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IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF COLUMBIA

UNITED STATES OF AMERICA,  
et al.,  
Plaintiffs,

Civil Action  
No. 1:20-cv-3010

vs.

GOOGLE, LLC,  
Defendant.

Washington, DC  
October 26, 2023  
1:30 p.m.

Day 28  
Afternoon Session

TRANSCRIPT OF BENCH TRIAL  
BEFORE THE HONORABLE AMIT P. MEHTA  
UNITED STATES DISTRICT JUDGE

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I N D E X

WITNESS

PAGE

PRABHAKAR RAGHAVAN

Continued Direct Examination by Mr. Sommer

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*\*Exhibit provisionally admitted.*

P R O C E E D I N G S

1  
2           **THE COURT:** Welcome back, everybody.

3           Mr. Sommer, whenever you're ready.

4           CONTINUED DIRECT EXAMINATION OF PRABHAKAR RAGHAVAN

5           **BY MR. SOMMER:**

6           **Q.** Thank you, Judge. Good afternoon, Dr. Raghavan.

7           **A.** Good afternoon.

8           **Q.** I'm going to now turn to another area you're  
9 responsible for, and that's search ads, okay.

10           Why does Google show ads on the search engine results  
11 page?

12           **A.** Earlier this morning, we discussed that users  
13 sometimes have commercial intent, and I pointed out they want  
14 deals in some sense. They want qualifying offers from good  
15 merchants. Merchants are anxious to reach these users in  
16 those moments of commercial need, and our ads facilitate  
17 that. They also -- obviously the revenue from them, helps  
18 make information universally accessible, making Google search  
19 accessible to anybody whether or not they can pay for it.

20           **Q.** Wouldn't users be better off just getting organic  
21 results?

22           **A.** That's not what our research shows quite  
23 consistently. When users are in a moment of commercial  
24 consideration, consistent user studies suggest that they  
25 would like to see the right number of tasteful and

1 well-matched advertisements.

2 Q. How can users distinguish advertisements from organic  
3 search results?

4 A. I can speak for Google. We try our best to label  
5 advertising conspicuously, and periodically conduct user  
6 studies to ensure that these labels are visible to users.  
7 And wherever we can, we make improvements. And every year or  
8 two, we actually make refinements in what we call the  
9 badging.

10 Q. Badging?

11 A. We refer to it as the badging of advertising.

12 Q. Does Google serve ads in response to every query?

13 A. We do not. To give you a rough sense, about  
14 80 percent of queries have zero ads, and the remaining  
15 20 percent have between one and four.

16 Q. So when there's a commercial query, how does the  
17 Google algorithm -- or whatever I should properly refer to it  
18 as, how does it decide how many ads should be served in  
19 response to the query?

20 A. It's a combination of factors. I'll try to be  
21 succinct. So we take into account the quality of match, how  
22 relevant the advertisement is for the query at hand. We take  
23 into account the quality of downstream user experience, so  
24 it's the landing experience. And we try to discern,  
25 obviously, between merchants where they get a good experience

1 versus the other extreme, a site that might be putting in  
2 malware into the user's computer, and elevate the ones to the  
3 highest quality. We take into account the bids that  
4 advertisers make on the user need at hand. So that's the --  
5 it's a very succinct summary of how it works.

6 Q. I appreciate that. You mentioned that it's from zero  
7 to four ads. Does Google ever show more than four topside  
8 ads?

9 A. No. And if that ever happened, it would be a bug and  
10 we would fix it immediately.

11 Q. It would be a bug, you said?

12 A. It would be a bug. By policy, we wouldn't show more  
13 than four.

14 Q. And what percentage of the time is Google showing  
15 less than four ads?

16 A. So let's split it up. So the biggest bucket is zero,  
17 which is 80 percent; one to three -- which is what I think  
18 you're asking, is roughly 18 percent; and four is a little  
19 less than 2 percent at this point.

20 Q. So four ads are shown, and only 2 percent of the  
21 time?

22 A. 2 percent of queries.

23 Q. Queries, thank you. Are you generally familiar with  
24 how many ads are shown by, for example, Bing in response to  
25 commercial queries?

1           **A.** Only from my experience, and what some of my  
2 colleagues have reported when trying Bing.

3           **Q.** And is it generally more than four?

4           **A.** My impression is that the ad load on Bing is higher.

5           **Q.** How about some verticals like Yelp, for example, any  
6 insight -- have you ever been on Yelp or had a colleague look  
7 at Yelp for you?

8           **MR. HAFENBRACK:** Your Honor, I'll object on foundation  
9 grounds.

10          **THE COURT:** If that's the objection, it's overruled. Go  
11 ahead, sir.

12          **THE WITNESS:** I've used some of the vertical services. I  
13 see far more ads on Yelp and Amazon, for instance.

14 **BY MR. SOMMER:**

15          **Q.** Now, why doesn't Google show more ads, wouldn't that  
16 increase Google's revenue?

17          **A.** In the very short term, yes. But really, the way we  
18 think of the system is how to deliver long-term value to the  
19 advertiser ecosystem into the business. And what we've  
20 learned -- and we've actually published on this. There was a  
21 publication we did in 2015 by Hohnhold, et al. -- and I'll  
22 spell that for the Court: H-O-H-N-H-O-L-D. It was a  
23 publication from colleagues that showed that if you crank up  
24 the ad load, that has a detrimental effect on the user  
25 experience that makes users go away. And so it's not a good

1 thing to do.

2 Q. Okay. And between short-term revenue and long-term  
3 user experience, which is paramount at Google?

4 A. We always want the long-term user experience to  
5 survive, because we think that's the best thing for our  
6 business as well.

7 Q. Are you familiar, sir, with various innovations that  
8 have been made to Google's search ads functions over the  
9 years?

10 A. Some of them, I would say.

11 Q. Okay. And is innovation something that is going on  
12 with great frequency?

13 A. I would say it's a fairly constant activity, and it's  
14 the reason why hundreds of engineers work on this problem all  
15 the time.

16 Q. Let me show you the next demonstrative, it's  
17 DXD21.007. Can you describe to the Court generally what we  
18 see on this slide?

19 A. There seems to be a timeline and then an arrow at the  
20 bottom. So the timeline begins in roughly 2000 and comes up  
21 to roughly today. And I should be clear that the left side  
22 of this timeline, I was not at Google and --

23 Q. Understood.

24 A. -- observing from the outside. And the slide shows a  
25 number of the key innovations as well as ongoing innovation



1 in something called NLU, natural language understanding.

2 Q. Does this show all the innovations or is this just a  
3 subset?

4 MR. HAFENBRACK: Your Honor, we'll object, because we  
5 don't have any foundation for this demonstrative, and it  
6 doesn't sound like the witness created it. Counsel's  
7 effectively using what it sounds like is a counsel-created  
8 demonstrative to lead the witness.

9 THE COURT: Do you have any reason to think any of it's  
10 inaccurate?

11 MR. HAFENBRACK: We just received it, Your Honor. We  
12 don't have any basis.

13 THE COURT: Well, it's a demonstrative, so he can use it  
14 to examine him.

15 MR. SOMMER: Thank you.

16 THE COURT: And as the witness has said, he can identify  
17 what he has personal knowledge of and does not.

18 BY MR. SOMMER:

19 Q. Dr. Raghavan, does this slide, based on your personal  
20 knowledge, represent every innovation that Google has done,  
21 even during the period you've been there?

22 A. No, it does not. This is a subset of salient  
23 features.

24 Q. Now I want to ask you about AdWords. Now, you just  
25 reminded us that you were not at Google when AdWords was

1 launched in 2000. Were you aware of the launch of AdWords in  
2 2000?

3 **A.** Very much so.

4 **Q.** How so?

5 **A.** For the left half of this slide, which is roughly the  
6 period I was not at Google, I think I'd say I was in grudging  
7 admiration for what Google was doing. AdWords dramatically  
8 simplified the buying experience of advertising on search  
9 engines. And to set a little context, a few people and the  
10 Court may recall that a little before the turn of the  
11 century, there were engines like Alta Vista that users like  
12 myself used. And there, sometimes you'll type in a query --  
13 for instance, you might type in artificial intelligence, and  
14 you get a banner right above for Seven Seas Cruises which has  
15 little bearing on the user's intent at the time. AdWords and  
16 its precedent, a company by the name Overture which actually  
17 invented the idea, put in place the idea of search  
18 advertising that was germane to the user's intent at that  
19 moment.

20 **Q.** Did AdWords separate organic results from ads on the  
21 search results page?

22 **A.** Absolutely. AdWords had no influence at all on the  
23 organic results, as I understood then. I think that would be  
24 shocking anywhere in the industry, if the advertising side  
25 were to impact the organic side.

1           **Q.** How about you're familiar with the acronyms CPC and  
2 CPM?

3           **A.** I am.

4           **Q.** How about using CPCs instead of CPM, was that an  
5 innovation introduced by AdWords?

6           **A.** If my memory serves me right, it was introduced right  
7 around the time. I wouldn't be able to tell you precisely if  
8 it first came from Google or Overture.

9           **Q.** Let's go to the next demonstrative, which is  
10 DXD21.009. What do you recognize this to be, Dr. Raghavan?

11          **A.** This looks like an ancient Google search page with a  
12 query for Drake Hotel in Chicago.

13          **Q.** And I take it from your work at Google, you know that  
14 the search engine results page has evolved over time; is that  
15 fair?

16          **A.** It definitely has.

17          **Q.** Let's go to the next slide, which has sort of a  
18 side-by-side. What do we see now on the right side of the  
19 slide?

20          **A.** The same query on a more modern Google search page.  
21 And what you see now is -- in the original version, there was  
22 something that said sponsored links to the right of the  
23 organic results. Now it's above the organic results, and the  
24 badging that I referred to earlier is far more prominent than  
25 before.

1 Q. Okay. So just to be clear, on the right side, the  
2 word "sponsored" is the badging you described; is that right?

3 A. Correct.

4 Q. And that indicates it's an ad?

5 A. It's a paid advertisement.

6 Q. Okay. What else about the current version of the  
7 results page do you see that's different?

8 A. Well, so you see much richer image-heavy content  
9 which came in, in this case, in an ad. But one of the things  
10 that evolved was user's expectations grew to demand more  
11 visually rich content. And I spoke earlier of how technology  
12 rises to meet user's expectations. And in this case, what  
13 happened was the available bandwidth to serve visually rich  
14 results in ads was there to deliver this better experience.

15 Q. Are you familiar with something referred to as ad  
16 extensions?

17 A. Yes.

18 Q. What are those?

19 A. So these are features within an advertisement that --  
20 and I'll point to an example here, that allow a user to  
21 navigate directly to some point within an advertiser's  
22 website. So, for instance, if a user were to see the  
23 advertisement on the top, and they were perhaps not  
24 interested in booking the hotel any longer because perhaps  
25 they'd already booked it, but they wanted to know what dining

1 facilities were available, they could click directly on that  
2 link below the main link that says dining at the hotel and  
3 get there.

4 Q. Okay. And was that an innovation that Google  
5 introduced into this --

6 A. I believe it was Google that first came up with this.

7 Q. These types of innovations, these -- excuse me, these  
8 new features where you can click on dining, for example, is  
9 that a benefit to users?

10 A. I would hope so, because for users, they want to  
11 continue their journey as efficiently as possible. This is a  
12 means to not have to go first to a home page, and then click  
13 their way down. It's also a case where an advertiser  
14 indicates what it is about their site might be of the  
15 greatest interest to users issuing this query. And this  
16 advertiser, for instance, says -- felt that dining at the  
17 hotel or viewing guest rooms would be especially useful in  
18 continuing the journey of a user directly.

19 Q. Let's go to the next slide, which is DXD21.010. What  
20 we've put up there is something called long-term value. Are  
21 you familiar with long-term value?

22 A. I am familiar with the idea for long-term value.

23 Q. And did you become aware of it when it was launched  
24 by Google?

25 A. In that terminology, yes. The general idea -- you

1 know, being outside Google, I'd heard that Google was  
2 contemplating this question. It was a very interesting way  
3 of thinking about it. But, yeah, in that -- with that  
4 terminology, long-term value, when it launched.

5 Q. And what does that terminology refer to, long-term  
6 value?

7 A. So here's the idea: When you place advertisements to  
8 a search result, you can estimate a potential revenue for a  
9 user who clicks on one of those ads, right. But when you  
10 place a number of advertisements, you have to assess the user  
11 impact of that slate of advertisements on the user's  
12 experience. So by that I mean is it too many ads, are they  
13 of low quality, are they poorly matched to the user's intent.  
14 And so you try and compute, you try and estimate the user  
15 impact, and subtract that from the revenue component with the  
16 premise that doing so adjusts any revenue upside for any  
17 potential downside from a bad user experience. And that  
18 composite -- I've described it in a very simplistic fashion,  
19 because over time that has become a fairly sophisticated  
20 mathematical function.

21 Q. And -- I'm sorry, were you --

22 A. But the idea is really to manage the composite value  
23 and estimate long-term value from this particular slate of  
24 advertisements.

25 Q. And is that all part of the ads auction process,

1 these factors you just described?

2       **A.** The way you should think about it is the long-term  
3 value function is a large component and the objective  
4 function that the auction considers, so that it weights both  
5 the user experience and the revenue in concluding which ads  
6 to serve up.

7       **Q.** What was innovative about the LTV function that got  
8 introduced that still is there?

9       **A.** I would say a couple of things. To my knowledge, it  
10 was the first formal quantification of user impact. And  
11 that's an incredibly hard thing to do, because you have to  
12 look at an event that's happening billions of times a day,  
13 and each single time come up with this value assessment. And  
14 then the second piece of it was to actually reduce the  
15 revenue upside so that we would have to consider the user  
16 impact, and make sure that the user got value -- enough value  
17 to come back. And establishing that connection is hard, but  
18 that's what the LTV function has been after.

19       **Q.** How, if at all, did this innovation distinguish  
20 Google from competitors like your former employer, Yahoo!?

21       **A.** Back when I was at Yahoo! and Yahoo! had a search  
22 engine, there wasn't as clear a quantification of long-term  
23 value. It's a hard problem, but we were not able to get  
24 quite the same quantification.

25       **Q.** Are you familiar with an innovation known as

1 second-price auction?

2 **THE COURT:** Before you do that, I'm sorry, can I just ask  
3 a follow up question, Dr. Raghavan?

4 **THE WITNESS:** Yes.

5 **THE COURT:** Can you just give me a sense of what are the  
6 components -- component parts of evaluating long-term value?

7 **THE WITNESS:** Yeah, there's a few things. So one piece  
8 that we learned early on as an industry, but I think Google  
9 got there first, is when you present an advertisement to a  
10 user, what is the likelihood that the user clicks on it,  
11 okay. And I say this, because the classic example was circa  
12 2000 on Yahoo! and other early engines. eBay would bid on  
13 virtually every keyword. So you might type Boeing 747, and  
14 you would get an ad that said: Buy a Boeing 747 on eBay,  
15 right. And the point is no user would actually click that,  
16 because no user querying that query would click it. So what  
17 this function managed to do was to say, well, nobody's  
18 clicking on it, so let's penalize this ad. That's one piece.

19 I'll give you one other example, right. When the user  
20 does click-through, what is the quality of experience they're  
21 about to have. Now, that's very hard to quantify, again, but  
22 we try and machine learn a bunch of signals to estimate what  
23 is the quality of the downstream experience and bring that as  
24 well. And if all of that is good, then we say it's better  
25 for the user's long-term value.



1 BY MR. SOMMER:

2 Q. Dr. Raghavan, I was just asking you, have you -- are  
3 you familiar with second-price auction?

4 A. Yes.

5 Q. And was that a Google innovation?

6 A. A little bit of history is in order.

7 Q. Okay.

8 A. So the original notion of a second-price auction is  
9 some decades old. It's due to three economists: Vickery,  
10 Clarke and Groves, and I believe they got a Nobel Prize for  
11 it. And the idea was to better design auctions so that  
12 participants lost the incentive to shill bid and gamify the  
13 auctions. So let me give a simple -- a very simple example  
14 that was the foundation for second-price auctions. Let's say  
15 I'm auctioning this bottle of water, and everybody here makes  
16 a sealed-bid, okay. And let's say the winning bid -- it's a  
17 dollar, somebody else bid 90 cents, 80 cents and so on. So  
18 I'll give the bottle to the winner, but the idea of the  
19 second-price auction is to not charge them a dollar, but the  
20 second highest price which is 90 cents, okay. And the  
21 intuition is nontrivial and draws on game theory, and it's  
22 actually a fascinating journey.

23 I set up that background, because then we come to what  
24 does it have to do with Google's role in this, right. Prior  
25 to Google's entering into this stage, search ads were sold

1 using a first-price auction, meaning the winner paid what  
2 they bid, not the bid below. The upshot was a lot of  
3 gamification and shilling, which has actually been captured  
4 and published scientific work. And the minute the  
5 second-price auction was introduced at Google, all of that  
6 went away.

7 Now, you're going to say wait a minute, Google isn't  
8 selling a single bottle of water. There are potentially four  
9 ads lodged, so what's really going on. So what Google did  
10 was the winner paid the second highest price, the second slot  
11 paid the third highest and so on. That auction became known  
12 as a generalized second-price auction. And the generalized  
13 second-price auction has now been the subject of hundreds of  
14 papers of scientific work with lots of variants studied in  
15 textbooks, courses and so on.

16 And I mention this, because there was the second-price  
17 auctions before Google, but the implementation in Google  
18 AdWords, I would say, had two side effects. First, Google  
19 was able to say to ad bidders: Come on in. We'll only  
20 charge you for clicks, and we'll never charge you more than  
21 you bid. That's number one. The other side effect -- which  
22 I actually think is just as important, not just for Google,  
23 but for the community, is this led to an instant sort of  
24 explosion in an area that's now called competition game  
25 theory where computer scientists and game theorists got

1 together and developed many, many versions.

2 So that the study of these auctions is very systematic,  
3 and has been fairly well developed over the last 15 or 20  
4 years. And that, to me, is actually a profound impact on the  
5 technical community.

6 **THE COURT:** I'm sorry, what gaming of the auction did the  
7 second-price auction -- at a very high level, what did it  
8 eliminate?

9 **THE WITNESS:** Yes, let me illustrate that further. Let's  
10 pretend that you bid a dollar and he bid 90 cents. The  
11 gaming that comes about is as you're entering a bid, you're  
12 saying should I bid a dollar; let me try and guess what the  
13 other person bid and drop my bid to see if I can get away  
14 with it, right. So what this led to is a behavior where  
15 nobody in the system was bidding the true value, true  
16 rational valuation for the bottle of water or the ad slot,  
17 right. Game theorists call an auction incentive-compatible  
18 if everybody is motivated to bid their true values, and the  
19 second-price auction fixes that.

20 **BY MR. SOMMER:**

21 **Q.** Let me ask you about another innovation that the  
22 Court's already heard a little bit about, and that's called  
23 keyword match types. Are you familiar with that?

24 **A.** I am.

25 **Q.** And let's advance to DXD21.012 -- there it is.

1 First, could you very briefly remind the Court what keyword  
2 match types are?

3 **A.** Let me develop the setting. Some 10 years prior to  
4 keyword match type, I and many colleagues in the industry and  
5 in academia were going around saying search challenge is not  
6 to match what the user typed, but the intent underlying what  
7 they typed, right. And users have a mismatch between their  
8 intent and the query they provide, for a number of reasons.  
9 They could just mistype it, okay. But let me give you  
10 another example. A user has a problem eliminating rodents in  
11 their house, and so they want to find traps. They come and  
12 type mousetrap, okay. Is the user looking for traps to catch  
13 mice or are they looking for theater tickets to a  
14 long-running play in London called Mousetrap. Should that  
15 depend on their locale; should it depend on time of day even.  
16 And those are things -- cases where you have to be very  
17 careful about how you take the user's query and match it to  
18 what the advertiser might be interested in.

