



Transcript of Dr. David A. Forsyth

Date: May 21, 2025

Case: Samsung Electronics Co., Ltd., et al./Google LLC -v- Eyesmatch Ltd.
(PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

Transcript of Dr. David A. Forsyth
Conducted on May 21, 2025

1 (1 to 4)

1	3
1 UNITED STATES PATENT AND TRADEMARK OFFICE	1 A P P E A R A N C E S
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD	2 ON BEHALF OF PETITIONER:
3 - - - - - x	3 XIRUI ZHANG, Ph.D., ESQUIRE
4 SAMSUNG ELECTRONICS CO., :	4 FINNEGAN, HENDERSON, FARABOW
5 LTD.; SAMSUNG ELECTRONICS :	5 GARRETT & DUNNER, LLP
6 AMERICA, INC.; and GOOGLE : Case Nos. IPR2024-00810	6 Two Seaport Lane
7 LLC, : and IPR2024-00856	7 Boston, Massachusetts 02210-2001
8 Petitioners, :	8 (617) 646-1626
9 v. : U.S. Patent Nos.	9 - and -
10 EYESMATCH LTD., : 8,982,110 and 8,982,109	10 SYDNEY R. KESTLE, ESQUIRE
11 Patent Owner. :	11 FINNEGAN, HENDERSON, FARABOW,
12 - - - - - X	12 GARRETT & DUNNER, LLP
13	13 901 New York Avenue, NW
14 Deposition of DR. DAVID A. FORSYTH	14 Washington, DC 20001-4413
15 Conducted Virtually	15 (202) 408-4241
16 Wednesday, May 21st, 2025	16 - and -
17 12:03 p.m. EDT	17 JOSE VILLARREAL, ESQUIRE
18	18 BAKER BOTTS, LLP
19	19 401 South 1st Street, Suite 1300
20 Job No.: 583015	20 Austin, Texas 78704-1296
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22 Reported by: Debra A. Whitehead	22
2	4
1 Deposition of DR. DAVID A. FORSYTH, conducted	1 A P P E A R A N C E S C O N T I N U E D
2 virtually.	2 ON BEHALF OF PETITIONER:
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22	22

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Conducted on May 21, 2025

2 (5 to 8)

1	C O N T E N T S	5	1	P R O C E E D I N G S	7
2	EXAMINATION OF DR. DAVID A. FORSYTH	PAGE	2	DR. DAVID A. FORSYTH	
3	By Ms. Zhang	7	3	having been duly sworn, testified as follows:	
4			4	EXAMINATION BY COUNSEL FOR PETITIONERS	
5	EXHIBITS MARKED IN TODAY'S SESSION		5	BY MS. ZHANG:	
6	(None Marked)		6	Q Good morning, Dr. Forsyth. Thank you for	
7			7	being here today.	
8	EXHIBITS MARKED IN PRIOR SESSIONS		8	A Good morning.	
9	(Not Attached)		9	Q Could you state your full name.	
10	DEPOSITION EXHIBIT	PAGE	10	A My name is David Alexander Forsyth.	
11	Exhibit 1001 (IPR2024-00856)	92	11	Q Have you been deposed before?	
12	Exhibit 1001 (IPR2024-00810)	96	12	A I have.	
13	Exhibit 1005 (IPR2024-00810)	107	13	Q For how many times?	
14	Exhibit 1005 (IPR2024-00856)	141	14	A I'm not absolutely certain, but I think	
15	Exhibit 1006 (IPR2024-00856)	165	15	it's probably more than ten.	
16	Exhibit 1007 (IPR2024-00810)	124	16	Q Are those in inter partes review	
17	Exhibit 1008 (IPR2024-00810)	133	17	proceedings, or IPR proceedings?	
18	Exhibit 1008 (IPR2024-00856)	168	18	A I'm afraid my memory is poor. The	
19	Exhibit 1009 (IPR2024-00810)	98	19	details would be in my CV. I believe they're	
20	Exhibit 1011 (IPR2024-00810)	160	20	mostly IPR proceedings. I think one proceeding	
21	Exhibit 1016 (IPR2024-00856)	161	21	was in the International Trade Commission and	
22	Exhibit 1040 (IPR2024-00856)	172	22	another was in district court somewhere.	
1	EXHIBITS MARKED IN PRIOR SESSIONS - CONTINUED	6	1	Q And do you remember what those cases are	8
2	DEPOSITION EXHIBIT	PAGE	2	about?	
3	Exhibit 2008 (IRP2024-00856)	75	3	MS. SAPUTO: Objection. Form.	
4	Exhibit 2013 (IPR2024-00856)	14	4	A Only vaguely. I forget cases largely	
5	Exhibit 2013 (IPR2024-00810)	15	5	once they're over.	
6			6	Q And do you recall some of the	
7			7	technologies you were opining on in those cases?	
8			8	MS. SAPUTO: Objection. Form.	
9			9	A I have a very good memory for technology,	
10			10	but no memory of mappings between technology and	
11			11	cases.	
12			12	Q So you have a lot of experience in these	
13			13	depositions, but I just have some general	
14			14	housekeeping questions, if you could bear with me.	
15			15	A Of course.	
16			16	Q And it is important for the court	
17			17	reporter that we do not talk over each other at	
18			18	the same time, and I can be guilty of that. So	
19			19	when I ask a question, please let me finish my	
20			20	question before you answer. And I will do my best	
21			21	to wait until your answer is done before asking my	
22			22	next question.	

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1 Is that okay? 2 A I will try to do that. 3 Q And you also need to give audible answers 4 instead of simply nodding your head so the court 5 reporter can record your answers. 6 Is that okay? 7 A I will do that. 8 Q And if at any time you do not understand 9 a question, please let me know. I will do my best 10 either to rephrase or make my question clear. 11 If you answer a question, I will assume 12 that you understood the question. 13 Is that okay? 14 A I will do that. 15 Q And if you ever feel like you need to 16 take a break, please let me know. But if there is 17 a question pending, please finish answering that 18 question before we take a break. 19 A I will do that. I will stick to that. 20 Q Thank you. 21 I have some questions regarding preparing 22 for this deposition. What did you do in	11 1 not sure how many times I met with them in 2 general. 3 Q So you have met with them in two meetings 4 to prepare for this deposition. Correct? 5 A I believe that's correct. 6 Q And how long was each meeting? 7 A I'd have to look at logs, but each 8 meeting was multiple hours. 9 Q Are those on separate days? 10 A They were on separate days. 11 Q And when were those days, do you 12 remember? 13 MS. SAPUTO: Objection. Form. 14 A I believe the attorneys and I met on the 15 13th of May and I believe the 14th of May. 16 Q Have you spoken to the inventors of the 17 patents you're opining on? 18 MS. SAPUTO: Objection. Form. 19 A I have not. 20 Q In preparing for this deposition, have 21 you reviewed any document not provided to you by 22 counsel?
10 1 preparation for this deposition? 2 A I read my declaration for the '109 and 3 '110 patent. I read the patents, I read the art, 4 I refreshed my memory of Dr. Karam's declarations. 5 I spoke with the attorneys in the case. I believe 6 that's it. 7 Q Thank you, Dr. Forsyth. 8 And you said you spoke with the attorneys 9 in this case? 10 A I believe I said that, yes. 11 Q And can you identify those attorneys for 12 me? 13 A Mr. Nelson and Ms. Saputo are the people 14 I spoke to. 15 Q And how many times have you meet to 16 discuss? 17 MS. SAPUTO: Objection. Form. 18 A How many times did I meet with the 19 attorneys in general, or to prepare for the 20 deposition? 21 Q For preparing for this deposition. 22 A I believe there were two meetings. I'm	12 1 A Any document not provided to me by 2 counsel? I have no memory of reviewing any 3 document not provided by counsel. 4 Q Did you speak to anyone else in preparing 5 for this deposition? 6 MS. SAPUTO: Objection. Form. 7 A I did not. 8 Q So you understand that today your 9 testimony will be part of two IPR proceedings? 10 A I do. 11 Q One of those IPR proceedings is IPR 12 Number IPR2024-00856, involving U.S. Patent Number 13 8,982,109. Correct? 14 A I have no memory of the numbers of the 15 IPR proceedings. I know that patent '109 is in 16 suit in the proceeding. 17 Q Okay. And I can represent to you that 18 Case Number is IPR2024-00856. 19 So if I refer to that as the '109 IPR, do 20 you understand what I'm talking about? 21 A I do. 22 Q And the second IPR case is IPR2024-00810,

1 involves U.S. Patent Number 8,982,110. 2 A Again, I have no memory of the numbers of 3 the IPR proceedings, but I know that the patent 4 982,110 is in suit. 5 Q And if I refer to that as the '110 IPR, 6 do you understand what I'm talking about? 7 A I do. 8 Q And Dr. Forsyth, who retained you for 9 these IPRs? 10 A I'm sorry, I think I missed a word. Can 11 you repeat that again? 12 Q Who retained -- 13 A Who retained? I believe -- well, I have 14 no memory of the details of the letter, but I was 15 contacted by Tensegrity, and I believe it is the 16 usual arrangement that I am retained by and work 17 for their clients, but work with Tensegrity. 18 Q Have you worked with Tensegrity before? 19 A I don't think so. Again, the details 20 would be in my CV. 21 Q Give me one second. I would like to 22 introduce a document.	13 15 1 A It certainly appears to be, yes. 2 Q And is it okay for me to refer to this as 3 your '109 declaration? 4 A I will understand what you're referring 5 to if you say that. 6 Q And if you could turn to Page 206 of this 7 document. Sorry. It's marked as 206 of the 8 stamped exhibit, but in your document is also Page 9 198. 198. 10 A I have that page. 11 Q And can you confirm that is your 12 signature on this page? 13 A That is my signature. 14 MS. ZHANG: And now we'll introduce 15 another document. 16 (Exhibit 2013, IPR2024-00810, previously 17 marked, not attached.) 18 Q Okay, I've uploaded the second document. 19 This is Exhibit 2013 in the '110 IPR. 20 A 2013 in the '110 IPR. I have that 21 document. 22 Q And if you could turn to Page 98 of
14 1 (Exhibit 2013, IPR2024-00856, previously 2 marked, not attached.) 3 Q I have uploaded a document which is 4 Exhibit 2013 of the '109 IPR. 5 A Where do I expect to see that document? 6 That's in the Planet Depos link? 7 Q Yes. Do you have the link for 8 downloading the exhibit? 9 A I have the link. Currently my -- oh, 10 here we are, I have the document. 11 Q Great. Can you open it? 12 A Do I open it in the link or should I open 13 it in Acrobat? 14 Q I think either way. If you could open it 15 and see the whole document. 16 A I will open it and look at the whole 17 document. 18 Q Let me know if you can open it. 19 A I have the document, and it's open. 20 Q And can you confirm this is the 21 declaration you provided in the '109 IPR 22 proceeding?	16 1 exhibit, or Page 94 of this document. 2 A I am at that page. 3 Q Can you confirm that's your signature on 4 this page? 5 A I can confirm that's my signature. 6 Q Thank you. If we could turn to 7 Attachment 1 of your '109 declaration, please. 8 A The '109. I am going to check I'm at the 9 right declaration. Attachment 1. I am at that 10 attachment. 11 Q And this attachment is a copy of your CV. 12 Right? 13 A That's correct. 14 Q And can you confirm all the information 15 in this CV is correct? 16 A I believe it's correct. It's possible 17 that I've left out a paper. I've published quite 18 a lot of papers. There might be small errors, but 19 I believe it's essentially correct. 20 Q And this document says you're currently 21 employed by University of Illinois. Correct? 22 A That's correct.

17 1 Q Are you with the computer science 2 department? 3 A We -- I am -- the organization I am with 4 has just changed names. It is now the Siebel 5 School of Computing and Data Science. It used to 6 be the computer science department. 7 Q And your position is full professor in 8 this department? 9 A I am full professor and 10 Fulton-Watson-Copp Chair. 11 Q And you have been in the position of full 12 professor since 2004. Correct? 13 A That's correct. 14 Q You have been in the position of 15 Fulton-Watson-Copp Chair since 2014. Correct? 16 A That's correct. 17 Q And you also provide consulting services. 18 Correct? 19 A That's correct. 20 Q For how long have you been providing that 21 services? 22 MS. SAPUTO: Objection. Form.	19 1 considered? 2 MS. SAPUTO: Objection. Vague. 3 A In -- this is a question that invites a 4 long answer. I'll try to be brief. And then if 5 you want expansion, I'll do so. 6 In the various patents under discussion, 7 both those in suit and those asserted against the 8 patents-in-suit, there are a variety of concepts 9 of virtual mirror that are elucidated. 10 Q Based on your review, what do you 11 understand a virtual mirror to be? 12 MS. SAPUTO: Objection. Vague. 13 A I understand that in certain -- I have 14 not been asked for any construction of the term 15 "virtual mirror." And I would need to think 16 fairly carefully to come up with a good and 17 precise construction. 18 In both the '109 and the '110 disputes, I 19 understand that the District Court has supplied a 20 construction, and I've applied that. 21 Q You mentioned you have read a series of 22 patent papers on virtual mirrors. What are those
18 1 A Well, looking at my CV, on and off since 2 1998. And I believe the CV to be correct. 3 Q What percentage of your work time do you 4 spend on the consulting services? 5 MS. SAPUTO: Objection. Form. 6 A Well under 20 percent. The university's 7 rules require that I do no more than eight hours a 8 week in the nine months of outside summer, and I 9 usually don't hit that limit. 10 Q Outside of the nine month, how many hours 11 do you spend on the consulting services? 12 A It does depend on the year. In the past 13 academic year, last summer was quite busy. 14 Usually not very much. 15 Q And are you familiar with virtual 16 mirrors? 17 MS. SAPUTO: Objection. Vague. 18 A Am I familiar with virtual mirrors? I've 19 seen, I've read a series of patents and papers 20 that purport to create virtual mirrors of one or 21 another form. 22 Q What forms of virtual mirrors have you	20 1 patents and papers? 2 A From memory, '109 describes a form of 3 virtual mirror. '110 describes a form of virtual 4 mirror. I believe Rosenberg describes a form of 5 virtual mirror. I believe Haan describes a form 6 of virtual mirror but makes some significant 7 errors in projective geometry in doing so. I 8 think Francois describes a form of virtual mirror. 9 There are a variety of documents referred 10 to that do so. Those are the ones I can remember 11 off the top of my head. 12 Q And do those documents describe the 13 virtual mirror display image of a person like a 14 conventional mirror? 15 MS. SAPUTO: Objection. Vague. 16 A Wow. Each of those documents describes 17 their own concept of a virtual mirror. Those 18 conceptions I think vary somewhat between 19 documents. 20 In each of -- let's see. In each of the 21 documents that I named, at least part of a 22 present -- of a person is shown in the mirror.

