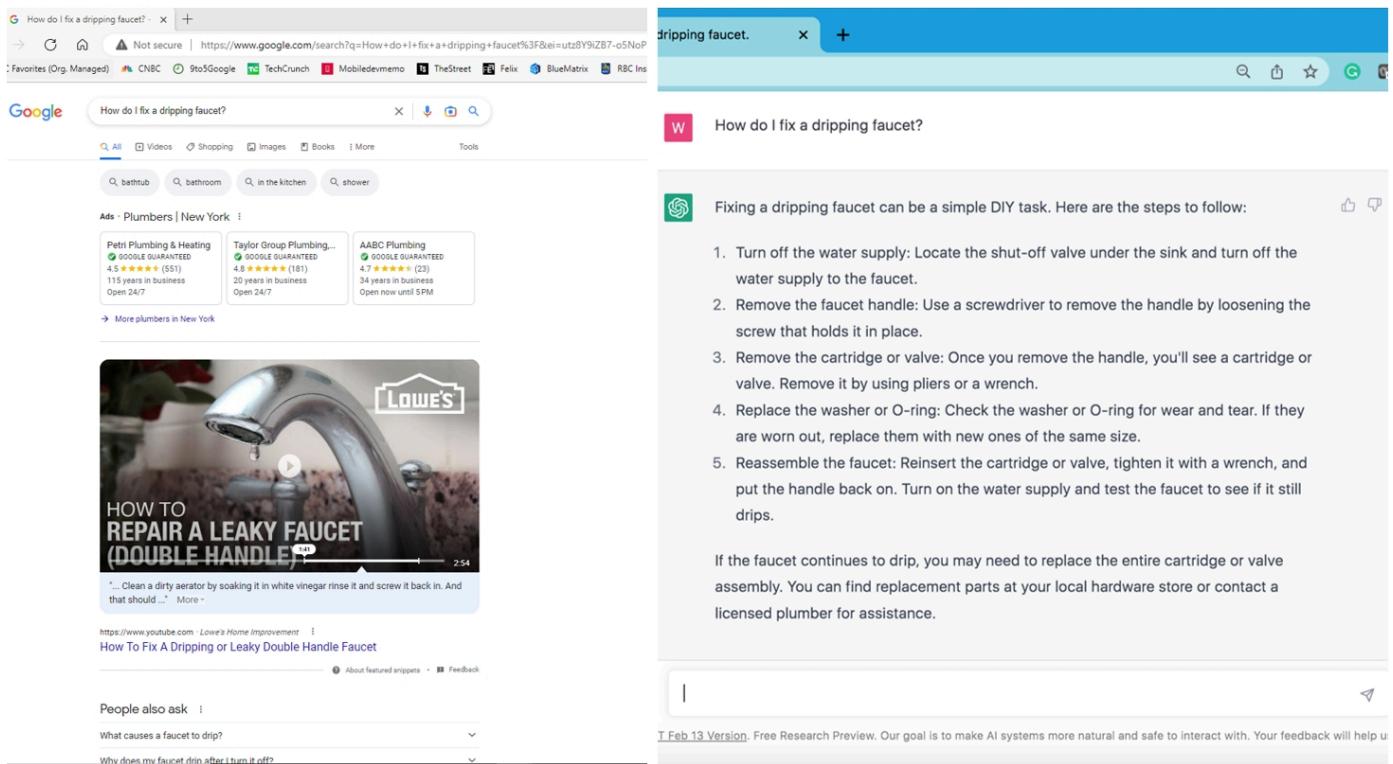


Figure 127 - Bing - Tie a Tie

The screenshot shows a Microsoft Bing search interface. At the top, there are buttons for 'SEARCH' and 'CHAT'. A blue button on the right says 'How do I tie a tie?'. Below the search bar, two green checkmarks indicate: 'Searching for: how to tie a tie' and 'Generating answers for you...'. A text box contains: 'There are different ways to tie a tie, depending on the style and size of the knot you want. Some of the most common knots are:' followed by a bulleted list: '• The full Windsor knot: a large and symmetrical knot that looks formal and elegant <sup>1</sup>.', '• The Pratt knot: a medium-sized and neat knot that works well with most shirts <sup>2</sup>.', and '• The four-in-hand knot: a small and simple knot that is easy to tie and casual <sup>3</sup> <sup>4</sup>.'. Below this, a question 'What kind of knot do you prefer?' is asked. At the bottom left, it says 'Learn more: 1. theknot.com 2. wikihow.com 3. ties.com 4. youtube.com +2 more'. To the right, it says '1 of 15'. A video thumbnail titled 'Videos of How to Tie a Tie' from bing.com/videos shows a person tying a tie. Below the video are buttons for 'New topic' and 'Ask me anything...'.

Source: Bing, RBC Capital Markets

Figure 128 - Google Search vs. ChatGPT - Fix Dripping Faucet



The figure shows two side-by-side search results for the query "How do I fix a dripping faucet?".

**Google Search Results:**

- Search Bar:** How do I fix a dripping faucet?
- Ads:** Ads - Plumbers | New York
  - Pearl Plumbing & Heating: 4.5 stars (55) 115 years in business Open 24/7
  - Taylor Group Plumbing: 4.8 stars (181) 20 years in business Open 24/7
  - AMES Plumbing: 4.7 stars (23) 34 years in business Open now until 5PM
- Image:** A Lowe's advertisement for repairing a leaky faucet.
- Video Snippet:** "How To REPAIR A LEAKY FAUCET (DOUBLE HANDLE)" from Lowe's Home Improvement, showing a person fixing a faucet.
- Text:** "...Clean a dirty aerator by soaking it in white vinegar rinse it and screw it back in. And that should..." More →
- URL:** <https://www.youtube.com/Lowe's Home Improvement>
- Feedback:** About featured snippets · Feedback
- People also ask:**
  - What causes a faucet to drip?
  - Why does my faucet drip after I turn it off?

**ChatGPT Response:**

- Search Bar:** How do I fix a dripping faucet?
- Text:** Fixing a dripping faucet can be a simple DIY task. Here are the steps to follow:
  - Turn off the water supply: Locate the shut-off valve under the sink and turn off the water supply to the faucet.
  - Remove the faucet handle: Use a screwdriver to remove the handle by loosening the screw that holds it in place.
  - Remove the cartridge or valve: Once you remove the handle, you'll see a cartridge or valve. Remove it by using pliers or a wrench.
  - Replace the washer or O-ring: Check the washer or O-ring for wear and tear. If they are worn out, replace them with new ones of the same size.
  - Reassemble the faucet: Reinsert the cartridge or valve, tighten it with a wrench, and put the handle back on. Turn on the water supply and test the faucet to see if it still drips.

If the faucet continues to drip, you may need to replace the entire cartridge or valve assembly. You can find replacement parts at your local hardware store or contact a licensed plumber for assistance.
- Feedback:** Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us.

Source: Google Search, ChatGPT, RBC Capital Markets

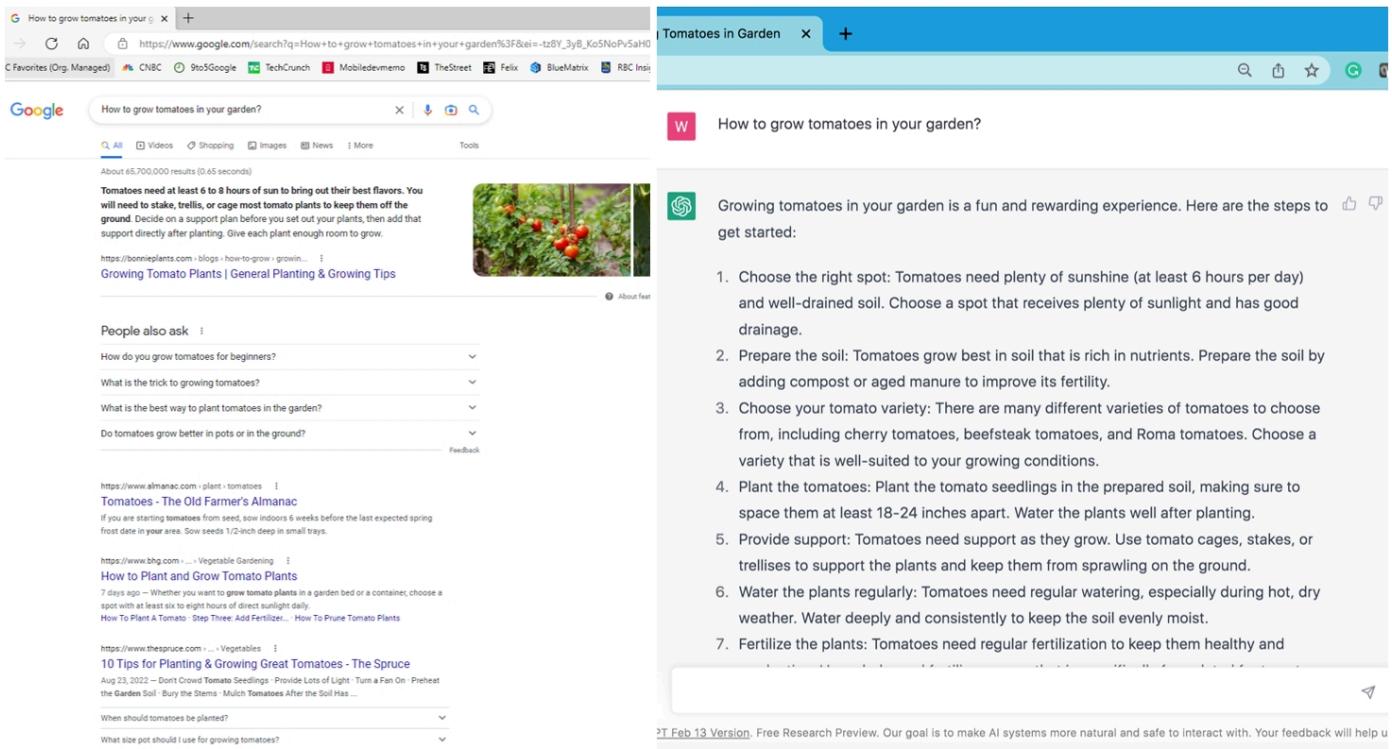


Figure 129 - Bing - Fix Dripping Faucet

The screenshot shows a Bing search results page. At the top, there are search input fields labeled "Microsoft Bing", "SEARCH", and "CHAT". A blue button on the right says "How do I fix a dripping faucet?". Below the search bar, two green checkmarks indicate the search process: "Searching for: how to fix a dripping faucet" and "Generating answers for you...". The main content area contains text about different types of faucets and repair steps, mentioning shutting off water supply valves, removing the handle, replacing the cartridge or stem, and replacing the faucet washer. It also lists three product links from Home Depot, Wm Henderson Inc., and Family Handyman. Below this, a section titled "Videos of How to Fix a Dripping Faucet" shows a thumbnail for a Lowe's video featuring a close-up of a chrome faucet. At the bottom of the page are two buttons: "New topic" with a pencil icon and "Ask me anything..." with a speech bubble icon.