19 Another example might be the user's perhaps somewhat  
20 careless, and instead of typing tennis shoes -- which is what  
21 they want, they type court shoes, right. Now, in certain  
22 circumstances, that query should trigger an advertisement  
23 from an advertiser who offers tennis shoes, right. And so  
24 figuring out these semantic matches is the notion of keyword  
25 match types. And Google introduced a number of match types

1 where an advertiser could say yes, please broaden my match so  
2 I can reach more of my audience.

3 Q. Let me just follow up very briefly on the two  
4 examples you gave. First, a misspelling. If a user  
5 misspells a query and Google can now correct for that, is  
6 that good for the user?

7 A. It's very good for the user I hope. And I hope in  
8 the right circumstances, when tastefully done, good for the  
9 advertiser as well.

10 Q. That was my next question, is it good for the  
11 advertiser. And I take it if it feeds a relevant ad to an  
12 interested user, that's good for both sides; is that fair?

13 A. That's correct.

14 Q. And the same thing with semantic matching, by -- I'll  
15 give you an example. Women's hats versus hats for women.  
16 That was an issue that Google figured out how to resolve with  
17 semantic meaning, correct?

18 A. Correct, but it has to be done right, because that  
19 example feels obvious. But if you type in white wine and get  
20 ads for red wine, that's not a good experience, right. So it  
21 has to be done tastefully, and this is where the technical  
22 notions may have come up in prior testimony of precision and  
23 recall matter: With what precision are you matching, and how  
24 often do you match correctly, right. And that's a delicate  
25 balance in the art.

1           Q. Dr. Raghavan, during your tenure -- early tenure at  
2 Google, was there a time you heard from advertisers that  
3 Google Ads were difficult to use compared to Facebook, for  
4 example?

5           A. Not early in my tenure at Google, but early in my  
6 tenure in Google Ads.

7           Q. Thank you.

8           A. My sales team -- our sales teams would come and say  
9 that was one of their biggest challenges. Advertisers said:  
10 Why don't you make it easy for me; and if you don't, I prefer  
11 Facebook ads.

12          Q. Was that important feedback for you to get?

13          A. Oh, yes.

14          Q. And why was that?

15          A. It's my hope and goal to make our products as useful  
16 as possible to all users, including our advertisers.

17          Q. Does Amazon -- just a quick question on Amazon. Does  
18 Amazon also use keywords on search?

19          A. You mean on search or on search ads? Because they  
20 have both -- well, so there's --

21          Q. I'm really talking about search ads now.

22          A. Yeah, I was just clarifying.

23          Q. I apologize.

24          A. But the answer is yes.

25          Q. The changes we just discussed, among others -- the

1 correcting for the misspelling and the semantic meaning, what  
2 impact, if any, did that have on Google and its ability to  
3 compete with Facebook or Amazon or other platforms?

4 **A.** To the extent it was done well, I think it expanded  
5 the opportunity to connect -- to be matchmaker more often  
6 between users in the right moment and advertisers, and  
7 increased advertiser value, hopefully increased user value,  
8 and with it, Google revenue as well.

9 **Q.** Are you familiar with the references to thinner or  
10 thicker when it comes to the auction, the ad auction?

11 **A.** I think I understand what those generally mean.

12 **Q.** Okay. Do you understand that thicker means more  
13 advertisers bidding and thinner is fewer?

14 **A.** Let's agree on that terminology.

15 **Q.** Okay, good. By correcting misspellings or solving  
16 the problem of semantic meaning, did that make the auction  
17 thicker?

18 **MR. HAFENBRACK:** Objection, leading.

19 **THE COURT:** That's overruled.

20 **THE WITNESS:** Should I proceed?

21 **THE COURT:** You can answer.

22 **THE WITNESS:** So it's very hard to make a categorical  
23 statement of that nature. This is a point I'll come back to  
24 later, because you can always come up with a hypothetical  
25 situation. But done right, it will actually have the right

1 outcomes for all parties: the user, the advertiser and for  
2 Google. Done wrong, it could potentially gratuitously  
3 thicken an auction, and that would be a bad thing.

4 **BY MR. SOMMER:**

5 Q. I take it that it was Google's intent to do it right?

6 A. We continue to try and do it right.

7 Q. By correcting for misspellings -- just the last thing  
8 on this, would that have the effect of bringing more  
9 advertisers into a particular auction in general?

10 A. More of the right advertisers, yes.

11 Q. And does that create -- withdrawn.

12 How would that relate to the user intent when they put  
13 their query in, if you follow where I'm going?

14 A. Yeah, so let me answer it this way. If the spell  
15 correction was done well, it enhances the user's experience  
16 by more closely patterning their intent. But if you overdo  
17 the spell correction and are careless with it, then you will  
18 damage the user experience.

19 Q. Okay, thank you.

20 **THE COURT:** I'm sorry, what do you mean by that?

21 **THE WITNESS:** Yeah, so let's say you were to type a query  
22 and, you know, it has some matches. But then I correct a  
23 large number of the characters in the query, and end up  
24 matching it to something that wasn't your intent at all,  
25 right. Perhaps the most trivial example is the red and white



1 wine, right. You type red wine, and I correct enough of the  
2 characters to match it to white wine sellers. That's bad for  
3 your experience.

4 **BY MR. SOMMER:**

5 Q. What if an advertiser doesn't want to match to  
6 something, is there a mechanism for them to address that?

7 A. There are a couple of ways advertisers can do that.  
8 One is they can opt out of some of these broadening  
9 mechanisms. The other is they can -- this is a mechanism  
10 that they sometimes use. They will put in negative keywords  
11 which means -- which is an instruction to us of the form do  
12 not match my ads to the following keywords.

13 Q. Are you familiar with branded keywords versus  
14 non-branded keywords?

15 A. I think I follow the general principle of branded and  
16 non-branded keywords.

17 Q. Okay. Let's start this way: What's a branded  
18 keyword, as you understand it?

19 A. It's a keyword that matches some company's brand,  
20 say, Nike.

21 Q. Let me show you a demonstrative, DXD21.013. In this  
22 example, the company is Joanne's Pro Shop. Do you see that?

23 A. I do.

24 Q. And do you see the two different pads there extending  
25 out from the -- to the right?

1           **A.** Joanne's Pro Shop and Tennis Gear Store.

2           **Q.** So can you describe the difference between branded  
3 and non-branded keyword here, that we're using as this  
4 example?

5           **A.** So in this slide, someone typing the precise query  
6 Joanne's Pro Shop is typing a branded keyword that would  
7 match Joanne's Pro Shop. But they could also type Tennis  
8 Gear Store, and that may be something that Joanne has bid on  
9 and therefore wants to be shown on.

10          **Q.** We can take that down. Are there instances when an  
11 advertiser might want to bid on a competitor's branded  
12 keyword?

13          **A.** Well, yes.

14          **Q.** And what would some of those circumstances be?

15          **A.** Here's the -- let me start with the physical world  
16 analogy and then get to the online world, right. The  
17 physical world analogy I would offer is you're driving up to  
18 a Honda dealership, and there's a billboard for Toyota across  
19 the street. So it's similar in it's spherical. In the  
20 online world, what often happens is a well-known brand such  
21 as Nike is offering their wares, perfectly fair. A  
22 less-known brand that you may not have heard of would like to  
23 say hey, I exist too, and if you're interested in Nikes,  
24 you're probably interested in me, HOKA -- which is a smaller  
25 shoe brand. So I would like to bid on the keyword Nike, and

1 if the user searches for that, give them the opportunity to  
2 see the HOKA ad. They may still go away and go to Nike, but  
3 at least I would have an opportunity at placement.

4 Q. In your example, sir, would Nike have any sort of  
5 advantage over HOKA in the ad auction?

6 A. I would say a small advantage. And the reason would  
7 be, if you recall, we spoke earlier of the downstream landing  
8 page and its match for the keyword at hand as part of the LTV  
9 function. In this case, the downstream landing page for Nike  
10 is more likely to match the query -- if it's just Nike, then  
11 Nike, than the HOKA home page, right. If it's Nike shoes,  
12 then the gap narrows a bit between Nike shoes and HOKA shoes.  
13 But you get the idea, that there is a slight advantage for  
14 Nike.

15 Q. And would that be incorporated into the quality  
16 score?

17 A. It would -- yes, in the LTV calculation.

18 Q. Thank you. Let me ask you about another innovation,  
19 and if we can go to DXD21.014. We've heard a fair amount  
20 about product listing ads or shopping ads.

21 I take it you're familiar with those?

22 A. Yeah, I prefer to think of them as product listing  
23 ads.

24 Q. Okay. We've heard different people have different  
25 preferences. We'll go with PLAs with you. And again, the

1 introduction by Google of product listing ads predated your  
2 arrival, correct?

3 A. Oh, yes.

4 Q. But again, you were aware of it from being in the  
5 industry; is that right?

6 A. I was.

7 Q. And why was that such a new innovation?

8 A. Users, when looking for specific product features --  
9 for instance, an electronic device, what is its wattage, et  
10 cetera, find it hard to discern that in a bunch of text  
11 that's in a text ad, but can easily glean that information by  
12 looking at an image and some of the dominant attributes of a  
13 product that are presented in this unit. For advertisers,  
14 it's sort of creating copy. For every product they had,  
15 they'd just upload millions of images and a database of all  
16 these product features, and Google can then compose a product  
17 listing ad, or a PLA, from the information the advertisers  
18 provided.

19 Q. Let's go to the next slide, DXD21.015. And let's  
20 advance to the next -- there we go. Can you describe what we  
21 see on this slide, both on the left and on the right?

22 A. These are instances of PLAs, product listing ads,  
23 from many years ago, roughly 15 years ago.

24 Q. Okay. And the one on the right is more current?

25 A. The one on the right is a current -- a pretty current

1 instantiation.

2 Q. And briefly, how have the PLAs changed over time?

3 A. There's a couple of things that you'll see right  
4 away. Based on user research, we've gone from the vertical  
5 ordering of these ads to a carousel, a horizontal carousel.  
6 This comes about in part because with smartphones, we find  
7 people -- users more able to fling through different ads and  
8 pick -- visually cue in on the one they want. Second, the  
9 badging is changed.

10 The final thing I'll point out is this auxiliary content  
11 that helps the user decide what product to buy, such as  
12 reviews, free shipping and so on. So we find that if there's  
13 extra information when added to a PLA, it increases the  
14 user's comfort with what they're seeing.

15 Q. What trends, if any, have you noticed over the last  
16 five to seven years between advertisers using text ads versus  
17 PLAs?

18 A. Yeah, the first thing I should point out -- because  
19 it's not obvious on this slide, is on a given query, you  
20 could have both PLAs and text ads. It's just not visible in  
21 this slide, right. As PLAs grew in popularity, advertisers  
22 started moving more and more of their budgets from text to  
23 PLAs. But then they had to do work, you see, because they  
24 had to upload all these images and structured information.  
25 So if they did the extra work, they were able to move budgets

1 to these.

2 Now, what happens in practice is, depending on the  
3 circumstances of a query -- and I'll explain that in just a  
4 second, advertisers will freely move money between PLAs and  
5 text ads. But the circumstances of a query, it's things like  
6 is it the holiday season. Then, for instance, having an  
7 annotation such as "free shipping" or "will be delivered by  
8 Christmas" helps users make choices. So all of those affect  
9 the dynamics of how advertisers behave.

10 Q. And you mentioned a moment ago that sometimes the  
11 search engine results page will show both a text ad and a PLA  
12 from the same advertiser; is that right?

13 A. That's possible.

14 Q. And does that, from your perspective, mean that those  
15 two ad formats are not being transitioned between by  
16 advertisers, as you described?

17 A. I think I said a minute ago that advertisers do  
18 transition in near realtime between these types.

19 Q. Let me ask you, if we go forward in the deck to --

20 **THE COURT:** Can I ask another question. We've heard  
21 evidence that the text ads, I guess it's on a cost-per-click  
22 basis, are more expensive than the PLAs. Can you explain why  
23 that is, if that's accurate?

24 **THE WITNESS:** It's a very complicated question, and only  
25 because they're not uniformly more expensive -- sometimes,

1 right. Really, what the advertiser cares about in the end is  
2 having paid whatever it is they pay, what is the likelihood  
3 in volume of the sale that happens at the end of the journey,  
4 right. And so they're adjusting their willingness to pay  
5 between text and PLAs constantly while observing what gives  
6 them the best return on their ad spend, right. So I would  
7 say there isn't a simple rule to explain that, well, these --  
8 the one or the more is more expensive. The right way to  
9 think about it is which one affords the better return on  
10 investment for the advertiser.

11 **BY MR. SOMMER:**

12 Q. And depending on that, is that when the advertiser  
13 will, as you said, shift the ad spend from one to the  
14 another?

15 A. They will.

16 Q. Let's go to the next slide, which is DX21.016. We've  
17 highlighted there something called Performance Max. That's  
18 something you're familiar with?

19 A. I am.

20 Q. Can you briefly describe to the Judge what  
21 Performance Max is.

22 A. I'll try to be brief.

23 Q. I wasn't trying to emphasize briefly too heavily.

24 A. Thank you.

25 Q. But please describe it.

1           **A.** A few minutes ago, I mentioned that when I assumed  
2 responsibility for our advertising products, one of the  
3 biggest complaints -- perhaps the biggest complaint, I heard  
4 was how complex it was, to use our advertiser phrasing,  
5 products. So I went to the team and said: Look, an  
6 advertiser should give us their budget, how much they're  
7 willing to spend. They should give us their objectives, like  
8 what is the return they want on their ad spend. And the rest  
9 should be AI magic. Why are they sitting and having to  
10 program the machine with lots of keywords and bids. And some  
11 of our larger advertisers have millions of keywords in their  
12 campaigns. That's just untenable. A very sophisticated,  
13 large advertiser can manage these things, because there are  
14 machines doing these things. But for most advertisers, this  
15 is way too much work.

16           So Performance Max was a way to give advertisers a way --  
17 a means to tell us here's what I'm willing to spend on  
18 Friday, here's the return I want; I want you, Google, do your  
19 magic and ensure that I get the best returns. So that's  
20 Performance Max broadly.

21           **Q.** Let's go to the next slide, DXD21.017. This is an  
22 excerpt from a Google Ads help page. Are you familiar with  
23 ads help pages?

24           **A.** I am.

25           **Q.** And why does Google post those publicly for



1 advertisers?

2           **A.** Like most tech companies, our users -- in this case,  
3 our advertisers, want to know how to make use of our  
4 products. When they have questions and doubts, they come and  
5 check the help pages. So this is a means for communicating  
6 to advertisers what Performance Max is all about.

7           **Q.** And Your Honor, we've marked this as DX3236.

8           Are these help pages maintained -- they're put out there  
9 publicly in the ordinary course of Google's business; is that  
10 right?

11           **A.** Yes.

12           **Q.** And they're available on the internet; is that fair?

13           **A.** Yes.

14           **MR. SOMMER:** Your Honor, we offer 3236, DX3236.

15           **MR. HAFENBRACK:** One point of clarification. Is this  
16 slide 3236?

17           **MR. SOMMER:** No, it's in your exhibit binder, the full --

18           **MR. HAFENBRACK:** The full. Gotcha, understood. No  
19 objection, Your Honor.

20           **THE COURT:** So the number's DX3236?

21           **MR. SOMMER:** Yes, Your Honor. I think it's the last  
22 exhibit in the exhibit binder.

23           **THE COURT:** It will be admitted.

24           (Exhibit DX3236 admitted into evidence)

25 **BY MR. SOMMER:**

1           **Q.** And on the slide that's up on the screen right now,  
2 Dr. Raghavan, there are various words highlighted. But I  
3 think you've already described what the goal of Performance  
4 Max is, so I'm not going to take you through that. Let me  
5 just show you one other demonstrative relating to Performance  
6 Max. Can we go forward to DXD21.018.

7           And again, I'm not asking you to repeat what you've said,  
8 but can you describe what we see here?

9           **A.** What you see here is Performance Max is a way for an  
10 advertiser to come in with a budget and campaign objectives,  
11 as I said a minute ago, and not worry about would they be  
12 text ads, PLAs or through YouTube or Gmail. It's really a  
13 demand to Google to do the right thing and give them the best  
14 return on ad spend. And what these arrows are showing  
15 basically is all of these delivery vehicles for ads,  
16 including Gmail, Maps, et cetera, are available through a  
17 single point for the advertiser.

18           **Q.** Okay, thank you. I just want to go back one slide to  
19 DXD21.016, because at the bottom of this slide that we've  
20 been talking about a little bit, there's something that says:  
21 "Ongoing NLU innovation." Do you see that?

22           **A.** I do.

23           **Q.** What does that reference?

24           **A.** Yeah, this is an important point. So NLU is a  
25 technical acronym for natural language understanding.

1 Natural language understanding is a subfield of artificial  
2 intelligence where we're trying to understand what it is a  
3 user is trying to get done, going back to the intent. So the  
4 example I'll offer -- I'll offer a small example and then why  
5 this is such a big deal. Let's say the user types in HP  
6 printer. The merchant says Hewlett Packard model XY3200 or  
7 whatever. Notice that what the merchant or the advertiser  
8 says and what the users say have nothing in common, and yet  
9 we have to perform this feat of natural language  
10 understanding, understanding the natural language of the  
11 user, and match it to what -- the language in which the  
12 advertiser is expressing themselves, okay.

13 I say this is a feat, because humans express themselves  
14 in so many different ways. And that's why you have this  
15 subfield of artificial intelligence called NLU. And I point  
16 this out, because throughout Google's history, and to an  
17 ongoing extent, a large -- easily the majority of our search  
18 ads quality work falls in this bucket. I'm distinguishing  
19 this from some of the things you've showed above. We have  
20 these very impactful things, but this is where a lot of the  
21 magic actually happens. And this, together with something  
22 else we didn't get into -- you know, it says deep learning  
23 for PCDR prediction, are instances where our founder's  
24 preoccupation with artificial intelligence came together with  
25 the business reality.

1           And it's a very interesting segment where our ongoing  
2 innovations feed off the AI developments and vice versa  
3 leading to such developments that we all hear about such as  
4 transformers, that I know the world is so excited about -- so  
5 generative AI. And so I like to highlight this as a place  
6 where we put a lot of effort. It's actually a large part of  
7 the magic that goes on in ad matching, and it has this  
8 consequence of spurring the field of AI significantly.

9           **Q.** Thank you. I want to ask you a couple of questions  
10 about some aspects of the ad auction itself. The Court has  
11 heard a little bit about how aspects of the ad auction is a  
12 black box.

13           Do you understand that phrase in this context?

14           **A.** I think so.

15           **Q.** Why does Google not publish all aspects of how its ad  
16 auction works?

17           **A.** I don't think it would be wise for us to do that, for  
18 a bunch of reasons. First, it's a trade secret. And just  
19 like Coke doesn't publish its formula, and various others  
20 don't, that's one reason. The second reason is publishing  
21 ranking functions in all their detail, whether for ads or for  
22 organic, makes it easier for large and sophisticated actors  
23 to game those functions at the expense of smaller players.

24           Finally, and perhaps least appreciated of the reasons, is  
25 gamification is not just something that good actors do.

1 There's actually a lot of bad actors out there, large botnets  
2 attack our systems. And knowing how to put in an ad with  
3 malware or other, it's the kind of thing you could manipulate  
4 easily if you knew exactly the function. So there are many  
5 reasons, but these are some of the biggest reasons.

6 Q. Thank you. You used the -- you've used the term a  
7 couple of times ROI, or return on investment. In your  
8 experience, sir, are advertisers focused on ROI?