21 1 Although I think -- let's see. Francois -- 2 Francois doesn't show a whole body; he shows a 3 face. As to the others, I don't recall if they 4 show all of the body or any part of it. 5 Q When did you become familiar with such a 6 virtual mirror concept? 7 MS. SAPUTO: Objection. Vague. 8 A I learned projective geometry in the late 9 '80s. Part of that is an understanding of what 10 mirrors do. The various conceptions of virtual 11 mirrors that appear in the different papers in the 12 art, in detail I became familiar with those only 13 when I started reading those papers. 14 Have I seen the idea after I learned 15 about projective geometry and before I was engaged 16 in this case, probably. But I've got no active 17 recall of particular instances. 18 Q So is it fair to say you read those 19 documents disclosing virtual mirrors for this 20 case? 21 A The document -- 22 MS. SAPUTO: Objection. Vague.	23 1 somewhere else. But I have no detailed recall of 2 a MeoMi virtual mirror. 3 Q Earlier you said part of your 4 understanding of what mirrors you learned 5 projective geometry in the late '80s. 6 A I did. 7 Q Why do you need to learn projective 8 geometry to understand what mirrors do? 9 MS. SAPUTO: Objection. Form. 10 A I don't believe I would claim that you 11 need to learn projective geometry to understand 12 what mirrors do. But it's certainly a good way of 13 describing what mirrors do. And it's helpful in 14 avoiding mistakes in mirror geometry, which are 15 fairly common in the literature. 16 Q Are there any principles for mirror 17 geometry? 18 MS. SAPUTO: Objection. Vague. 19 A I would -- I think of mirrors as a fairly 20 straightforward application of projective 21 geometry. I would regard projective geometry as 22 the principles, but you can understand the
22 1 A The documents I named are the documents I 2 read for this case. 3 Q Have you ever designed a virtual mirror? 4 MS. SAPUTO: Objection. Vague. 5 A Have I ever designed a virtual mirror? I 6 have not. 7 Q Have you heard of virtual mirror MemoMI? 8 (Clarification by the court reporter.) 9 MS. ZHANG: I will rephrase that 10 question. 11 Q Have you heard of a MemoMi memory mirror? 12 MemoMi spells as M-E-M-O-M-I. 13 A I believe that MeoMi is a term that 14 appears in at least one, possibly both of the two 15 patents. But apart from that, no. 16 Q Which two patents? 17 A Memory tells me that the term "MeoMi" 18 appears somewhere in either the '109 or the '110 19 patent. But you're asking me questions about 20 documents I read. I read a fairly large number of 21 documents in this case, and I have a memory of 22 encountering that term. So it may have been	24 1 geometry of mirrors without a very deep 2 understanding of projective geometry. 3 Q Can you give us an example of the 4 projective geometry involved in mirror symmetry -- 5 or sorry, the mirror images? 6 MS. SAPUTO: Objection. Vague. 7 Objection, calls for -- 8 A It may -- yes, I can give an example. 9 The question is whether you want one. 10 It would be easier if I could draw. 11 Q That's okay. If you could just describe 12 an example of how projective geometry applies. 13 MS. SAPUTO: Objection. It's vague. It 14 calls for an incomplete hypothetical. Can we tie 15 this to something in his declaration? 16 MS. ZHANG: So this deposition and the 17 declarations are about virtual mirrors. And 18 Dr. Forsyth mentioned that he understood 19 projective geometry for virtual mirrors, and we 20 are asking about an example of how that projective 21 geometry works in virtual mirror. 22 A So --

25 1 MS. SAPUTO: Is there a question there, 2 Counsel? I still think, you know, you need to -- 3 you need to direct this to his declaration. He's 4 written a declaration. Please address your 5 comments and questions to his declaration. 6 MS. ZHANG: Yes, we will look at the 7 declaration, but right now we are asking about his 8 background and his understanding of virtual 9 mirrors based on the documents he has read reading 10 to the '109 and '110 patents. And we have a 11 question. We do have a question about how he 12 understood -- sorry. We do have a question how he 13 understood projective geometry principles apply 14 for mirror images. 15 A Perhaps you might restate the question 16 because my memory of the original question is 17 could I give an example of how the projective 18 geometry applied to virtual -- to mirrors. 19 Q Yes. Do you want me to restate the 20 question? 21 A No. The question -- 22 MS. SAPUTO: I'm going to object on	27 1 or closer to the mirror, the size of your image is 2 always the same in the mirror. When you want to 3 look at a detail in your face, you lean your head 4 forward towards the mirror. 5 Q Yeah. So if you could illustrate one or 6 two of these principles here for us, that would be 7 very helpful. 8 MS. SAPUTO: Objection, scope. 9 Objection, also vague. 10 MS. ZHANG: This is within the scope of 11 his declaration and opinions provided within the 12 declarations regarding optical properties of 13 conventional mirror, and this is within the scope. 14 MS. SAPUTO: My objection stands. 15 A Which principles would you like me to 16 illustrate, or just some principles? 17 Q Can you illustrate what you described 18 about the phenomenon that even though you're 19 further away from the mirror, closer to the 20 mirror, the size of your image is always the same 21 in the mirror? 22 A Let me find the relevant spot in the
26 1 scope. If, Dr. Forsyth, you don't need the 2 question restated, then I'm going to object to 3 this question on the basis of scope. 4 You can proceed, if you're able. 5 A I believe the question was could I give 6 an example of how projective geometry applied to 7 mirrors. I can. It is in one of the two 8 declarations where there is an explanation of why, 9 although the actual size of a -- your reflection 10 in a mirror never changes as you move closer to 11 the mirror or further away from it, people move 12 their heads towards a mirror to see greater detail 13 on their face. That is an application of 14 projective geometry. 15 Q You said that people move their heads 16 towards a mirror to see greater detail on their 17 face, and that's based on an application of a 18 projective geometry. Correct? 19 A That's not what I said. 20 What I said was, there is an explanation 21 in the declaration of the phenomenon that even 22 though when you are further away from the mirror	28 1 declaration, because then I will not need to do 2 drawings. 3 The phenomenon is described in -- which 4 declaration is this? It is the '110 declaration, 5 around page, where the page at the bottom right of 6 the page is 25 of 11, and the number on the page 7 is 21. You will see a figure. There is a 8 discussion there of general properties in optical 9 mirror. 10 In the following paragraphs, 60 and 61, 11 60 makes the point that the image of a person 12 looking into a mirror is always approximately the 13 same size, regardless of the person's movement 14 toward or away from the mirror. If the mirror is 15 a perfect plane and a perfect reflector, that 16 approximately is unnecessary. 17 Now, experience teaches that if you move 18 your face towards a mirror, it appears bigger, and 19 that experience may seem to contradict 60. 20 Paragraph 61 explains this effect, which is if I 21 move my face towards a mirror and look at my eye, 22 the size of the iris reflected in the mirror -- so

29 1 about a third of the way down 61 -- does not 2 change, but what I would call the visual angle 3 subtended by the iris does change. It says there 4 the larger fraction of the viewer's retina. 5 What that means is you have the 6 impression that the iris is bigger. That's an 7 application of the principle of projective 8 geometry. There's a Figure on Page 27 of 111, the 9 bottom right things, showing a person closer to 10 and further away from the mirror, and the visual 11 angle subtended by their eye on their body at the 12 mirror. 13 Q So here, based on your description in the 14 declaration and also your testimony just now, do 15 you -- you agree that when a person looks into a 16 mirror, the -- like a conventional mirror, the 17 image will appear to be the same size regardless 18 of user movement towards or away from the mirror. 19 Correct? 20 A For a conventional mirror, assuming the 21 mirror is flat and a perfect reflector and the 22 like, the size of the image of the person in the	31 1 optical properties of conventional mirror is that 2 image appears left-right reversed? 3 A I do. 4 Q And you stated that these optical 5 properties for conventional mirror have been known 6 for millennia. 7 A Is the court reporter happy? 8 I believe I state something of the sort. 9 It's not in this paragraph. 10 Q If you need a paragraph number, it is in 11 Paragraph 240 in your '109 declaration. Can we 12 turn to Paragraph 240 of your '109 declaration. 13 A 240 of the '109 declaration. Where is 14 it? 15 Q This is on Page 85 of your declaration. 16 A I have that paragraph. Where it states 17 that the optical properties of conventional 18 mirrors have been known for millennia. 19 Q Here "the optical properties of 20 conventional mirrors" refers to the same size 21 property, double the distance property, left-right 22 reverse property that you just talked about.
30 1 mirror is the same however far away from the 2 mirror the person is. 3 Q And if I could turn -- if we could turn 4 to the paragraph above these discussions in your 5 declaration on Page 25. 6 A Twenty-five. I see that. 7 Q Of Exhibit -- if you could turn to 8 Paragraph 59, please. 9 A Yes, that's correct, I'm at 59. 10 Q Here you agreed that when a person looks 11 into a conventional mirror, the image will appear 12 to be approximately double the distance that the 13 person standing is from the mirror. Correct? 14 A I stated that. 15 Q And in the paragraph above, Paragraph 58, 16 you said the image of the person looking into the 17 mirror appears left-right reversed. Right? 18 A I do. 19 Q And you said with a conventional mirror. 20 Correct? 21 A That's correct. 22 Q So do you agree that one of the general	32 1 Correct? 2 A It includes those properties, yes. 3 Q Here you used the word "a POSITA." Do 4 you understand what that means? 5 A I believe in the declaration there may -- 6 there is a definition of a -- what I'd expect a 7 POSITA to know, or the training I would expect a 8 POSITA to have had. 9 Q So would a POSITA would have understood 10 that a conventional mirror would include these 11 properties? 12 MS. SAPUTO: Objection. Vague. 13 A A POSITA should certainly have known 14 that. 15 Q If we could go back to Paragraph 13 of 16 your declarations. 17 A Is this '109 or -- 18 Q Yes, the '109 declaration. This is on 19 Page 13 of the exhibit, Page 5 in your 20 declaration. 21 A Yes, I have that Paragraph 13. 22 Q You state that you believe that you are

33 1 considered to be an expert in the field of 2 computer vision, including image analysis. 3 Correct? 4 A I do. 5 Q Can you explain what is computer vision? 6 A I can. Computer vision in general is the 7 field of study that involves capturing, 8 understanding, and transforming and using the 9 information in images, video, Lidar data, range 10 data. It ranges from computational photography 11 where one purely transforms an image, to areas 12 where one attempts to write sentences that 13 describe images or determines the geometry of the 14 objects present in images to areas where one 15 attempts to generate images from random numbers or 16 videos from random numbers. It's an extremely 17 broad field. 18 Q Does this field involve the study of 19 optics for light manipulation? 20 MS. SAPUTO: Objection. Vague. 21 A I'm sorry, did you say like manipulation? 22 Q Light.	35 1 physical object. 2 Q Are you familiar with optics in digital 3 cameras? 4 MS. SAPUTO: Objection. Vague. 5 A Moderately. 6 Q And does computer vision involve the 7 study of image-capturing systems? 8 MS. SAPUTO: Objection. Vague. 9 A A decent fraction of the research 10 literature on image-capturing systems appears in 11 what are thought of as computer vision venues. 12 Most computer vision textbooks, including my own, 13 have discussions of image capture and 14 image-capturing processes in them. 15 So, yes, it does. 16 Q And do those systems use digital cameras? 17 A Some of them do. 18 Q You mentioned that you are moderately 19 familiar with optics in digital cameras. In what 20 way? 21 MS. SAPUTO: Objection. Vague. 22 A Well, I need to write up the basic
34 1 A I'm not familiar with the phrase "objects 2 for light manipulation." 3 Could you perhaps rephrase that? 4 Q Yeah, I can ask the question again. 5 Does the field computer vision involve 6 studying optics for light manipulation? 7 A There's a significant minor computer 8 vision literature using complex or variant optics 9 to either process images or put them in forms that 10 are easier to process. There's a section of 11 vision that attempts to make -- to correct images 12 obtained by nasty optics or bad optics. So I 13 would say yes, a significant chunk of optical 14 processing is under computer vision. 15 Q By "optical processing" do you mean using 16 software processing or hardware processing? 17 A Actually, using optical materials to 18 transform the imaging process in convenient ways. 19 There is a small community of people who 20 try to replace software processing with optical 21 processes, although it's kind of not that active 22 right now, both hardware and software and actual	36 1 principles of how lenses work, how apertures work, 2 how mosaicing, color mosaicing works in digital 3 cameras as part of the textbook. 4 I have done a little bit of work on how 5 one corrects errors caused by very low light in 6 digital camera images. Mostly I'm not directly 7 engaged with digital cameras, but I follow that 8 literature with a moderately careful eye. 9 Q And you mentioned correcting errors 10 caused by low light in digital camera images. Is 11 that through software processing? 12 A These days it's mostly through software 13 processing, yes. 14 Q You mentioned you need to write up the 15 basic principles of how different components work 16 in the digital cameras. 17 Do you work with different -- do you work 18 on different components of digital cameras? 19 A I don't -- 20 MS. SAPUTO: Objection. Vague. 21 THE WITNESS: I'm sorry. 22 A I don't directly do any research into the

37 1 components of digital cameras. I have reasonable 2 familiarity with some of the components in detail. 3 Q Is it fair to say that you're more -- 4 sorry. Is it fair to say that you're more 5 familiar with software processing of camera 6 captured images than hardware components of 7 cameras? 8 A I think that would be fair for some 9 hardware components of cameras, but perhaps not 10 for others. Mostly what I do as research involves 11 software processing, but I am deeply familiar with 12 lens geometry, aperture effects, and a variety of 13 other optical effects in cameras and have moderate 14 familiarity with the image-capture device at the 15 back of the camera. 16 Q Are you familiar with a camera obscura 17 model? 18 A I am familiar with a camera obscura 19 model. 20 Q Is it also known as a pinhole camera 21 model? 22 A Yes, it's sometimes known as a pinhole	39 1 Q Is it the point where parallel light 2 converges? 3 A I'm sorry, could you ask that again? 4 Q Yes. Is the focal point where the 5 parallel light converges? 6 A No. 7 Q So light does not converge at this focal 8 point? 9 A The light -- 10 MS. SAPUTO: Objection. Misstates 11 testimony. 12 Go ahead. 13 A Your question was does parallel light 14 converge at this focal point. And the answer to 15 that question is no. 16 Does light converge or pass through the 17 focal point, light doesn't really -- well, you can 18 think of light as converging through the focal 19 point. But what happens at the focal point is 20 only light that passes through the focal point can 21 get to the back of the camera. You can think of 22 that as converging. No other light is aware of
38 1 camera model. I use the term myself. 2 Q What is this model? 3 A It's a model of an extremely simple 4 optical system. You have a closed volume with a 5 very small hole in it. At the back of that closed 6 volume is either a screen or a image capture 7 device of some form, some chemical, chemically 8 treated materials or a CCD, something of that 9 sort. 10 At any point in the back of the dark box, 11 the only light that can arrive is light that goes 12 through the pinhole at the front. And assuming 13 the pinhole is neither too big nor too small, that 14 light comes from essentially a single point in the 15 world. And the result is that an inverted image 16 of the world appears at the back of the camera 17 obscura or the pinhole camera. 18 I believe there's a figure in one of the 19 declarations. 20 Q What is the focal point for this model? 21 A What is the focal point for this model? 22 In this model the focal point is the pinhole.	40 1 the presence of the focal point. 2 Q Yes. To correct my question, so parallel 3 light does not converge at a focal point? 4 A Parallel light does not converge at the 5 focal point. 6 Q Which in this model is the pinhole? 7 A Oh, the focal point -- in the pinhole 8 camera, the focal point is the pinhole. 9 Q When you move the camera, is it your 10 opinion that you also move the focal point? 11 A That depends entirely on the camera and 12 how you move it. 13 Q If you would move the camera over a 14 linear distance, do you move the focal point? 15 A Ah. Generally if you translate a camera, 16 you also translate its focal point unless you do 17 something to the lens system to prevent that 18 happening. 19 Q Does this camera model has a lens system? 20 A The pinhole camera model does not have a 21 lens system. 22 Q So if you translate the camera, you also