Source: Bing, RBC Capital Markets

Figure 130 - Google Search vs. ChatGPT - Grow Tomatoes



The screenshot shows a comparison between a standard Google search result and a response from ChatGPT.

**Google Search Results:**

- Search query: "How to grow tomatoes in your garden?"
- Results count: About 65,700,000 results (0.65 seconds)
- Summary: Tomatoes need at least 6 to 8 hours of sun to bring out their best flavors. You will need to stake, trellis, or cage most tomato plants to keep them off the ground. Decide on a support plan before you set out your plants, then add that support directly after planting. Give each plant enough room to grow.
- Image: A small thumbnail image of a tomato plant with red tomatoes.
- Links:
  - [Growing Tomato Plants | General Planting & Growing Tips](https://bonnieplants.com/blogs/how-to-grow-growing-tomato-plants)
  - [Tomatoes - The Old Farmer's Almanac](https://www.almanac.com/plant/tomatoes)
  - [How to Plant and Grow Tomato Plants](https://www.bhg.com/gardening/vegetable-gardening/how-to-grow-tomato-plants/)
  - [10 Tips for Planting & Growing Great Tomatoes - The Spruce](https://www.thespruce.com/tips-for-planting-growing-great-tomatoes-10-tips-1360770)
- People also ask:
  - How do you grow tomatoes for beginners?
  - What is the trick to growing tomatoes?
  - What is the best way to plant tomatoes in the garden?
  - Do tomatoes grow better in pots or in the ground?

**ChatGPT Response:**

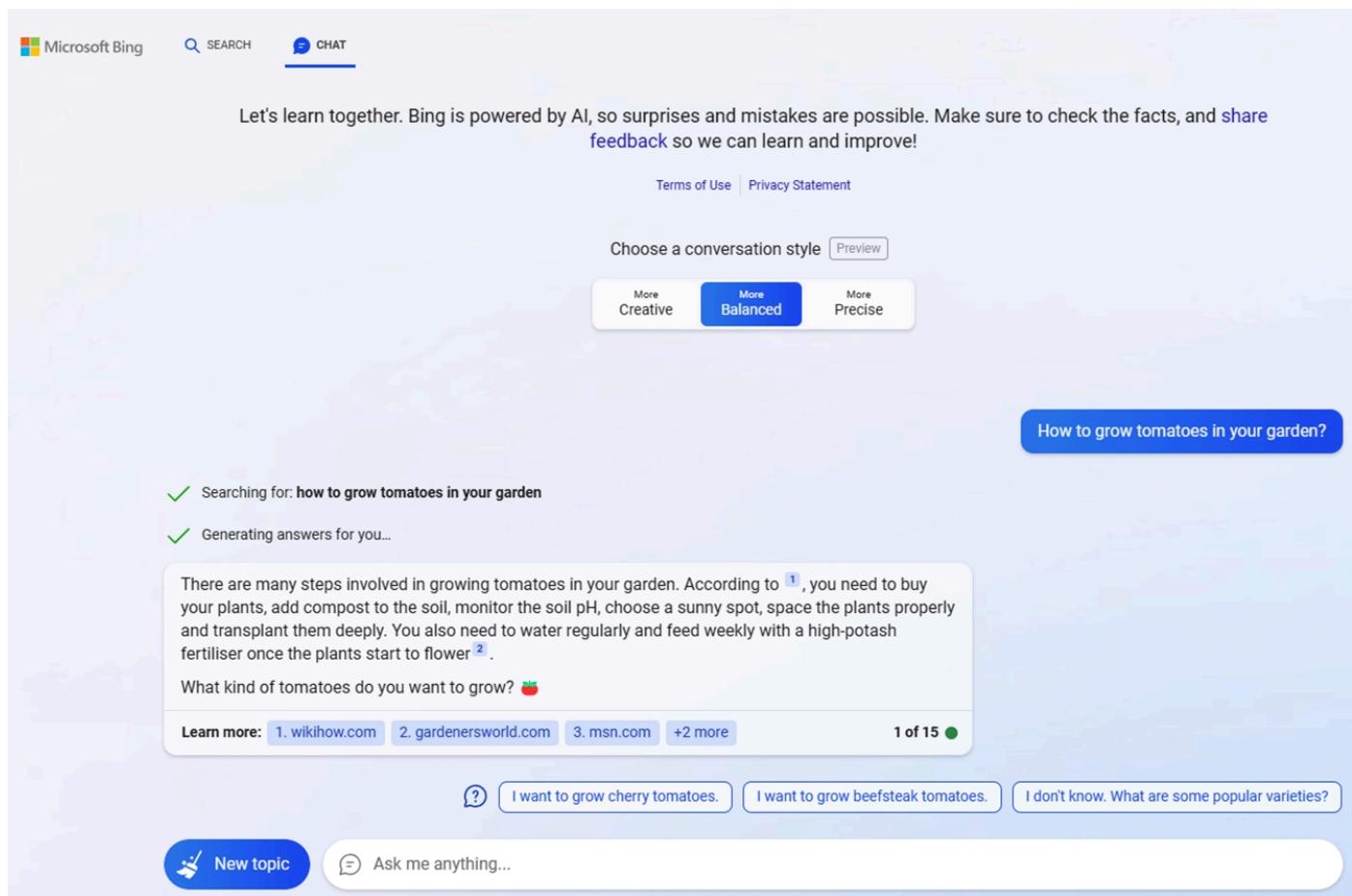
Growing tomatoes in your garden is a fun and rewarding experience. Here are the steps to get started:

- Choose the right spot: Tomatoes need plenty of sunshine (at least 6 hours per day) and well-drained soil. Choose a spot that receives plenty of sunlight and has good drainage.
- Prepare the soil: Tomatoes grow best in soil that is rich in nutrients. Prepare the soil by adding compost or aged manure to improve its fertility.
- Choose your tomato variety: There are many different varieties of tomatoes to choose from, including cherry tomatoes, beefsteak tomatoes, and Roma tomatoes. Choose a variety that is well-suited to your growing conditions.
- Plant the tomatoes: Plant the tomato seedlings in the prepared soil, making sure to space them at least 18-24 inches apart. Water the plants well after planting.
- Provide support: Tomatoes need support as they grow. Use tomato cages, stakes, or trellises to support the plants and keep them from sprawling on the ground.
- Water the plants regularly: Tomatoes need regular watering, especially during hot, dry weather. Water deeply and consistently to keep the soil evenly moist.
- Fertilize the plants: Tomatoes need regular fertilization to keep them healthy and productive.

Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve.

Source: Google Search, ChatGPT, RBC Capital Markets

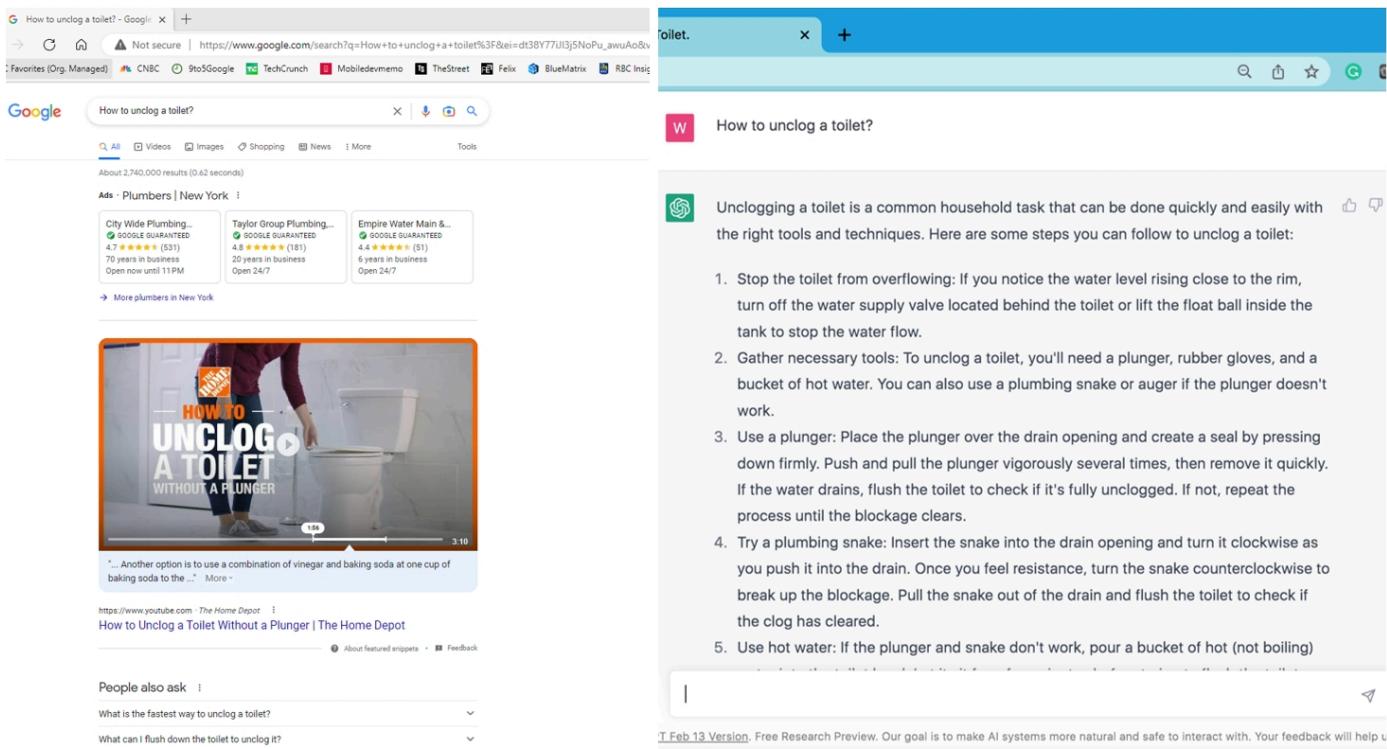
Figure 131 - Bing - Grow Tomatoes



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "Search" and a "CHAT" button. Below the search bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". A "Choose a conversation style" button has "Preview" selected. Below this, three options are shown: "More Creative" (gray), "More Balanced" (blue), and "More Precise" (gray). In the main search area, a blue button says "How to grow tomatoes in your garden?". Underneath, a list of steps is shown with green checkmarks: "Searching for: how to grow tomatoes in your garden" and "Generating answers for you...". A text box contains: "There are many steps involved in growing tomatoes in your garden. According to <sup>1</sup>, you need to buy your plants, add compost to the soil, monitor the soil pH, choose a sunny spot, space the plants properly and transplant them deeply. You also need to water regularly and feed weekly with a high-potash fertiliser once the plants start to flower <sup>2</sup>." Below this, a question asks "What kind of tomatoes do you want to grow?" with a tomato emoji. A "Learn more:" section lists links: 1. [wikihow.com](#), 2. [gardenersworld.com](#), 3. [msn.com](#), +2 more. It also shows "1 of 15" with a green dot. At the bottom, there are three buttons: "I want to grow cherry tomatoes.", "I want to grow beefsteak tomatoes.", and "I don't know. What are some popular varieties?". There are also "New topic" and "Ask me anything..." buttons.