9 A. In my experience, maniacally so.

10 Q. Maniacally so, is that what you said?

11 A. Yes.

12 Q. Okay. And from your experience, sir, are advertisers  
13 able to understand their ROI?

14 A. I think it's fair to say they're able to get a very  
15 good estimate of it. Remember that these are statistics, and  
16 a computed statistic is close to but not a perfect  
17 computation.

18 Q. How are advertisers able to get a good understanding  
19 of their ROI?

20 A. It depends on the advertiser. The largest and most  
21 sophisticated ones have entire teams and robots dedicated to  
22 computing this. The simplest example, I think one we touched  
23 on earlier briefly, is Amazon is able to see the full flow.  
24 So if Amazon places an ad, they get a click, they're able to  
25 watch the transaction at the other end. They're able to say

1 I spent \$5 here and I got \$60 here. That's a straightforward  
2 ROI calculation, right. There are cases -- so anybody who  
3 has what I call full funnel visibility -- which Amazon  
4 does -- is able to perform such a computation, right.

5 We, Google, provide tools to advertisers that are not  
6 privy to that end transaction. We can say we sent you so  
7 many clicks, here was the average price you paid, and now you  
8 go figure the rest, right. So there are tools out there --  
9 so those are estimates. The other thing that happens, there  
10 are a number of businesses out there -- third parties not  
11 affiliated with Google -- that offer services to advertisers  
12 that say let me help you compute your ROI, right. As I said,  
13 with the exception of the Amazon full funnel flow, very few  
14 of these is a perfect computation. But over time, the  
15 sophistication in this area has grown.

16 Q. And in addition to Google providing tools to assist  
17 advertisers in assessing ROI, do some of the other platforms  
18 provide tools as well?

19 A. My understanding is that several others do, including  
20 Facebook. And in fact, Amazon does to its advertisers.

21 Q. Let me ask you this question: If all factors remain  
22 the same and CPC goes up, what is the impact on ROI?

23 A. If all factors -- everything is kept flat and CPCs  
24 goes up, ROI goes down.

25 Q. Okay. And from your perspective, sir, are

1 advertisers -- I think you said maniacally, focused on ROI?

2 A. Correct.

3 Q. What would be the impact to Google if, by virtue of  
4 raising CPCs, ROI was going down for your advertisers?

5 A. So let me break that question up, because I think it  
6 deserves some careful discussion. So if I may rewind a bit,  
7 remember we talked about auctions and the game theory that  
8 accompanies them, right. So what I'll take a few seconds is  
9 to outline what is the right way to look at any of these  
10 changes, including potentially an increase in CPC, right,  
11 because it is a hard science.

12 So my favorite way of being able to assess any change is  
13 to have a game theoretic analysis. And this results in  
14 theorems that said this is what happens to user impact,  
15 advertisers and the matchmaker -- in this case, Google. Now,  
16 such theorems are possible in a few cases like generalized  
17 second-price auctions, but not in all cases; some of these  
18 changes will not. So the next tool we have is to run live  
19 experiments where we take a fraction of traffic and try a  
20 change and see what happens. When we run these experiments,  
21 we look at a whole bunch of variables -- CPC being one of  
22 them, return on advertiser spend, Google revenue. These are  
23 all variables we study, okay. And roughly the picture -- I  
24 want to take away two conclusions, and then I promise to  
25 answer your question.

1           The first thing to think about any change in auction  
2 dynamics -- or for that matter, even some of the matching  
3 that we talked about, the keyword matching, natural language  
4 understanding, will result in observed -- observed from  
5 experiment -- changes to some of these things. I say  
6 observed, unless you can prove a theorem about it, right.

7           **Q.** Unless, I'm sorry?

8           **A.** Unless you could have proved a theorem about it,  
9 which in a few cases we can. So when you run the experiment,  
10 you will see some change in CPC and revenue, et cetera, okay.  
11 First, those are point-in-time observations, meaning you're  
12 taking a particular experiment and scenario and seeing what  
13 happens. And based on that, you'll sometimes launch one of  
14 these features, right. And then we have to observe over a  
15 period of time, often three to six months, what actually  
16 happens, because users react, advertisers react. And so  
17 computing the fixed point of what happens takes a while.

18           The second thing I would caution is I don't think it's a  
19 good idea to look at launches in isolation. Yes, it's good  
20 to make a launch decision. But really, my instruction to the  
21 team is to look at a sequence of launches, put them together,  
22 okay. And all of it is to say your question's not invalid,  
23 but I'm trying to say that the way to consider these auction  
24 changes or keyword match changes is somewhat harder and  
25 deeper.



1           Now, the short version of it: If CPC increased -- that's  
2 the denominator for the advertiser, so their return on  
3 investment would go down.

4           **Q.** Do you have insight, from your position at Google,  
5 into whether advertisers using Google are satisfied with the  
6 ROI they are getting by placing ads on Google?

7           **A.** In general terms I would say yes, but they're always  
8 demanding better ROI.

9           **Q.** You just referred to various ad launches. Does  
10 Google make many ads launches in the course of a year,  
11 quality ads launches?

12           **A.** When you say quality ads launches, all of the things  
13 that were in that picture that we saw. I would say big and  
14 small, of the order of hundreds of launches a year.

15           **Q.** Hundreds of launches. And do each of those come to  
16 you for your review or approval?

17           **A.** No.

18           **Q.** I wanted to pick up on the point you made about  
19 looking at launches in the aggregate. Let's go to the next  
20 slide, DXD21.020. Now, a portion of this, sir, has been  
21 redacted because it's got a bunch of numbers. So if you open  
22 up your binder -- your demonstrative binder, you'll be able  
23 to see it's, in the lower right-hand corner, DXD21.020.

24           **A.** Yes, I do see it.

25           **Q.** You're there, great. So again, I'd just caution you

1 not to mention some of the numbers, okay, in the boxes.

2 Are you familiar with the chart depicted in this  
3 demonstrative?

4 A. Not any of the detail. Actually, the letters are  
5 small, sorry.

6 Q. But you're familiar with the type of chart it is?

7 A. Yes.

8 Q. Let's start that way. Do you see at the top where it  
9 says: "AQ is creating value. Negative excess CPC." Do you  
10 see that?

11 A. I do.

12 Q. What does that mean?

13 A. The slide header refers to the cumulative impact of  
14 roughly a dozen launches. I'm not reading any particular  
15 numbers, but the cumulative impact seems to say that CPC has  
16 come down from the superposition of these launches.

17 Q. And what does AQ refer to in this?

18 A. Oh, AQ refers -- is how the ads quality team refers  
19 to themselves.

20 Q. So that's ads quality, okay. And then the negative  
21 excess CPC, that refers to CPCs coming down in the aggregate  
22 from these launches?

23 A. In the aggregate.

24 Q. Now, this document, I will tell you, is from 2020.  
25 Is your testimony about these aggregate launches and what

1 happens, is that still true today, that you look at these  
2 launches in the aggregate to assess what they're doing and  
3 then look at it over time?

4 **A.** Correct, and I'm contending that's the right way to  
5 look at it.

6 **Q.** Are there some launches that result in CPCs going up?

7 **A.** There are.

8 **Q.** Does -- and this was asked of a prior witness. Does  
9 Google notify all of its advertisers in advance of a launch  
10 to let the advertiser know whether the forecast is that their  
11 CPC will go up or down or stay the same?

12 **A.** We do not.

13 **Q.** Is that -- well, let me back it up one second. Are  
14 there some times when Google does announce certain launches?

15 **A.** So, two things. Number one, yes, for some of our  
16 biggest launches. But even there, it would be really  
17 difficult to say to every one of 3,000,000 advertisers:  
18 Here's what we think will happen to you, because it is such a  
19 hard dynamic system to estimate in this fashion.

20 **Q.** You beat me to it. 3,000,000 advertisers on Google,  
21 correct?

22 **A.** Correct, roughly.

23 **Q.** And any particular launch could have a different --  
24 theoretically could have a different impact on all 3,000,000;  
25 isn't that right?

1           A. Oh, quite likely will.

2           Q. So is it feasible for Google to try to forecast and  
3 tell each advertiser what a launch might or might not do for  
4 each individual advertiser?

5           A. Not with fidelity.

6           Q. At the end of the day, sir, notwithstanding any  
7 aggregate launch -- withdrawn.

8           At the end of the day, notwithstanding any aggregate  
9 increase in CPC or decrease in CPC, who decides how much to  
10 spend on an ad?

11          A. The advertiser.

12          Q. You've described to the Court now over several --  
13 many years that Google has invested significant resources in  
14 improving its ad auction and the overall experience for  
15 advertisers.

16          Why does Google invest so much in that process, to make  
17 the ads auction best of breed, for lack of a better term?

18          **MR. HAFENBRACK:** Objection, leading.

19 **BY MR. SOMMER:**

20          Q. Why does Google invest so much money?

21          **THE COURT:** I missed the first question that was objected  
22 to, but what was the second question?

23 **BY MR. SOMMER:**

24          Q. The second question is why does Google invest so much  
25 in its ad auctions platform?

1           **THE COURT:** You can answer.

2           **THE WITNESS:** I can answer, okay. Because advertisers  
3 who are focused on return on ad spend have other places to  
4 take their budgets. If we don't make it easy for them and if  
5 we don't provide value to them, they evaporate.

6 **BY MR. SOMMER:**

7           **Q.** And when you talk about other places, you're talking  
8 about the competitors you've mentioned before?

9           **A.** I think, yeah, I've mentioned a couple.

10          **Q.** Okay. We've talked about -- I want to turn now to  
11 some of the competitors Google has when it comes to ads. We  
12 talked about on the user side, and now I want to talk about  
13 on the ads side.

14          Does Google compete with Amazon for ad spend from  
15 advertisers?

16          **A.** Absolutely.

17          **Q.** Does it compete with Meta and its platforms?

18          **A.** Yes.

19          **Q.** Does it compete with TikTok?

20          **A.** Oh, yes.

21          **Q.** I want to start with some of the social platforms.  
22 Facebook, Instagram, TikTok, what makes those social  
23 platforms such significant competitors for Google for ad  
24 spend?

25          **A.** Yeah, you may recall earlier today I talked about

1 latent intent, and the fact that people, especially young  
2 people, are spending many hours each day. And over the  
3 course of those hours, they're emitting signals of latent  
4 intent so that volume of data is put together extremely  
5 effectively by TikTok, by Instagram, Facebook to glean  
6 insights about when a user is ready to purchase whatever they  
7 have a latent intent for. Although on the face of it, it's  
8 distinctive from the patent intent they express at a Google  
9 or a Bing, right. In the end, what the advertiser cares  
10 about is whether they were able to make a sale through their  
11 ad spend. And so this vast accumulation and divining of  
12 latent intent is what makes TikTok and Instagram and others  
13 so powerful.

14 Q. How does Meta's platforms, how do they compare in  
15 terms of digital ads business to Google in terms of size?

16 A. They're smaller than us, but they've been fairly  
17 consistently -- with few exceptions in the last years, been  
18 growing faster than us. So they're effectively taking share  
19 from us.

20 Q. Does Google perform competitive analyses on Facebook  
21 in the digital advertising space in the ordinary course of  
22 its business?

23 A. There are various people who look at different  
24 aspects of a player like Facebook. But we also hear from  
25 advertisers what they're seeing. One indication we've been

1 getting fairly consistent is from one of the largest  
2 marketplace platforms, it's a company by the name Shopify.  
3 Shopify has been telling us that their merchants are  
4 consistently getting more traffic by advertising on Facebook  
5 than from us.

6 Q. In your exhibit binder as opposed to the  
7 demonstrative binder, the second binder there, there's an  
8 exhibit marked DX163. It's a slide deck titled 2020 Global  
9 Ads Marketing Plan: PR Review. Can you find that?

10 A. I see that.

11 Q. Okay. And is this the type of competitive analysis  
12 that Google does in the ordinary course?

13 **THE COURT:** I'm sorry, where are you again?

14 **MR. SOMMER:** Your Honor, DX163.

15 **THE COURT:** Okay, sorry about that.

16 **THE WITNESS:** This is a case where, as I --

17 **BY MR. SOMMER:**

18 Q. I just want to ask you a couple what's called  
19 foundation questions, so just stick with me for one second.  
20 This is a deck you're familiar with, correct?

21 A. Somewhat, vaguely familiar with it.

22 Q. These types of analyses are done at Google; is that  
23 right?

24 A. Yes.

25 Q. And they're kept in the records of Google?

1           **A.** Yes.

2           **Q.** In case I ask you to dust one off and show it to me;  
3 is that right?

4           **A.** Yeah, yeah.

5           **MR. SOMMER:** Your Honor, we offer DX163 into evidence.  
6 And also, there's a native version, DX163A, that's more  
7 legible that we'll offer with it.

8           **MR. HAFENBRACK:** Your Honor, we have no objection except  
9 to the extent that this document does contain some embedded  
10 hearsay.

11           **MR. SOMMER:** Same ground rules, that's fine.

12           **MR. HAFENBRACK:** Yeah, so same ground rules on the  
13 standing objection, we're fine with that.

14           **THE COURT:** Okay, so it will be admitted.

15           (Exhibits DX163 and DX163A admitted into evidence)

16 **BY MR. SOMMER:**

17           **Q.** Now, what is being reviewed and looked at in this  
18 particular deck, sir?

19           **A.** So this deck, as best as I can reconstruct, is the  
20 marketing team's -- just one of the teams at Google, plan to  
21 compete more effectively with Facebook. It says 2020, so in  
22 October 2019. So they were making a proposal for the year  
23 2020 in the fall of 2019.

24           **Q.** Could you turn to page five of this, it's .005.  
25 Again, I'm just going to alert you that some of this has been



1 redacted.

2 But at a high level, Dr. Raghavan, what does this show in  
3 terms of Google's focus on Facebook as a competitor for  
4 digital advertising dollars?

5 A. I think what we're seeing here, it's the marketing  
6 team is saying that with Facebook being the strong competitor  
7 it is, we need to solve for it.

8 Q. As you said, this is late 2019. What was Google's  
9 conclusion in late 2019 as to the growth of the online ads  
10 industry at that time?

11 A. Growth at that time was decelerating in a secular  
12 manner.

13 Q. And did something happen shortly after that that  
14 changed the trajectory of that industry?

15 A. Oh, yes.

16 Q. What was that?

17 A. It was COVID.

18 Q. What did that -- what impact did that have?

19 A. COVID messed up many of these forecasts. It began by  
20 jamming supply chains to the point where it wasn't  
21 interesting to advertise because you couldn't get goods to  
22 consumers anyways. So that was roughly the movie of the  
23 first half of 2020. But then, as supply chains got  
24 unclogged, you had this unprecedented massive shift of  
25 offline commercial activity to online platforms. So you had

1 this amazing increase for a few quarters in online marketing.

2 Q. I just want to ask you one additional question on  
3 this slide on page five. On the right side, do you see the  
4 bar chart there?

5 A. I do.

6 Q. And again, without reading any of the numbers, what  
7 is the general conclusion reached by Google as a result of  
8 this particular analysis?

9 A. Qualitatively, I'd say our marketing team was finding  
10 that advertisers preferred Facebook to Google.

11 Q. And how does an analysis like this impact you in your  
12 job and what you direct folks to do in terms of additional  
13 innovation on ads products?

14 A. We touched on some of this earlier, but the push to  
15 my team was go back and build a better product to better  
16 compete with Facebook.

17 Q. What, if anything, has changed since this analysis in  
18 regard to Google's perception of its competition with  
19 Facebook for digital ad budgets?

20 A. Substantively, it's the same dynamic as before.

21 Q. They're still out there fighting with you?

22 A. Yeah, I think we need to be a little careful, because  
23 we were using the word Facebook, but increasingly it's  
24 Meta -- which they re-branded themselves. But that umbrella  
25 includes Instagram which has been one of their most fast

1 growing offer offerings.

2 Q. Let's take that down. Let me -- back on the  
3 demonstrative deck, can we turn to DXD21.022.

4 What do we see here, Dr. Raghavan, with respect to  
5 TikTok?

6 MR. HAFENBRACK: Your Honor --

7 THE WITNESS: This is a visible --

8 MR. HAFENBRACK: Your Honor, I apologize, but we object  
9 to this one. These are hearsay statements from non-Google  
10 employees. We don't think this is a proper basis to question  
11 the witness with.

12 THE COURT: Well, let me see what the question's going to  
13 be, so go ahead.

14 BY MR. SOMMER:

15 Q. Are you familiar with articles about TikTok and a  
16 buzz about TikTok over the last couple of years?

17 A. Abundantly so.

18 Q. Yeah, okay. And so in your position at Google, is  
19 that something you care about?

20 A. Yes.

21 Q. And when you see articles such as these, does that  
22 influence how you think about a competitor like TikTok and  
23 what Google's strategy should be?

24 A. Very much so.

25 Q. So why don't you just take us through your thinking

1 about seeing some of these headlines.

2           **A.** It's beyond the headlines, just to be clear. Because  
3 TikTok does not report as a public company in the U.S., we've  
4 been, like many of us, trying to estimate their ad revenue  
5 growth. And we look at a number of these sources, such as  
6 the ones represented here, to try and estimate how quickly  
7 they're growing. And the conclusion I have to arrive at is  
8 they're growing faster than us. And it's also clear that  
9 they have an extremely compelling product, especially for a  
10 younger demographic.

11           And so all these various socials -- including eMarketer  
12 there, which is a fairly good source, telling us that Gen Z  
13 adults start their online product searches on TikTok rather  
14 than Bing or Google is deeply concerning, and we have to  
15 figure out how to respond.

16           **Q.** How about the one -- the headline on the right, that  
17 was just before this trial began. What's that about?

18           **A.** So --

19           **MR. HAFENBRACK:** Same objection, Your Honor. This is a  
20 hearsay statement from --

21 **BY MR. SOMMER:**

22           **Q.** I'll rephrase, I'll rephrase. Did there come a time,  
23 Dr. Raghavan, where you heard or learned that TikTok had  
24 introduced an e-commerce site within its platform?

25           **A.** Yes.

1           Q. And what was your understanding of that new  
2 e-commerce platform that TikTok introduced?

3           A. So they were clearly going towards -- and TikTok is  
4 also a partner, but they were going towards the work where a  
5 user could initiate their commercial need on TikTok and  
6 complete the shopping task right there on TikTok. So you  
7 have, in some sense, the best of the Instagram world where  
8 you divine latent intent, inspire a purchase, but then you  
9 close the loop -- so Amazon on the other side. So you have  
10 the best of Instagram and Amazon coming together in a very  
11 compelling capability.

12          Q. We can take that down. We've talked about some of  
13 the social platforms on the ads side. Let me just quickly go  
14 back to Amazon on the ads side.

15           Does Google also do competitive analyses with respect to  
16 Amazon as a competitor to its advertising business?

17          A. There are many analyses of Amazon at Google, yeah.

18          Q. Let me ask you to find in your binder, the thicker  
19 binder, DX126. It's actually the first one in the binder.

20           Do you see that?

21          A. One moment. So this binder?

22          Q. Yeah, I think it's -- it says Amazon Overview on the  
23 first page. It's the first exhibit.

24          A. Oh, yeah, sorry.

25          Q. Are you familiar with this type of analysis done at

1 Google?

2 A. This is one of many decks that have gone by me  
3 regarding Amazon, yes.

4 MR. SOMMER: Your Honor, we offer DX126.

5 MR. HAFENBRACK: No objection, Your Honor, subject to the  
6 same standing of that hearsay objection.

7 THE COURT: So 126 will be admitted.

8 (Exhibit DX126 admitted into evidence)

9 BY MR. SOMMER:

10 Q. And generally, Dr. Raghavan, can you describe what  
11 the purpose of this deck was?

12 A. The purpose of this deck was for the authors to look  
13 at Amazon's ads business -- I'm looking at the date, in 2018.  
14 At that time, numerically it still felt small, but these  
15 authors were raising the possibility that it was one of the  
16 fastest growing ads businesses.