41 1 translate the focal point for this pinhole model. 2 Correct? 3 A If you translate a pinhole camera, you do 4 translate the focal point. 5 Q And this model has an imaging plane. 6 Correct? 7 A Pinhole cameras usually have image 8 planes, yes, that's correct. 9 Q If the camera does not move, if you move 10 the imaging plane to or away from the camera, does 11 it change the magnification of the camera? 12 A I'm sorry, it takes me a moment to 13 interpret that question. 14 I am assuming you are referring to a 15 pinhole camera. 16 Q Yes. 17 A And you are asking if in a pinhole camera 18 the focal point remains fixed and the image plane 19 is translated – it would need to be translated 20 perpendicular to the principal axis. 21 But if you translate it perpendicular to 22 the principal axis, then the image would get	43 1 careful about the effect that actually occurs. 2 The image will get larger or smaller. If 3 that's what you mean by the magnification of the 4 camera changing, then that's correct. 5 Q If the image plane stays and you move the 6 camera along the principal axis towards or away 7 from the image plane, does magnification of the 8 camera change? 9 A Sorry. When you say "move the camera," 10 do you mean move the focal point or move the whole 11 camera? 12 Q In this pinhole model you move the camera 13 with the focal point. 14 A Right. So the question was, if you move 15 the pinhole camera, the whole pinhole camera, does 16 the image on the image plane of the camera get 17 larger or smaller. 18 And the answer is no. A variety of other 19 important effects occur. And those effects are 20 explained I believe in both declarations. 21 Q If you move the pinhole camera away from 22 the image plane along the principal axis, does the
42 1 larger or smaller. 2 Q So if you translate the imaging plane 3 perpendicular to the principal axis towards or 4 away from the camera, the magnification changes. 5 Correct? 6 A I'm afraid I have to correct that. I was 7 in such a muddle by the phrasing of the question. 8 It is not perpendicular to the principal axis, 9 it's along the principal axis, in the direction of 10 the principal axis. 11 Apart from that, if you translate the 12 imaging plane in the direction of the principal 13 axis, the image will get larger or smaller. 14 Q So yes, if you translate the imaging 15 plane along the principal axis towards or away 16 from the camera, the magnification of the camera 17 changes. Correct? 18 A The image will get larger or smaller. 19 Q Does that mean the magnification of the 20 camera changes? 21 A The magnification of the camera is not a 22 conventional term of art. And I'm trying to be	44 1 image get smaller on the image plane? 2 MS. SAPUTO: Objection. Vague. 3 A I'm having trouble interpreting the 4 question. When you say, "move the pinhole 5 camera," if I move the whole camera, then I'm not 6 sure how the image plane is moving independently 7 of the camera. Perhaps you can restate it. 8 Q I see what you mean. If you move the 9 pinhole, the focal point in your view away from 10 the image plane, does the image become smaller on 11 the image plane? 12 A Some parts of the image may get smaller; 13 but a variety of other important effects occur, 14 which are again described in the two declarations. 15 Q What are the other important effects? 16 A There are changes in occlusion between 17 objects. Objects that may have been visible in 18 the first image will – may become invisible in 19 the second. Objects that may have been visible in 20 the first image – sorry, the other way around, so 21 things can go from being visible to invisible or 22 from invisible to visible. Depends on the

45 1 geometry of the scene in front of the camera. 2 Q You said, "it depends on the geometry of 3 the scene in front of the camera." 4 Do you mean 3D geometry? 5 (Clarification by the court reporter.) 6 A 3D geometry. Yes, I mean 3D geometry. 7 Q And could you please turn to Page 29 of 8 the '109 declaration. 9 A Twenty-nine -- 10 Q Thirty-seven of the exhibit, 29 in your 11 declaration. 12 A Thirty-seven. I'm at that page. 13 Q Here you give an example of imaging a 14 coffee shop using the camera obscura model. 15 Correct? 16 A Imaging a coffee shop using a camera 17 model, pinhole model, yes, that's correct. 18 Q And in the next page you show an 19 illustration using a camera taking a picture of a 20 coffee shop. Correct? 21 A That's correct. 22 Q And at this position, the image, if you	47 1 expect there to be some changes around those. 2 Q So if I just want the image the windows 3 facing the camera, do the size of the windows in 4 the image change at these two positions? 5 MS. SAPUTO: Objection. Form. 6 Q Sorry, I can rephrase. 7 Let's say in the configuration of Image 1 8 on Page 38, the size of the window in the image 9 is, has an area of area A. 10 MS. SAPUTO: Objection. Vague. 11 Q I can simplify this. 12 So in the configuration of Image 1, the 13 image of the window has one size, that's the first 14 size. 15 Are you with me? 16 A I understand what you're saying. 17 Q And in the configuration of Image 2 on 18 Page 39, the image of the window has a second 19 size. 20 A Yes. 21 Q Do you agree that a size of the window, 22 the second size of the window, is larger than the
46 1 take an image, you can see the top, the chimney 2 part of the coffee shop. Correct? 3 A That's correct. 4 Q In the image you can also see the window 5 facing the camera. Correct? 6 A That's correct. 7 Q If you could move on to the next page. 8 A I'm there. 9 Q In this example, the pinhole position of 10 the camera moved closer to the coffee shop. 11 Correct? 12 A That's correct. 13 Q And if you take an image of the coffee 14 shop at this position, the chimney wouldn't be in 15 the image. Correct? 16 A That's correct. 17 Q But the windows facing the camera would 18 be in the image. Correct? 19 A That's correct. Although slightly 20 different portions of the windows might be present 21 because of the presence of those brown overlapping 22 frames. I didn't analyze that, but you would	48 1 first size of the window? 2 MS. SAPUTO: Objection. Form. 3 A For this example drawn as it is and for 4 this window, I believe the answer is that you 5 would see the whole window in each image; and that 6 in the second image that window would be bigger 7 than it was in the first image. 8 Q So between these two images, the size of 9 that window changed. Correct? 10 MS. SAPUTO: Objection. Form. 11 A I believe -- I believe in this example 12 between these two images, the size of that window 13 changed, yes. 14 Q Does changing the sizes of the windows 15 appearing in the images change the point of view 16 from which the image appears to be captured? 17 A Is this a question about this scene or a 18 general question? 19 Q For the same scene. 20 A In this specific scene -- 21 Q Yeah, in this specific scene. 22 A -- does changing the size of the windows

49 1 change the position from which the image was 2 captured. No. 3 Q Let me repeat my question. Does changing 4 the sizes of the windows appearing in the images 5 change the point of view from which the images 6 appear to be captured? 7 MS. SAPUTO: Objection. Vague. 8 A So the question is, does changing the 9 size of the windows in the images change the point 10 of view for which the image appears to be 11 captured. The answer to that question is no. 12 Q Why not? 13 A Because you might have changed the size 14 of the images -- sorry, the sizes of the windows 15 in the images by simply scaling the image. 16 Q So does scaling the image change the size 17 of the image -- windows in the images? 18 A Scaling the image would change the size 19 of windows in the images -- will generally change 20 the size of the windows in the images. 21 Q Does scaling the images change the point 22 of view for which the image appeared to be	51 1 through a developing process that makes the 2 picture bigger. 3 Another would be you use a digital sensor 4 at the back of the pinhole camera, and then you 5 scale the image using software. That's a pinhole 6 camera, that's correct. 7 We have been running for an hour and a 8 half now. Perhaps we could stop for a few minutes 9 at some point in the near future? 10 MS. ZHANG: Yes, we can take a break now 11 and then come back to it. 12 THE WITNESS: Okay. 13 (A recess was taken.) 14 BY MS. ZHANG: 15 Q Dr. Forsyth, I asked you a question 16 before. The question is, does changing the size 17 of the windows in the images change the point of 18 view for which the images appear to be captured. 19 MS. SAPUTO: Objection. Form. 20 Q And you answered, No, because you may 21 have -- you might have changed the size of the 22 images by simply scaling the images.
50 1 captured? 2 A Scaling an image does not change the 3 point of view from which the image appears to have 4 been captured, except in a -- no, it does not 5 change the point of view from which the image 6 has -- appears to be captured. 7 Q So in no circumstances does scaling 8 change the point of view from which the image 9 appeared to be captured? 10 A Assuming that the camera is a pinhole 11 camera or a camera with a lens system that 12 substantially simulates a pinhole camera, that's 13 correct. 14 Q Have you performed scaling in this 15 pinhole camera model? 16 MS. SAPUTO: Objection. Form. 17 A Well, there's several things you could 18 do. The simplest is you move the image plane 19 further away from the pinhole along the direction 20 of the principal axis of the camera. 21 Another possibility would be you capture 22 the image on film, and then you pass the film	52 1 Is that correct? 2 A I believe that was the exchange. 3 Q So do you agree scaling the images is one 4 way to change the size of the windows in the 5 images? 6 MS. SAPUTO: Objection. Misstates 7 testimony. 8 A I believe that you can change the size of 9 images -- sorry, of windows in an image by scaling 10 that image. 11 Q Can you change the size of the windows in 12 the images by changing the point of view of those 13 images? 14 MS. SAPUTO: Objection. Vague. 15 A There are certainly circumstances where 16 you can change the size of windows in the images 17 by changing the point of view of that image. Yes, 18 that is -- that's the case. 19 Q So is it fair to say that if the size of 20 the windows change in the images, it could be due 21 to scaling, it can also be due to the change of 22 point of view?

53 1 A It would usually be very easy to 2 distinguish between those two cases because things 3 other than the size of the windows would have 4 changed in different ways if you changed the point 5 of view, as opposed to scaling the image. 6 Q And what are those things? 7 A In the example we looked at earlier of 8 the coffee shop, for example the apparent height 9 of the building has changed and the visibility of 10 the chimney has changed. A variety of other 11 details with change as well. 12 Q In that hypothetical we are imaging the 13 windows facing the camera. Correct? 14 A Are we talking -- so I need to understand 15 which scene you're referring to. The scene we 16 were discussing is the scene in the declaration 17 which showed a coffee shop, part of which were 18 windows. 19 If we're discussing a scene that consists 20 only of windows, the answer may change. 21 Q Yes, I believe when we discuss the sizes 22 of the windows, we're focusing on imaging just the	55 1 out the geometry. 2 If the windows are not parallel to the 3 image plane, then moving towards the window has an 4 effect that is distinct from scaling. 5 Q Yes, if you assume the windows are on a 6 plane facing the camera parallel to the image 7 plane. 8 A Okay. 9 MS. SAPUTO: Objection. Vague. 10 MS. ZHANG: Can I continue? 11 Q Is it fair to say that if the size of the 12 window change between the images, it could be due 13 to scaling? 14 A So -- 15 MS. SAPUTO: Objection. Vague. 16 A -- the windows are on a plane parallel to 17 the image plane, and the size of the windows 18 change in the image, could that be due to scaling? 19 Yes, that could. 20 Q And is it fair to say that if the size of 21 window change between the images, it could be due 22 to change of point of view as well?
54 1 windows facing the camera, not the chimneys. 2 MS. SAPUTO: Objection. Vague. 3 A I'm afraid I need you to be more precise. 4 Are there no other objects in the scene, 5 only windows; or are we talking only about the 6 windows that appear in the scene? 7 Q Yeah, if you could assume that we are 8 just talking about the windows, imaging those 9 windows. 10 A Okay. And then the question is? 11 Q Yeah, let me rephrase that question. 12 If we are just looking at the images of 13 the windows facing the camera, is it fair to say 14 that if the size the window change between the 15 images, it could be due to two things: one, 16 scaling; two, change of point of view? 17 A If the size changes it could be due to 18 two things, one scaling, the other change in point 19 of view? 20 The -- I believe that would also depend 21 on whether the windows were parallel to the image 22 plane, but I'd need to spend a few minutes working	56 1 A In the specific case where the windows 2 are parallel to the image plane and get larger in 3 the image, they could have gotten larger in the 4 image as a result of moving the point of view; but 5 that requires one attend only to the image in the 6 windows and no other portion of the image. 7 Q Let's look at Paragraph 65 of your '110 8 declaration. 9 A Paragraph 65, '110. 10 I see Paragraph 65. It leads, "The key 11 geometric feature of a camera." 12 Q At the bottom of Page 29 of the exhibit, 13 Page 25 of the declaration, you stated, "There is 14 no pure transformation of an image that can 15 reproduce the effect of moving a camera focal 16 point toward or away from a scene." What do you 17 mean by -- sorry. 18 A It's -- the sentence continues, "absent 19 detailed 3D geometric information." 20 Q Thank you. 21 To help me understand this paragraph 22 better, can you explain what you mean by pure

57 1 transformation? 2 A So the intention is, you cannot take an 3 image, and by acting on that image alone, without 4 detailed 3D geometry information about the scene, 5 reproduce the effect of moving a camera focal 6 point away, toward or away from the scene. 7 Q What do you mean by "acting on that 8 image"? 9 A What I mean is transforming only that 10 image and the information in the image, not using 11 any 3D geometry information about the scene. 12 So, for example, in the case of the 13 coffee shop, I'm -- there is no transmission that 14 takes only the image of the coffee shop and no 15 other information and reproduces what happens when 16 the camera focal point moves towards the coffee 17 shop or away from it. 18 If you have a detailed 3D model of the 19 coffee shop, the situation changes. 20 Q By "transformation" do you mean software 21 transformations? 22 A I believe the scope here would include	59 1 I have no way of reconstructing the image in Image 2 1 without knowing something about where the 3 chimney on the coffee shop is, how far away the 4 ruler is, and what the chimney looks like. 5 Q In this example, what would be the 3D 6 geometric information that you need for 7 reproducing the scene? 8 A For going from the image taken from Image 9 2 to the image taken in Image 1, you would need, 10 at the very least, you'd need to know what the 11 section of ruler that used to be invisible and now 12 becomes visible, you'd need to know where that was 13 and what it looked like. You'd need to know where 14 the section of chimney that you could not see but 15 now can see, where that was and what it looked 16 like. 17 There are likely in the scene a variety 18 of other occlusion cases. So if you see the 19 small -- the gray rim around -- sorry, not gray, 20 it's brown. Brown rim around the windows of the 21 coffee shop, that stands out from the facade of 22 the shop. And as a result, it will occlude the
58 1 hardware transformation or any way of rearranging 2 information that is given only the image and no 3D 3 geometric information. 4 This is a point about geometry rather 5 than a point about the competence of software. 6 Q You mean even with hardware or hardware 7 combined with software, you cannot reproduce the 8 fact of moving a camera focal point toward or away 9 from a scene without detailed 3D geometric 10 information. Correct? 11 A That is correct. 12 Q Why is that? 13 A I mean, if you look at the example in 14 Image 1 on Page 31 of the exhibit, you see that in 15 that image the camera sees the top of the chimney 16 of the coffee shop, and it sees the height of the 17 coffee shop to be six units on the ruler. 18 If I move the focal point, the chimney of 19 the coffee shop is now missing, and the height of 20 the coffee shop would now be nine units on the 21 ruler. 22 Assume I am given the image in Image 2.	60 1 bricks on the bottom and on the top in different 2 ways between Image 2 and Image 1. 3 So you would need to know where that 4 stuff was and what the textures for that stuff was 5 as well. 6 Q Does the '109 patent or the '110 patent 7 describe using such 3D geometric information for 8 transforming camera capture image? 9 MS. SAPUTO: Objection. Vague. 10 A I have no detailed recollection of a 11 discussion of 3D information in either patent, but 12 it's possible there's some small discussion. 13 I don't recall recording anything about 14 that point in either declaration. 15 Q Does transformation mapping described in 16 these patents use this type of 3D geometric 17 information? 18 A I think you'd need to allow me to look at 19 the document. I don't want to answer that 20 question from memory. 21 Q Do you recall the types of transformation 22 described in the '109 patent and '110 patent?