Source: Bing, RBC Capital Markets

Figure 132 - Google Search vs. ChatGPT - Unclog Toilet



The figure shows two side-by-side browser windows. The left window is a Google search for "How to unclog a toilet". It displays a list of local plumber ads from New York, followed by a featured snippet from The Home Depot titled "HOW TO UNCL~~O~~G A TOILET WITHOUT A PLUNGER". Below the snippet is a video thumbnail showing a person unclogging a toilet. The right window is a ChatGPT interface with the query "How to unclog a toilet?". ChatGPT provides a step-by-step guide:

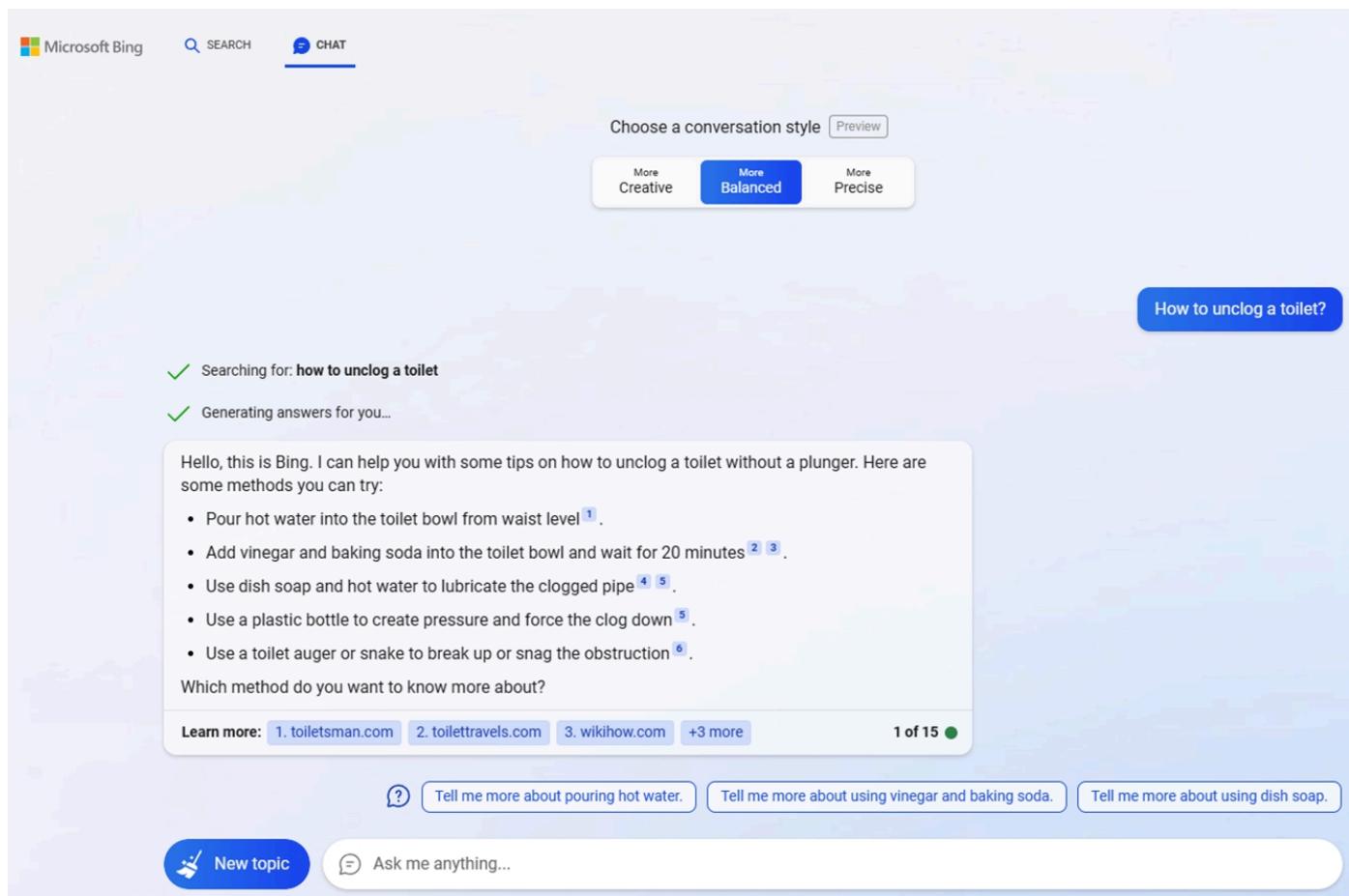
Unclogging a toilet is a common household task that can be done quickly and easily with the right tools and techniques. Here are some steps you can follow to unclog a toilet:

1. Stop the toilet from overflowing: If you notice the water level rising close to the rim, turn off the water supply valve located behind the toilet or lift the float ball inside the tank to stop the water flow.
2. Gather necessary tools: To unclog a toilet, you'll need a plunger, rubber gloves, and a bucket of hot water. You can also use a plumbing snake or auger if the plunger doesn't work.
3. Use a plunger: Place the plunger over the drain opening and create a seal by pressing down firmly. Push and pull the plunger vigorously several times, then remove it quickly. If the water drains, flush the toilet to check if it's fully unclogged. If not, repeat the process until the blockage clears.
4. Try a plumbing snake: Insert the snake into the drain opening and turn it clockwise as you push it into the drain. Once you feel resistance, turn the snake counterclockwise to break up the blockage. Pull the snake out of the drain and flush the toilet to check if the clog has cleared.
5. Use hot water: If the plunger and snake don't work, pour a bucket of hot (not boiling)

At the bottom of the ChatGPT window, there is a note: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve."

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 133 - Bing - Unclog Toilet



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the text "SEARCH" and a "CHAT" button. Below the search bar, there is a "Choose a conversation style" section with three options: "More Creative", "More Balanced" (which is selected), and "More Precise". A progress message says "Searching for: how to unclog a toilet" and "Generating answers for you...". The main content area starts with a greeting from Bing: "Hello, this is Bing. I can help you with some tips on how to unclog a toilet without a plunger. Here are some methods you can try:". Below this, there is a bulleted list of five methods: 1. Pour hot water into the toilet bowl from waist level. 2. Add vinegar and baking soda into the toilet bowl and wait for 20 minutes. 3. Use dish soap and hot water to lubricate the clogged pipe. 4. Use a plastic bottle to create pressure and force the clog down. 5. Use a toilet auger or snake to break up or snag the obstruction. A link "Learn more" leads to external sites: 1. toiletsman.com, 2. toiletravels.com, 3. wikihow.com, and +3 more. A status indicator shows "1 of 15". At the bottom, there are three buttons: "Tell me more about pouring hot water.", "Tell me more about using vinegar and baking soda.", and "Tell me more about using dish soap.". There are also "New topic" and "Ask me anything..." buttons.

Source: Bing, RBC Capital Markets



## General Knowledge

Figure 134 - Google Search vs. ChatGPT - Three States of Matter

The figure shows two side-by-side browser windows. The left window is a Google search for 'What are the three states of matter?'. It displays a snippet from the University of Western Australia's website, a diagram of the three states (Solid, Liquid, Gas), and a sidebar with related questions like 'What are the 3 states of matter and give one example for each?'. The right window is a ChatGPT interface with the same question. ChatGPT's response is a detailed list: 1. Solid: A fixed shape and volume, molecules tightly packed. Examples: rocks, ice, wood. 2. Liquid: Takes shape of container, definite volume, molecules close together. Examples: water, milk, oil. 3. Gas: No fixed shape or volume, molecules far apart, move freely. Examples: air, oxygen, carbon dioxide.

Source: Google Search, ChatGPT, RBC Capital Markets



Figure 135 - Bing - Three States of Matter

Microsoft Bing SEARCH CHAT

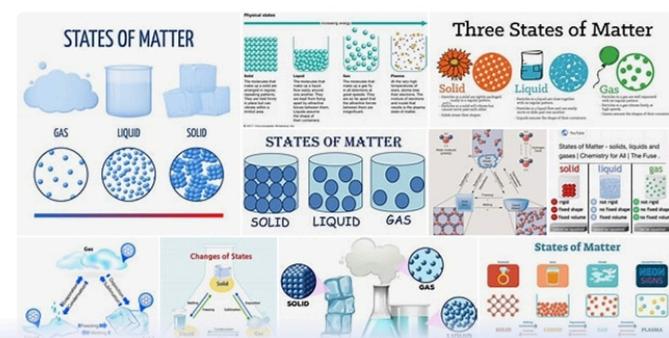
What are the three states of matter?

✓ Searching for: **three states of matter**  
✓ Generating answers for you...

The three states of matter are **solid**, **liquid** and **gas** <sup>1</sup> <sup>2</sup>. They differ in how their particles are arranged and how they move <sup>3</sup>. For example, solids have fixed shapes and volumes, liquids can flow and take the shape of their containers, and gases can expand and fill any space <sup>2</sup>. There are also other states of matter that exist under extreme conditions, such as plasma, degenerate matter and quark matter <sup>4</sup> <sup>5</sup>.

Learn more: [1. en.wikipedia.org](https://en.wikipedia.org) [2. byjus.com](https://byjus.com) [3. bbc.co.uk](https://bbc.co.uk) [4. en.wikipedia.org](https://en.wikipedia.org) [+1 more](#) 1 of 15

Images of three States of Matter  
[bing.com/images](https://bing.com/images)



New topic Ask me anything...

Source: Bing, RBC Capital Markets



Figure 136 - Google Search vs. ChatGPT - Pulp Fiction

The figure shows two side-by-side browser windows. The left window is a Google search results page for the query "Who starred in Pulp Fiction?". It displays a snippet from IMDB showing the main cast: Quentin Tarantino, John Travolta, Samuel L. Jackson, Uma Thurman, Bruce Willis, Tim Roth, and Christopher Walken. Below this is a link to the full cast list on IMDB. The right window is a ChatGPT interface with the same query. ChatGPT provides a detailed list of the ensemble cast and their roles, followed by a statement about the film's impact. Both windows show standard browser navigation bars at the top.