17 Q. Has anything happened since 2018 with Amazon's ads  
18 business that has changed that view, that it's one of the  
19 fastest growing ads businesses?

20 A. They're one of the very fastest growing, yes,  
21 certainly growing faster than Google. So some of the  
22 prognoses by these authors is coming true.

23 Q. If you could just turn to page -- we're going to go  
24 through a few pages really quickly before our afternoon  
25 break. If you could turn to page five of the document. And

1 again, there's some redactions with boxes on this one. Just  
2 look up when you're there.

3 A. Okay.

4 Q. Again, without disclosing any of the specific  
5 information, what is the analysis going on in this slide?

6 A. So the authors are trying to take the valuation of  
7 Amazon and break it down into its constituent businesses.

8 Q. Turn to page 19 of the exhibit, .019.

9 A. I'm there.

10 MR. SOMMER: Actually, Your Honor, I think this page is  
11 no longer confidential, so we can show this one.

12 THE COURT: What's the number again?

13 BY MR. SOMMER:

14 Q. This is the same exhibit, it's at page .019. It's  
15 Exhibit DX126.

16 What's being addressed here, sir? I'm under the heading  
17 Risks from Amazon.

18 A. I think the authors are talking about areas where  
19 Amazon and Google compete more or less directly.

20 Q. So it says: "Google and Amazon have tons of  
21 overlapping products," and then there's a list below that.  
22 And we see some of the ones we've heard a lot about in this  
23 case: We see search ads, PLAs; we see display ads, we see  
24 video content.

25 A. Ad platforms is one.

1           Q. Right, thank you, ad platforms. And so is the point  
2 here that these are various products that both Google and  
3 Amazon are out there competing for ad spend?

4           A. Both of them offer this. An advertiser sees both.

5           Q. Just turn to page nine in the same exhibit. Let's  
6 take that down for a second because there's a red box on it.  
7 Is that now unredacted? Okay, let's just leave that one  
8 down.

9           What's being analyzed on page nine, sir?

10          A. It's talking about Amazon's ad business.

11          Q. In the years since this analysis was done,  
12 Dr. Raghavan, have you and your team continued to watch  
13 Amazon's ad business grow?

14          A. We have continued to watch it grow.

15          Q. And let me show you in a demonstrative, DXD21.023.  
16 Is this the type of article you have seen from time to time  
17 over the past several years about Amazon?

18          A. Increasingly so.

19          Q. And what impact has that had on you in terms of your  
20 view of the competitiveness of Amazon vis-a-vis Google?

21          A. I think they're doing a great job of using their  
22 closed loop to attract ad dollars in a way we cannot because  
23 we don't have a closed loop.

24          Q. And just to quickly define closed loop for the  
25 Court -- and that may have come up, but just to make sure.



1           **A.** It came up briefly. It's the idea that a user who  
2 shows up on Amazon and searches for a product, Amazon knows  
3 their trajectory all the way to the cart and the transaction,  
4 and so is able to attribute to an ad click on Amazon a dollar  
5 volume of transactions.

6           **Q.** Let's pull up DXD3.005. And again, this is eMarketer  
7 data that you described. You've mentioned a couple of times  
8 that Google's -- Google has lost out to some of these  
9 competitors over recent years; is that right?

10          **A.** I did.

11          **Q.** And if we look at this chart, Google is in green,  
12 correct?

13          **MR. HAFENBRACK:** Your Honor, we'd object to questioning  
14 the witness based on this. We understand this is prepared by  
15 an expert who is going to be testifying pretty soon before  
16 the Court, this is not an ordinary course document.

17          **MR. SOMMER:** I'm not offering it as such. I'm offering  
18 it to elicit from Dr. Raghavan his view of the competitors  
19 that Google is dealing with in this industry.

20          **THE COURT:** I'm sorry, is this already -- I think we've  
21 seen this before, haven't we?

22          **MR. SOMMER:** Yes, Judge. This was --

23          **THE COURT:** Was it not admitted?

24          **MR. SOMMER:** This was offered, and then when one or the  
25 other plaintiffs objected, we said we would offer it with the

1 witness who actually prepared it. So we offered it subject  
2 to that at that time, and that's still what's going to happen  
3 based on my expectation.

4 **MR. HAFENBRACK:** It's a document prepared by their  
5 witness -- by their expert for this litigation and not an  
6 ordinary course document.

7 **MR. SOMMER:** Again, I'm not offering it --

8 **THE COURT:** Hang on, hang on, hang on. Let's get one  
9 thing clear, just because it's not an ordinary course  
10 document doesn't mean it can't be presented to a witness. So  
11 let's get that out of the way, one. Two, what are you going  
12 to ask him? I mean, if you're going to ask him about the  
13 shares, then that may not be something he knows about.

14 But what's the question that's going to be asked?

15 **MR. SOMMER:** Just trends that he's personally aware of  
16 that are made quite visual by this chart. I mean, I could do  
17 it without the chart, but quite honestly it's easier to  
18 follow with the chart.

19 **THE COURT:** Well, why don't you -- it's fine. I'm not  
20 going to seek to admit it at this point. If you want to just  
21 ask him whether this chart in general terms reflects his  
22 observations, then he can certainly --

23 **MR. SOMMER:** I was going to even make it narrower than  
24 that, starting --

25 **THE COURT:** Fine.

1 BY MR. SOMMER:

2 Q. -- with Google, his knowledge of Google.

3 So Dr. Raghavan, if we look at this chart, we see that  
4 over the past seven or so years, Google's market share has  
5 slowly declined. Do you see that?

6 A. I do.

7 Q. And to what do you attribute that?

8 A. So let me just point out something to the Court  
9 before there's any confusion, because this is also a period  
10 during which the pie of digital advertising has grown  
11 significantly. So that the shrinkage of Google's share is  
12 not at odds with any financial performance of Google, any  
13 numbers that you see.

14 Q. You beat me to the punch again.

15 A. So that's important to understand.

16 Q. Let me back it up, ask two quick questions, and then  
17 I'll get back to my question. So the digital advertising  
18 industry as a whole is growing, correct, so there's more ad  
19 spend?

20 A. Yep.

21 Q. And so when we see decline here on Google's part,  
22 does that indicate shrinking revenues in a growing market?

23 A. It does not.

24 Q. So to what do you attribute that Google is losing  
25 market share?

1           **A.** It's clear without doubt from the chart that the big  
2 winners, from all we can see, are Amazon. And for the most  
3 part, barring a little bit of slack in the middle,  
4 Meta/Facebook.

5           **Q.** And you've discussed TikTok a little. If you look at  
6 the pink one, like the fifth -- if you go to the 2022 column,  
7 the fifth one up is pink and that's TikTok.

8           That doesn't even appear on 2019, correct?

9           **A.** TikTok's rise has been mercurial, and it's now  
10 actually visible on this chart. And I expect it to grow  
11 again at the expense of some of the others.

12           **MR. SOMMER:** Judge, is this a good time for the afternoon  
13 break?

14           **THE COURT:** Sure. How much longer in your direct exam?

15           **MR. SOMMER:** Less than half an hour, Your Honor.

16           **THE COURT:** All right. So let's go ahead and take our  
17 afternoon break. We will return at 3:15. See everybody  
18 shortly.

19           (Recess taken at 2:59 p.m.)

20           (Back on the record at 3:17 p.m.)

21           **THE COURT:** Welcome back, everybody.

22           Mr. Sommer, whenever you're ready.

23           **BY MR. SOMMER:**

24           **Q.** Dr. Raghavan, just two last topics that I want to ask  
25 you about. The first one --

1           **THE COURT:** Mr. Sommer -- oh, go ahead. I was going to  
2 ask somebody to shut the door. Thank you.

3           Go ahead, Mr. Sommer.

4 **BY MR. SOMMER:**

5           **Q.** The first one you actually briefly mentioned a while  
6 ago, artificial intelligence?

7           **A.** I did.

8           **Q.** How long has Google been using some form of  
9 artificial intelligence in its products?

10          **A.** Between 15 and 20 years now.

11          **Q.** So it's not an entirely new thing for Google; is that  
12 right?

13          **A.** The field is about 75 years old, and at Google it's  
14 about 20.

15          **Q.** Can you briefly describe to the Court some of  
16 Google's recent developments in the field of artificial  
17 intelligence?

18          **A.** There's a couple that I would especially highlight.  
19 There's a paradigm called reinforcement learning that has  
20 come into great use of late. The first artifact that was  
21 visible to the world kind of blew me away, was when one of  
22 our systems beat the world champion at Go.

23          **Q.** At what?

24          **A.** At the game of Go, which I did not think was feasible  
25 in my lifetime. But then that wasn't just some pastime, the

1 successor to that system solved the protein folding  
2 problem -- which is of humongous importance to medicine and  
3 drug discovery. To put that in perspective, the protein  
4 folding problem takes a protein and tells us how it sits in  
5 three-dimensional space so it can be used for therapies.

6 Typically, folding of protein is a biology PhD thesis.  
7 And AlphaFold, our program, folded about 200,000,000 of these  
8 at one shot, and it's now in the hands of drug discovery.  
9 That's something I'm really proud of. The second has to do  
10 with techniques from what are called deep neuralnets. In  
11 particular, a family of deep neuralnets that are called  
12 transformers that we published, I would say, 2016 or 2017.  
13 And what these transformers do is take an input and spit out  
14 an output in a way that transforms an input potentially from  
15 a user into an output. The input could be a sentence, the  
16 output could be a paragraph, it could be an image. It's very  
17 exciting technology.

18 Q. Google's work on transformers, did it publicly  
19 publish that?

20 A. Yes.

21 Q. Why?

22 A. Because it's breakthrough science, and we have a  
23 tradition to publish breakthrough science.

24 Q. Are you familiar with something called ChatGPT?

25 A. Yes.

1           Q. To what extent, if any, did that incorporate Google's  
2 transformer work?

3           A. The second of the Ts in ChatGPT is transformer, and I  
4 think they made adroit use of transformer technology.

5           Q. You're familiar with the term generative AI?

6           A. That's a term that's commonly used.

7           Q. What does that refer to?

8           A. The idea of using transformers to generate artifacts  
9 which could be -- as I said, it could be a paragraph, it  
10 could be an image, in response to a stimulus which could also  
11 be an image, but it could also be two words.

12          Q. In I think it was February of last year when ChatGPT  
13 was released, there was an enormous buzz. What impact, if  
14 any, have you seen from this -- now this generative AI having  
15 on both the search side and the ads side?

16          A. Let me take two things apart, right. So ChatGPT was,  
17 I think, introduced the previous December, and immediately  
18 got caught up in the popular site -- you know, a thing you  
19 could chat with, very engaging experience. Wonderful stuff,  
20 right. But I think the question you were asking has to do  
21 with what transformers have to do with search or potentially  
22 search advertising. We've been using transformers in our  
23 search stack for over five years at this point. But visible  
24 artifacts didn't come to light until recent.

25          So let me take a moment to explain that. It won't

1 surprise many of you if I gave you the following statistic:  
2 Namely, 99.3 percent of all search queries contain a noun.  
3 And we were serving those queries fine, but user expectations  
4 increased to the point where every query had multiple nouns.  
5 So for instance, they said "small vacuum cleaner" -- or  
6 "vacuum cleaner for a small apartment with pets." And to  
7 make sense of that query, whether the user wants an  
8 apartment, a vacuum cleaner or a pet, took transformer  
9 technology embedded in our search engine to do the  
10 understanding of the query. This ties to the natural  
11 language understanding I said.

12 So we brought that in in 2018, and have been using it for  
13 document and query understanding for a while, okay. ChatGPT  
14 was a change, because it put the transformer technology  
15 directly in view of the user, something we'd been testing  
16 previously. And our sense was it was not quite yet  
17 responsible to put that technology out in front of users  
18 because of concerns about factuality and toxicity.  
19 Factuality meaning these things get responses wrong more  
20 often than we would tolerate at Google. And toxicity, they  
21 can sometimes go on a rant about something. So we were  
22 keeping it behind the covers, but were gradually developing  
23 it.

24 We've now put it out in the market on a limited basis --  
25 I believe only in the U.S., Japan and India at this point,



1 but with all sorts of caveats on how things can go wrong.  
2 Because we're still not completely certain in our  
3 responsibility in doing this.

4 Q. On the Microsoft Bing side --

5 THE COURT: I'm sorry, can I interrupt. What you were  
6 just discussing, are you referring to the Bard product or  
7 something else?

8 THE WITNESS: Okay, two answers. So Bard is where you  
9 directly interact with the language model, much as you would  
10 with ChatGPT. ChatGPT is built on a bunch of functionality;  
11 Bard is built on a bunch of functionality. In addition,  
12 within the search product, what we now do is provide what we  
13 call a generative experience; which is you still get the  
14 search results that you would normally get, but we preface it  
15 with something of an abstract, of here's what you're about to  
16 see. We call it the search generative experience, and it's  
17 only available in what we call the Search Labs. So users  
18 have to opt in saying yes, I know I'm getting into difficult  
19 territory. So both are out in the marker right now.

20 BY MR. SOMMER:

21 Q. I was just going to ask, to what extent has this new  
22 technology been implemented in any way on the ads side?

23 A. On the ads side, we have -- the first concrete  
24 instantiation which we announced, I believe, at the end of  
25 May was an offering where an advertiser can come in, and

1 instead of thinking about exactly what creative I should  
2 write for my company or my product, they point Google to  
3 their website. And we grab the website, feed it into the  
4 language model, the transformer, and it comes back and says:  
5 Here are half a dozen potential creatives you could use for  
6 advertising, make sure they're okay. And once you approve  
7 some subset of them, we will run experiments to see which one  
8 performs the best for your return. So in that sense,  
9 transformers have...

10 Q. And is there an impact on the search side as opposed  
11 to the advertising side that you have either seen or are  
12 starting to see?

13 A. An impact of transformer technology, yeah, it's the  
14 thing I described all the way leading up to the Judge's  
15 question. Which is, we were using it within the stack, but  
16 now we're giving that synthesized abstract of here's the  
17 search results page that you're about to see, but in a  
18 limited labs artifact.

19 Q. Thank you. All right, last topic.

20 **THE COURT:** I'm sorry to interrupt. When you say  
21 synthesized abstract, is that something that would also --  
22 would that be a result produced in response to a commercial  
23 query or to a non-commercial query or any query?

24 **THE WITNESS:** Any query -- actually, let me be careful  
25 how I answer that, right. So we assess the quality of the

1 synthetic responses on various families of queries. In some  
2 families, we feel good about the result, in some other  
3 families we don't. So for instance, if the user appears to  
4 be asking for legal advice, we would probably pull back and  
5 say, you know, we don't want to be making up stuff about the  
6 law. If it's medical advice, we are similarly circumspect,  
7 right.

8 So for commercial queries, yes, we will say here are  
9 strollers you can purchase or whatever. But for many query  
10 families, we pull back because we don't as yet feel good  
11 about the quality of what we're doing.

12 **THE COURT:** So when you say an abstract, do you mean to  
13 say a written narrative of some kind; is that what you're  
14 referring to?

15 **THE WITNESS:** It typically will have a written summary  
16 with corroborative links; it will have some images; and it  
17 might have a table occasionally. So those are the elements  
18 that go into the abstract.

19 **THE COURT:** Thank you.

20 **BY MR. SOMMER:**

21 **Q.** Last topic I want to cover with you, it's a brief  
22 one, and that's privacy. There's going to be a different  
23 Google witness who will cover that more extensively, but  
24 there are a couple of questions I want to ask you about  
25 privacy.

1           What is your involvement in Google's privacy efforts?

2           **A.** It's a couple of things. One, for the products I  
3 directly oversee, I am responsible for the policies we adopt.  
4 But I also serve on a cross-company privacy council, which is  
5 a bunch of senior leaders whose job it is to coordinate these  
6 policies across different parts of the company, and to ensure  
7 that we remain in good compliance with regulations.

8           **Q.** What considerations does Google take into account in  
9 determining whether and how to implement changes to its  
10 privacy protections?

11          **A.** By far, the biggest factor that I always push for is  
12 user research, which is what is it our users have come to  
13 expect. And I will say user expectations have changed over  
14 time, especially beginning about five, six years ago when  
15 things like Cambridge Analytica came to light. So we have to  
16 react to how users see online tech platforms, and so that's  
17 the biggest consideration. The second thing we look at is  
18 will a proposed privacy change impact the user's experience  
19 negatively in any way.

20          So, as an example, for a user who queries for plumber,  
21 you have to give them plumbers in their vicinity. And if we  
22 don't know where they are, then it's going to be very hard to  
23 give them useful plumbers. I don't want to give them  
24 plumbers in Australia when they're here, right. So we assess  
25 the user impact. In all cases, we also ensure that we can

1 train various models for both search ranking and ad ranking,  
2 and keep them fresh and useful to users and advertisers.

3 Q. How, if at all, do the privacy practices of competing  
4 companies impact Google's analysis of whether and how to  
5 implement changes to its own privacy protections?

6 A. We -- well, we have access to them, we look at them.  
7 But to me, that's not the principle dimension to look at  
8 here. It's what our users want, and how we can keep our  
9 products relevant to our users and advertisers.

10 Q. Let me put up on the screen what's in evidence  
11 already as UPX501, and if you can just highlight the top  
12 there.

13 This is an e-mail from you to Benedict Gomes in June of  
14 2019?

15 A. Yes.

16 Q. And you've had a chance to review this e-mail before,  
17 correct?

18 A. I have.

19 Q. Okay.

20 A. But let me keep it in front of me.

21 Q. Yeah, I hope we have it in the binder. Let me just  
22 check.

23 A. I see it.

24 Q. Yeah, UPX501.

25 A. Yes.

1           Q. Do you need a moment to refresh your memory on it or  
2 should I proceed?

3           A. I think we can proceed.

4           Q. I'll push forward. What's the issue here? What's  
5 being discussed in this e-mail exchange?

6           A. So this was a discussion that came through a forum we  
7 had at that time called the Consumer Council that consisted  
8 of, well, all the addressees on this e-mail: Ben Gomes,  
9 myself, Jen Fitzpatrick and Cory Ondrejka. And the proposal  
10 was that a competitor was making some privacy changes, and  
11 suggesting that we were failing to make those privacy  
12 changes.

13          Q. Let me stop you for one moment. Who was the  
14 competitor?

15          A. In this case, it was DuckDuckGo.

16          Q. Okay, please continue.

17          A. And the team that came forward with the proposal said  
18 we need to do exactly what they're doing. And my pushback  
19 was maybe we do, maybe we don't, but I'd like to see the data  
20 on the impact on users, and on our ability to build a good  
21 search and search ad system.

22          Q. Let me stop you there for a moment. Can we just  
23 highlight the top e-mail here that's Dr. Raghavan's e-mail.  
24 Go ahead.

25          A. Yeah, so my advice, my feedback was this is an

1 important area, and it's captured very succinctly in the  
2 words "space of private search," right. And I was seeking  
3 far more careful data and analysis to see what it is we could  
4 do to serve users the best.

5 Q. Let me -- I want to put up a chart that was sent with  
6 the e-mail, which is in evidence as -- at page 4420 of this  
7 same exhibit, I believe -- I'm sorry, UPX811.

8 A. I see that.

9 Q. At 4420.

10 A. 811?

11 Q. Yeah, it will be up on the screen in a second, and I  
12 think we can do it from there.

13 A. Okay, good.

14 Q. Can you see it on the screen?

15 A. I do.

16 Q. Do you remember this chart?

17 A. I do.

18 Q. And what does this chart -- this came to you as part  
19 of this same proposal, is that right, or in connection with  
20 the proposal?

21 A. In that Consumer Council meeting, yeah.

22 Q. And what does the chart on the right show, what is it  
23 trying to show?

24 A. So the team was arguing that there were features  
25 DuckDuckGo had implemented and marketed that Google had not

1 implemented, and was arguing that we replicate those  
2 features.