61 1 A Do I recall the types of transformation? 2 Probably not all of them. I recall a left-right 3 transformation. I recall a discussion of scaling. 4 I believe there may be a discussion of rotation. 5 There's a discussion of -- in one of the patents 6 there's a discussion of transforming the image 7 such that the -- it was -- sorry, of applying a 8 transformation mapping such that the image appears 9 to have been taken from a different point of view 10 or a different angle, but I don't recall which of 11 the two patents has that transformation in it. 12 I think one of the claims has that 13 language, possibly both. 14 Q And you recall the left-right 15 transformation. Does that transformation 16 described in the '109 and '110 patent use 3D 17 geometric information? 18 A The -- I have no memory of that 19 transformation using 3D geometric information, but 20 I do not have the document in front of me. 21 Q You mentioned you have read the 22 documents --	63 1 patent describe scaling. Correct? 2 A Memory tells me there's a description of 3 scaling in those patents, at least one of those 4 patents. 5 Q And does the scaling described in those 6 patents use any 3D geometric information? 7 A I have no -- whoops. I have no active 8 memory of the scaling using 3D geometric 9 information, but I do not have the document in 10 front of me. 11 I want to shade my answer to previous 12 questions. There is at least -- in at least one 13 of the patents -- this is the peril of answering 14 questions from memory without a document in front 15 of one -- there is a description of adjusting the 16 rate of the transformations -- the rate at which 17 the transformations are applied based on the 18 distance to the user, and that is arguably the use 19 of 3D geometric information. 20 Apart from that, I have no active memory 21 of seeing it there. 22 Q You also mention you recall applying --
62 1 A I have read the documents, yes. 2 Q Correct? Sorry. 3 A I apologize. 4 Q Yeah, I was saying, you mentioned you -- 5 in the beginning of deposition you said you have 6 read these documents in preparation for this 7 deposition. Correct? 8 A Certainly. 9 Q And do you recall the rotation 10 transformation described in the '109 and '110 11 patent use any 3D geometric information? 12 MS. SAPUTO: Objection. Form. 13 A I have no active memory of the rotation 14 transformation using 3D geometric information. 15 But again, I do not have the document in front of 16 me. 17 Q And you mentioned you recall scaling 18 described in the '109 and '110 patent. Correct? 19 (Clarification by the court reporter.) 20 A Can you repeat the question? 21 Q Yeah, I haven't asked a question. 22 You recall the '109 patent and '110	64 1 you recall one of the patents discuss applying a 2 transformation mapping such that the images appear 3 to have been taken from a different point of view 4 or a different angle. 5 Does that transformation mapping, as 6 described in the '109 and '110 patents, use 3D 7 geometric information? 8 MS. SAPUTO: Objection. Form. 9 A A transformation that made an image 10 appear to be taken from a different viewpoint 11 would, in its nature, need to use some form of 3D 12 geometric information somewhere. 13 Q Does the patent describe that 3D 14 geometric information? 15 A I -- 16 MS. SAPUTO: Objection. Form. 17 A I have no active recall of the detailed 18 description of 3D geometric information in either 19 patent. 20 Q And going back to our example of the 21 coffee shop, you were discussing the occlusion 22 fact on the chimney of the coffee shop. Does the

65 1 same effect apply if we are just imaging the front 2 facade of the coffee shop? 3 MS. SAPUTO: Objection. Vague. 4 A This is a question about this coffee shop 5 in these figures? 6 Q Correct. 7 A Is that -- the same effect applies. 8 Q Do you need 3D geometric information for 9 reproducing an image of the front face surface of 10 the coffee shop? 11 MS. SAPUTO: Objection. Vague. 12 Q I can rephrase that question. 13 A Thank you. 14 Q If we are only imaging the facade of the 15 coffee shop, and that facade or that front of the 16 coffee shop is in parallel to the imaging plane, 17 do you need the 3D geometric information to 18 reproduce the fact of moving a camera focal point 19 toward or away from this scene? 20 A So the answer depends on precisely what 21 you mean by "the facade of the coffee shop." 22 My understanding of the facade would be	67 1 And as the camera moves forward, you will see 2 slightly less of the base of the coffee shop, the 3 gray section between the lowest brown bit and the 4 ground and the bit between the brown bit and the 5 roof. 6 Q So if we just look at Image 1, Image 2, 7 assume does the camera positions are as they are 8 in Image 1 and Image 2, the image taken by the 9 camera of the coffee shop in the configuration 10 shown Image 1, does it include the whole facade? 11 A In Image 1, no, it doesn't. 12 Q Does it include the whole window facing 13 the camera? 14 A Let me see. In Image 1 does it include 15 the whole window? Yes, I believe it includes the 16 whole window. 17 Q And in Image 2, in the configuration 18 shown in Image 2, the image taken by the camera of 19 the coffee shop, does it include the whole window 20 facing the camera? 21 A In Image 2, with the focal point where it 22 is, that should include the whole window.
66 1 the area from the ground to the front roof of the 2 coffee shop, where there is geometric relief 3 provided by the brown stuff which sticks out of 4 the facade from the windows. 5 If that is the facade, then you need 6 geometric information because there will be 7 occlusion effects. If it is not, if you're 8 attending only to the windows as the facade, then 9 because they are plane and frontal, then you would 10 nod. 11 Q If we look at the images you have in the 12 declaration, Image 1 and Image 2 -- 13 A I see them. 14 Q -- of the coffee shop, what part of the 15 facade would be occluded between these two images? 16 A Okay. This is very difficult without a 17 way to draw and show the image. 18 But do you see the brown section at the 19 top of the windows and below the windows? That 20 section sticks out a little bit from the plane of 21 the facade. The same effect illustrated for the 22 chimney occurs at the corners of those sections.	68 1 Q If I can ask you to turn to Paragraph 62 2 of the '109 declaration, please. 3 A '109, Paragraph 62. 4 I see '109, Paragraph 62. 5 Q Here you stated, Person of ordinary 6 level -- sorry, "A person of ordinary skill in the 7 art in this field at the relevant time frame would 8 have been familiar with the design of theory 9 behind principles of operation of, intended use 10 of, and the underlying technology used in computer 11 vision." 12 A I do. 13 Q And you added, The graduate training or 14 relevant experience, including experience in 15 computer vision techniques and the principles. 16 A I did. 17 Q And you provide the same definition of a 18 person of ordinary skill in the art in the '110 19 declaration. Correct? 20 A That's correct. 21 Q And this is the person of ordinary level 22 skill in the art that you used in providing your

69 1 opinions in the '109 declaration. Correct? 2 A Yes, I believe that's correct. Although, 3 small changes in the definition I don't see 4 leading to any changes in the conclusion. 5 Q You did not provide opinions under any 6 other definition of a person of ordinary skill in 7 the art for the '109 declaration. Correct? 8 A I did not. 9 Q And this is the same level of ordinary 10 skill in the art you used in providing your 11 opinions in the '110 declaration. Correct? 12 A That is correct. 13 Q And you did not provide opinions under 14 any other definition of person of ordinary skill 15 in the art for '110 declaration. Correct? 16 A I did not. 17 Q If we could turn to Paragraph 17 of your 18 '109 declaration. 19 A Paragraph 17. Let's see. 20 Paragraph 17, I have that. 21 Q You provide a statement of what you 22 understand to be the claim construction standard.	71 1 light of the specification and file history." 2 Q So you understand that this is the claim 3 construction standard the patent office applied. 4 Correct? 5 A I understand that that's the standard 6 that the patent office applies in assessing the 7 patentability of a claim. 8 Q Do you understand that this standard is 9 used for understanding the meaning of a claim from 10 the perspective of person of ordinary skill in the 11 art? 12 MS. SAPUTO: Objection. Vague. 13 A I'm unable to have legal opinions about 14 claim construction. 15 Q Do you understand that the meaning of a 16 claim term needs to be understood from the 17 perspective of a person of ordinary skill in the 18 art? 19 A I believe that to be -- 20 MS. SAPUTO: Objection. Form. 21 A I believe that to be correct as a 22 description of what the patent office does in
70 1 Correct? 2 A That's correct. 3 Q And you stated, "The patent office 4 generally construes claim terms in accordance with 5 their ordinary and customary meaning as understood 6 by a person of ordinary skill in the art." 7 A I state that that is the case in 8 assessing the patentability of a claim. 9 Q But that's not what you said here. 10 Right? You said, Patent office generally 11 construes claim terms? 12 MS. SAPUTO: Objection. Misstates the 13 document. 14 A I believe the document -- either we're 15 looking at different documents, but I believe the 16 document -- Paragraph 17 of the document says, "I 17 understand that in assessing the patentability of 18 a claim, the patent office generally construes 19 claim terms in accordance with their ordinary and 20 customary meaning, as understood by a person of 21 ordinary skill in the art (POSITA) at the time of 22 the invention in view of the claim language in	72 1 assessing the patentability of a claim. 2 Q So the claims are not assessed in a 3 vacuum. Right? 4 MS. SAPUTO: Objection. Form. 5 A In assessing the patentability of a 6 claim, the claim is not assessed in a vacuum, 7 that's correct. 8 Q It's assessed based on how a person of 9 ordinary skill in the art would have understood 10 them. Correct? 11 MS. SAPUTO: Objection. Form. 12 A I believe that in understanding the -- in 13 assessing the patentability of a claim, the claim 14 is interpreted in the terms that -- as understood 15 by a person of ordinary skill in the art. 16 Q And you said the claims need to be 17 understood in accordance with their ordinary and 18 customary meaning as understood by a person of 19 ordinary skill in the art at the time of the 20 invention. Correct? 21 A I did not say they needed to be 22 understood. I said in this paragraph that I

73 1 understand that in assessing the patentability of 2 a claim, the patent office generally construes 3 claim terms in accordance with their ordinary and 4 customary meaning as understood by a person of 5 skill in the art at the time of the invention in 6 view of the claim language in light of the 7 specification and the file history. 8 Q Do you understand what is a claim 9 construction? 10 A Moderately. 11 Q In what way? 12 A Well, usually when I'm asked for 13 opinions, I'm either told to interpret claim terms 14 according to some standard, often in accordance 15 with their ordinary or customary meaning. 16 On other occasions a district judge has 17 said what the claim means, and I then interpret 18 the claim, adopting that construction. 19 Q What did you consider for interpreting 20 claim terms of these patents? 21 A What did I consider? The ordinary and 22 customary meaning as understood by a person of	75 1 in the art, and my background and knowledge of 2 computer vision. 3 Q Anything else? 4 A I recall nothing else. I believe the 5 declaration to give a complete account of the 6 things I considered. 7 Q I'm handing you the document that you 8 just mentioned, Exhibit 2008 in the '109 and '110 9 IPR. 10 (Exhibit 2008, IRP2024-00856, previously 11 marked, not attached.) 12 A This will appear on the share? 13 Q Please let me know when you see it. 14 A I have the document, I'm just opening it. 15 I have the document. 16 Q You recognize this as the document that 17 you mentioned just now, the claim construction 18 order. Correct? 19 A Correct. 20 Q And you have reviewed this document 21 before today. Correct? 22 A I have read the document.
74 1 skill in the art, other sources including the text 2 of the claims themselves. This is in Paragraph 3 18. The patent specification, prior art. I 4 believe I was shown the prosecution history of the 5 patent, but I don't believe I tended to it in any 6 detail. 7 I also was shown a construction for some 8 terms. I don't recall -- in '109 there were three 9 terms. It appears to mimic the reflection of a 10 mirror. 11 District Court construed that in a 12 fashion that I have reproduced in Paragraph 26. 13 District Court construed transformation mapping, 14 which I've adopted and describe in Paragraph 27. 15 And District Court construed varying the 16 rate at which the nonordered steps are performed 17 on the series of images according to the distance, 18 which I reproduce in Paragraph 28. And I took 19 that construction as well. 20 Q Did you consider anything else? 21 A My knowledge and experience of reading 22 patents, my account of the level of ordinary skill	76 1 Q You read this document before today? 2 A I have read this document before today. 3 Q Did you review any of the related 4 briefing in the District Court relating to claim 5 construction? 6 A No. Or I have no recall of reviewing 7 that. 8 Q Looking at this document, there's a 9 construction for the varying rate limitation, 10 Limitation 1(h) of the '109 patent. Correct? 11 A That is constructed, yes. I believe 12 that's correct. Hang on. No. I must check. On 13 Page -- well, 25 there's some discussion of that 14 point, but I don't recall what the discussion was. 15 Twenty-three, 24, 25. 16 Yes, there is a discussion of varying 17 rate at which the non-ordered steps are performed 18 on the series of images according to the distance. 19 Q You applied that construction of the 20 varying rate limitation in forming your opinions 21 in the '109 IPR. Correct? 22 A I believe that is correct. And I believe