Google search results for "Who starred in Pulp Fiction?":

- Quentin Tarantino as Quentin Tarantino
- John Travolta as Vincent Vega
- Samuel L. Jackson as Jules Winnfield
- Uma Thurman as Mia Wallace
- Bruce Willis as Butch Coolidge
- Tim Roth as Pumpkin
- Christopher Walken as Captain Koons

ChatGPT response:

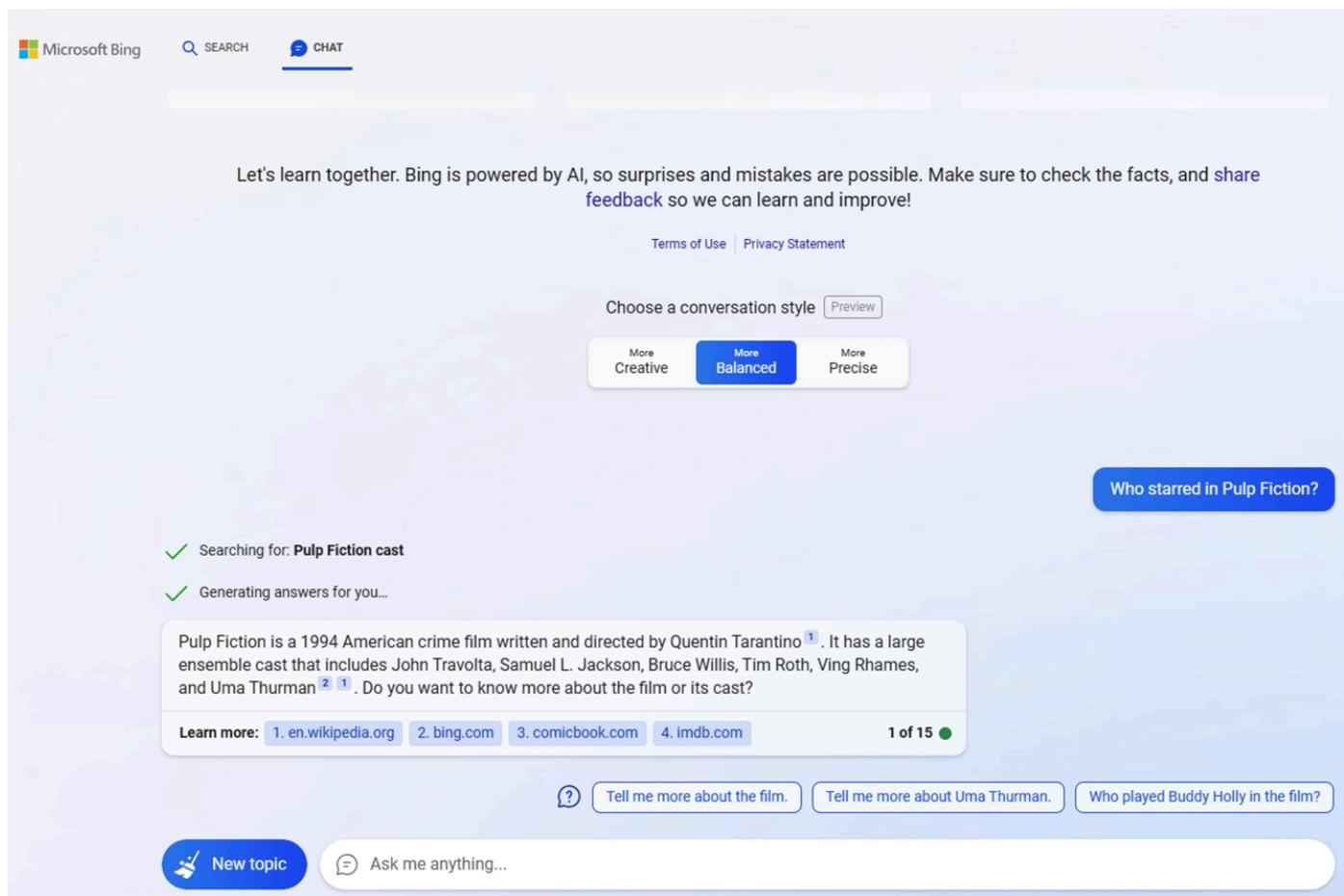
Pulp Fiction is a 1994 American crime film directed by Quentin Tarantino, and it features an ensemble cast of talented actors. Some of the main actors who starred in Pulp Fiction are:

1. John Travolta as Vincent Vega
2. Samuel L. Jackson as Jules Winnfield
3. Uma Thurman as Mia Wallace
4. Harvey Keitel as Winston "The Wolf" Wolfe
5. Tim Roth as Pumpkin (Ringo)
6. Amanda Plummer as Honey Bunny (Yolanda)
7. Maria de Medeiros as Fabienne
8. Ving Rhames as Marsellus Wallace
9. Eric Stoltz as Lance
10. Rosanna Arquette as Jody

These actors delivered exceptional performances in the film and contributed to making Pulp Fiction a classic in the history of cinema.

Source: Google Search, ChatGPT, RBC Capital Markets

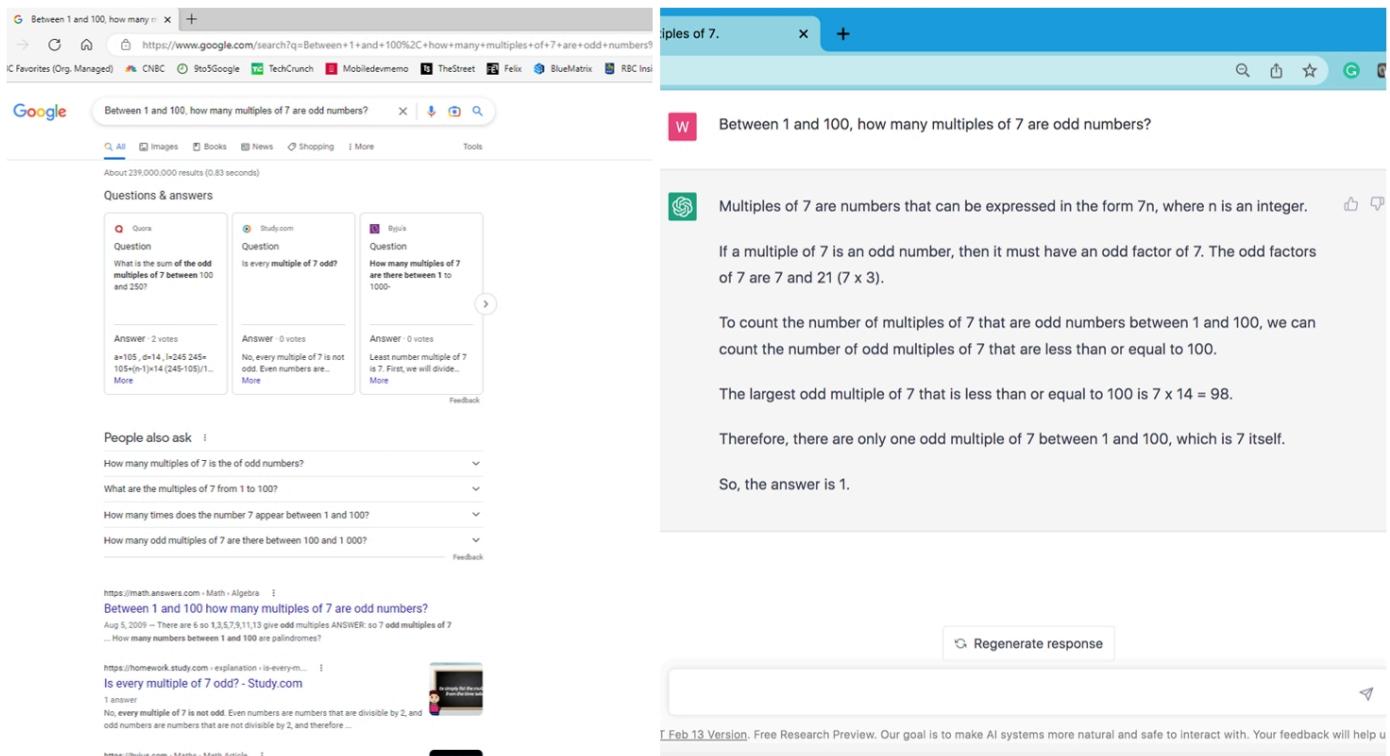
Figure 137 - Bing - Pulp Fiction



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the search bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". A section titled "Choose a conversation style" offers options: "More Creative" (gray), "More Balanced" (blue, selected), and "More Precise" (gray). In the main search area, a question "Who starred in Pulp Fiction?" is asked. Below it, a green checkmark indicates: "Searching for: Pulp Fiction cast" and "Generating answers for you...". A text box displays: "Pulp Fiction is a 1994 American crime film written and directed by Quentin Tarantino <sup>1</sup>. It has a large ensemble cast that includes John Travolta, Samuel L. Jackson, Bruce Willis, Tim Roth, Ving Rhames, and Uma Thurman <sup>2</sup> <sup>1</sup>. Do you want to know more about the film or its cast?". Below this, a "Learn more:" section lists links: 1. en.wikipedia.org, 2. bing.com, 3. comicbook.com, 4. imdb.com. A "1 of 15" indicator is shown. At the bottom, there are buttons for "New topic", "Ask me anything...", and three other questions: "Tell me more about the film.", "Tell me more about Uma Thurman.", and "Who played Buddy Holly in the film?".

Source: Bing, RBC Capital Markets

Figure 138 - Google Search vs. ChatGPT - Math Teaser



The figure shows two side-by-side search results for the query "Between 1 and 100, how many multiples of 7 are odd numbers?"

**Google Search Results:**

- Search URL:** https://www.google.com/search?q=Between+1+and+100%2C+how+many+multiples+of+7+are+odd+numbers
- Results:** About 239,000,000 results (0.83 seconds)
- Questions & answers:**
  - Q: Quora Question: What is the sum of the odd multiples of 7 between 100 and 250?
  - A: Answer - 2 votes:  $a=105, d=14, l=245 \Rightarrow 105 + n-1) \times 14 = 245 \Rightarrow n=15$
  - Q: Study.com Question: Is every multiple of 7 odd?
  - A: Answer - 0 votes: No, every multiple of 7 is not odd. Even numbers are...
  - Q: Byju's Question: How many multiples of 7 are there between 1 to 1000?
  - A: Answer - 0 votes: Largest number multiple of 7 is 7. First, we will divide...
- People also ask:**
  - How many multiples of 7 is the of odd numbers?
  - What are the multiples of 7 from 1 to 100?
  - How many times does the number 7 appear between 1 and 100?
  - How many odd multiples of 7 are there between 100 and 1 000?