3 Q. I just want to go quickly through the features -- at  
4 least the ones that -- the X under Google, does that  
5 represent that Google does not have that feature at that  
6 time?

7 A. Or not in quite the same way, because you'll see the  
8 words "eventually expires" in some cases. So it does not  
9 replicate the features, that's correct.

10 Q. Let's just go through each of them quickly. First,  
11 does Google log the user's IP address?

12 A. It does.

13 Q. And why?

14 A. A good example is the example I just gave, which is  
15 if you're looking for a plumber, one of the best signals of  
16 your coarse location is your IP address. And I want to give  
17 you plumbers in your locale, within a few square miles or  
18 whatever.

19 Q. Okay.

20 A. Another reason where IP address can be useful is  
21 looking at sequences of events with IP address and some of  
22 these others gives us excellent signals to detect botnets and  
23 fraudulent clicks. And I didn't want to lose that ability in  
24 a hurry.

25 Q. Can you explain, in general terms, how IP addresses



1 are used to combat botnets or spam or other bad things?

2 **A.** Yeah, when these attacks happen, typically a system  
3 combs through the logs and detects a certain recurrent  
4 pattern that a certain IP address is engaging in behavior at  
5 very predictable and periodic intervals. I don't want to go  
6 too much into this, because there's a lot --

7 **Q.** That would defeat the point.

8 **A.** Sort of. But that was a very simple way. Analysis  
9 of logs with IP addresses can indicate to us that a  
10 fraudulent attack is underway.

11 **Q.** How about for security, is there an aspect of saving  
12 IP addresses that is for security, user security?

13 **A.** It is useful in some ways to secure a user without  
14 excessively annoying them. You know, that, again, goes to  
15 both the IP address and the third row cookie ID where we  
16 sometimes know that it's the same user who's authenticated  
17 themselves recently to us. On the other hand, if I appear as  
18 a user today here, and hours later appear in Armenia, then  
19 that's a signal to our systems that something's going on.

20 **Q.** Let me go to the second item on this list, which is  
21 user agent. First, what's user agent?

22 **A.** It's an indication of what kind of client the user is  
23 using: is it a Safari browser perhaps or Edge browser, is it  
24 the Chrome browser, et cetera.

25 **Q.** Does Google log the user agent?

1           **A.** We do.

2           **Q.** Why?

3           **A.** Partly in continuation of the previous point on  
4 detecting bad actors. But also, the user agent in some cases  
5 can tell us this user is on a browser but on a mobile device.  
6 And so the aspect ratio with which we format our output  
7 should change depending on what kind of user agent it is, so  
8 that's one more reason.

9           **Q.** In other words, if I'm on a mobile device, that might  
10 have some impact on the results I get?

11          **A.** And how they're laid out in front of you.

12          **Q.** Got it. And then the third item refers to cookie  
13 IDs. Does Google log cookie IDs?

14          **A.** Yes.

15          **Q.** And why does it do that?

16          **A.** So the simplest reason is the one I gave you earlier,  
17 which is to not constantly annoy you to re-authenticate.  
18 There are a couple of other reasons. For instance, Google  
19 search itself has minimal personalization, but in your  
20 suggestions we do personalize your recent activity, your  
21 recent query activity. Cookies are a good way to keep track  
22 of that.

23          **Q.** Does Google save click and query to a user ID?

24          **A.** Click and query to a user ID, yes, and for signed in  
25 users.

1 Q. And why does it do that?

2 A. I mean, you're saying doesn't save, I think -- or  
3 sorry, maybe you should repeat the question.

4 Q. Well, in the context of this slide, I'm reading it as  
5 DuckDuckGo doesn't save, Google has a checkmark next to it  
6 which I assume means doesn't save?

7 A. Yeah.

8 Q. Then there's words under it. If you could just  
9 explain those to the Court.

10 A. Oh, those words simply mean that if you're not signed  
11 in, there is no user ID to log against.

12 Q. And how about the last one: "Doesn't target search  
13 ads based on search history." What does Google do or do not  
14 do in that regard?

15 A. So our search ads can adapt to your search history,  
16 but the user has a bunch of controls to turn that off. They  
17 can decree that all search ads personalization be off. We  
18 also provide them capabilities, as users, to come in and say:  
19 I don't want to see any ads of a certain topic. It's an  
20 interface we call My Ad Center. So it's don't personalize in  
21 these categories I consider sensitive. So there are various  
22 controls we give users, so that's what we mean here.

23 Q. Did Google implement the proposal that came to you in  
24 this DDG deck?

25 A. Not in the form it was proposed, no.

1           **Q.** Has Google adopted privacy policies that mirror  
2 DuckDuckGo?

3           **A.** No.

4           **Q.** Why not?

5           **A.** Going back to where we began, the right thing to do  
6 is look for what our users are seeking and give them those  
7 controls. Our user research suggested a few things. One  
8 that I just mentioned on ads personalization. Another thing  
9 we learned was users sometimes will forget that they set or  
10 did not set something. But in the instant, they sometimes  
11 will have some activity, and then they say oops, I wish  
12 Google would forget my last 15 minutes, whatever I did. And  
13 so we give a facility to turn off your last 15 minutes of  
14 activity. And those were things that we felt were  
15 user-impactful, and we do allow that.

16           **Q.** And apart from what DuckDuckGo is doing, has Google  
17 implemented its own changes to address privacy issues over  
18 the past several years?

19           **A.** I think I gave you two of the examples. There were a  
20 few others. One, we've said to all our incoming users that  
21 their location history and their search history will be  
22 automatically deleted after 18 months, but the user  
23 themselves can elect to delete it all and make us not  
24 remember any of it. So these are all controls we've been  
25 using.

1 Q. And finally, I take it Google is also constantly  
2 monitoring anything from any regulator in terms of new  
3 privacy policies in response to that as well?

4 A. Inevitably, yes.

5 MR. SOMMER: Thank you, Your Honor. No further  
6 questions.

7 THE COURT: All right. Why don't we begin with  
8 cross-examination.

9 **CROSS-EXAMINATION OF PRABHAKAR RAGHAVAN**

10 BY MR. HAFENBRACK:

11 Q. Your Honor, Joshua Hafenbrack for the United States.  
12 Dr. Raghavan, good afternoon.

13 A. Good afternoon.

14 Q. It is a pleasure to meet you.

15 A. Likewise.

16 Q. I represent the United States, I'll be asking you a  
17 few questions this afternoon. You mentioned -- and I'm not  
18 sure you spelled this out in your direct, the products that  
19 roll up to you. What products do you oversee?

20 A. Google Search; Google's GO division which includes  
21 Maps and Waze; Google Assistant which includes Bard; Google's  
22 Shopping team, Payments team and the Ads team.

23 Q. And do you oversee Google Search as well?

24 A. Yes, that was my first --

25 Q. Oh, got you. I missed that, okay. And am I correct

1 that you have been the head of Google Ads since 2018, and the  
2 head of both Google Ads and Google Search since 2020?

3 A. Correct.

4 Q. You testified on direct about -- on your direct  
5 examination about competition that Google faces from social  
6 media sites and from vertical search engines.

7 Do you recall that?

8 A. I do.

9 Q. Let's -- I have a few questions about TikTok, since  
10 you mentioned TikTok at various points in your direct  
11 testimony.

12 Are you, yourself, a user of the TikTok application,  
13 Dr. Raghavan?

14 A. Not a frequent user, I'll confess, but I've played  
15 with it.

16 Q. Okay. Users do not have to enter a search to view  
17 content on TikTok, correct?

18 A. They do not have to enter a search.

19 Q. And Google has described TikTok as a query list  
20 format, correct?

21 A. I don't know if I used those terms, but if I did, I  
22 did.

23 Q. Okay. Users of TikTok can scroll through a video  
24 feed that's based on an algorithm of their engagement with  
25 past videos, right?

1           A. Correct.

2           Q. And the ads that are shown on TikTok are usually  
3 videos or sponsored posts that are embedded in the user's  
4 feed as they scroll through, correct?

5           A. Correct.

6           Q. They're social ads, right?

7           A. I'm not sure what you mean by social ads, but you  
8 described functionally what they were, correct.

9           Q. And they're ads that are not served in response to a  
10 query, correct?

11          A. Those ads are not typically served in response to a  
12 query. You can query TikTok.

13          Q. And if I do a search on TikTok, what I'll get back  
14 are TikTok videos, correct?

15          A. Potentially with advertising.

16          Q. And it's a walled garden, right?

17          **THE COURT:** A what?

18          **MR. HAFENBRACK:** A walled garden, Your Honor. Have you  
19 heard that phrase in this trial?

20          **THE COURT:** I don't think I have.

21 **BY MR. HAFENBRACK:**

22          Q. Okay. Well, let me ask it a different way then.  
23 When you do -- if you do do a search on TikTok, what you get  
24 back is TikTok content, correct?

25          A. Correct.

1 Q. You don't get back non-TikTok content?

2 A. As best as I know you don't.

3 Q. And TikTok doesn't provide any links or information  
4 from the open web, correct?

5 A. Correct.

6 Q. It doesn't provide 10 blue links, correct?

7 A. Correct.

8 Q. And you have no reason to think TikTok is drawing  
9 results from a web index, correct?

10 A. I have no knowledge of that, what TikTok is planning  
11 to do with the open web.

12 Q. Can you think of any reason TikTok would need to  
13 index the open web based on the services they provide today?

14 A. Oh, yes.

15 Q. Okay. Google indexes TikTok, correct?

16 A. Not quite. We have access to some of their videos of  
17 their choosing.

18 Q. And the videos that you get will be included in  
19 appropriate search engine results page if the query matches  
20 the video?

21 A. That's correct.

22 Q. TikTok doesn't provide users with written  
23 information, news articles, stories from the open web,  
24 correct?

25 A. As far as I know they don't.



1 Q. If I want directions somewhere, Google will give me  
2 the answer, TikTok will not, correct?

3 A. When you say Google, you're talking about Maps?

4 Q. Google Search. If I enter a query for directions  
5 somewhere into Google Search, I'll get the answer, correct?

6 A. We typically get a link to a map, and then it will  
7 open up your Maps app for directions.

8 Q. And TikTok would not be a good source of information  
9 for that query, correct?

10 A. For that particular query, no.

11 Q. Have you ever searched "coffee near me" on TikTok,  
12 Dr. Raghavan?

13 A. As I said, I'm not a common frequent user of TikTok.

14 Q. Okay. Fair to say there's not a lot of mystery with  
15 that query, when someone enters a query for "coffee near me,"  
16 Google would assume they're looking for coffee near them,  
17 right?

18 A. In the case of Google, you would actually enter that  
19 query. In the case of TikTok, my analysis -- or my  
20 understanding of the user research is they get inspired for  
21 coffee near them. And the statistics are stunningly high,  
22 that people look for coffee near them through TikTok.

23 Q. Let's put up a demonstrative, I think it's UPXD19.

24 A. From -- oh, okay.

25 Q. It's there on your screen, Dr. Raghavan. And this is

1 a demonstrative I created yesterday --

2 **MR. SOMMER:** Sorry to interrupt. Do you have a set of  
3 demonstratives for us, counsel?

4 **MR. HAFENBRACK:** Oh, I do. Sorry about that, counsel.

5 **MR. SOMMER:** No worries. Thank you so much.

6 **BY MR. HAFENBRACK:**

7 **Q.** Dr. Raghavan, I've handed you a demonstrative.  
8 You've got it in paper form and on the screen, you can look  
9 at whatever you prefer. This is a demonstrative I created  
10 yesterday. Same query, same location a few blocks from here.  
11 And you can see TikTok's results on the left and Google's  
12 results on the right.

13 Do you see that?

14 **A.** I do.

15 **Q.** And these two results pages look nothing alike,  
16 correct?

17 **A.** That is correct.

18 **Q.** And as between the two, Google's results page, far  
19 more likely to fulfill the user's intent of finding a place  
20 to get coffee near them, right?

21 **MR. SOMMER:** Objection.

22 **THE COURT:** Basis?

23 **MR. SOMMER:** It's calling for speculation. I don't think  
24 the witness can know the relative likelihood, especially  
25 since he's not a user of TikTok, with any frequency.

1           **THE COURT:** That's sort of his area of specialization.  
2 If he can't answer it, he can't answer it. You can answer  
3 the question. It's overruled.

4           **THE WITNESS:** I'll try. So I don't know how to conclude  
5 the one or the other is far more likely. I'd love to do a  
6 user test. I do know that TikTok users look for lunch places  
7 and restaurants near them using TikTok.

8 **BY MR. HAFENBRACK:**

9           **Q.** The TikTok videos, you don't even know if the videos  
10 will have relevant information even if you watched them,  
11 correct?

12           **A.** I don't.

13           **Q.** The Google --

14           **A.** Magically TikTok users seem to know.

15           **Q.** The Google results provide the direct answer to the  
16 query, correct?

17           **A.** They answer the query. The experiences are quite  
18 different, that's clear.

19           **Q.** You can take that down, thank you. I think you  
20 mentioned in your direct testimony that TikTok is a partner  
21 with Google?

22           **A.** In that they provide some videos of their choosing to  
23 be shown in our results.

24           **Q.** Is that the only sense you meant that Google and  
25 TikTok are partners?

1           **A.** I think they also advertise their app through our  
2 systems in our app advertising product.

3           **Q.** Dr. Raghavan, in the Chrome browser, Google's the  
4 default search engine, right?

5           **A.** In the Chrome -- it depends what the user sets.

6           **Q.** Out-of-the-box?

7           **A.** Out-of-the-box, yes.

8           **Q.** And users, to your point, can navigate through the  
9 settings menu and change the default, if they want to, right?

10          **A.** They can.

11          **Q.** And they can pick from a list of options that Google  
12 provides, right?

13          **A.** Correct.

14          **Q.** And TikTok is not among the options to be the default  
15 search engine in Chrome, right?

16          **A.** TikTok is not a potential default search engine, yes.

17          **Q.** All the options to be the default search engine in  
18 Chrome that can be chosen by users on the screen are general  
19 search engines, correct?

20          **A.** Yes.

21          **Q.** You mentioned Hotels.com and Home Depot earlier.  
22 Those are not options to be the default search engine in  
23 Chrome on the alternative list, correct?

24          **A.** I don't recall, but you're probably right.

25          **Q.** And you showed a picture of Walmart. Walmart's not

1 an option to be the default search engine in Chrome, right?

2 A. Because a default search engine has a specific  
3 connotation to the user, so the Chrome team includes whatever  
4 they think of as default search engines.

5 Q. And what is the connotation that a default search  
6 engine has to the user, to your understanding?

7 A. Not to the user, to the Chrome team, first of all.

8 Q. Okay.

9 A. They put in that menu, as I understand -- I'm not  
10 responsible for Chrome I should tell you -- as I understand,  
11 engines that do traditional web search.

12 Q. That provide all-purpose answers to all different  
13 types of queries, right?

14 A. Yes.

15 Q. And nor is Amazon or Facebook an option to be the  
16 default search engine in Chrome, right?

17 A. I don't think of Amazon or Facebook to be general  
18 purpose search engines. But maybe you can help me understand  
19 how this is coming together, and I'll try to answer you  
20 better.

21 Q. And because Amazon and Facebook aren't general  
22 purpose search engines, they're not available as options to  
23 be set as the default search engine in Chrome, correct?

24 A. Correct.

25 Q. And the same is true with Safari, that none of these

1 services that we've been talking about -- TikTok, Facebook,  
2 Amazon -- are options to be the default search engine in  
3 Safari, right?

4 A. Correct.

5 Q. Dr. Raghavan, do you agree that some users might have  
6 concerns about downloading TikTok on their phone because of  
7 foreign ownership of TikTok?

8 A. I don't know that to be true.

9 Q. I'm sorry, what?

10 A. I've read accounts of this, but I don't know that to  
11 be true.

12 Q. Okay. Based on your experience as head of Google  
13 Search, do you have any understanding that a lot of people  
14 might be wary of using TikTok because of privacy and security  
15 concerns?

16 A. The data I am privy to suggests that users pretty  
17 much everywhere are busily downloading TikTok, so that's the  
18 evidence I go by, except where it's banned.

19 Q. Except what?

20 A. Where it is banned.

21 Q. Let's turn to your demonstrative. Can we put up page  
22 six from demonstrative. It is DX21.006. Here it is. Thank  
23 you.

24 This is -- Dr. Raghavan, this is a page that shows five  
25 websites. You see Wayfair, Amazon, Google, Overstock and

1 Walmart, right?

2 A. Correct.

3 Q. And these are all websites that will provide answers  
4 to shopping queries, correct?

5 A. Correct.

6 Q. If I did the "coffee near me" query that we were just  
7 asking about, which of these search engines would provide a  
8 good result?

9 A. Probably Google would.

10 Q. Okay. And none of the others, correct?

11 A. Correct.

12 Q. If I wanted to research medications, only Google on  
13 this page would provide good results, right?

14 A. You might get something from Amazon and Walmart, but  
15 probably not Wayfair or Overstock.

16 Q. If I wanted to find an attorney or a plumber or a  
17 music teacher, Google is the only option on this page that  
18 would provide good results --

19 A. Correct.

20 Q. -- right? Yes?

21 A. Correct, yes.

22 Q. If I want to look up how many points Michael Jordan  
23 scored in game six of the 1996 NBA finals, only Google would  
24 tell me the result, right?

25 A. I think I get the drift of your question. Maybe we

1 should get to the premise you're aiming for, and I'll be  
2 happy to --

3 Q. I would just appreciate it if you answered my  
4 question. The only one that would provide --

5 A. Yes.

6 Q. -- a good result to that query is Google, right?

7 A. Yes.

8 Q. You can take that down, thank you. You're familiar  
9 with -- strike that.

10 Google has revenue share agreements with Android partners  
11 to distribute Google Search on Android phones, you're  
12 familiar with that, correct?

13 **MR. SOMMER:** Objection, beyond the scope.

14 **THE COURT:** Let's just see where it's going. Go ahead.

15 **BY MR. HAFENBRACK:**

16 Q. Thank you, Your Honor.

17 A. I'm generally aware of this.

18 Q. Okay. And those agreements contain a provision that  
19 restrict Google's Android partners from downloading general  
20 search services on Android phones, correct?

21 A. I'm not aware of those details.

22 Q. Are you aware that Google's Android phones prohibit  
23 the pre-loading of general search engines like Bing and  
24 DuckDuckGo, but not TikTok, Facebook and Amazon?

25 A. I'm not aware of the details of those agreements, I'm



1 not party to them.

2 Q. During your direct testimony, you talked about  
3 competition that Google faces from Amazon, correct?

4 A. Correct.

5 Q. Are you familiar with a project called Project  
6 Charlotte?

7 A. The name rings a bell. The challenge is Google has  
8 so many project names, I have trouble keeping them separate.  
9 But generally, I'm vaguely familiar it had something to do  
10 with Amazon.

11 Q. Something with Amazon, okay. And you recall the  
12 purpose of Amazon -- strike that.

13 And you recall the purpose of Project Charlotte was to  
14 try to analyze or quantify the impact of Amazon on Google's  
15 queries and search ad revenues, right?

16 A. Generally, that's my recollection.

17 Q. Okay. Let's take a look at a document, UPX344.  
18 UPX344 is in evidence, Your Honor.

19 Dr. Raghavan, you've got a binder with the document.  
20 We're going to put the relevant portions on the screen, so  
21 whatever is more convenient for you.

22 A. Which -- sorry, three --

23 **MR. HAFENBRACK:** We need to hand that up, Your Honor.  
24 May I approach?

25 **THE COURT:** Sure.

1           **THE WITNESS:** Did you say 344?

2           **MR. HAFENBRACK:** Yes, sir.

3           **THE COURT:** Sorry, is this a different binder or just the  
4 same?

5           **MR. HAFENBRACK:** The same binder that I just forgot to  
6 hand up to the witness, Your Honor.