77 1 I said so, yes. 2 Q And you did not provide opinions under 3 any other construction of this limitation. 4 Correct? 5 A I did not. 6 Q And if you could turn to Page 14 of this 7 document. 8 A Of the declaration or the claim 9 construction? 10 Q Of this Exhibit 2008. 11 A Page 14 of claim construction. I'm at 12 Page 14. 13 Q This is where the District Court 14 discussed the limitation, it appears to mimic a 15 reflection of a mirror. Correct? 16 A That is correct. 17 Q And if you could turn to Page 19. 18 A Nineteen. 19 I'm at Page 19. 20 Q At the top of the page the court 21 construed this limitation to mean, "An image where 22 the user sees their reversed reflection appearing	79 1 mirror tracking mode limitation. Correct? 2 A Yes, that's correct. 3 Q And if you can move on to Page 41. 4 A Forty-one, I see that. 5 Q At the top of the page the court 6 construed this limitation to mean, "A mode of 7 operation in which the user sees their reversed 8 reflection appearing at roughly double the 9 distance from the camera and the reflection 10 maintains roughly the same size regardless of the 11 user movement." 12 Do you see that? 13 A I see that. 14 Q And you applied that construction in 15 forming your opinions in the '110 IPR. Correct? 16 A I -- the declaration gives the 17 constructions I applied. And I believe that is 18 the construction I applied. Yes, in Paragraph 26 19 of the declaration is the District Court's 20 construction, and I applied that. 21 Q You did not provide opinions under any 22 other construction of that limitation. Correct?
78 1 at roughly double the distance from the camera, 2 and the reflection maintains roughly the same size 3 regardless of the user movement." 4 Do you see that? 5 A I see that. 6 Q And you applied this construction in 7 forming your opinions in the '109 IPR. Correct? 8 A I applied the construction I said I 9 applied. And in Paragraph 26 of the declaration 10 it repeats the District Court's construction, and 11 that's the construction I applied. 12 Q So you applied the District Court's 13 construction of this limitation in forming your 14 opinions in the '109 declaration. Correct? 15 A That's correct. 16 Q You did not provide opinions under any 17 other construction of this limitation. Correct? 18 A That's correct. 19 Q And if you could turn to Exhibit 2008 20 Page 38, please. 21 A Page 38. I am at Page 38. 22 Q Here the District Court construes the	80 1 A I did not. 2 MS. SAPUTO: Objection. Form. 3 A I believe I used this construction in all 4 opinions I provided. 5 Q And do you agree with this construction? 6 MS. SAPUTO: Objection, form. Also 7 scope, outside of scope. 8 A I applied the construction the District 9 Court gave me. 10 Q Do you agree with the construction the 11 District Court provided? 12 A There's in no -- 13 MS. SAPUTO: Objection. Outside of 14 scope. 15 A I'm in no position to correct a district 16 judge. 17 Q Do you agree with the interpretation that 18 the limitation mirror tracking mode is a mode of 19 operation in which the user sees their reverse 20 reflection appearing at roughly double the 21 distance from the camera and the reflection 22 maintains roughly the same size regardless of the

81 1 user movement? 2 MS. SAPUTO: Objection, outside of scope. 3 Objection, asked and answered. 4 A Again, that construction was provided by 5 the District Court, and I've applied it. 6 MS. ZHANG: Counsel, this is within the 7 scope of his declaration because Dr. Forsyth 8 explained he applied these constructions in the 9 declaration. 10 MS. SAPUTO: He provided no opinion on 11 whether he agreed with them. It's outside of 12 scope. My objection stands. You can ask your 13 questions, I'll make my objections. 14 Q So you understand a claim term needs to 15 be interpreted in accordance with the ordinary and 16 customary meaning as understood by a person of 17 ordinary skill in the art. Correct? 18 MS. SAPUTO: Objection. Vague. 19 A I understand that one way to interpret a 20 claim term is according to the ordinary and 21 customary meaning as understood by a person of 22 ordinary skill in the art. But under some	83 1 MS. ZHANG: Your objections are not 2 following the proper -- 3 MS. SAPUTO: Oh, they are. They are. 4 You go check the PTAB rules. Do you want to go 5 take a break and take a look at them? Be my 6 guest. 7 MS. ZHANG: I'd like to finish my 8 questions, please, Counsel. 9 MS. SAPUTO: And I am going to make my 10 objections, as I am entitled to do. So ask your 11 questions. Let's proceed. 12 Q So I'm going to ask you again, 13 Dr. Forsyth, do you agree, as a person of ordinary 14 skill in the art, do you agree with the District 15 Court's construction of the claim terms we just 16 talked about? 17 MS. SAPUTO: Objection, outside of scope. 18 Objection, asked and answered. 19 A Which claim term are we talking about 20 here? 21 Q Let's look at Claim Limitation 1.(h), the 22 varying rate limitation of the '109 patent.
82 1 circumstances, if a district judge has told me 2 what a term means, then I must adopt that 3 construction. 4 Q So do you as a person of ordinary skill 5 in the art think it is how a person of ordinary 6 skill in the art would have interpreted the term? 7 MS. SAPUTO: Objection, outside of scope. 8 Objection, asked and answered. 9 A I'm sorry, I've lost track. Which term 10 are we talking about? 11 MS. ZHANG: Counsel, would you please 12 limit speaking objections. If it is a standing 13 objection, we understand. It's interrupting the 14 questions and answers. 15 MS. SAPUTO: I'm going to make my 16 objections. I'm entitled to make my objections. 17 I am making my objections in accordance with the 18 PTAB rules. Ask your questions. 19 MS. ZHANG: These questions are not 20 proper under the PTAB rules. 21 MS. SAPUTO: Your questions aren't proper 22 under the PTAB rules, or my objections?	84 1 A '109, varying rate. I have my 2 declaration in front of me on that. 3 I'm in no position to correct a District 4 Court judge. I don't see -- I have not attended 5 to the exact question of how -- or the question of 6 how exactly this claim should be construed, 7 because the judge provided me with a construction. 8 But looking at the construction now, it 9 seems fairly reasonable to me. 10 Q So you agree with this construction? 11 MS. SAPUTO: Objection. Misstates the 12 testimony. 13 A What I said was, looking at this 14 construction now, it seems fairly reasonable to 15 me. I haven't analyzed the construction in 16 detail, because I was provided with the District 17 Court judge's order. 18 Q So you applied the District Court's 19 construction, but you do not have opinion on 20 whether it was right or wrong? 21 A I applied the District Court's 22 construction. I did not analyze the construction,

85 1 because it was given to me as the correct 2 construction. 3 Looking at it now, it doesn't seem to me 4 to have any serious problems with it, but that is 5 a looking-at-it-now judgment, not an analysis. 6 Q And for the mirror mimic limitation in 7 the '109 and '110 patent, in '109 the limitation 8 is, "appears to mimic a reflection of a mirror." 9 Do you agree with that construction? 10 MS. SAPUTO: Objection, outside of scope. 11 Objection, asked and answered. 12 A Again, I've been provided the 13 construction that the District Court supplied, and 14 I adopted that construction because it came from 15 the District Court. I did not analyze the 16 construction in any detail because I assumed that 17 the district -- well, there is a document, the 18 District Court does that. 19 I -- looking at the construction, it 20 appears reasonable to me, but that is a 21 looking-at-the-construction answer rather than an 22 analysis. And again, I am in no position to	87 1 "transformation mapping" and "mapping 2 transformation" of the '109 patent and '110 3 patent. Correct? 4 A That's correct. At the bottom of the 5 page, that's correct. 6 Q And if you could turn to Page 14. At the 7 top of the page. 8 A I'm at the top of Page 14. 9 Q The court construed transformation 10 mapping, mapping transformation to be selected set 11 of image transformations. Correct? 12 A Construes transformation mapping and 13 mapping transformation to mean selected set of 14 image transformations, that's correct. 15 Q And you applied that construction in 16 forming your opinions in the '109 IPR. Correct? 17 A I applied the constructions that I 18 describe in the declaration. In the declaration 19 for '110, it's on Paragraph 27, and that's the 20 District Court's construction. And in '109, again 21 it's the District Court's construction. So I 22 applied those constructions.
86 1 correct a district judge. 2 Q And turning to the term "mirror tracking 3 mode of '110 patent," do you agree with the 4 District Court's construction of that limitation? 5 A Mirror tracking -- 6 MS. SAPUTO: Objection. Asked and 7 answered. Outside of scope. 8 A Mirror tracking mode. Again, I was 9 provided this construction by the District Court. 10 I did not analyze the construction because the 11 District Court had already done that and I'm in no 12 position to correct a federal judge. 13 As a looking at it now, without any 14 opportunity for detailed analysis, it looks 15 reasonable to me. But I applied the construction 16 that the federal -- that the district judge 17 supplied. 18 Q If you could turn to Exhibit 2008. 19 A I'm at that exhibit. 20 Q Please turn to Page 7. 21 A Page 7. I am at Page 7. 22 Q Here the District Court discusses a term	88 1 Q And you apply this construction in 2 forming your opinions in the '110 IPR -- in the 3 '110 declaration. Correct? 4 A That's correct. 5 Q Do you agree with this construction? 6 MS. SAPUTO: Objection, outside of scope. 7 Objection, asked and answered. 8 A Again, the construction was given to me 9 by the District Court, and I'm in no position to 10 correct the district judge. I did not analyze the 11 construction; I applied it. 12 Looking at the construction now and 13 attending to this question for the first time, it 14 seems like a reasonable construction, but that's 15 not an analysis. 16 Q And you did not provide opinions under 17 any other construction of this limitation. 18 Correct? 19 A I did not provide opinions under any 20 other construction of this limitation. 21 Q Could you please turn to Page 33 of 22 Exhibit 2008?

89 1 A Thirty-three. I am at Page 33. 2 Q Here the District Court discusses the 3 limitation, "adaptive transformation mapping of 4 the '110 patent." Correct? 5 A That's correct. 6 Q And if you could turn to Page 37, at the 7 bottom of Page 37. 8 A Bottom of Page 37. 9 Q And the court construed this limitation 10 to mean "continuously variable transformation 11 mapping." Correct? 12 A That's correct. 13 Q And you applied this construction in 14 forming your opinions in the '110 declaration. 15 Correct? 16 A The '110 declaration gives the 17 construction that I applied. The – in Paragraph 18 1827, adaptive transformation mapping, continuously 19 variable transformation mapping. So yes, I 20 applied the District Court's construction. 21 Q And you did not provide opinions under 22 any other construction of this limitation.	91 1 constructions you adopted are all the 2 constructions supplied by the District Court. 3 Is that right? 4 A When I – I believe I applied the 5 constructions supplied by the District Court when 6 the District Court construed a term. 7 Q So is it your understanding that the 8 District Court only construed the terms we just 9 talked about? 10 A As far as I know, the District Court 11 construed the term "utilizes the angle of the 12 images captured by the camera," and we did not 13 talk about that. 14 If it is not in my declaration, then it's 15 possible I didn't need it. This is in '110. 16 '110, in my declaration in '110 I do not list the 17 construction for "utilizes the angle of the images 18 captured by the camera." Although the 19 construction is "utilizes the camera angle of the 20 camera that is generating the stream of images of 21 the user." 22 I don't believe I used that
90 1 Correct? 2 A I did not provide opinions under any 3 other construction. 4 Q Do you agree with this construction? 5 MS. SAPUTO: Objection, outside of scope. 6 Objection, asked and answered. 7 A Again, the construction was supplied by 8 the District Court. I'm in no position to correct 9 a District Court judge. I have not analyzed the 10 construction, as opposed to applied it. 11 Looking at the construction right now, 12 which is not the same as an analysis, I – it 13 seems perfectly reasonable to me. But that's a 14 seat-of-the-pants answer. 15 Q You did not apply any other constructions 16 from the District Court order in forming your 17 opinions in the '109 IPR. Correct? 18 A Each of the declarations has the 19 constructions that I applied. I understand that 20 to be all the constructions supplied by the 21 District Court. 22 Q So you say you understand the claim	92 1 construction – sorry, I don't believe I needed to 2 construe the term, utilizes the angle of the 3 images of the camera – sorry, "utilizes the angle 4 of the images captured by the camera." 5 Q There are also other terms the District 6 Court construed that you did not apply in your 7 declaration of the '109 IPR. Correct? 8 A There may be terms that the District 9 Court construed and that I did not list in the 10 '109 declaration. If that's the case, it's 11 because I didn't need the construction of the 12 term. 13 MS. ZHANG: I'm about to move on to a 14 next module. Would you like to take a break, 15 Doctor? 16 THE WITNESS: This might be a good time 17 for me. Thank you. 18 (A recess was taken.) 19 BY MS. ZHANG: 20 Q I am sending you a document. One second. 21 (Exhibit 1001, IPR2024-00856, previously 22 marked, not attached.)

93 1 Q I'm handing you Exhibit 1001 of the '109 2 IPR. 3 A Here we are. Okay. 4 Q Let me know if you see it. 5 A It's arrived. This is the '109 patent. 6 Q Yeah, so you recognize this is the '109 7 patent? 8 A Yes, I'm just waiting for it to download 9 and open. 10 Q Oh, okay. 11 A Here we are. I have it. 12 Q Do you recognize this as the '109 patent? 13 A This is the '109 patent. 14 Q Have you reviewed this document before? 15 A I have read this document. 16 Q And have you reviewed the entire 17 document? 18 A Yes, I've reviewed the entire document. 19 Q And you understand the disclosure in this 20 document. Right? 21 A Yes. 22 Q And do you agree that the '109 patent	95 1 could be. 2 Column 22 reveals that it is achieved by 3 software. My error. 4 Q And those software transformations 5 include a transformation mapping to modify the 6 image so it looks like a conventional mirror 7 image. Correct? 8 A Claim 1 says, "Applying a transformation 9 mapping to the image, to modify the image so that 10 it appears to mimic the reflection of a mirror." 11 Q And in Paragraph 65 you said, you stated, 12 "A transformation mapping is applied to modify the 13 image such that it mimics the reflection in a 14 conventional mirror." 15 Right? 16 A That's correct. 17 Q And do the software transformation seen 18 through the resizing the image based on the user 19 distance? 20 A The software transformation, as Paragraph 21 65 says, the image is resized based on the user's 22 distance from the camera.
94 1 describes software transformations performed on a 2 camera captured image to make that image mimic a 3 conventional mirror? 4 A That sounds like a quote. Did I say 5 that, or is that your phrasing? The – I'm not 6 absolutely certain that the software 7 transformations is a necessary feature of '109. 8 I'm looking for the relevant paragraph. 9 Q If you look at Paragraph 65 of your '109 10 declaration. 11 A Sixty-five? I see – ah, yes. That's a 12 quote from me. Discloses a series of software 13 transformations, that's correct. 14 Q Did those software transformations 15 include left and right flipping? 16 A Did those software transformations 17 include left-right flipping? I believe they do. 18 In the Claim 1 it's – in Claim 1 it says, 19 "Flipping the image about a vertical axis so as to 20 reverse left and right sides of the image." 21 The – I am not sure that that is 22 necessarily achieved by software, but it certainly	96 1 Q I'm dropping you another document. 2 A Okay. 3 (Exhibit 1001, IPR2024-00810, previously 4 marked, not attached.) 5 Q Exhibit 1001 of the '110 IPR. 6 A I have that. I'm just downloading it. I 7 have that document. 8 Q Is it okay if we refer to this as the 9 '110 patent? 10 A That – that's fine, yes. 11 Q And you have reviewed this document 12 before? 13 A I have reviewed this document before. 14 Q And you have reviewed the entire 15 document? 16 A I have read the entire document. 17 Q And you agree that you understand the 18 disclosure in this document? 19 A I understand the disclosure in this 20 document. 21 Q And do you agree that the '110 patent 22 describes methods of modifying images using