**ChatGPT Response:**

- Question:** Between 1 and 100, how many multiples of 7 are odd numbers?
- Answer:**

Multiples of 7 are numbers that can be expressed in the form  $7n$ , where  $n$  is an integer.

If a multiple of 7 is an odd number, then it must have an odd factor of 7. The odd factors of 7 are 7 and 21 ( $7 \times 3$ ).

To count the number of multiples of 7 that are odd numbers between 1 and 100, we can count the number of odd multiples of 7 that are less than or equal to 100.

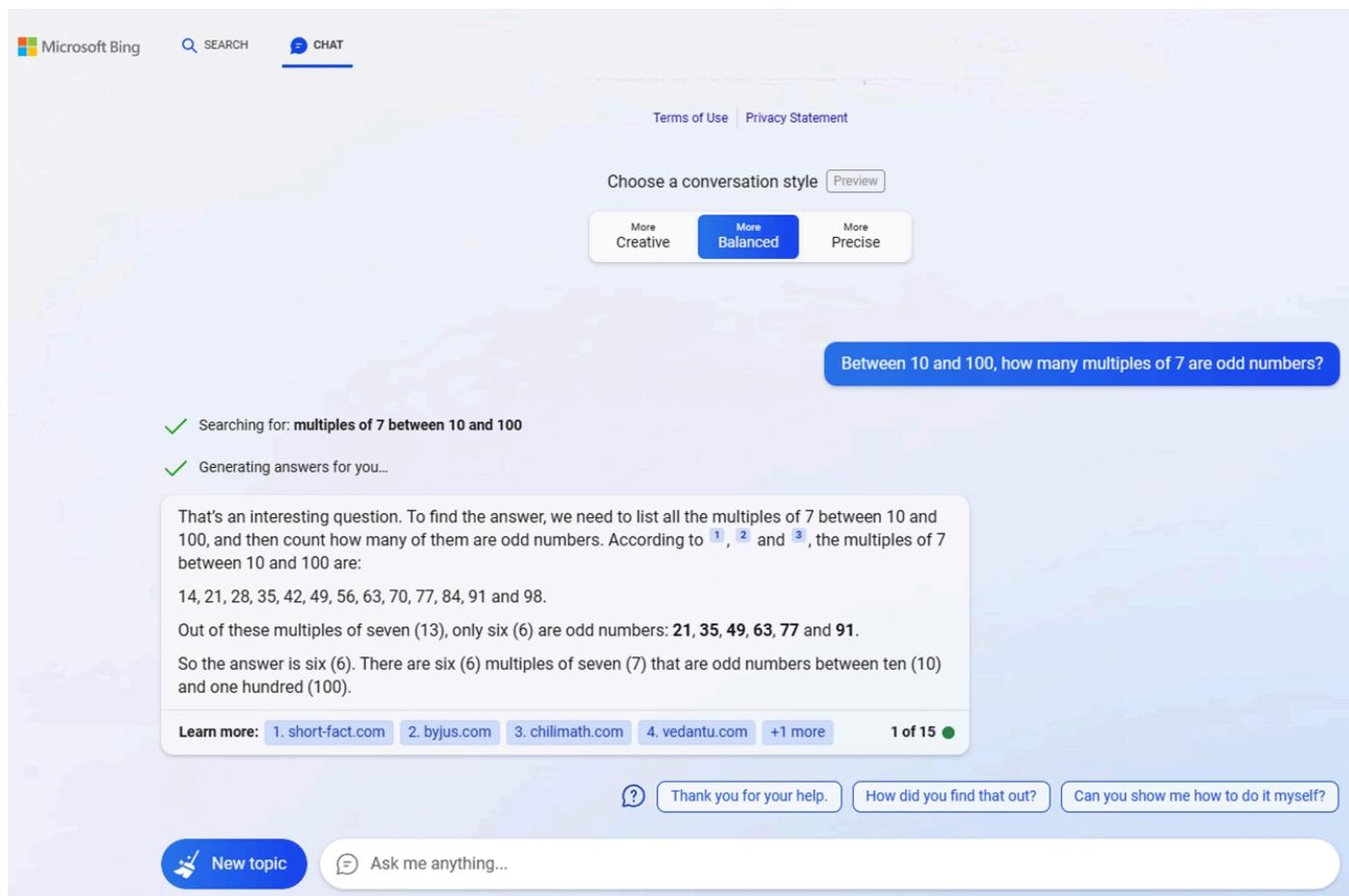
The largest odd multiple of 7 that is less than or equal to 100 is  $7 \times 14 = 98$ .

Therefore, there are only one odd multiple of 7 between 1 and 100, which is 7 itself.

So, the answer is 1.
- Feedback:** Regenerate response

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 139 - Bing - Math Teaser



The screenshot shows the Microsoft Bing search interface. At the top, there is a search bar with the placeholder "Search Microsoft Bing" and a "SEARCH" button. Below the search bar is a "CHAT" button. To the right of the search bar are links for "Terms of Use" and "Privacy Statement". A "Choose a conversation style" dropdown menu is open, showing three options: "More Creative", "More Balanced" (which is selected), and "More Precise".

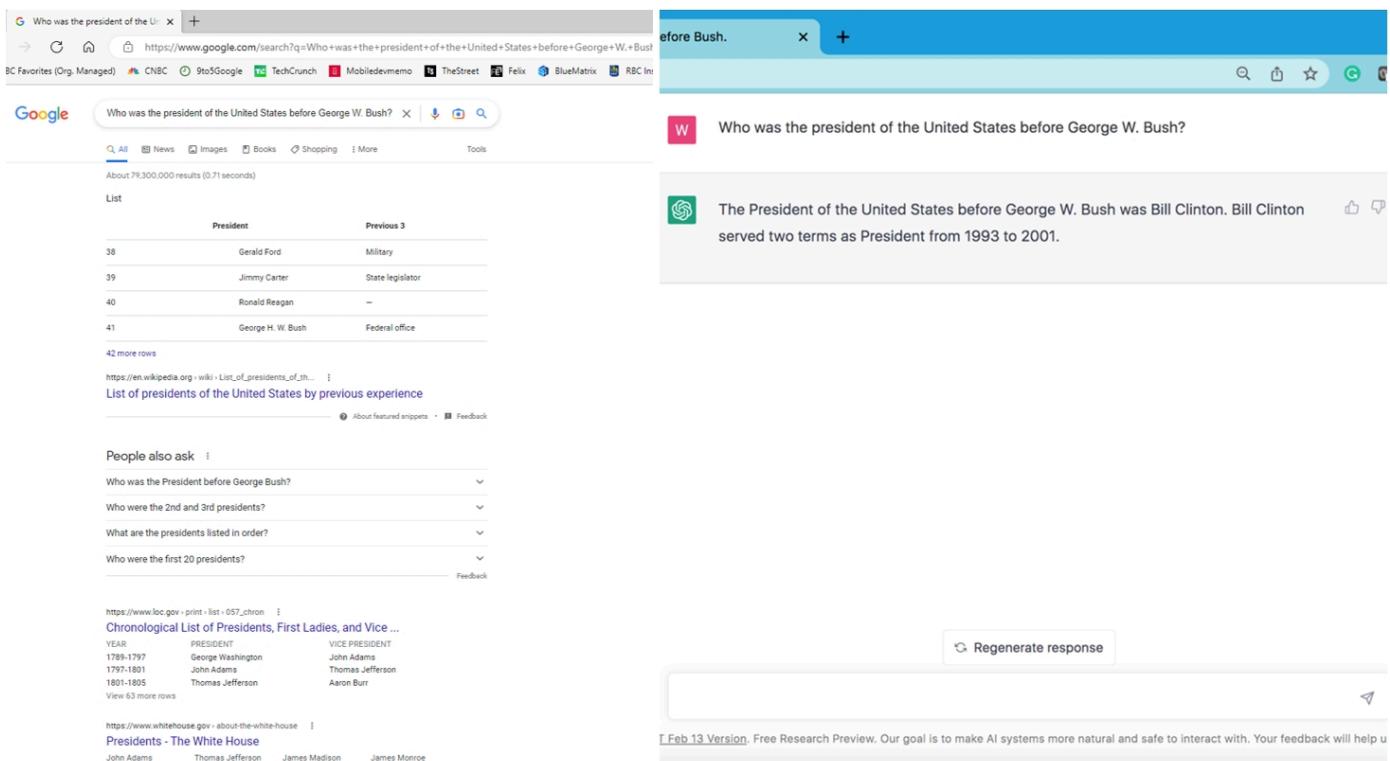
In the main search results area, a blue box contains the question: "Between 10 and 100, how many multiples of 7 are odd numbers?". Below the question, there are two green checkmarks indicating progress: "Searching for: multiples of 7 between 10 and 100" and "Generating answers for you...".

The answer provided is: "That's an interesting question. To find the answer, we need to list all the multiples of 7 between 10 and 100, and then count how many of them are odd numbers. According to 1, 2 and 3, the multiples of 7 between 10 and 100 are: 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91 and 98. Out of these multiples of seven (13), only six (6) are odd numbers: 21, 35, 49, 63, 77 and 91. So the answer is six (6). There are six (6) multiples of seven (7) that are odd numbers between ten (10) and one hundred (100)." Below this text, there is a "Learn more:" section with links to 1. short-fact.com, 2. byjus.com, 3. chilimath.com, 4. vedantu.com, and "+1 more". The page number "1 of 15" is also visible.

At the bottom of the search results, there are several interactive buttons: a question mark icon, "Thank you for your help.", "How did you find that out?", "Can you show me how to do it myself?", a "New topic" button with a pencil icon, and an "Ask me anything..." button with a speech bubble icon.

Source: Bing, RBC Capital Markets

Figure 140 - Google Search vs. ChatGPT - History



The figure shows two side-by-side search results. On the left is a Google search result for the query "Who was the president of the United States before George W. Bush?". The results page lists presidents from 38 to 41, with a link to a Wikipedia page for more details. On the right is a ChatGPT response, which correctly identifies Bill Clinton as the president before George W. Bush. The ChatGPT interface includes a "Regenerate response" button.