7           **THE COURT:** Okay.

8 **BY MR. HAFENBRACK:**

9           **Q.** Dr. Raghavan, 344 is a document with the cover slide  
10 entitled Project Charlotte Exec Update, January 24th, 2019.  
11 And you were the custodian on this document.

12           **A.** I see.

13           **Q.** And let's take a look at the first page, the next  
14 page. And there's an executive summary there, do you see  
15 that?

16           **A.** I do.

17           **Q.** And you're familiar that what Google had done in  
18 Project Charlotte, is it had analyzed the query behavior on  
19 Google of Amazon users, right?

20           **A.** Not quite.

21           **Q.** Okay. Please explain your understanding.

22           **A.** Yeah, if you look at the page next to it -- which I  
23 think has the page number 3059, it says: "No observed impact  
24 on inferred search ads revenue for 12 weeks after becoming a  
25 shopping loyalty member." The reason I'm calling that out,

1 that is a very different and smaller cohort than Amazon users  
2 at large.

3 Q. Okay, and we'll get to that. Take a look at the  
4 first bullet point that's here on the screen.

5 A. Yep.

6 Q. And you see it says: "We have found no evidence of  
7 short-term negative per-user revenue impact or a negative  
8 query volume impact or a meaningful shift in query volume of  
9 Shopee queries away from Google resulting from a user  
10 becoming an online retail loyalty program member or being  
11 active on large online retailers."

12 Do you see that?

13 A. I do.

14 Q. And when the first bullet point says that there was  
15 no meaningful shift in Shopee queries away from Google, do  
16 you understand that to mean retail queries?

17 A. Roughly.

18 Q. And Shopee queries are a subset of the overall  
19 commercial queries; is that right?

20 A. It's not a well-defined subset. I'd have to go back  
21 in here to see the exact definition of Shopee queries, but I  
22 think what you're indicating is commercial queries.

23 Q. And this is -- this bullet point's saying that when a  
24 user signs up to be a loyalty member at Amazon or another  
25 large online retailer, there's no observed negative impact on

1 how many queries they do on Google, right?

2 A. For that cohort of users.

3 Q. And that cohort for Amazon would be like Amazon Prime  
4 members, is that your understanding?

5 A. I don't know what -- I would have to go back to  
6 refresh my memory in what they mean by loyalty member, and  
7 why they used those words as opposed to Prime -- which they  
8 might have used. But some loyalty -- oh, yeah, I don't want  
9 to speculate. Some loyalty program was considered, and for  
10 the cohort that were loyal shoppers in the sense of the word,  
11 they reached these conclusions.

12 Q. And the cohort that you're describing, the loyalty  
13 cohort, you would expect it's a cohort that's heavier users  
14 of Amazon and the other large online retailers, right?

15 A. I'm not certain of that; I couldn't tell you for  
16 certain.

17 Q. Wouldn't you expect, Dr. Raghavan, a loyalty member  
18 of a large online retailer to have higher than average  
19 dealings with that retailer?

20 A. That's a good question. I haven't seen data on that.

21 Q. Okay, fair enough. Let's take a look at the second  
22 bullet point. And there, the study says: "In fact,  
23 engagement on large online retailers and query on G.com" --  
24 and that's Google.com right?

25 A. Correct.

1           Q. "Are positively correlated. We have observed that  
2 loyalty program members and regular shoppers at large online  
3 retailers have higher query volume on G.com, including higher  
4 query volume in Shopee verticals."

5           Do you see that?

6           A. I do.

7           Q. And so loyalty members, Amazon Prime members tend to  
8 do more searches, not fewer searches on Google.com, right?

9           A. That's correct.

10          Q. And that doesn't just apply to Amazon Prime or  
11 loyalty members, the same positive correlation exists for  
12 regular shoppers of large online marketplaces, right?

13          A. That's what it says here. I haven't been able to  
14 find or recollect a notion of regular shoppers in this  
15 analysis.

16          Q. And Amazon -- this is also saying, Dr. Raghavan, that  
17 Amazon users tend to do more queries on Google.com, even in  
18 the verticals where Amazon is particularly strong, right?

19          A. The members of the loyalty program -- or whatever  
20 their definition of the cohort is, have satisfied this  
21 property.

22          Q. So even something like, I don't know, TVs where you  
23 would think Amazon has a particularly strong presence, Amazon  
24 Prime members correlated with doing more searches for that  
25 type of item on Google?

1           **A.** That may not be surprising, actually.

2           **Q.** Okay.

3           **A.** That may not be surprising, because when we -- it's  
4 coming back to me now. When we discussed it, one of the  
5 explanations I offered was Prime members who in any way  
6 intend to shop at Amazon might come to Google and do a lot of  
7 research before they do it. So we will see that correlation,  
8 yeah, as reported here.

9           **Q.** So your understanding is before someone goes and buys  
10 a TV on Amazon, they might do a lot of research about the TV  
11 options that are out there on Google?

12           **A.** About features of TVs, and should it be Samsung or  
13 whatever else before purchasing. Research is one of the  
14 things users in the commercial mode do a lot of on Google.

15           **Q.** And the positive correlation between Amazon and other  
16 large online retail use and Google queries found in this  
17 Project Charlotte study was statistically significant,  
18 correct?

19           **A.** I believe so. I don't recall the exact numbers, but  
20 I believe so.

21           **Q.** And if you could flip to page 13.

22           **A.** One moment, please.

23           **Q.** It's the one that ends in Bates 069. I'll just ask  
24 you to read the first bullet point to yourself, and then I'll  
25 re-ask my question.

1           A.    Yep.

2           Q.    Let me re-ask my question.  And the positive  
3 correlation between use of Amazon and other large online  
4 retailers and Google queries found in this study was  
5 statistically significant, right?

6           A.    That's what it says, yes.

7           Q.    Okay.  Let's take a look at page three.

8           **THE COURT:**  Can I just pause for a moment and just ask  
9 precisely what this is suggesting, which is that if somebody  
10 visits an Amazon, is the idea that that visitor to Amazon  
11 will also increase their searching on Google?

12          **THE WITNESS:**  I wouldn't state it as a causation.  I  
13 think what he's talking about here is a correlation that  
14 people who end up spending more time on Amazon might also be  
15 the same kinds of people who spend more time on Google.  The  
16 one does not in any way cause the other.

17          **THE COURT:**  Right.

18          **THE WITNESS:**  And then there's the general population,  
19 which does not belong to this cohort, whose behavior is  
20 whatever it is.  We make no conclusions about that.

21          **THE COURT:**  Okay, thank you.

22 **BY MR. HAFENBRACK:**

23          Q.    So the next slide I wanted to ask you about,  
24 Dr. Raghavan, is on the screen.  And you see the title there  
25 is No Observed Impact on Inferred Search Ads Revenue Over 12

1 Weeks After Becoming Shopping Loyalty Member. Do you see  
2 that?

3 A. Yes.

4 Q. And then I just wanted to ask you briefly about the  
5 analysis notes at the bottom. Do you see that?

6 A. I do.

7 Q. And the first bullet point, it's redacted there so  
8 you don't have to say the figure in court, but that's  
9 describing the sample size of this analysis, right?

10 A. Yes.

11 Q. And below that -- and I believe you mentioned this  
12 earlier, the bullet is describing how this study was  
13 conducted over a 12-week period, correct?

14 A. I see that.

15 Q. This was a detailed study, correct?

16 A. When you say detailed, sorry, help me.

17 Q. You have referred to this study in subsequent  
18 correspondence as a very detailed longitudinal study that  
19 Google conducted, correct?

20 A. I don't recall that.

21 Q. Sitting here today, do you agree with that?

22 A. I haven't gone through all the details. I mean, this  
23 is dim in my memory, but if I went through it again, I might  
24 come to that conclusion.

25 Q. You see the date of this study was January 2019th --



1 January 2019, I'm sorry. You see that from the cover page,  
2 correct?

3 A. Let me take a quick look, sorry. January 2019 is the  
4 date on it. Ah, interesting. Yes, and in very fine print  
5 that unfortunately I can barely read, there are also a bunch  
6 of caveats in the executive summary on this analysis. I see  
7 that now.

8 Q. And if you'd look back at DX126 from the binder that  
9 your counsel handed you this morning.

10 A. 126, yep.

11 Q. Yes, sir. You can see that DX126 is from an earlier  
12 point in time, correct?

13 A. Yes.

14 Q. You can put that one aside. Dr. Raghavan, you're not  
15 aware of any study done by Google that is inconsistent with  
16 the findings of Project Charlotte, correct?

17 A. So the specific question of does, shall we call it,  
18 the prime cohort have more of your queries, I haven't seen  
19 anything to dispute that.

20 Q. And you've certainly never seen any study at Google  
21 that concludes that Amazon's rise in growth has come at the  
22 expense of Google's search ad revenues, correct?

23 A. I'll answer that, but want to make sure that this is  
24 distinct, it's not a follow-up question to the earlier  
25 question?

1 Q. It's a totally distinct question.

2 A. It is the same question?

3 Q. No, no, it's a separate question from what I just  
4 asked.

5 A. Okay, I want to make sure I understand it.

6 Q. Let me ask it again.

7 A. Thank you.

8 Q. You have not seen any studies at Google that reached  
9 the conclusion that Amazon's rise in growth have come at a  
10 cost for Google's search ad revenue, correct?

11 A. I mean, I think there are public studies that show  
12 them growing more search ads revenue and us not getting the  
13 search ads revenue, to the tune of \$40 billion a year right  
14 now.

15 Q. My question was about studies at Google. Let me ask  
16 again, one more time. You have not seen any studies at  
17 Google that reached the conclusion that Amazon's rise in  
18 growth have come at a cost to Google's search ads revenue,  
19 correct?

20 A. I cannot recall a specific study.

21 Q. You can't recall -- is it a no or is it can't recall?

22 A. I really cannot recall.

23 Q. Do you recall being deposed on this matter on  
24 December 14th, 2021?

25 A. Somewhere back in 2021, I was.

1 Q. And you were under oath at that deposition?

2 A. Yes.

3 MR. HAFENBRACK: May I approach, Your Honor?

4 THE COURT: Sure.

5 BY MR. HAFENBRACK:

6 Q. Dr. Raghavan, if you could -- actually, you were  
7 deposed on -- over two days, December 14th and December 15th  
8 in 2021, correct?

9 A. I believe those were the dates.

10 Q. And if you could turn to the -- your December 15th  
11 deposition and go to page 441, starting at line three, sir.  
12 I'm going to read the question and answer. Let me know when  
13 you're there.

14 A. 441?

15 Q. Yes, sir. 441, starting on line three, there's a  
16 question and answer by you. I'm going to read the question  
17 and answer:

18 "Question: Have you seen any studies at Google that  
19 reached the conclusion that Amazon's rise in growth comes at  
20 a cost for Google's search ad revenue?"

21 "Answer: I've not seen a study that reaches a  
22 conclusion."

23 Were you asked that question, and did you give that  
24 answer?

25 A. Yes.

1 Q. You can put that aside for now. Sir, is Amazon one  
2 of the largest advertisers on Google search?

3 A. It is one of the largest.

4 Q. And any idea of the volume of advertising that Amazon  
5 does on the Google search engine results page?

6 A. Roughly. It varies a lot by season and year.

7 Q. Okay. What's the rough number?

8 MR. SOMMER: Objection, Your Honor. It's confidential  
9 information.

10 THE COURT: It sounds like it's a rough number.

11 MR. SOMMER: Even a rough number can be confidential.

12 THE WITNESS: It is a material non-public --

13 THE COURT: I'm sorry, this is a material public  
14 proceeding, so I think a general rough number is okay. Go  
15 ahead.

16 BY MR. HAFENBRACK:

17 Q. Please answer.

18 THE WITNESS: Sorry, did you -- Your Honor, did you say a  
19 general rough number?

20 THE COURT: A general rough number is fine.

21 THE WITNESS: Billions of dollars.

22 BY MR. HAFENBRACK:

23 Q. Okay. Multiple billions; is that right?

24 A. Sorry?

25 Q. Multiple billions; is that right?

1           A. Billions of dollars is what I would say.

2           Q. Switching topics, you discussed latency a bit in your  
3 direct --

4           A. Yes, I did.

5           Q. -- examination or direct? Okay. Search engines  
6 compete for users based on latency, correct?

7           A. Latency is one of several factors that users consider  
8 in picking a search engine.

9           Q. When users are picking a search engine, they might  
10 consider latency, correct?

11          A. They might.

12          Q. And search users systematically drop off with even a  
13 few extra milliseconds in latency, correct?

14          A. I don't recall the exact sensitivity, but you're  
15 generally correct that latency is not a good thing, and  
16 latency causes users to drop off.

17          Q. And it causes them to drop off with even surprisingly  
18 just a few milliseconds in difference, right?

19          A. Yes.

20          Q. And Dr. Raghavan, Google can reduce latency by  
21 investing in computing capacity, correct?

22          A. That is one lever. In my experience at Google, that  
23 has not been the most effective lever. Great engineering has  
24 been a much better lever, and that's what we put in place.

25          Q. Engineering, one lever, right?

1           A. Yes.

2           Q. And computing capacity another lever, correct?

3           A. The latter if in fact you're constrained by serving  
4 capacity, if an engine is constrained by serving capacity,  
5 yes. But unequivocally you can say that better optimized  
6 engineering in the stack will lead to latency improvements,  
7 and that's what we -- in my direct testimony I was  
8 discussing.

9           Q. And another way Google can reduce latency is by  
10 building more data centers, correct?

11          A. Not necessarily. Not necessarily.

12          Q. And again, you recall you were deposed in this  
13 matter, correct?

14          A. Yeah.

15          Q. Let's take a look at your first deposition from  
16 December 14th, 2021. Please take a look at page 48.

17          A. From December when?

18          Q. December 14th, sir, the first one in the binder.

19          A. Okay.

20          Q. I'm going to ask you about the question starting at  
21 48, line 12. Let me know when you're there, and I'll read  
22 you the answer -- or the question, rather.

23          A. Page 48?

24          Q. Yes, sir, line 12.

25          A. Yeah.

1           Q. "Question: If Google builds more data centers closer  
2 to wherever people are, that's sort of a hardware way of  
3 reducing latency; is that correct?"

4           "Answer: That would -- you know, to the extent that  
5 we're constantly doing that, yes, absolutely that's something  
6 that reduces latency."

7           Were you asked that question, and did you give that  
8 answer?

9           A. That differs from your question, the one you just  
10 asked me, because Mr. Dintzer asked me closer to where users  
11 are. My point is that's why I said not necessarily, it  
12 depends on where you build additional data centers.

13          Q. Let me ask you again, then.

14          A. Okay, please.

15          Q. Google can build data centers closer to where people  
16 are, and that is a way of reducing latency, correct?

17          A. Potentially.

18          Q. Absolutely that's something that reduces latency,  
19 right?

20          A. We've made changes in our system where it's not  
21 always the case that putting data centers closer to users is  
22 the best way of improving latency. And that's because we've  
23 invested a great deal in optical fiber, so that getting to a  
24 distance data center, that latency has come down  
25 dramatically.

1 Q. Let's take a look at a document. If you could --  
2 we're going to pull up UPX223.

3 A. Yes, one moment, please. Is it in this witness  
4 binder?

5 Q. It's in the white witness binder, exactly.

6 A. Yes.

7 Q. And you'll see the slide is Radical Latency?

8 A. Yes.

9 Q. You're familiar with this document, right?

10 A. I am.

11 Q. And you're the custodian for this document. The date  
12 for it is 2020. And Dr. Raghavan, you recall a proposal for  
13 a radical latency project around the 2020-2021 timeframe when  
14 you were head of Google Search, right?

15 A. Yes, this came in right around the time I assumed  
16 responsibility for Search.

17 Q. Understood. And let's take a look at slide 42.

18 **MR. HAFENBRACK:** Before we put this one on the screen, I  
19 just want to confirm: This one's okay?

20 **MR. SOMMER:** What's the page number in the bottom corner?

21 **MR. HAFENBRACK:** It is -- just a second, Bates 122.

22 **MR. SOMMER:** Just one moment.

23 **THE WITNESS:** 122?

24 **MR. HAFENBRACK:** Yes, sir, Bates 122.

25 **MR. SOMMER:** Yes, Your Honor, there is a confidentiality



1 issue with respect to the very right part of the chart, the  
2 red arrow. That's proprietary.

3 **MR. HAFENBRACK:** If I may, Your Honor. We don't really  
4 agree, this is six years old -- yeah. It's showing -- it  
5 looks like it's at least four or five years, even the most  
6 recent period.

7 **THE COURT:** I guess I'm just not seeing the harm that  
8 would come up making this a public document -- or at least  
9 displaying it publicly. Can you articulate what the harm  
10 would be?

11 **MR. SOMMER:** Judge, everything to the left of the red  
12 arrow on the right we have no issue with. But there is  
13 sensitivity on the part Google with respect to the data on  
14 the right.

15 **THE COURT:** Okay. So I haven't heard you explain --

16 **MR. SOMMER:** Judge, we just got this at lunch from the  
17 government. So literally the first time I'm seeing this page  
18 is right now.

19 **THE COURT:** I don't see how that's possible, because it's  
20 got your little red line around it. So somebody has seen  
21 this before it was introduced just a couple minutes ago,  
22 right, on your side? Because I didn't make the red box nor  
23 did the government.

24 **MR. SOMMER:** The red line is our red on the original  
25 document, not the --

1           **THE COURT:** No, no, I'm talking about the red line around  
2 it, around the page.

3           **MR. SOMMER:** Well, I don't have that on mine.

4           **THE COURT:** I've got it on every single page of the  
5 exhibit.

6           **MR. SOMMER:** That just means it hasn't been reviewed for  
7 confidentiality.

8           **THE COURT:** Right. In other words, it's something that  
9 you've seen before a few minutes ago is my point.

10          **MR. SOMMER:** We were not on notice that this was going to  
11 be used, so it hasn't been reviewed for confidentiality.

12          **THE COURT:** All right, let's show it on the record. I  
13 mean, unless you can articulate to me right now why this is  
14 going to create competitive disadvantage for Google, then  
15 let's show it, because I haven't heard an explanation of why.  
16 Thank you.

17          **MR. HAFENBRACK:** Can we put that slide on the screen?  
18 Thank you so much.

19          **MR. SOMMER:** Judge, I'm sorry, I would ask that if there  
20 are going to be additional documents that we weren't told of  
21 that are designated for confidential review, that they be  
22 disclosed to us so I at least have a chance to talk to my  
23 client.

24          **THE COURT:** That's fine, and we've put a process in  
25 place. But let me -- we can take this up afterwards, we

1 don't need to interrupt this with Dr. Raghavan's testimony.

2 Go ahead. Sorry, sir.

3 **BY MR. HAFENBRACK:**

4 Q. Dr. Raghavan, you see this is a slide that is showing  
5 growth in Google's latency over a period of 2010 -- 2011 to  
6 2020, correct?

7 A. Correct.

8 Q. And you see latency grew steadily throughout that  
9 time period, correct?

10 A. Correct.

11 Q. That means that when users enter queries into Google,  
12 the results they were getting back were getting slower and  
13 slower over time, right?

14 A. Correct.

15 Q. And you see the scale of the increase that built up  
16 over this time period was 500 milliseconds, correct?

17 A. Roughly.

18 Q. And that's a significant amount of increased latency,  
19 correct?

20 A. Yes, it is.

21 Q. And you testified earlier even a few milliseconds is  
22 something that might affect user behavior, right?

23 A. Indeed, which is why I brought that latency down by  
24 500 milliseconds.

25 Q. Let's take a look at slide seven.

1           **A.** Sorry, could you read the number at the bottom,  
2 please?

3           **Q.** Yes, it says 087, Dr. Raghavan. You see the title of  
4 this slide is Google vs. Bing, right?