97 1 adaptive transformation mappings so that the 2 images appear to be captured from a different 3 point of view than the camera's actual point of 4 view? 5 A I believe that that's correct. It sounds 6 like a quote, so it's likely in my declaration on 7 '110. 8 Q And do those transformations include 9 rotation? 10 A Do those transformations include 11 rotation? They appear to, yes. 12 Q And do those transformations include 13 resizing? 14 A Resizing? I believe they do. Yes, they 15 do. 16 Q Do those transformations include changing 17 the image magnitude? 18 A I don't recall that phrase being used. 19 And I would -- I'm not sure what the distinction 20 between that and resizing the image is, so I would 21 generally say yes. 22 Q The phrase was used the top of Page 25 of	99 1 discussed in the '110 declaration? 2 A I do. 3 Q And you have reviewed this document 4 before? 5 A I have reviewed this document. 6 Q And you reviewed the entire document? 7 A I did. 8 Q And you understand the disclosure in this 9 document? 10 A I understand the disclosure in this 11 document, yes, that's correct. 12 Q If you could take a look at your '110 13 declaration, Paragraph 68? 14 A Paragraph 68, that's correct. I'm there. 15 Q Francois discloses a software 16 architecture model. Correct? 17 A A software architecture for what Francois 18 describes as immersipresence, that's correct. 19 Q Is this software architecture for 20 immersipresence for SAI a computer vision 21 application? 22 A I would say part of it is a computer
98 1 your '110 declaration, Paragraph 56. 2 A Paragraph 56? 3 Q If you go to the second page for 4 Paragraph 56? 5 A Rotating, resizing or varying image 6 magnitude, right. I would regard varying image 7 magnitude to be the equivalent to resizing. And 8 in fact, the phrase "image magnitude" is used in 9 Column 36 of the patent. 10 Q I'm introducing another document. 11 (Exhibit 1009, IPR2024-00810, previously 12 marked, not attached.) 13 A Okay. 14 Q Exhibit 1009 in '110 IPR. 15 A The Planet Depos pages seems to be slow 16 in refreshing. The page has not refreshed on my 17 computer, but ... 18 Is it still uploading? 19 Q It appears to be uploaded on my end. 20 A Oh, here we go. This is Francois. I'll 21 download it and open it. I have that document. 22 Q So you recognize this is the Francois	100 1 vision application. It's certainly applied in 2 part to something I would recognize as a computer 3 vision problem. There are parts of it that are 4 not. 5 Q What part is not a computer vision 6 application? 7 A Francois has a bunch of software 8 architecture stuff about pipes and filters, which 9 is really much more a software engineering 10 question than a computer vision question. 11 He has some stuff about parallel 12 processing and buffering of data streams, which 13 is, again, not primarily a computer vision issue. 14 He has some stuff about managing 15 repository and message passing, which, again, is 16 not primarily a computer vision issue. A bunch of 17 stuff about parallelism. But he describes all 18 this stuff and then offers I believe two -- two, 19 maybe three designs using this -- four designs 20 using this -- five designs using this 21 architecture. 22 The designs, or the applications are to

101 1 video segmentation and tracking, which is firmly a 2 computer vision topic. Real-time video painting, 3 which is a computer vision topic, although not 4 firmly one. To mirror simulation, which is I 5 think firmly a computer vision topic. And to a 6 platform for data sharing, which is not. Live 7 video and animated 3D graphics I would think of as 8 being a computer vision application, although not 9 core. 10 Q And is this SAI a model used to provide a 11 virtual mirror simulation? 12 A Francois uses this model to provide a 13 virtual mirror simulation in Section 4.3. 14 Q And it teaches it provides close 15 approximation of what the user will see if it were 16 a real mirror. Right? 17 A It teaches a number of things, including 18 that some aspects of the geometry of a mirror are 19 out of scope, but it offers a close approximation. 20 Q In Paragraph 69 of your '110 declaration 21 you stated, "The image displayed on the screen is 22 described as a close approximation of what the	103 1 figures, second paragraph below the figures. It 2 says, "For example, it is a testbed for developing 3 and testing video analysis techniques that could 4 be used to replace the magnetic trackers, 5 including face detection and tracking, and gaze 6 tracking." 7 Right? 8 A It says that. 9 Q Is detecting user's face different from 10 detecting a user in a captured image? 11 A Is that a general question, or is there a 12 specific context for the question? 13 Q Yeah, it's a general question. 14 MS. SAPUTO: Objection. Vague. 15 A Wow. As a matter of computer vision 16 history, face detection has always been dealt with 17 using slightly different specialized techniques 18 than person detection. It's usually seen as 19 easier. The -- okay. Sorry. I need to be 20 careful about the time of the question. 21 Are you asking about now or 2015, or 22 when?
102 1 user would see on the screen surface if it were a 2 real mirror." 3 Right? 4 A That's correct. 5 Q And Francois discloses that SAI model 6 allows for modular developments. Correct? 7 A I believe that to be correct, yes. 8 Q So does that mean that you can add new 9 components to the system? 10 MS. SAPUTO: Objection. Form. 11 A It means that you should be able to add 12 new components to the system. 13 Q And it also discloses, "The mirror 14 simulation can be a testbed for developing and 15 testing video analysis techniques." 16 Right? 17 A You might want to point me to the line in 18 the document. That sounds correct, but ... 19 Q Yeah. Could you please turn to Page 15 20 of Francois. 21 A I'm at Page 15. 22 Q In the middle of the page below the	104 1 Q The relevant time period for these 2 patents, December 2012 -- December -- 3 A December 2012. 4 Q Yeah. 5 A Okay. Around 2012 face detection would 6 have been seen as firmly different from person 7 detection. 8 Q How is -- how different? 9 A Significantly. The methods that were 10 applied -- again I'm answering this question 11 without checking dates in a library or -- but my 12 knowledge of the history of computer vision is 13 fairly good. 14 Before 2012, faces were typically 15 detected by looking for whole face-like patents 16 and images, often using neural networks. Almost 17 all person detection was referred to as pedestrian 18 detection, and that used specialized features 19 which were not learned. 20 It aimed almost entirely at detecting 21 people who were sort of in a loose standing 22 configuration or walking in a sideways view. So

105 1 they were really quite different activities. 2 Q Can you detect a person by detecting 3 their face? 4 MS. SAPUTO: Objection. Vague. 5 A Now or as of 2012? 6 Q As of 2012, December 2012. 7 A Often if they're looking at -- at that 8 time often if they were looking at the camera, but 9 the detection would be unreliable because if you 10 saw the whole of the person, the face would have 11 relatively low resolution, and face detectors 12 worked poorly in low resolution. 13 There were a variety of tricks for 14 detecting people by looking at bits and pieces. 15 The most effective one was looking for the top of 16 the head as opposed to the face. None of them 17 were particularly satisfactory. 18 Again, I'm answering on my reasonable 19 memory of the history of the computer vision and 20 without checking a library. 21 Q So in your opinion, detecting the user's 22 face is not detecting the user. Correct?	107 1 only the Francois reference. Right? 2 A In Paragraph 87 and 88? 3 Q Yes? 4 A Paragraphs 87 and 88 discuss only the 5 Francois reference. In fact, those two paragraphs 6 list the limitations of the patent. 7 Q And in Paragraphs 89 to 90, you discussed 8 only the Francois reference. Correct? 9 A That's correct. 10 Q I'm dropping you another document, 11 Exhibit 1005 of the '110 IPR. 12 (Exhibit 1005, IPR2024-00810, previously 13 marked, not attached.) 14 A I have this document. It's downloading. 15 And let me open it. 16 I have the document. 17 Q This as Exhibit 1005 in '110 IPR and 18 Exhibit 1022 in the '109 IPR. 19 You recognize this as the Haan reference 20 you discuss in the declarations. Right? 21 A I recognize this as the Haan reference. 22 Q You have reviewed this document before?
106 1 A That's not what I said. I said that 2 detecting faces was different from detecting 3 people, and that detecting a person by detecting 4 their face was not reliable. 5 In many applications at the time, 6 detecting the user essentially involved detecting 7 their face because that's all you would see. So I 8 believe Francois's application basically all the 9 camera sees is the face and maybe a little bit of 10 the shoulders. And Francois would refer to 11 detecting the face as detecting the user. 12 Q Let's look at Page 39, Paragraph 87 to 90 13 of your '110 declaration. 14 A '110, sorry, you said Page 39? 15 Q Yeah, Page 39, Paragraph 87 to 90. 16 A And Paragraph 87, you said? 17 Q Yes, starting from Paragraph 87. 18 A I am there. 19 Q Here you talked about Limitations 1(c) 20 and 1(e) of the '110 patent. Right? 21 A That's correct. 22 Q And in these paragraphs you discussed	108 1 A I have reviewed this document before. 2 Q And have you reviewed the entire 3 document? 4 A I have reviewed the entire document. 5 Q And you understand the disclosure in this 6 document? 7 A I do. 8 Q If you could turn to Page 28 at Paragraph 9 Number 66 of the '110 declaration. 10 A Paragraph Number? 11 Q Sixty-six. 12 A Sixty-six. I am at that paragraph. 13 Q Haan discloses a mirror device. Correct? 14 A That's correct. 15 Q And it's a digital system for replicating 16 a mirror. Correct? 17 A It asserts it's a digital system for 18 replicating a mirror. 19 Q Is this a computer vision application? 20 A I would think of Haan's devices being a 21 computer vision application, yes. 22 Q How so?

109 1 A It takes pictures and processes them, and 2 displays them. 3 Q So Haan discloses that its mirror device 4 operates in three modes. Correct? 5 A I'm sorry, say that again? I missed 6 something. 7 Q Yeah, let me repeat. Haan discloses that 8 its mirror device operates in three modes. 9 Correct? 10 A I believe that's correct. 11 Q One of those three modes is the display 12 mode. Correct? 13 A Display mode, yes, that's correct. 14 Q And another mode is a reflective mode. 15 Correct? 16 A That's correct. 17 Q And in the reflective mode, it displays a 18 mirror image. Correct? 19 A In a reflective mode, it displays a 20 mirror image. I – let me see, just to be sure 21 that I am answering correctly. I believe that's 22 correct.	111 1 A Augment – this device can certainly 2 switch between the reflective mode and – I don't 3 believe it's referred to as the augmented mode. I 4 think it's the dual mode. But it can switch 5 between modes. 6 Q If you could go to Paragraph 94 of Haan. 7 A Ninety-four? Yep. I am at that 8 paragraph. 9 Q Starting from the second sentence. "In 10 the first mode the customer can watch a movie, in 11 the second mode, the device is a simple mirror, 12 and the third dual mode can be used when the 13 hairdresser wants to show the customer the results 14 of his efforts. In embodiments a remote control 15 is provided to switch between the modes. A manual 16 control is also possible." 17 In a dual mode do you understand that 18 include the display mode and the second mode? 19 (Clarification by the court reporter.) 20 Q Let me rephrase that. The third dual 21 mode, in the third dual mode can switch between 22 the first mode and the second mode. Correct?
110 1 Mirror image of the device. Yes. Yes, 2 that's correct. 3 Q And in this mode, Haan's device acts like 4 a conventional mirror. Correct? 5 A Yes, that's – 6 MS. SAPUTO: Objection. Objection. 7 Vague. 8 A Paragraph 92 of Haan says, "A simple 9 reflective mode to act as a mirror." 10 Q And Haan also describes a dual mode that 11 includes a reflective mode and augmented mode. 12 Correct? 13 A A dual mode, I believe that's correct. 14 Within a range of angles displaying – yes, that's 15 correct. 16 Q And in augmented mode, the device 17 displays an exaggerated angle when the head or 18 body is turned. Correct? 19 A That's correct. 20 Q And in this mode, the device can switch 21 between the reflective mode and the augmented 22 mode. Correct?	112 1 A The dual mode doesn't switch between 2 modes. The dual mode in Paragraph 93 is 3 reflective within a range of angles or positions, 4 and displaying an exaggerated angle when the head 5 or body is turned. 6 Q That's the augmented mode. Right? 7 That's in the augmented mode the device displays 8 an exaggerated angle when the head or body is 9 turned. 10 A I do not believe that Haan uses the term 11 "augmented." 12 Q Yes. If you can think of it as like 13 exaggerated mode. 14 A I believe Haan uses three terms. He's 15 got a display mode, a reflective mode, and a dual 16 mode. 17 Q If you could turn to Paragraph 93 above. 18 A I see that. 19 Q It says, A dual mode, reflective within a 20 range of angles and positions, and displaying an 21 exaggerated angle when the head or body is turned. 22 Do you see that?