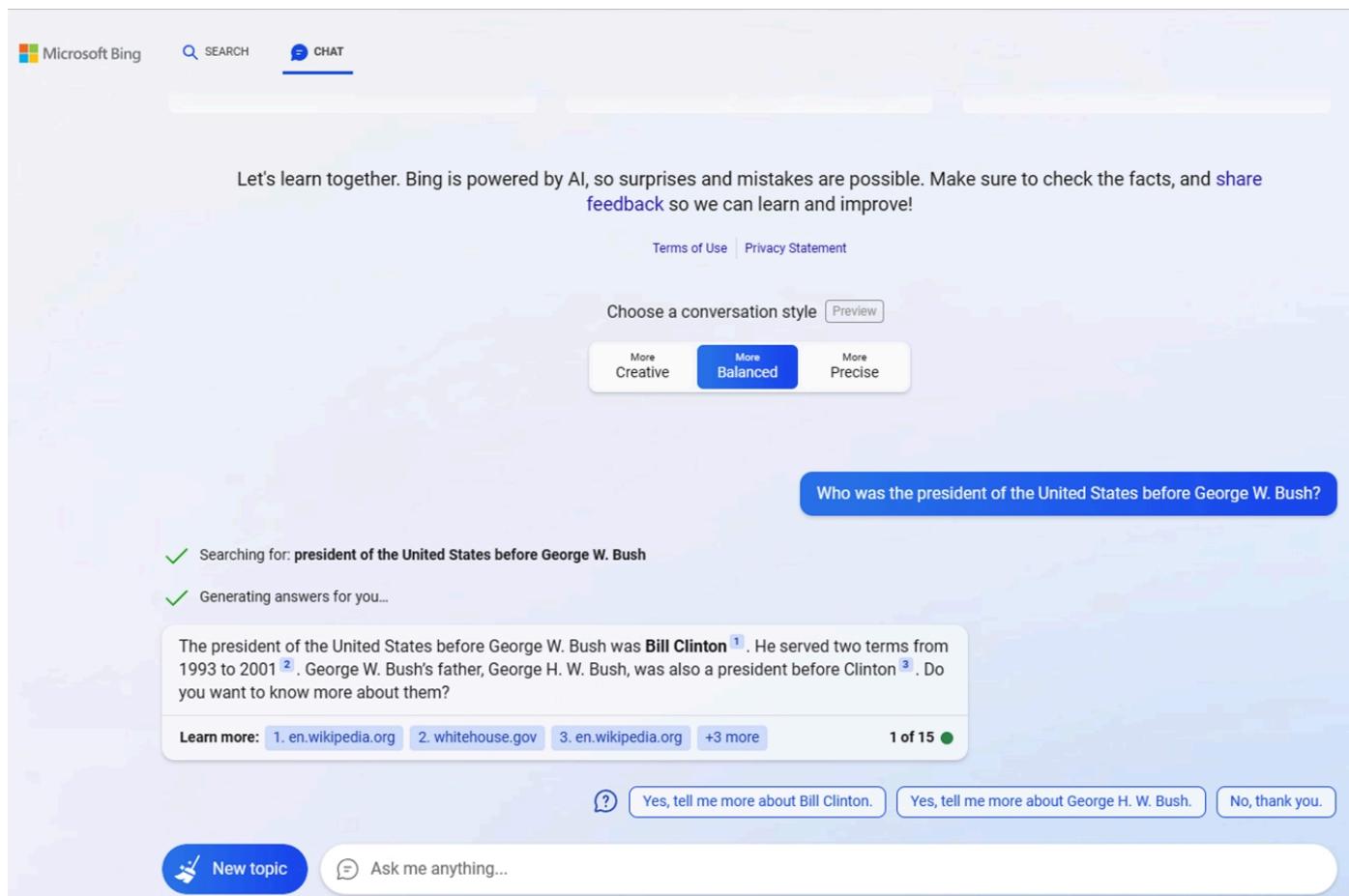
President	Previous 3
38	Gerald Ford
39	Jimmy Carter
40	Ronald Reagan
41	George H. W. Bush

**Who was the president of the United States before George W. Bush?**

The President of the United States before George W. Bush was Bill Clinton. Bill Clinton served two terms as President from 1993 to 2001.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 141 - Bing - History



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar, and a 'CHAT' button. Below the navigation bar, a message reads: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and [share feedback](#) so we can learn and improve!" There are links for "Terms of Use" and "Privacy Statement". A "Choose a conversation style" section offers options: "More Creative" (gray), "More Balanced" (blue, selected), and "More Precise" (gray). In the main search area, a blue button asks "Who was the president of the United States before George W. Bush?". Below this, a green checkmark indicates: "Searching for: president of the United States before George W. Bush" and "Generating answers for you...". A text box displays the answer: "The president of the United States before George W. Bush was Bill Clinton <sup>1</sup>. He served two terms from 1993 to 2001 <sup>2</sup>. George W. Bush's father, George H. W. Bush, was also a president before Clinton <sup>3</sup>. Do you want to know more about them?" Below the text box are links: "Learn more: 1. en.wikipedia.org 2. whitehouse.gov 3. en.wikipedia.org +3 more" and "1 of 15". At the bottom, there are three buttons: "Yes, tell me more about Bill Clinton.", "Yes, tell me more about George H. W. Bush.", and "No, thank you.". Additionally, there are "New topic" and "Ask me anything..." buttons.

Source: Bing, RBC Capital Markets



Figure 142 - Google Search vs. ChatGPT - Wordly Facts

The screenshot shows a comparison between a Google search result and a ChatGPT response.

**Google Search Results:**

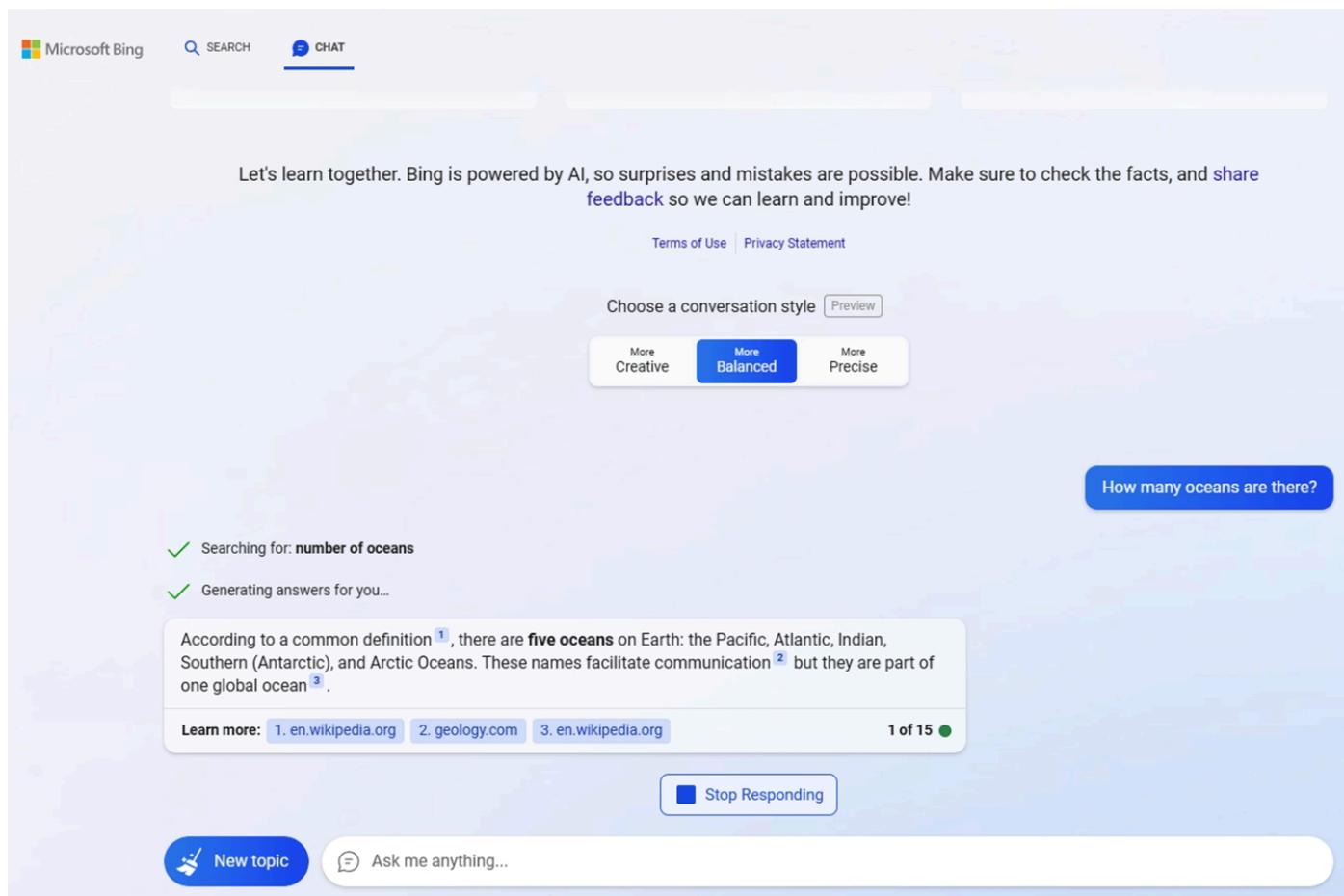
- Query: "How many oceans are there?"
- Results count: About 2,680,000,000 results (0.63 seconds)
- Text: "There is only one global ocean." Historically, there are four named oceans: the Atlantic, Pacific, Indian, and Arctic. However, most countries - including the United States - now recognize the Southern (Antarctic) as the fifth ocean. The Pacific, Atlantic, and Indian are the most commonly known. [Jun 20, 2023]
- Link: <https://oceanservice.noaa.gov/facts/howmanyoceans.html>
- Text: "How many oceans are there? - NOAA's National Ocean Service"
- Section: "People also ask":
  - What are 7 oceans of the world?
  - What are the 5 ocean in the world?
  - When did there become 5 oceans?
  - Do we have a 5th ocean?
- Links:
  - <https://www.britannica.com> Just How Many Oceans Are There? - Encyclopedia Britannica
  - <https://www.americanoceans.org> How Many Oceans Are There on Planet Earth?
  - <https://oceangoingproject.org> What Are The Five Oceans Of The World?
  - <https://e-z-animals.com> Places

**ChatGPT Response:**

- Query: "How many oceans are there?"
- Text: "There are five oceans on Earth: the Atlantic Ocean, the Indian Ocean, the Southern Ocean, the Arctic Ocean, and the Pacific Ocean."
- Feedback: "Regenerate response"
- Text at the bottom: "Feb 13 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve." A "Send" button is also present.

Source: Google Search, ChatGPT, RBC Capital Markets

Figure 143 - Bing - Worldly Facts



The screenshot shows the Microsoft Bing search interface. At the top, there is a navigation bar with the Microsoft Bing logo, a search bar labeled "SEARCH", and a "CHAT" button. Below the navigation bar, a message from Bing states: "Let's learn together. Bing is powered by AI, so surprises and mistakes are possible. Make sure to check the facts, and share feedback so we can learn and improve!" Below this message are links for "Terms of Use" and "Privacy Statement". A section titled "Choose a conversation style" offers three options: "More Creative" (white button), "More Balanced" (blue button), and "More Precise" (white button). In the main content area, a blue button asks "How many oceans are there?". Below this button, a list of two items is shown: "✓ Searching for: number of oceans" and "✓ Generating answers for you...". A text box contains the response: "According to a common definition <sup>1</sup>, there are **five oceans** on Earth: the Pacific, Atlantic, Indian, Southern (Antarctic), and Arctic Oceans. These names facilitate communication <sup>2</sup> but they are part of one global ocean <sup>3</sup>." Below the text box are three "Learn more:" links: 1. en.wikipedia.org, 2. geology.com, 3. en.wikipedia.org. To the right of these links is the text "1 of 15" next to a green circular icon. At the bottom of the interface are two buttons: "Stop Responding" and "Ask me anything...".