5           **A.** I do.

6           **Q.** And what this is comparing Google and Bing on is  
7 latency, right?

8           **A.** On specific queries.

9           **Q.** Exactly. You see five sample queries that are listed  
10 here, right?

11          **A.** Yes.

12          **Q.** And these are all pretty common queries, would you  
13 agree?

14          **A.** Some of them are.

15          **Q.** Would you think all five of these would be considered  
16 head queries?

17          **A.** I'd say they're all important queries.

18          **Q.** And for all five, Bing -- at least at this time in  
19 2020, Bing was faster than Google in loading the results,  
20 right?

21          **A.** Noting that what Bing loaded may not match what  
22 Google loaded. In other words, very simple example, the  
23 Google results were more visually rich, then there is more  
24 stuff to send to the client. So that's why I'm a little  
25 careful on the specific queries as opposed to a general query

1 sample, which is more representative.

2 Q. Okay. But whatever metric you were using here to  
3 compare Google versus Bing, Bing was significantly faster on  
4 all five of the queries listed here; is that correct?

5 A. Load some results, that's the point I want to  
6 emphasize. Because what they load might be a text only page,  
7 and that is much faster in general.

8 Q. If you take a look at the car rental query, the  
9 fourth one down. Do you see that?

10 A. I do.

11 Q. And you see the difference in load time is almost 400  
12 milliseconds there, correct?

13 A. I do.

14 Q. Let's go to one more page on this exhibit, it's page  
15 13, Dr. Raghavan. And if you want to look in your binder,  
16 it's 093, the Bates number on the bottom right. The headline  
17 here is Radical Latency in a Nutshell. Do you see that?

18 A. I see the headline.

19 Q. And under impact, the team is outlining a goal to  
20 decrease latency that's redacted. Do you see that?

21 A. I do.

22 Q. And it's outlining a goal to decrease latency over an  
23 18-month estimate, correct?

24 A. Correct.

25 Q. And you chose not to fund this radical latency

1 project, correct?

2 A. I chose not to fund this radical latency project,  
3 because I didn't think it was the right project to reduce  
4 latency.

5 Q. You can put that one aside. Switching topics to data  
6 privacy. Search engines -- general search engines, including  
7 Google, compete on data privacy, correct?

8 A. As always, it's one of many dimensions. We just  
9 spoke of latency, so there are many dimensions. The quality  
10 of the output is the most important thing.

11 Q. Latency and privacy both dimensions of competition  
12 among general search engines, you would agree?

13 A. I would agree.

14 Q. And you also agree that consumers should and will  
15 consider how a search engine uses their data in picking a  
16 search engine, correct?

17 A. In principle, yes. In practice, most consumers don't  
18 get into the nuance of exactly how data is retained and  
19 governed.

20 Q. Just to make sure I'm getting a clean answer, I'm  
21 going to ask that one again. You agree that consumers should  
22 and will consider how a search engine uses their data in  
23 picking a search engine, right?

24 A. I would agree they should. It's the "will" part that  
25 I'm unsure about, simply because it's a complex topic most

1 consumers don't really understand.

2 Q. Let's go back to your deposition binder again, page  
3 269, starting at line five:

4 "Question: And do you agree that whether the search  
5 engine maintains that individual's data might be one of the  
6 factors that some consumers consider when choosing a search  
7 engine?"

8 "Answer: I absolutely say consumers should and will  
9 consider that."

10 Were you asked that question, and did you give that  
11 answer?

12 A. I'd say they should. Some will.

13 Q. Sir, were you asked that question, and did you give  
14 that answer?

15 A. Yes.

16 Q. And in fact, Dr. Raghavan, Google has conducted user  
17 research that shows that users -- search engine users care a  
18 great deal about privacy, correct?

19 A. I don't know about great deal, but I recall generally  
20 that users -- our user research show that search engine users  
21 do care about privacy.

22 Q. Let's take a look at one such study. If you could  
23 look at DX183 in the white binder I gave you. It should be  
24 the first document in there. This is in evidence, Your  
25 Honor.

1           The title here is Search Trust Drivers Analysis from  
2           2020, and you're the custodian for this document. Let's go  
3           to page one -- page two, rather. There's a research  
4           objective, and what's it's describing, Dr. Raghavan, is the  
5           purpose of this study was to identify the strongest drivers  
6           of trust in Google in four countries, including the United  
7           States, right?

8           **A.** I see that.

9           **Q.** And that's an important question to Google, whether  
10          users trust the company, right?

11          **A.** It is.

12          **Q.** And let's go to slide 15, which is Bates 892. This  
13          is a slide that shows that in this study, Google had weak  
14          performances on data privacy and data security in all four  
15          countries, correct?

16          **A.** I want to make sure. The red boxes, I think, are in  
17          the original study, not because of any highlighting, correct?

18          **Q.** Yes, sir.

19          **A.** Okay, yeah.

20          **Q.** Yes?

21          **A.** The numbers are in the 20s.

22          **Q.** And you see at the top Google had weak performance  
23          scores, right?

24          **A.** Yeah, 24, 17 percent have rated us as good on  
25          privacy.



1           Q. And those two categories, data privacy, data  
2 security, were the most important attributes in this study  
3 for creating user trust in Google Search, right?

4           A. Yes.

5           Q. You can put that one aside. Let's talk about the  
6 data Google collects from search users, okay?

7           A. Okay.

8           Q. By default, or without the user taking any action,  
9 Google collects and logs the search history of its users,  
10 correct?

11          A. Yes.

12          Q. And that's true for both signed in and signed out  
13 users, correct?

14          A. Up to that 18-month window that we talked about  
15 earlier.

16          Q. And the distinction there between signed in and  
17 signed out users is if a user has signed into their Google  
18 account before they're -- at the time they're conducting  
19 their search, they'll be considered a signed in user, right?

20          A. Correct.

21          Q. Let's talk about signed out users for a couple  
22 minutes first. For signed out users --

23           **THE COURT:** I'm sorry, when you say signed in versus  
24 signed out, you mean, for example, with a Gmail address,  
25 that's how somebody is signed in to their Google software

1 that's available?

2 **THE WITNESS:** Yeah, the scenario that makes it the  
3 simplest to think about is let's say you have the Chrome  
4 browser, you've signed into your Gmail. Maybe it could be  
5 Calendar, but most commonly it's Gmail. Then you open a new  
6 tab and you run a search. That is what counsel is referring  
7 to as a signed in user, I believe so.

8 **BY MR. HAFENBRACK:**

9 **Q.** And to pick up on the Court's question and your  
10 answer, if someone signs into their Gmail account, they'll  
11 automatically be signed into Google.com the next time they go  
12 to do a search, correct?

13 **A.** In Chrome. That's not true necessarily of Safari,  
14 for instance.

15 **Q.** If I'm a Chrome user, I sign into Gmail, the next  
16 search I do on Chrome or on Google.com I'm going to be signed  
17 in, right?

18 **A.** In fact, the next activity on any Google service. So  
19 for instance, you open the Calendar on a different tab,  
20 you're signed in. So the idea is your identity is preserved  
21 across the services.

22 **Q.** And it's valuable to Google if users sign in, right?

23 **A.** And I hope it's valuable to users as well.

24 **Q.** And Google takes a lot of steps to encourage users to  
25 sign in, right?

1           A. I think the most natural scenario is people signing  
2 in through Gmail without which they don't access their e-mail  
3 or calendar or documents. So that is by far the biggest  
4 source of sign ins.

5           Q. But if you're searching on Google.com and you haven't  
6 signed in, you're pretty likely to see a prompt, a pop-up  
7 prompt nudging you to sign in, correct?

8           A. Actually, I don't know that because I've always  
9 remained signed in.

10          Q. Fair enough. You're a good employee. Back to signed  
11 out users for a minute.

12          **THE COURT:** Let me assure you, you do get a prompt. Go  
13 ahead.

14 **BY MR. HAFENBRACK:**

15          Q. Thank you, Your Honor.

16          For signed out users, Dr. Raghavan, Google collects and  
17 logs search history by default, and ties that search history  
18 to a unique identifier that's created by Google, correct?

19          A. So for signed out users, so we maintain a log and it  
20 is tied to the user without their identity.

21          Q. It's tied to a unique cookie that Google creates for  
22 that browser or that device, right?

23          A. For that browser at that time, yes.

24          Q. Let's put up UPXD17, another demonstrative. Thank  
25 you. And this is Google's privacy policy that is available

1 online. You see in the bottom left it says  
2 policies.google.com/privacy?

3 A. Yes.

4 Q. And Google publishes its privacy policies for anyone  
5 to see, right?

6 A. Yes.

7 Q. And in the second paragraph there, the privacy policy  
8 reads: "When you're not signed into a Google account, we  
9 store the information we collect with unique identifiers tied  
10 to the browser, application or device you're using."

11 Do you see that?

12 A. I do.

13 Q. And that's an accurate statement, correct?

14 A. It is.

15 Q. And the unique identifier that Google creates, is  
16 something called a Zwieback cookie?

17 A. I don't remember the names. We have these cookies,  
18 so that could be what it's still called. I think way back  
19 many years, when I first heard about these things, they were  
20 called Zwieback cookies.

21 Q. Okay. And for the court reporter, that's  
22 Z-W-I-E-B-A-C-K.

23 You see in the next sentence here on the privacy policy  
24 that one of the things that Google does with that uniquely  
25 device identified data for signed out users is to use it to

1 help target ads to them, correct?

2 A. Based -- so such as preferred language and relevant  
3 search ads based on recent activity.

4 Q. Google uses the search data it collects by default  
5 from signed out users to inform personalized advertising to  
6 that device, right?

7 A. It does.

8 Q. Is that a yes?

9 A. Yes.

10 Q. Am I correct that Google doesn't ask or prompt signed  
11 out users whether or not they want Google to log their  
12 searches when they're signed out?

13 A. Let me make sure I understood. Do we prompt people  
14 asking whether they want that logging to happen?

15 Q. Yes, sir.

16 A. Again, I'm not sure I know, because I haven't been a  
17 signed out user in a long time. But I'm not aware of such  
18 prompting.

19 Q. Now let's turn to signed in users, okay.

20 MR. HAFENBRACK: Oh, Your Honor, we'll offer UPXD17  
21 because it's a Google web page.

22 MR. SOMMER: Judge, could we just check it overnight?  
23 Because we just tried to access it and couldn't get it using  
24 the URL, so we'll get back to counsel on that.

25 THE COURT: Okay. So it will be provisionally admitted.

1 (Exhibit UPXD17 provisionally admitted into evidence)

2 **BY MR. HAFENBRACK:**

3 Q. Signed in users. For signed in users, by default  
4 Google logs my search history and ties that search history to  
5 my Google account, correct?

6 A. Correct, signed in.

7 Q. Signed in, yes, sir. Correct?

8 A. Yes.

9 Q. It's a personalized search history, right?

10 A. I wouldn't have used that term, but we do what you  
11 said in the log. We have the identity and the query history.

12 Q. It's not an anonymized dataset like Google uses to  
13 train its algorithms, correct?

14 A. So for -- it depends on which algorithms you're  
15 talking about. But generally, our algorithms that have  
16 training will not use your user ID.

17 Q. They won't use your data that's tied to your Google  
18 account?

19 A. To the Google account, yes.

20 Q. And you mentioned this on your direct. The default  
21 data collection period for signed in users is 18 months,  
22 correct?

23 A. For signed in users, 18 months, yes.

24 Q. Do you know what it is for signed out users?

25 A. It's whenever the cookie, whatever it's called these

1 days, expires. I forget the expiration period at this point.

2 Q. By default, Google logs every query that a signed in  
3 user enters for 18 months, correct?

4 A. Correct.

5 Q. And Google logs for 18 months by default every web  
6 page and every ad that that user clicked on from the search  
7 page, correct?

8 A. Correct.

9 Q. And Google also logs whether the user went back to  
10 the search page after clicking on any link or ad, right?

11 A. Correct.

12 Q. And Google logs by default for 18 months every  
13 location where a signed in user conducted a search, correct?

14 A. Every location, so we hold the IP address. We have a  
15 separate control for your location, and if you turn that off,  
16 then we cannot use your fine-grained location, right. So we  
17 can only use the IP address which gives us coarse-grained  
18 location, so I want to make that distinction.

19 Q. If you opt out of location tracking, you won't --  
20 Google won't track your location, right?

21 A. Your fine-grained location.

22 Q. But by default, Google logs every location where a  
23 signed in user conducts a search for 18 months, correct?

24 A. Yes.

25 Q. If I conduct a search outside the courthouse, Google

1 will log my query and log the location where that query  
2 occurred, correct?

3 A. Yes.

4 Q. And Google doesn't just log clicks and queries for 18  
5 months, it also tracks detailed information about signed in  
6 user's engagement with the Google search page, correct?

7 A. So to make sure I understand, when you say detailed  
8 engagement, what do you have in mind?

9 Q. Fair question. Google knows and logs my swipes,  
10 scrolls, hovers on the search page, correct?

11 A. I don't know that's true for all users, actually.

12 Q. For signed in users, Google -- let's take them one at  
13 a time. Google -- for signed in users, Google for 18 months  
14 logs my swipes and scrolls on the search page, correct?

15 A. I don't know that for a fact. I don't recall,  
16 actually.

17 Q. Do you have any reason to doubt that?

18 A. No.

19 Q. And it ties that activity to my Google account,  
20 correct?

21 A. Correct.

22 Q. Now, Dr. Raghavan, Google implemented the 18-month  
23 default collection period in 2019, right?

24 A. I don't remember the date, but somewhere in that  
25 vicinity.



1 Q. It was right before you took over as head of Search,  
2 right?

3 A. I think so.

4 Q. And before that, from Google's founding up until  
5 2019, Google collected search history indefinitely, correct?

6 A. As I think most search engines continue to do.

7 Q. Forever, correct?

8 A. Correct, forever.

9 Q. And before 2019, users had no option to tell Google  
10 to autodelete their search history at set intervals, right?

11 A. That's correct, and we provided it based on user  
12 research that said users wanted it.

13 Q. Users wanted an option, correct?

14 A. Correct.

15 Q. And the research that Google did showed that users  
16 wanted an autodelete that was much less time than the 18  
17 months that Google settled on, correct?

18 A. I don't recall the exact results from the research,  
19 but these questions were explored in the user research for  
20 sure.

21 Q. Half of the people in the user research said one  
22 month; isn't that true, sir?

23 A. I don't recall that.

24 Q. And Google today -- there's an 18-month default, and  
25 there's a dropdown menu where users can change the 18-month

1 default. Are you familiar with that?

2 A. I am.

3 Q. And are you aware it takes 10 clicks for a user who  
4 knows where that is to find that page?

5 A. I'm not.

6 Q. And are you aware that the lowest option, the least  
7 data retention that's available in that screen, is three  
8 months?

9 A. I don't recall that.

10 Q. Now, Dr. Raghavan, Google uses the search history  
11 that it collects from users to serve personalized ads to  
12 those users, correct?

13 A. Correct.

14 Q. And Google serves personalized ads to users based on  
15 their search history by default, correct?

16 A. By default, with the option of turning it off.

17 Q. And Google uses search history for personalized ads  
18 both on and off search, right?

19 A. Help me with that, please. What do you mean by on  
20 and off search?

21 Q. One category Google uses user search history to  
22 personalize ads on the Google Search results page, right?

23 A. Yes.

24 Q. And another category Google uses user search history  
25 to personalize ads when they're on YouTube, Gmail, the

1 Discover product, correct?

2 A. I see, yes.

3 Q. And so, as an example, if I'm -- if I type "need a  
4 plumber now," and I've been searching for a plumber on the  
5 Google search page, I might get an ad for a plumber when I'm  
6 watching videos on YouTube, right?

7 A. Yes.

8 Q. Dr. Raghavan, as head of Google Search today, you  
9 would sign off to any major change to Google's privacy  
10 policies, fair?

11 A. Any major change, yes.

12 Q. And before implementing a privacy change or a privacy  
13 enhancement, you would consider whether that change will  
14 result in more or less queries for Google, right?

15 A. That's not the primary thing I would look at. Did  
16 you literally mean more or less queries? Because the first  
17 thing I would look at is the impact on the user's experience  
18 before I looked at that question.

19 Q. At least one of the considerations in whether you'd  
20 approve a privacy enhancement is whether that enhancement led  
21 to less or more queries for Google, yes or no?

22 A. One of several considerations, yeah.

23 Q. Yes?

24 A. Yes.

25 Q. And in considering whether to sign off on a potential

1 privacy enhancement for Google Search, you would consider  
2 whether Google is losing queries to any rival on the basis of  
3 privacy, correct?

4 A. So just to make sure I understood the complete  
5 question, is one of the considerations how well users are  
6 responding to other search engines? Yes.

7 Q. The question is --

8 A. Please.

9 Q. -- in considering whether to sign off on a potential  
10 privacy enhancement for search, you would consider whether  
11 Google is losing queries to any rival, correct?

12 A. If it is relevant to the privacy proposal, yes.

13 Q. You discussed with your counsel the discussions that  
14 were going on in and around June 2019 about privacy messaging  
15 by DuckDuckGo, and whether Google should respond to that?

16 A. Yes.

17 Q. Let's take a look at UPX500. Dr. Raghavan,  
18 Mr. Sommer showed you a different fork of this e-mail, which  
19 was UPX501. This one has the same first e-mail from Cory  
20 Ondrejka, so I'm going to ask you a few questions about this  
21 one, and then I'm going to ask you a few questions about 501,  
22 okay?

23 A. Is there a paper form of this I can look at?

24 Q. Yes, there is, it should be in your binder there.

25 A. One moment, please.

1 Q. This 500's in evidence, Your Honor.

2 This is an e-mail exchange between you and Cory Ondrejka.

3 Do you see that?

4 A. Yes. One moment, please.

5 Q. Sure, take your time.

6 A. Okay.

7 Q. E-mail chain between you and Cory Ondrejka, correct?

8 A. Correct.

9 Q. And Mr. Ondrejka was a VP at Google?

10 A. Yes.

11 Q. And you see, if you look in sort of the first couple  
12 of paragraphs of Mr. Ondrejka's e-mail to you, he mentions  
13 that -- he talks about the DuckDuckGo discussions.

14 That's what you discussed on your direct testimony,  
15 right?

16 A. Correct.

17 Q. And he says: "DuckDuckGo is having a successful  
18 marketing moment." Do you see that?

19 A. I do.

20 Q. And that was around attacking Google on privacy in  
21 the public, right?

22 A. They were insinuating that we weren't private enough.

23 Q. And you see Mr. Ondrejka -- we'll zoom down to his  
24 proposed action items, which is just below. And he  
25 references a Kathy, and that's Kathy Edwards, right?

1           A. Kathy Edwards.

2           Q. And she was -- Ms. Edwards was one of the employees  
3 at Google working on privacy and trust issues around this  
4 time, right?

5           A. At that time, yes.

6           Q. And Your Honor, we have designated deposition  
7 testimony from Ms. Edwards.

8           And you see, Dr. Raghavan, the first action item there  
9 from Mr. Ondrejka is about gathering data around users  
10 switching between Google and DuckDuckGo. Do you see that?

11          A. Yes.

12          Q. And you see he asks whether users are migrating to  
13 DuckDuckGo, and whether there's data you can leverage to  
14 better understand that, right?

15          A. Correct.

16          Q. Let's look at your e-mail at the top of the string  
17 back to Mr. Ondrejka. I want to ask you in particular about  
18 your point number two.

19          A. Okay.

20          Q. And you asked for a study analogous to what impact is  
21 DuckDuckGo having on our search volume. Do you see that?

22          A. I have asked for that.

23          Q. You saw that. And the very detailed longitudinal  
24 study you mentioned there refers to the Project Charlotte  
25 analysis we discussed earlier on, right?