113 1 A I see that. 2 Q Do you agree that in the dual mode, when 3 the device is reflective within a range of angles 4 or positions it's mimicking, it's acting as a 5 mirror? 6 A Reflective within a range of angles or 7 positions. To -- those reflections, which appear 8 to be limited to a particular range of angles or 9 positions, would all be mirror reflections because 10 Paragraph 92 says they are reflective. 11 Q And this device transitions from this 12 reflective mode to the exaggerated mode when the 13 head or body turn. 14 Is that correct? 15 A Haan does not refer to it as 16 transitioning. Haan says it is a dual mode, which 17 means both -- which to me means both things are in 18 operation. It is reflective within a range of 19 angles or positions. And it would -- and displays 20 an exaggerated angle when the head or body is 21 turned. 22 Q So here in dual mode, if it is within a	115 1 of the '110 declaration. 2 A Seventy-seven to 78. I see Paragraph 77. 3 Q In these paragraphs you discuss the 4 Paragraph 72 to 73 -- actually, 72 through 76 and 5 Figures 7 and 8 of Haan. Correct? 6 A That's correct. 7 Q So let's look at these paragraphs. 8 When a user approaches a camera in Haan, 9 does the apparent size of the user increase in the 10 image? 11 A When a user approaches, does the apparent 12 size of the user increase? Within the embodiments 13 of the invention, so Paragraph 72 has within it 14 embodiments the displayed image is magnified as a 15 function of the distance. The Figure 8 gives a 16 magnification. Figure 8 operates in the opposite 17 direction from a mirror. The camera in Haan -- 18 let's see. As a user approaches Haan's screen, 19 Figure 8, in combination with Paragraph 72, tells 20 me that the image of the -- the user is detected. 21 The image of the user is then displayed. As the 22 user gets closer to the screen, the image of the
114 1 range of angles or positions, the device is 2 reflective like a mirror, it does not display an 3 exaggerated angle. Correct? 4 A Within a range of angles or positions, I 5 believe that's correct. I believe it displays the 6 exaggerated angle when the head or body is turned. 7 Q So is it fair to say in this dual mode of 8 Haan, the device is reflective, but changes to 9 exaggerated mode when the head or body turns? 10 MS. SAPUTO: Objection. Vague. 11 A As far as I can tell from the wording of 12 Haan, there is no evidence that the device 13 changes. It says it will display an exaggerated 14 angle when the head or body is turned, but it 15 doesn't say that the device changes. 16 Q So can you change switch -- sorry. Let 17 me rephrase. 18 Does Haan disclose switching between the 19 reflective mode and the dual mode? 20 A Haan discloses switching between the 21 reflective mode and the dual mode, yes. 22 Q If you could turn to Paragraph 77 to 78	116 1 user that is displayed is magnified by this term M 2 in Figure 8. Then Figure 8 shows that as I get 3 closer, the image that the camera has is magnified 4 by an increasing amount. 5 Q Thank you. But that wasn't my question. 6 My question's about apparent size of the user. So 7 let me reask the question. 8 Taking the pinhole camera model, for 9 example, that we talked about earlier today, when 10 a user approaches a camera, does the apparent size 11 of the user in image increase? 12 MS. SAPUTO: Objection. Vague. 13 A When you say "apparent size," do you mean 14 the size of the image of the user on the image 15 plane? 16 Q Correct. 17 A Ah. When a user approaches a pinhole 18 camera, the size of the user on the image plane 19 increases. 20 Q And you opined that most modern cameras 21 are based on this pinhole model. Correct? 22 A Most models of cameras are based on a

117 1 pinhole model. 2 Q So in Haan's system, you assume that Haan 3 does not do any magnification. If when a user 4 approaches a camera, does the size of the user in 5 the image increase? 6 MS. SAPUTO: Objection. Vague. 7 A Haan's system uses a pinhole system which 8 is placed behind the screen. As I move towards 9 that camera, the -- my size on the image plane 10 will increase. So the size of the image of me 11 that the camera produces will get bigger. What 12 happens on the screen depends on what Haan does to 13 that image. He says that he will magnify it. 14 Q If he does not -- if we assume that Haan 15 does not do any magnification, that's what 16 happened like you said, the size of image will get 17 bigger. Right? 18 A Yeah, I will get bigger in the screen, 19 that is correct. 20 Q So now if you assume that you're at a 21 Point A away from the camera and you have a Size 22 A, a Size 1 in the -- in the image -- are you	119 1 change will either be B plus focal length of A 2 plus focal length times my original height, or B 3 over A times my original height. 4 Q So Point B is closer to the camera than 5 Point A. 6 Do you understand? 7 A Yes. 8 Q At Point B, the size of your image is 9 Size 2. At Point A, the size of your image is 10 Size 1. 11 A Okay. 12 Q Is Size 2 bigger than Size 1 in this 13 example? 14 A I'm now somewhat confused about the setup 15 of the example. Are A and B known, or are you 16 asking me what happens when I choose A and B such 17 that when I'm in A I have Size 1 and when I'm at B 18 I have Size 2? 19 Q Yes, when you're at the position Point A 20 away from the camera, you have -- your image has a 21 Size 1. 22 A Okay.
118 1 following me? 2 A Yes, I'm wondering if it's proper for me 3 to take a note of the sizes and distances? I 4 don't want to get muddled between your A's and 5 your 1's. 6 Q Right. Yeah. Let me know if anything is 7 not clear and I can rephrase. 8 A Okay. 9 Q You are at Point A away from the camera, 10 and you're -- the size of your image is Size 1. 11 Okay? 12 A Yes. 13 Q Now you're moving towards the camera, 14 closer to the camera, Point B. 15 A Yes. 16 Q Without magnification, the size of your 17 image is Size 2. Correct? 18 A That's not correct. 19 Q Sorry. Size 2. Assume -- assume that. 20 A We have an A, a B, and a 1. If I move 21 from A to B, depending on whether your distances 22 involve the focal length of the camera or not, my	120 1 Q And when you're at Point B, which is 2 closer to the camera, the size of your image is 3 Size 2. 4 A Size 2. 5 Q Assuming you know the distance of Point A 6 to the camera and the distance of Point B to the 7 camera. 8 MS. SAPUTO: I'm going to object as vague 9 and incomplete hypothetical. 10 You can answer, if you're able. 11 A And I'm sorry, I've lost track of what 12 the actual question was. 13 Q Yeah, I was going to follow up with the 14 question, but I got interrupted. 15 Assuming you know the distance of Point A 16 to the camera and distance of Point B to the 17 camera. 18 A Okay. 19 Q The size of your image when you're at 20 Point B, which is Size 2, is it bigger than the 21 size of your image at Point A, which is Size 1? 22 MS. SAPUTO: Same objection.

121 1 A I'm sorry, it seems like you are asking 2 me if 2 is bigger than 1. And the answer is yes. 3 But I may have missed something. 4 Q I can take away the numbering. Let me 5 rephrase that question. 6 The size of your image when you're at 7 Point B is bigger than the size of your image at 8 Point A. Correct? 9 A If B is closer to the camera, the size of 10 your image at Point B where the size of the image 11 is the size on the image plane at the back of the 12 pinhole camera, if B is closer to the camera, then 13 the size will be bigger. And there are formulas 14 that tell you how much bigger. 15 Q Okay. Now moving to Haan's system. 16 Assuming that you can change the magnification of 17 the image to be greater than 1 or less than 1, 18 when you move from Point A to Point B to maintain 19 the same size of your image, does a less than 1 20 magnification need to be applied to the image? 21 MS. SAPUTO: Same objection. 22 A So to -- I believe the question is if I	123 1 you move close. And he's clear about that. In 2 Paragraph 73 he talks about determining the 3 magnification. Do I have the -- oh, yeah. Here 4 is the paragraph here. He is very muddled about 5 projective geometry. But Haan 8 that the 6 magnification increases from 1 to 2 as you move 7 closer to the mirror. 8 Q So in Figure 8, I see the line is plateau 9 at 1 as a -- at a distance from about 30 to 50. 10 Do you see that? 11 A I see that. 12 Q And in those distances is a magnification 13 equal to 1? 14 A The intention of Haan's figure is, in 15 those distances the magnification is equal to 1. 16 Q And Haan's changing the magnification 17 changes the size of the user in the image. 18 Correct? 19 MS. SAPUTO: Objection. Vague and form. 20 A Users -- magnifies the displayed image. 21 Magnifying the displayed image would change the 22 size of the user, yes.
122 1 move from a point further away from Haan's system 2 to a point closer to the system, does a 3 magnification less than 1 need to be applied such 4 that my image has the same size. 5 To that question, the answer is yes, the 6 magnification would need to be less than 1. 7 Q Yes, your understanding of that question 8 is correct. Thank you. 9 And that's -- that change of 10 magnification to maintain the size of the user 11 depends on the user's distance to the camera. 12 Right? 13 A The change of magnification would depend 14 on the user's distance to the camera. And Haan 15 has it wrong in Figure 8. 16 Q So you said Haan has it wrong in Figure 17 8. How so? 18 A In Figure 8 Haan shows magnification 19 increasing as one moves closer to the camera. 20 That is not what a mirror does. 21 What Haan is intending to do is allow you 22 to see a very much bigger picture of yourself when	124 1 Q I am going to introduce another document. 2 (Exhibit 1007, IPR2024-00810, previously 3 marked, not attached.) 4 Q This is Exhibit 1007 of the '110 5 declaration. Sorry, Exhibit 1007 of the '110 IPR. 6 A I don't see it yet. 7 Q One moment. 8 A Okay. Oh, here we are. 1007. I've 9 downloaded the document. I have the document open 10 in front of me. 11 Q Do you see the document? 12 A I see the document. 13 Q Okay. This is Exhibit 1007 in the '110 14 IPR. 15 Do you recognize this document as the 16 Geisner reference? 17 A I recognize this document as the Geisner 18 reference. 19 Q Have you reviewed this document before? 20 A I have reviewed this document. 21 Q Have you reviewed the entire document? 22 A I have reviewed the entire document.

125 1 Q And you understand the disclosure in this 2 document? 3 A I understand the disclosure in this 4 document. 5 Q If we could turn to page -- sorry, 6 Paragraph 72 of your '110 declaration. 7 A Seventy-two, '110. I'm at 72. 8 Q So Geisner describes a shopping 9 application that uses a virtual mirror. Correct? 10 A That's correct. 11 Q And this is a computer vision 12 application. Correct? 13 A Yes, that's correct. 14 Q And Geisner also discloses tracking the 15 user. Correct? 16 A Yes, that's correct. 17 Q And Geisner discloses acquiring the 18 user's features, like size, height, arm length, 19 and width of the head, et cetera, for tracking the 20 user. Correct? 21 A I believe that's correct, yes. 22 Q And Geisner discloses an avatar.	127 1 A Probably, yes. 2 Q Have you considered Figure 9 of Geisner? 3 A Figure 9? I read all of Geisner. Let's 4 see. Figure 9. I've read -- I've read Geisner 5 and looked at Figure 9. 6 Q In Figure 9 does the user avatar appear 7 left and right reversed? 8 A Does the user -- well, I know of no way 9 to be sure of the answer to that question because 10 the figure doesn't show me what the camera sees 11 where the user is with respect to the screen. 12 It could be. 13 Q Is it possible to make an avatar the same 14 size as a mirror image of the user? 15 A Is it possible to make an avatar the same 16 size -- 17 Q I'll rephrase that question. Sorry. 18 A I'm sorry? 19 Q Yeah, I'll reask the question. 20 In your view, is it impossible to have an 21 avatar that appears like a mirror image? 22 MS. SAPUTO: Objection. Vague.
126 1 Correct? 2 A Geisner discloses an avatar. Yes, I 3 think that's correct. Yes. 4 Q And is it your opinion that an avatar can 5 never be a mirror image? 6 MS. SAPUTO: Objection. Vague. 7 A An avatar can never be a mirror image? 8 I'm not aware of the term "avatar" ever being used 9 for a realistic mirror image of a user. And I 10 would be extremely surprised by that usage. I 11 think that would be -- that opinion would be 12 consistent with most POSITAs. 13 Q What's the difference between an avatar 14 and a mirror image? 15 A An avatar is typically a simplified 16 representation of a person. I don't remember the 17 etiology, but avatar refers to something that is a 18 secondary representation of yourself. A mirror 19 image exactly shows you what you would look like 20 in a mirror. 21 Q Would you use computer vision techniques 22 to add details to an avatar?	128 1 A Is it impossible to have an avatar that 2 appears like a mirror image? I don't -- I have 3 never heard anyone use the term "avatar" to refer 4 to anything like a mirror image. The -- I don't 5 think it is technically impossible to create a 6 mirror image and then refer to it as an avatar, 7 but that's basically just not how the term is 8 used. 9 Q Can you make an avatar that has the same 10 size property of a conventional mirror? 11 MS. SAPUTO: Objection. Vague. 12 A Which size property are you referring to? 13 Q So you opined earlier that one of the 14 optical properties of conventional mirror has the 15 same size regardless of user's distance. Right? 16 A Yes, that is the property you're 17 referring to. 18 Q Can you generate an avatar that remains 19 the same size regardless of user movement on the 20 screen? 21 A Could I now? Probably, yes. 22 Q In your opinion, back in 2012 you cannot?

129 1 A In my opinion, back in 2012 none of the 2 references that I reviewed had done so. 3 Q Would it be technically impossible to do 4 so back in 2012, make the avatar remain the same 5 size regardless of the user's distance? 6 A Would it have been technically 7 impossible? So this is a tremendously speculative 8 question. I'm aware of no one who did it. I'm 9 aware of no one who tried to do it. That may be 10 because there was a technical obstacle or it may 11 be that they didn't realize it was important or 12 useful. 13 I'm not aware of a major technical 14 obstacle, but I haven't attended to that question. 15 Q Was it technically possible to change the 16 size of an avatar on the screen? 17 A As of 2012? 18 Q Yes. 19 A Yes, it was. 20 Q Was it possible to have an avatar that 21 appeared left and right inverted, like a mirror 22 image?	131 1 Q The '110 patent discusses avatars having 2 body characteristics that correspond to user. 3 Correct? 4 A The '110 patent discusses avatars. I do 5 not recall – oh, here we are. Another memory 6 error. 7 Yes, the '110 patent does discuss avatars 8 that have body characteristics corresponding to 9 body characteristics of a user. 10 Q And in your view, are avatars excluded 11 from Claim Limitation 1(c) of the '110 patent? 12 A 1(c)? (a), (b) – there is no mention of 13 avatars in that claim. 14 Q Are avatars excluded from Limitation 1(f) 15 of the '110 patent? 16 A 1(f)? (c), (d), (e). (f)? Captured 17 by ... 18 There is no mention of avatars in the 19 claim. I think they are excluded, because in 1(c) 20 you must apply the transmission mapping to the 21 stream of images captured by the camera. And an 22 avatar is a thing inside a computer system rather
130 1 A As of 2012, yes, it was. 2 Q And was it possible to have an avatar 3 that appears to be double the distance of the user 4 away from the screen as of 2012? 5 A So to answer that accurately I would need 6 access to a library and check some dates. Because 7 I don't remember the time that – the date at 8 which depth-measurement devices were introduced 9 and available. It may have been doable. It is 10 certainly not the case that I'm aware of anyone 11 who actually did it. 12 Q So you said it requires depth 13 measurement? 14 A It requires some way of knowing how far 15 away the user is. 16 Q Does Geisner disclose sense of depth 17 in -- sense of depth of the user? 18 A Does Geisner disclose – I think Geisner 19 does. Geisner has a depth sensor, I believe. 20 Yep, Geisner has a depth sensor. So my 21 chronology – my caution about chronology was 22 correct.	132 1 than imaged in a stream of images. 2 Similarly in 1(f) you utilize the angle 3 of the images captured by the camera and applied 4 parametric input to change the imaging 5 perspective. 6 So again, I think avatars are excluded 7 simply because avatars are things that live inside 8 the computer. 9 I guess an absolutely precise answer 10 depends on what you mean by "avatars are 11 excluded." If I took a picture of an avatar and 12 held it up in front of me, then Claim 1(c) might 13 operate on that picture. 14 Q If you could turn to your '110 15 declaration, Paragraph 153 to 156. 16 A '110, 153. 17 Q Starting from Page 90 of the exhibit. 18 A Sorry, some of the paragraphs are long. 19 153. Here I am. 20 Q So here from Paragraph 153 to Paragraph 21 156 you discuss Limitations 1(c) and 1(e) of the 22 '110 patent. Correct?