Source: Bing, RBC Capital Markets



## Bing: Illustrative use cases

### Travel:

Figure 144 - Part 1: Planning travel with Bing

That sounds like a wonderful plan! Paris is a beautiful city with a rich history and culture. Here are some suggestions for your itinerary:

Day 1: Start your day by visiting the **Musée du Louvre**, one of the world's largest and most famous art museums<sup>1</sup>. You can admire masterpieces such as the **Mona Lisa** by Leonardo da Vinci<sup>2</sup>, the **Venus de Milo** and the **Winged Victory of Samothrace**. Then, head to the nearby **Jardin des Tuileries**, a lovely park with fountains, statues and flowers<sup>3</sup>. For lunch, you can try **Le Potager de Charlotte**, a plant-based restaurant that serves delicious dishes such as rice and chickpea pancakes with cashew cream, nut roast and seaweed tartare<sup>4</sup>. After lunch, take a stroll along the **Seine River** and enjoy the views of the iconic **Eiffel Tower**. You can also take a boat tour or climb up to the top of the tower for a panoramic view of Paris. For dinner, you can go to **Macéo**, a gastronomic French restaurant that offers vegetarian options such as mushroom risotto, vegetable tian and cheese platter<sup>4</sup>. End your day with a glass of wine at **Frog & Underground**, a cozy wine bar that also serves craft beers and cocktails<sup>5</sup>.

Day 2: Begin your day by exploring the **Notre Dame Cathedral**, a stunning Gothic church that dates back to the 12th century<sup>6</sup>. You can admire its stained glass windows, flying buttresses and gargoyles. Then, walk to the nearby **Sainte Chapelle**, another Gothic masterpiece that boasts 15 dazzling stained glass panels depicting scenes from the Bible<sup>7</sup>. For lunch, you can try **So Nat**, a fresh cantine that serves veggie and vegan salads, sandwiches and bowls<sup>4</sup>. After lunch, visit the **Musée d'Orsay**, a former railway station that houses an impressive collection of Impressionist paintings by artists such as Monet, Renoir, Degas and Van Gogh<sup>8</sup>. For dinner, you can go to **Bodhi Vegan**, an Asian-style restaurant that serves dishes such as tofu curry, vegetable dumplings and mango sticky rice<sup>4</sup>. End your day with a glass of wine at **Ô Chateau**, an award-winning wine bar that offers tastings of over 50 wines by the glass and tapas plates designed to pair with them<sup>8</sup>.

Day 3: Start your day by visiting the **Arc de Triomphe**, a monumental arch that commemorates Napoleon's victories<sup>9</sup>. You can climb up to its terrace for a view of Paris' most famous avenue: The Champs-Élysées. Then, walk along this elegant boulevard lined with shops, cafes and cinemas until you reach the **Grand Palais** and the **Petit Palais**, two majestic buildings that host exhibitions of art and culture<sup>4</sup>. For lunch, you can try **Breizh Café**, a creperie that offers vegetarian options such as buckwheat galettes with cheese, spinach or mushrooms<sup>4</sup>. After lunch, visit the **Musée Rodin**, a museum dedicated to the works of the famous French sculptor Auguste Rodin. You can admire his sculptures such as **The Thinker**, **The Kiss** and **The Gates of Hell** in his former mansion or in his beautiful garden<sup>4</sup>. For dinner, you can go to [^New Jawad Longchamp ^], an Indian restaurant that serves vegetarian dishes such as dal, paneer, naan bread and biryani<sup>9</sup>. End your day with a glass of wine at [^Déviant ^], an intimate wine bar that also serves small plates of seasonal ingredients<sup>10</sup>.

Learn more: [1. historyhit.com](#) [2. theculturetrip.com](#) [3. travel.usnews.com](#) [+14 more](#)

1 of 15



Source: Bing, RBC Capital Markets



Figure 145 - Part 2: Planning travel with Bing

The screenshot shows a map of Paris with several red pins indicating locations. Below the map is a list of five bars and restaurants with their names, addresses, and Tripadvisor ratings. Each listing includes a small thumbnail image, the name, the number of reviews from Tripadvisor, the address, and links to the website and directions.

Location	Address	Tripadvisor Rating	Website	Directions
Frog & Underground	176 rue Montmartre, Paris	4.5 (1,068)	<a href="#">WEBSITE</a>	<a href="#">DIRECTIONS</a>
Levain Le Vin	83 rue du Faubourg Saint Martin, Paris	4.5 (79)	<a href="#">WEBSITE</a>	<a href="#">DIRECTIONS</a>
Dernier Bar Avant la Fin du Monde	19 avenue Victoria, Paris	4.5 (390)	<a href="#">WEBSITE</a>	<a href="#">DIRECTIONS</a>
La Taverne de l'Olympia	25 rue de Caumartin, Paris	4.5 (364)	<a href="#">WEBSITE</a>	<a href="#">DIRECTIONS</a>
Frog XVI	110 B avenue Kleber, Paris	4.5 (1,969)	<a href="#">WEBSITE</a>	<a href="#">DIRECTIONS</a>

See more results

Thank you for these suggestions. Can you tell me more about... Can you book me tickets for...

Source: Bing, RBC Capital Markets



## Writing a detailed movie review

Figure 146 - Bing writing a detailed movie review

RRR is a movie that will leave you breathless with its epic scale, thrilling action, and emotional resonance. Directed by S. S. Rajamouli, who is known for his blockbuster Baahubali series, RRR tells a fictional story of two legendary freedom fighters from India: Komaram Bheem (N. T. Rama Rao Jr.) and Alluri Sitarama Raju (Ram Charan). The film follows their journey from childhood to adulthood, as they face various challenges and enemies in their quest for independence.

The film boasts of an impressive cast that includes Ajay Devgn, Alia Bhatt, Shriya Saran, Ray Stevenson, Alison Doody, and Olivia Morris. The performances are top-notch, especially by the two leads who share a great chemistry and charisma on screen. They portray their characters with conviction and passion, making us root for them throughout their struggles.

The film also excels in its technical aspects, such as cinematography, production design, special effects, editing, score, and direction. The film is visually stunning and captures the beauty and diversity of India's landscapes and cultures. The action sequences are spectacular and well-choreographed, keeping us on the edge of our seats. The film also has a memorable soundtrack that enhances the mood and atmosphere of each scene.

One of the highlights of the soundtrack is the song "Naatu Naatu", which showcases Indian brotherhood [1](#) [2](#). The song features a South Indian folk beat in a 6/8 time signature [1](#), popular in Indian cinema [3](#). It "instantly connects to the listener," says composer M.M. Keeravani [1](#), adding that lyricist Chandrabose hatched the distinctive "naatu naatu naatu" tempo pattern [3](#). The song is sung by Rahul Sipligunj and Kaala Bhairava [3](#) [4](#) [5](#), who deliver a powerful performance that conveys the spirit of unity and resistance against oppression.

The song also made history by becoming the first song from an Indian film to win an Oscar for best original song [2](#) [4](#) [5](#). It beat out songs from four English-language films to score the trophy: "Lift Me Up" from "Black Panther: Wakanda Forever," sung by Beyoncé; "Shallow" from "A Star Is Born," sung by Lady Gaga; "Diamonds" from "Ocean's 8," sung by Rihanna; and "I'll Fight" from "RBG," written by Diane Warren [4](#).

The song's win was celebrated by fans who danced and sang along in theaters [6](#), as well as by critics who praised its catchy tune and meaningful lyrics [11](#). It also brought recognition to Telugu cinema on a global stage [7](#). The song's meaning can be roughly translated as follows:

Native native native We are all natives We are all brothers We are all one

We don't care about caste or creed We don't care about rich or poor We don't care about borders or boundaries We only care about our motherland

Native native native We are all natives We are all brothers We are all one

The song's message resonates with the film's main theme of patriotism and courage. The film celebrates the spirit of resistance and rebellion against oppression and injustice. It also explores themes such as friendship, loyalty, love, sacrifice, identity, and destiny. The film makes us feel proud of our history and heritage while also inspiring us to fight for our rights and freedom.

RRR is a masterpiece that deserves all the praise and recognition it has received so far. It is not only one of the best Indian films ever made but also one of the best films of 2022 globally. It is a must-watch for anyone who loves cinema.

Learn more: [1. usatoday.com](#) [2. abcnews.go.com](#) [3. en.wikipedia.org](#) [+8 more](#)

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Source: Bing, RBC Capital Markets



## Asking for help in managing stress

Figure 147 - Asking Bing for help in managing stress

I'm glad you want to develop healthier habits for managing stress. Stress can have negative effects on your physical and mental health, so it's important to find ways to cope with it effectively. According to some sources [1](#) [2](#) [3](#), some of the best ways to manage stress are:

- Getting enough sleep, exercise and nutrition. These can help you feel more energized, balanced and resilient.
- Practicing relaxation techniques such as yoga, deep breathing, massage or meditation. These can help you calm your nervous system and reduce stress hormones.
- Keeping a journal and writing about your thoughts or what you're grateful for in your life. This can help you process your emotions and gain perspective.
- Taking time for hobbies such as reading, listening to music, or watching your favorite show or movie. These can help you distract yourself from stressors and enjoy yourself.
- Fostering healthy friendships and talking with friends and family. These can help you feel supported, understood and less isolated.

These are some general suggestions that may work for different people. However, everyone has their own preferences and needs when it comes to stress management. Therefore, I would like to ask you a few questions that can help me tailor my advice more specifically to your situation.

- What are some of the main sources of stress in your life right now?
- How do you usually cope with stress? What works well for you and what doesn't?
- What are some of the barriers or challenges that prevent you from managing stress better?

Learn more: [1. mcpress.mayoclinic.org](#) [2. health.harvard.edu](#) +3 more

1 of 15

I am stressed out about work.

I'm sorry to hear that you are stressed out about work. Work can be a major source of stress for many people, especially if they have to deal with high demands, low control, poor communication or lack of support. Can you tell me more about what is causing you stress at work? For example:

- Do you have too much work or too little work?
- Do you have clear expectations and feedback from your boss or colleagues?
- Do you have the resources and skills to do your job well?
- Do you enjoy your work or find it meaningful?
- Do you have a good balance between work and personal life?