1           A. I expect it does.

2           Q. And what you were suggesting here was that before  
3 Google enacted any response to DuckDuckGo in response to this  
4 messaging campaign, you wanted to see data on whether Google  
5 was actually losing queries to DuckDuckGo, right?

6           A. I wanted to see data.

7           Q. And you wanted to see data on whether Google was  
8 losing queries to DuckDuckGo, right?

9           A. I wanted to see data, correct.

10          Q. You wanted to know if it was just a PR problem or if  
11 it was actually a query loss problem, right?

12          A. Correct.

13          Q. Let's look at 501, the one that your counsel showed  
14 you. This, again, has the same sort of base e-mail from  
15 Mr. Ondrejka, and there's a different fork above it. I want  
16 to direct your attention to the Ben Gomes e-mail.

17          A. The e-mail from Ben?

18          Q. Exactly, from Mr. Gomes.

19          A. Okay.

20          Q. Your Honor, I think we'll be hearing from Mr. Gomes  
21 next week.

22                 Mr. Gomes was a senior vice president or a vice president  
23 in search at this time; is that right?

24          A. That's correct.

25          Q. Do you know which it was?

1           A. He was -- oh, you were asking me his title?

2           Q. Yeah, well, general.

3           A. Sorry, senior vice president for search.

4           Q. Okay. He was head of search at this time?

5           A. That's correct.

6           Q. And you recall that during these DuckDuckGo  
7 discussions, Mr. Gomes, among a few others, was an advocate  
8 for making a product change in response to DuckDuckGo, right?

9           A. Correct.

10          Q. And it was the view of Mr. Gomes, along with Nick  
11 Fox, another VP in the search department, that if Google  
12 didn't take action you'd lose queries, right?

13          A. Correct.

14          Q. And you disagreed with that, right?

15          A. I wanted to see more data before agreeing with that  
16 conclusion.

17          Q. Let me put it this way: You weren't convinced with  
18 their case, right?

19          A. That's correct.

20          Q. You wanted to see more evidence?

21          A. Correct.

22          Q. Let's take a look at your e-mail at the top. And  
23 this is the one that your counsel spoke with you briefly  
24 about. And you send, I think it's fair to characterize, a  
25 sharply worded response to Mr. Gomes. Do you agree with



1 that?

2 A. It's likely more sharply worded than I might like to.  
3 I'm generally mild mannered, but yes.

4 Q. You were making your point very clearly?

5 A. Sharply.

6 Q. Let's take a look at the first two bullets in your  
7 e-mail. You say: "I agree that there's something worth  
8 exploring in this space of private search."

9 And the space of private search would be offering search  
10 options that have enhanced privacy protections, right?

11 A. Correct.

12 Q. You write: "But the working teams have to do much  
13 more careful work before wasting our valuable time," correct?

14 A. Correct.

15 Q. And the much more careful work you had in mind there  
16 was similar to the query loss data that teams had done around  
17 Amazon previously, right?

18 A. That's one instance of how it could manifest itself,  
19 but really what I wanted was thorough analysis.

20 Q. The second bullet that's highlighted on the screen  
21 says: "I want to see evidence that there's a real impact on  
22 Google users attributable to this factor." Do you see that?

23 A. I do.

24 Q. And the factor there would be privacy or privacy  
25 messaging, right?

1           **A.** But -- I agree that the sentence is sort of left  
2 incomplete. But the fact there would specifically be the  
3 features that DuckDuckGo put forth can be attributed to those  
4 and impact on our users.

5           **Q.** Understood. And one more e-mail from you. I think a  
6 couple lines down, there's a bullet point that starts with:  
7 "I disagree with the methodology that consists of conflating  
8 people care increasingly about privacy. DuckDuckGo is making  
9 a lot of noise about it. Sundar mentioned it in the IO. All  
10 true statements. Then concluding that this needs a product  
11 change."

12           Do you see that?

13           **A.** Yes.

14           **Q.** And the reference to Sundar is Mr. Pichai, the CEO?

15           **A.** Correct.

16           **Q.** And the IO is a big conference Google does every  
17 year?

18           **A.** Correct.

19           **Q.** And the CEO had mentioned privacy as a focus at the  
20 2019 conference; is that right?

21           **A.** I vaguely recall he did.

22           **Q.** Okay. And when you said all true statements, you  
23 meant that you thought it was true, that people do care  
24 increasingly about privacy, right?

25           **A.** I do -- I did, sorry.

1 Q. But that's a separate question, people caring about  
2 privacy, from whether Google needed to enact a product change  
3 to prevent query loss to DuckDuckGo, right?

4 A. That one had to make a product change in light of all  
5 of the above.

6 Q. You can put this one -- take this one down.  
7 Subsequent to this e-mail exchange in 2019, Dr. Raghavan,  
8 Google has not run any studies or surveys, to your knowledge,  
9 on whether -- to follow up on whether Google is losing  
10 queries to DuckDuckGo, correct?

11 A. I don't recall any.

12 Q. You don't recall any such studies?

13 A. I don't recall.

14 Q. And as head of Google Search, you could ask for such  
15 a study or survey, correct?

16 A. I could ask for such a study.

17 Q. And you haven't done that, correct?

18 A. No.

19 Q. Dr. Raghavan, you have referred to DuckDuckGo search  
20 engines that attack Google on privacy as, quote, ankle  
21 biters, unquote, correct?

22 A. I may have used that unfortunate term.

23 Q. Okay. That's a yes?

24 A. Yes.

25 Q. The Court has heard testimony from a couple witnesses

1 previously in this trial about incognito mode, and  
2 particularly how it relates to browsers.

3 You're familiar with incognito mode, correct?

4 A. It has different semantics in different places, but  
5 yes -- the general idea, yes.

6 Q. And Google offers an incognito mode for the Chrome  
7 browser, right?

8 A. For Chrome, and separately for Maps where it means  
9 something else.

10 Q. And I want to ask you about something slightly  
11 different, which is incognito mode for Google Search, okay?

12 A. Okay.

13 Q. And you -- okay, strike that.

14 Today, Google doesn't have a generally available  
15 incognito mode for search, correct?

16 A. That's correct.

17 Q. But around the 2019 timeframe we were discussing,  
18 Google did consider offering an incognito option for  
19 Google.com, right?

20 A. And beyond, actually, yes.

21 Q. And beyond 2019 continued to consider it?

22 A. Yes.

23 Q. And what Google contemplated was a standalone search  
24 site where incognito mode would be the default, right?

25 A. Yes.

1           Q. And it would have -- and that proposal, had it been  
2 enacted, would have offered users an option for searching  
3 where Google would anonymize the user's data and never log  
4 it, right?

5           A. Correct.

6           Q. And Google never adopted that proposal, correct?

7           A. Correct.

8           Q. And one of the concerns was if Google adopted that  
9 proposal, users would pick it and Google would lose billions  
10 of dollars in revenue, correct?

11          A. That was only one of the concerns, yes.

12          Q. But that was one of the concerns, correct?

13          A. Yes.

14          Q. And Google could offer an incognito mode for Google  
15 Search if it wanted to, right?

16          A. It's not as simple as that. Part of our challenge is  
17 we already have two incognito modes in our products, and  
18 we've had fairly vigorous debates about how not to add a  
19 third incognito mode that means something else. So one of  
20 the things we are trying to do is figure out how to reconcile  
21 this variance.

22          Q. But certainly as a technical matter, and as a matter  
23 of priority, if Google wanted to, it could put a little  
24 toggle on the Google.com search bar that let people click on  
25 incognito mode if they wanted to?

1           A. As a technical matter, yes. That doesn't make a good  
2 product design.

3           Q. And you could launch a separate search site, like  
4 you've discussed in 2019 and beyond, for incognito mode?

5           A. Again, that may not be the product design, but yes.

6           Q. And similar to Google.com, Dr. Raghavan, Google does  
7 not offer an incognito option for the search widget, the  
8 Google widget on Android devices; is that right?

9           A. We do not offer an incognito mode in search, correct.

10          Q. Google is the default search engine in Safari, yes?

11          A. It's whatever the user sets, but yes.

12          Q. Out-of-the-box?

13          A. Out-of-the-box.

14          Q. And if I enter a query into the Safari query bar,  
15 browser bar, using the default settings with Google as the  
16 default, that query goes to Google, right?

17          A. That query goes to Google.

18          Q. And for those users -- Safari users conducting  
19 default searches using all the default settings, Google  
20 doesn't offer an incognito mode for them either, correct?

21          A. Correct.

22          **THE COURT:** Mr. Hafenbrack, I can ask you where you are  
23 in your examination?

24          **MR. HAFENBRACK:** I'm switching gears now, so it's a good  
25 time to stop.

1           **THE COURT:** Okay, so why don't we stop for the day and  
2 then we'll pick up tomorrow.

3           Dr. Raghavan, we are going to conclude for the day and we  
4 will resume tomorrow. So we'll look forward to seeing you in  
5 the morning. We'll start at 9:30.

6           **THE WITNESS:** Yes.

7           **THE COURT:** And I'll just ask you not to discuss your  
8 testimony with anyone overnight.

9           **THE WITNESS:** Of course.

10          **THE COURT:** Thank you, sir. And you can just step  
11 outside, thank you.

12          (Witness not present)

13          **THE COURT:** I'm just trying to get a sense of tomorrow.  
14 We have Dr. Raghavan. How much longer do you think you'll  
15 be, Mr. Hafenbrack?

16          **MR. HAFENBRACK:** I would say around an hour, Your Honor.

17          **THE COURT:** And the States?

18          **MR. KAUFMANN:** Half hour approximately.

19          **THE COURT:** Okay. How does that put us in terms of  
20 getting to Dr. Fox tomorrow, Professor Fox?

21          **MR. SCHMIDTLEIN:** He will be here prepared to begin his  
22 testimony.

23          **THE COURT:** Okay. And I assume -- well, let me -- is it  
24 still the case that Mr. Pichai is scheduled for Monday?

25          **MR. SCHMIDTLEIN:** That is correct, Your Honor. If we are

1 not concluded with Dr. Fox tomorrow, we would ask that we  
2 take him sort of out of order.

3 **THE COURT:** Sure, that's what I figured. That's what I  
4 wanted to talk about. So at least the plan would be -- look,  
5 it seems unlikely that we would finish Dr. Fox tomorrow, so  
6 we would begin Monday with Mr. Pichai's testimony first thing  
7 in the morning.

8 And with respect to Mr. Pichai's testimony, we might as  
9 well just talk about it now. Is there any anticipation of a  
10 closed session with Mr. Pichai?

11 **MR. SCHMIDTLEIN:** No, we're going to try to work around  
12 it as best we can. There may be some segments where we're  
13 going to have to navigate around it, but our intention and  
14 hope is that we will not have to do that.

15 **THE COURT:** Okay, terrific. I appreciate that. Thank  
16 you. I think that concludes what we need to get done for the  
17 day.

18 Are there any loose ends or anything else we need to talk  
19 about?

20 **MR. GOWER:** Cameron Gower for the United States. We have  
21 designations and objections for the final four witnesses for  
22 our opening case -- or our case-in-chief. And there's a  
23 cover letter here explaining the details on a flash drive.

24 **THE COURT:** Okay. Terrific, thank you.

25 **MR. GOWER:** As with the previous --



1           **THE COURT:** Go ahead.

2           **MR. GOWER:** As with the previous witnesses, the videos  
3 will follow.

4           **THE COURT:** Okay. Terrific, thank you. Just one quick  
5 observation I'd like to make. In terms of the redacting of  
6 documents that are being presented -- and I know the  
7 parties -- let me just first say the parties have worked very  
8 hard to work on redactions in advance of their presentation  
9 in court, so I'm grateful for that.

10           The one thing I would just make an observation is with  
11 respect to numbers -- and I just mean that in a very broad  
12 sense, all numbers are not the same. I think we ought to  
13 just be a little bit more careful about what is being  
14 redacted as a number. You know, just one example that stood  
15 out, as I was looking at things today, you know, the sample  
16 size of one of the surveys, for example, was redacted. That  
17 doesn't need to be redacted.

18           Again, I go back to the market share percentages. Again,  
19 these are -- it may be the case that these are not otherwise  
20 public, but we are operating under different parameters here.  
21 And it is not -- it's fair to say that it's not ultimately a  
22 party's responsibility to do the Hubbard factor weighing, but  
23 I would just ask you all to be more -- to be mindful of that  
24 when it comes to numbers, and that essentially all numbers  
25 are not the same.

1 All right. Thank you, everybody. We will see you in the  
2 morning.

3 (Proceedings adjourned at 5:04 p.m.)  
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I, **Jeff M. Hook, Official Court Reporter,**  
certify that the foregoing is a true and correct transcript  
of the record of proceedings in the above-entitled matter.

October 26, 2023

DATE



Jeff M. Hook

BY MR. HAFENBRACK: [14] 7418/9 7420/20 7423/5 7424/7 7429/14 7431/7 7436/21 7440/4 7441/15 7441/21 7448/2 7455/7 7456/13 7459/1 BY MR. SOMMER: [23] 7345/4 7348/13 7350/17 7357/25 7360/19 7365/3 7366/3 7372/10 7374/24 7385/18 7385/22 7386/5 7388/16 7389/15 7392/13 7393/20 7395/8 7396/12 7399/25 7401/22 7402/3 7406/19 7408/19 MR. GOWER: [3] 7477/19 7477/24 7478/1 MR. HAFENBRACK: [29] 7348/7 7350/3 7350/10 7364/17 7374/14 7374/17 7385/17 7389/7 7389/11 7392/5 7392/7 7393/18 7395/4 7398/12 7399/3 7420/17 7423/3 7430/22 7431/1 7431/4 7440/2 7445/17 7445/20 7445/23 7446/2 7447/16 7458/19 7475/23 7476/15 MR. KAUFMANN: [1] 7476/17 MR. SCHMIDTLEIN: [3] 7476/20 7476/24 7477/10 MR. SOMMER: [36] 7350/14 7374/13 7374/16 7374/20 7388/13 7389/4 7389/10 7395/3 7396/9 7398/16 7398/21 7398/23 7399/6 7399/14 7399/22 7401/11 7401/14 7418/4 7423/1 7423/4 7423/20 7423/22 7429/12 7441/7 7441/10 7445/19 7445/21 7445/24 7446/10 7446/15 7446/23 7447/2 7447/5 7447/9 7447/18 7458/21 THE COURT: [75]	7345/1 7348/9 7350/8 7350/12 7350/15 7357/1 7357/4 7360/5 7364/18 7364/20 7365/19 7371/19 7374/19 7374/22 7385/20 7385/25 7388/12 7388/14 7389/13 7392/11 7395/6 7396/11 7398/19 7398/22 7399/7 7399/18 7399/24 7401/13 7401/15 7401/20 7401/25 7406/4 7407/19 7408/11 7408/18 7418/6 7420/16 7420/19 7423/21 7423/25 7429/13 7430/24 7431/2 7431/6 7436/7 7436/16 7436/20 7440/3 7441/9 7441/12 7441/19 7446/6 7446/14 7446/18 7446/25 7447/3 7447/7 7447/11 7447/23 7454/22 7456/11 7458/24 7475/21 7475/25 7476/6 7476/9 7476/12 7476/16 7476/18 7476/22 7477/2 7477/14 7477/23 7477/25 7478/3 THE WITNESS: [25] 7348/11 7357/3 7357/6 7360/8 7364/19 7364/21 7365/20 7371/23 7386/1 7388/15 7392/6 7406/7 7407/23 7408/14 7424/3 7430/25 7436/11 7436/17 7441/11 7441/17 7441/20 7445/22 7455/1 7476/5 7476/8	0 069 [1] 7435/23 087 [1] 7449/3 093 [1] 7450/16 1 10 [3] 7361/3 7421/6 7463/3 10019 [1] 7343/11 10036 [1] 7342/25 1100 [1] 7342/14 1133 [1] 7342/24 12 [4] 7431/24 7436/25 7443/21 7443/24 12-week [1] 7437/13 122 [3] 7445/21 7445/23 7445/24 126 [2] 7395/7 7438/10 13 [2] 7435/21 7450/15 1300 [1] 7343/4 1301 [1] 7343/10 14th [4] 7439/24 7440/7 7443/16 7443/18 15 [6] 7360/3 7369/23 7402/10 7417/12 7417/13 7453/12 15th [2] 7440/7 7440/10 17 percent [1] 7453/24 18 [10] 7417/22 7459/21 7459/23 7460/3 7460/5 7460/12 7460/23 7461/4 7461/13 7462/16 18 percent [1] 7347/18 18-month [5] 7450/23 7454/14 7461/22 7462/24 7462/25 19 [1] 7396/8 1996 [1] 7428/23 1:20-cv-3010 [1] 7342/4 1:30 [1] 7342/6 2 2 percent [3] 7347/19 7347/20 7347/22 20 [3] 7360/3 7402/10 7402/14 20 percent [1] 7346/15 200,000,000 [1] 7403/7 2000 [4] 7349/20 7351/1 7351/2 7357/12	20001 [2] 7342/18 7343/25 20005 [1] 7342/15 20024 [1] 7343/8 2010 [1] 7448/5 2011 [1] 7448/5 2015 [1] 7348/21 2016 [1] 7403/12 2017 [1] 7403/12 2018 [4] 7395/13 7395/17 7405/12 7419/1 2019 [18] 7389/22 7389/23 7390/8 7390/9 7401/8 7410/14 7431/10 7438/1 7438/3 7461/23 7462/5 7462/9 7465/14 7471/20 7472/7 7473/17 7473/21 7475/4 2019th [1] 7437/25 2020 [10] 7383/24 7388/8 7389/21 7389/23 7390/23 7419/2 7445/12 7448/6 7449/19 7453/2 2020-2021 [1] 7445/13 2021 [5] 7439/24 7439/25 7440/8 7443/16 7445/13 2022 [1] 7401/6 2023 [1] 7342/5 209 [1] 7342/20 20s [1] 7453/21 2200 [2] 7342/24 7342/24 24 [1] 7453/24 24th [1] 7431/10 26 [1] 7342/5 269 [1] 7452/3 28 [1] 7342/7 2:59 p.m [1] 7401/19 3 3,000,000 [3] 7384/17 7384/20 7384/24 3010 [1] 7342/4 3059 [1] 7431/23 3236 [2] 7374/14 7374/16 333 [1] 7343/24 344 [2] 7431/1 7431/9 3:15 [1] 7401/17 3:17 p.m [1] 7401/20 4 400 [1] 7450/11 40th [1] 7343/10 42 [1] 7445/17	441 [3] 7440/11 7440/14 7440/15 4420 [2] 7412/6 7412/9 450 [1] 7342/18 48 [3] 7443/16 7443/21 7443/23 5 500 [2] 7448/16 7448/24 500's [1] 7466/1 501 [2] 7465/21 7468/13 5:04 p.m [1] 7479/3 6 600 [1] 7342/20 60604 [1] 7342/21 680 [1] 7343/8 7 7345 [1] 7344/4 7374 [1] 7344/12 7389 [2] 7344/13 7344/14 7395 [1] 7344/15 7418 [1] 7344/5 7459 [1] 7344/16 747 [2] 7357/13 7357/14 75 [1] 7402/13 7th [1] 7343/4 8 80 [1] 7358/17 80 percent [2] 7346/14 7347/17 80203 [1] 7343/4 811 [1] 7412/10 892 [1] 7453/12 9 90 [3] 7358/17 7358/20 7360/10 99.3 percent [1] 7405/2 9:30 [1] 7476/5 A ability [3] 7364/2 7411/20 7413/23 able [17] 7352/7 7356/23 7359/19 7370/7 7370/25 7378/13 7378/14 7378/18 7378/23 7378/24 7378/25 7379/4 7380/12 7382/22 7387/10 7398/4 7434/13 above [6] 7351/14 7352/23 7376/19 7468/15 7472/5 7480/5 above-entitled [1] 7480/5
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