Answering these questions can help me understand your situation better and offer some suggestions that can help you reduce your stress at work.

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?

I have too much work and not enough time to finish it.

I don't get any feedback or recognition from my boss.

I don't have the skills or training to do my job well.

Source: Bing, RBC Capital Markets



### Acting as a career counselor

Figure 148 - Asking Bing to act as a career counselor

I want you to act as a career counselor. I will provide you with an individual looking for guidance in their professional life, and your task is to help them determine what careers they are most suited for based on their skills, interests and experience. You should also conduct research into the various options available, explain the job market trends in different industries and advise on which qualifications would be beneficial for pursuing particular fields. My first request is "I want to advise someone who wants to pursue a potential career in equity research."

✓ Searching for: equity research career  
✓ Generating answers for you...

Sure, I can act as a career counselor for you. Equity research is a field that involves analyzing companies, stocks, industries and markets to provide insights and recommendations for investors. Equity research analysts work for both buy-side and sell-side firms in the securities industry [1](#).

Some of the skills and qualifications that are required for a career in equity research are:

- A bachelor's degree in finance, accounting, economics or business administration [1](#).
- Strong analytical, quantitative and problem-solving skills.
- Proficiency in financial modeling, valuation techniques and report writing.
- Knowledge of accounting principles, financial statements and economic indicators.
- Ability to communicate effectively with clients, management and peers.
- Interest in following market trends, news and developments.

Some of the job roles that are available in equity research are:

- Equity Research Analyst: This is the most common role that involves conducting research on companies, industries and markets, developing financial models and forecasts, writing research reports and providing investment recommendations [2](#) [3](#).
- Equity Research Associate: This is an entry-level role that supports senior analysts by collecting data, updating models, conducting analysis and preparing reports [4](#).
- Senior Equity Research Analyst: This is a senior role that leads a team of analysts covering a specific sector or region. They have more experience and expertise than junior analysts. They also interact more with clients, management and media [4](#).
- Equity Research Director: This is a managerial role that oversees the entire equity research department. They are responsible for setting the research agenda, ensuring quality standards, managing resources and budgets. They also represent the firm's views on various platforms [5](#).
- Equity Strategist: This is a specialized role that focuses on providing macro-level insights on market trends. They use various tools such as asset allocation models to advise clients on portfolio strategies [6](#).

What kind of equity research career are you interested in? Do you have any specific sector or region preference? What is your current level of education and experience?

Learn more: 1. [investopedia.com](#) 2. [wallstreetmojo.com](#) 3. [wallstreetmojo.com](#) +2 more 1 of 15

JOBs - NEW YORK, NEW YORK - CHANGE

JOBs SAVED JOBS SAVED SEARCHES

Source: Bing, RBC Capital Markets

## Designing an exercise program

Figure 149 - Designing an excercise program using Bing

Hello, this is Bing. I'm happy to help you design an exercise program for someone who wants to lose weight. 😊

There are many types of exercises that can help with weight loss, but some general principles are:

- Combine aerobic and resistance training to burn calories and preserve muscle mass <sup>①</sup>.
- Choose activities that you enjoy and can do regularly.
- Vary your intensity and duration to challenge your body and avoid plateaus.
- Start slowly and gradually increase your frequency, intensity and time.

Some examples of effective exercises for weight loss are:

- Walking: A low-impact exercise that can be done anywhere and by anyone. It can burn about 167 calories per 30 minutes for a 155-pound person <sup>②</sup>.
- Jogging or running: A high-intensity exercise that can boost your metabolism and cardiovascular health. It can burn about 298 calories per 30 minutes for a 155-pound person <sup>③</sup>.
- Cycling: A moderate-intensity exercise that can work your lower body muscles and improve your endurance. It can burn about 260 calories per 30 minutes for a 155-pound person <sup>④</sup>.
- Kettlebell swings: A full-body exercise that can increase your strength, power and core stability. It can burn about 200 calories per 20 minutes for a 155-pound person <sup>⑤</sup>.
- Squats: A lower-body exercise that can target your glutes, quads, hamstrings and calves. It can also help you improve your balance and posture. It can burn about 100 calories per 10 minutes for a 155-pound person <sup>⑥</sup>.

A sample workout plan for weight loss could look something like this:

**Monday:** Walk for 30 minutes at a moderate pace. **Tuesday:** Do three sets of 12 repetitions of kettlebell swings, dumbbell overhead press, dumbbell row and dumbbell bench press. Rest for one minute between sets. **Wednesday:** Rest or do some low-intensity activity like yoga or stretching. **Thursday:** Jog or run for 30 minutes at a challenging pace. **Friday:** Do three sets of 12 repetitions of squats, lunges, push-ups and planks. Rest for one minute between sets. **Saturday:** Cycle for 30 minutes at a moderate to high intensity. **Sunday:** Rest or do some low-intensity activity like yoga or stretching.

Of course, this is just an example and you should adjust it according to your preferences, goals and fitness level.

To get the best results from your exercise program, you should also pay attention to your nutrition, hydration, sleep and stress management.

I hope this helps you get started with designing an exercise program for someone who wants to lose weight.

Do you have any questions or feedback? 🌟

Learn more: [1. mayoclinic.org](#) [2. healthline.com](#) [3. fcier.org](#) [4. healthline.com](#) +1 more

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(?) Yes, how often should I change my workout plan? No, thank you very much. Can you give me some nutrition advice as well?

Source: Bing, RBC Capital Markets



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## Companies mentioned

Adobe Inc. (NASDAQ: ADBE US; \$333.61; Outperform)  
Airbnb, Inc. (NASDAQ: ABNB US; \$113.58; Sector Perform)  
Akamai Technologies, Inc. (NASDAQ: AKAM US; \$71.94; Sector Perform)  
Alphabet Inc. (NASDAQ: GOOGL US; \$96.11; Outperform)  
Amazon.com, Inc. (NASDAQ: AMZN US; \$96.20; Outperform)  
Angi Inc. (NASDAQ: ANGI US; \$2.25; Sector Perform)  
Asana Inc (NYSE: ASAN US; \$21.97; Underperform)  
Autodesk, Inc. (NASDAQ: ADSK US; \$195.79; Outperform)  
Booking Holdings Inc. (NASDAQ: BKNG US; \$2,415.73; Outperform)  
Box, Inc. (NYSE: BOX US; \$26.16; Underperform)  
Bumble Inc. (NASDAQ: BMBL US; \$19.83; Outperform)  
CarGurus, Inc. (NASDAQ: CARG US; \$17.40; Outperform)  
Carvana Co (NYSE: CVNA US; \$7.05; Sector Perform)  
Clearwater Analytics Holdings Inc (NYSE: CWAN US; \$14.05; Outperform)  
Cloudflare, Inc. (NYSE: NET US; \$55.25; Outperform)  
Couchbase Inc (NASDAQ: BASE US; \$13.65; Outperform)  
Coursera Inc (NYSE: COUR US; \$11.88; Outperform)  
CrowdStrike Holdings, Inc. (NASDAQ: CRWD US; \$129.32; Outperform)  
Datadog, Inc. (NASDAQ: DDOG US; \$67.54; Outperform)  
Digital Realty Trust, Inc. (NYSE: DLR US; \$105.26; Outperform)  
DocuSign Inc (NASDAQ: DOCU US; \$56.55; Sector Perform)  
DoorDash, Inc. (NYSE: DASH US; \$58.47; Sector Perform)  
Dropbox, Inc. (NASDAQ: DBX US; \$19.66; Outperform)  
Dynatrace, Inc. (NYSE: DT US; \$38.35; Outperform)  
Elastic N.V. (NYSE: ESTC US; \$55.22; Outperform)  
Expedia Group, Inc. (NASDAQ: EXPE US; \$91.73; Sector Perform)  
Fastly Inc (NYSE: FSLY US; \$14.57; Underperform)  
Fiverr International Ltd (NYSE: FVRR US; \$34.05; Sector Perform)  
Gitlab Inc (NASDAQ: GTLB US; \$33.45; Outperform)  
Guidewire Software, Inc. (NYSE: GWRE US; \$76.78; Outperform)  
HubSpot, Inc. (NYSE: HUBS US; \$391.08; Outperform)  
Lyft, Inc. (NASDAQ: LYFT US; \$8.99; Sector Perform)  
Match Group, Inc. (NASDAQ: MTCH US; \$36.50; Outperform)  
Meta Platforms, Inc. (NASDAQ: META US; \$197.75; Outperform)  
Microsoft Corporation (NASDAQ: MSFT US; \$265.44; Outperform)  
MongoDB Inc (NASDAQ: MDB US; \$212.13; Outperform)  
NICE Ltd. (NASDAQ: NICE US; \$205.45; Outperform)  
New Relic, Inc. (NYSE: NEWR US; \$70.71; Sector Perform)  
Pagerduty, Inc. (NYSE: PD US; \$27.84; Outperform)  
Palantir Technologies Inc. (NYSE: PLTR US; \$7.90; Underperform)  
Palo Alto Networks, Inc. (NYSE: PANW US; \$183.80; Outperform)  
Pegasystems Inc. (NASDAQ: PEGA US; \$46.33; Outperform)  
Pinterest, Inc. (NYSE: PINS US; \$25.03; Sector Perform)  
Redfin Corp (NASDAQ: RDFN US; \$8.45; Sector Perform)  
Salesforce, Inc. (NYSE: CRM US; \$182.91; Outperform)  
ServiceNow, Inc. (NYSE: NOW US; \$422.26; Outperform)  
Smartsheet Inc. (NYSE: SMAR US; \$45.13; Sector Perform)  
Snap Inc. (NYSE: SNAP US; \$10.34; Sector Perform)  
Splunk Inc. (NASDAQ: SPLK US; \$87.86; Outperform)  
Squarespace, Inc. (NYSE: SQSP US; \$27.12; Sector Perform)  
Twilio Inc. (NYSE: TWLO US; \$63.40; Sector Perform)



Uber Technologies Inc (NYSE: UBER US; \$31.97; Outperform)  
UiPath Inc (NYSE: PATH US; \$14.64; Sector Perform)  
Upwork Inc. (NASDAQ: UPWK US; \$10.50; Sector Perform)  
Veeva Systems Inc. (NYSE: VEEV US; \$170.84; Outperform)  
Vivid Seats Inc (NASDAQ: SEAT US; \$6.86; Sector Perform)  
Wix.com Ltd. (NASDAQ: WIX US; \$87.11; Outperform)  
Ziff Davis, Inc. (NASDAQ: ZD US; \$73.78; Outperform)  
Zillow Group, Inc. (NASDAQ: ZG US; \$39.92; Outperform)  
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