133 1 A That's correct. 2 Q In your discussion of these limitations 3 in these paragraphs you discussed only Geisner. 4 Correct? 5 A That's correct. 6 Q And you didn't discuss any other 7 references. Correct? 8 A I believe that's correct, yes. 9 MS. ZHANG: And we've been going on for 10 an hour. Would you like a break? 11 THE WITNESS: I think that would be good. 12 Have we reached a natural point? 13 MS. ZHANG: Okay. Maybe take a 14 ten-minute break? 15 THE WITNESS: Okay. 16 (A recess was taken.) 17 BY MS. ZHANG: 18 Q Dr. Forsyth, I just handed you a new 19 document. 20 (Exhibit 1008, IPR2024-00810, previously 21 marked, not attached.) 22 Q Exhibit 1008 of the '110 IPR. It is also	135 1 Q Is this a computer vision application? 2 A Yes. 3 Q Does mirrored silhouette means the image 4 is flipped? 5 A In Lizee I believe the image is viewed 6 from behind, and so would need to be flipped. In 7 the – I think that quote is from the abstract of 8 Lizee, Paragraph 12 it says. 9 So the silhouette is flipped, yes. 10 Q And do you agree that Lizee's silhouette 11 is an image of the user with reduced details? 12 (Clarification by the court reporter.) 13 Q Do you agree that Lizee's silhouette is 14 an image of the user with reduced details? 15 A An image of the user with reduced detail? 16 MS. SAPUTO: Objection. Vague. 17 A The detail's been very aggressively 18 reduced, and there are many images of users with 19 reduced detail that would not be silhouettes. But 20 with those caveats, I'd agree. 21 Q If you could turn to Paragraph 137 of the 22 '110 declaration, please.
134 1 Exhibit 1017 of the '109 IPR. 2 A I have that document. I am downloading 3 it now. Here we go. Yes, I have that document. 4 Q And you recognize this as the Lizee 5 reference you talked about. Correct? 6 A That's correct. 7 Q And you have reviewed this document 8 before. Right? 9 A I have. 10 Q And you have reviewed the entire 11 document? 12 A That's correct. 13 Q And you understand the disclosure in this 14 document? 15 A I do. 16 Q If you could turn to Paragraph 73 of your 17 '110 declaration. 18 A Seventy-three. I am at Paragraph 73. 19 Q Lizee describes a virtual presence system 20 that provides a mirrored silhouette. 21 Is that right? 22 A That's correct.	136 1 A Paragraph 137. 2 Q Sorry. Page 77. 3 A It takes a moment. Here we go. 4 Paragraph 137. Here we go. 137. 5 Q And you agree that Lizee's silhouette is 6 not the image captured by the camera. Correct? 7 A Lizee says the silhouette is not the 8 image captured by the camera. 9 Q And if you move down to Paragraph 139. 10 A I'm there. 11 Q And you agree that Lizee discloses the 12 silhouette is inverted; that is, left to right 13 flipped. Correct? 14 A That's correct, yes. 15 Q And Lizee describes it as a translucent 16 mirrored silhouette transformation. Correct? 17 A Lizee uses those phrase – that phrase, 18 yes. 19 Q Would you please go turn to the Lizee 20 reference at Paragraph 88? 21 A Paragraph 88 in Lizee. 22 I'm at Paragraph 88 in Lizee.

137 1 Q Here Lizee discloses capturing an image 2 of the user. Correct? 3 A He does. 4 Q And Lizee discloses performing 5 transformations to the captured image. Correct? 6 A Instructions -- yes, that's correct. 7 Q If you could turn to Paragraph 40, 0040 8 of Lizee. 9 A Paragraph four zero of Lizee. I see it. 10 Q This paragraph describes that as the user 11 moves relative to the image capture device, the 12 size of the silhouette remains the same. Correct? 13 A A to E in the real world. Figure 2A. 14 The size of the silhouette remains the same, 15 that's correct. Figure 2A shows 2A to E -- yes, 16 that's correct. 17 Q If you could turn to Paragraph 141 of 18 your '110 declaration. 19 A Paragraph 141? I am there. 20 Q You discuss the Paragraph 8 of Lizee 21 here. Correct? 22 A That's correct.	139 1 representation of the player in the game. 2 Q And do you agree that here Lizee 3 discloses the representation of the user on the 4 screen is looking at the user like a mirror, not 5 aware that the user is looking? 6 A I agree that -- sorry, this paragraph 7 discloses Lizee pointing out that a player will 8 feel unnatural if they see a mirror representation 9 of themselves. The character on the screen should 10 be looking -- it continues to point out that the 11 character on the screen should be looking at where 12 the player is looking, not at the player. So in 13 this paragraph Lizee is referring to a situation 14 where the silhouette is presented as if there was 15 a camera behind the player's shoulder. 16 Q So if you look at the last sentence of 17 this paragraph, it states the character on the 18 screen is looking at the player, like in the 19 mirror, and not where the player is looking. 20 Correct? 21 A That is what that sentence says. In the 22 context of the paragraph, it's clear that Lizee
138 1 Q Do you agree that Lizee discloses use of 2 a mirror captured image to obtain the silhouette? 3 A Do I agree that Lizee discloses a mirror 4 captured image to obtain the silhouette? I do 5 not -- 6 Q Let me repeat that question. I don't 7 think you get all of it. 8 A Okay. 9 Q Do you agree that Lizee in this paragraph 10 discloses the use of a mirror captured image to 11 obtain the silhouette? 12 MS. SAPUTO: Objection. Vague. 13 A In -- I'm sorry, I did not follow that. 14 In this paragraph, you're referring to Paragraph 8 15 of Lizee. In this paragraph, Lizee does not 16 describe anything to do with obtaining a 17 silhouette. 18 Q Does the term representative -- sorry, 19 does the term "a representation of the player in 20 the game" here refer to the silhouette of the user 21 in Lizee? 22 A The silhouette of a user could be a	140 1 intends that this is an explanation for why the 2 player sees a representation that feels unnatural 3 and requires significant adaptation from the 4 player. 5 Q So Lizee discloses performing 6 transformations of the captured image to obtain 7 the silhouette. Correct? 8 A That's correct, yes. 9 Q Do those transformations include 10 distortion correction? 11 A I -- quite possibly. I'd have to check 12 to be sure. 13 Memory does not say so, but it's entirely 14 possible that there is a distortion correction. 15 Q If I could turn -- if you could take a 16 look at Paragraph 88 that we looked at? 17 A Eighty-eight. 18 Q Does that refresh your recollection that 19 Lizee discloses correction distortion? 20 A This is 88 in Lizee? 21 Q Uh-huh. 22 A I don't think you're -- I agree with your

141 1 question as stated. I believe you asked me does 2 Lizee use distortion correction to create the 3 silhouette. And I do not see support for that in 4 this paragraph. 5 Q Can you turn to Paragraph 84 of Lizee. 6 A Eighty-four? I have 84. 7 Q And it may -- if I may direct you to top 8 of Page 27, Lizee. 9 A "To adjust any distortion or perceptual 10 inconsistency associated with a plural-bodied 11 silhouette model." 12 So that supports the idea that Lizee will 13 adjust the distortion associated with -- well, 14 adjust any distortion. Distortion, yes, Lizee 15 corrects distortion constructing the silhouette. 16 Q And following that first two sentences, 17 Lizee state the images could be processed to 18 compensate for potential perspective errors? 19 A Yes, that's correct. 20 Q Okay. I have another document to present 21 to you. 22 (Exhibit 1005, IPR2024-00856, previously	143 1 A That's correct. 2 Q Is this also a computer vision 3 application? 4 A I would think of Rosenberg as a computer 5 vision application, yes. 6 Q And does Rosenberg's system emulate a 7 traditional mirror? 8 A Rosenberg's system emulates a traditional 9 mirror in the manner that he describes. He says 10 it emulates a traditional mirror, and then he says 11 in what way it emulates a traditional mirror. So 12 I would say partially rather than fully. 13 Q Rosenberg discloses different modes of 14 operation. Correct? 15 A That's correct, yes. 16 Q It discloses a traditional mirror 17 emulation mode. Correct? 18 A I believe that's correct, yes. 19 Q It also discloses a mirror image freeze 20 feature. Right? 21 A It discloses a mirror image freeze 22 feature. I don't recall whether it refers to that
142 1 marked, not attached.) 2 A Which document is this? 3 Q This is Exhibit 1005 of the '109 IPR. 4 This is also Exhibit 1006 of the '110 IPR. It 5 just got uploaded. 6 A Is this Rosenberg? 7 Q Yes. You recognize this as the Rosenberg 8 reference? 9 A I recognize this as Rosenberg. Sorry, I 10 have eight documents on the screen, or ten 11 documents on the screen, and this isn't very 12 helpful. I'll open it now. 13 Q And you have reviewed this Rosenberg 14 reference before. Correct? 15 A I have, that's correct. 16 Q And you reviewed entire document? 17 A I did. 18 Q And you understand the disclosure in this 19 document? 20 A I do. 21 Q So Rosenberg discloses a digital mirror 22 system. Correct?	144 1 as a mode or not. 2 Q And it also discloses a mirror image 3 buffering feature. Correct? 4 A Again, I believe it discloses a mirror 5 image buffering feature. I don't believe it 6 refers to that as a mode. 7 Q It also discloses a picture image display 8 mode. Correct? 9 A That's correct. 10 Q And in Rosenberg's traditional mirror 11 emulation mode, it discloses flipping the image 12 about a vertical axis to more accurately replicate 13 a mirror image. Correct? 14 A That's correct. 15 Q Is it your opinion that providing double 16 the distance in same size properties of a 17 conventional mirror more difficult and more 18 complex than flipping the image? 19 A Yes. 20 Q In your view, a POSITA would not know how 21 to implement these known conventional mirror 22 properties with known transformation techniques?

145 1 A I think my view is stated that a POSITA 2 would not have realized it was important. And the 3 support for that view in the fact that Rosenberg 4 doesn't do it, nor do a number of other people. 5 Q So in your opinion, a POSITA would not 6 have realized those features are important? 7 A In my opinion, a POSITA -- a POSITA would 8 not have realized those features were important. 9 And a number of documents I've looked at here 10 describe mirror emulation without having those 11 features, suggesting that authors at the time did 12 not realize that it was important either. 13 Q A POSITA would have known how to 14 implement those mirror properties with 15 transformations. Correct? 16 MS. SAPUTO: Objection. Vague. 17 A That's not a question I attended to in 18 preparing the declaration. And I'd need a little 19 time and care to give an accurate answer. But I 20 think it's certainly possibly true. 21 Q How does the '109 patent disclose 22 obtaining these optical properties of the mirror	147 1 Q Sorry, I'll rephrase. 2 A Okay. 3 Q You mentioned Claim 1 recites applies a 4 transformation mapping. Does that transformation 5 mapping allow you obtain the optical properties of 6 conventional mirror? 7 A Likely it's not the only thing, because 8 the next step says, "resizing the image to reduce 9 variations caused by the change in object's 10 distance to the camera." That would suggest that 11 the scope of transformation mapping may not cover 12 that particular act. 13 Q So can you obtain the optical properties 14 of conventional mirror image by doing 15 transformation mapping and the resizing? 16 A Can you obtain the optical properties -- 17 you can certainly obtain an artifact that meets 18 the construction of the claims, which is not quite 19 the same as the optical properties of a 20 conventional mirror. Or may not be quite the same 21 as the optical properties of a conventional 22 mirror.
146 1 image? 2 MS. SAPUTO: Objection. Form. 3 A How does the '109 patent disclose. Are 4 you asking me from my memory of the patent or do 5 we look at the document? 6 Q Yeah, you can go ahead take a look at the 7 document. And you have the document. Right? 8 A I believe I have the document. It is -- 9 oh, '109. It applies a transformation mapping to 10 the image to modify -- this is in Claim 1. It 11 applies a transformation image -- mapping the 12 image to modify the image such that it appears to 13 mimic the reflection of a mirror, resizing the 14 image to reduce variations caused by changes in 15 the object's distance to the camera. And then 16 displays the image and the like. It's explicit 17 that it achieves this. 18 Q Those steps are all required to obtain a 19 mirror mimicking image for the '109 patent? 20 MS. SAPUTO: Objection. Vague. 21 A Are the steps required to obtain a mirror 22 mimicking image?	148 1 Q What do you mean an artifact that meets 2 the construction of the claims? 3 A I understand that to display a mirror 4 mimicking image on the monitor I need an image 5 that is by the construction it needs to be 6 left-right inverted, and I believe it needs to 7 show the user at a distance of about twice the 8 user's distance from the mirror. That I can 9 certainly do with a transformation mapping and 10 resizing. There are other optical properties that 11 may require more than transformation mapping and 12 resizing. 13 Q Can you give an example of that 14 transformation mapping? 15 A The transformation mapping required to 16 modify the image. 17 Q What kind of transformation mapping was 18 disclosed in the '109 patent? 19 A '109 discloses a number of transformation 20 mappings, I believe. 21 Q Can you give an example? 22 A I'm looking for one.

149 1 One transformation mapping on Column 29, 2 Line 30 and below, removes an image appearing to 3 have been taken from a camera position at eye 4 level height and pointing horizontally. The -- 5 that class of transformation mapping comprises at 6 least a tilt transformation and an elevation 7 transformation, and there's some more detail. 8 Q How does the '110 patent disclose 9 obtaining the optical properties of a conventional 10 mirror? 11 A Passing from '109 to '110? 12 Q Right. '110 patent. 13 A All right. Let me open the patent. 14 '110. 15 In '110 I -- in '110 Claim 1, last 16 element. "Wherein during mirror tracking mode I 17 use the angle of the images captured by the camera 18 and apply parametric input for a mapping 19 transformation that changes imaging perspective of 20 the images captured by the camera." 21 It also -- yeah, that's what it does. 22 Q Can you give an example of the mapping	151 1 A Well, at least part of it would be a 2 homography. But Figure 1 reveals that there is 3 more. You apply to the image the right mapping to 4 match the camera point of view with the 5 theoretical mirror point of view. And you then 6 fill in missing pixels. Filling in missing pixels 7 means that you do use some form of 3D structural 8 information, which suggests that my earlier answer 9 about 3D structural information may have been 10 wrong. Well, it's hardly an explicit mention of 11 3D structure. 12 Q Can you turn to Claim 2 of '110 patent. 13 A Claim 2? I have Claim 2. 14 Q And to recite, The mapping transformation 15 comprises a combination of at least two of the 16 following transformations: Vertical flips about a 17 vertical axis, a projection transformation, 18 rotation, and et cetera. Right? 19 A Claim 2 modifies Claim 1. And Claim 2 20 describes a system where the mapping 21 transformation contains -- or comprises, sorry, 22 the combination of at least two of those following
150 1 transformation disclosed in the '110 patent? 2 A Yes. It might take a moment. The 3 imaging perspective. Okay. The -- the relevant 4 figure is at -- I'm trying to give you a example 5 of transformation mapping. 6 Sure. In the figures there are -- there 7 is an eyes match transformation. In Figure 1, 103 8 of Figure 1, is an eyes match transformation that 9 applies on the image right mapping to match the 10 camera point of view with theoretical mirror point 11 of view (user eyes reflection), and fill the blind 12 pixels if there are after the mapping. 13 Q What is the eyes match transformation? 14 A The eyes match transformation is 15 described in a bunch of sections of the patent. 16 It's in Column 11. It's in the figures. I 17 understand it to be a transformation that modifies 18 the image such that it looks as though it was 19 taken from a better position with respect to the 20 person. 21 Q What type of transformation would that 22 be?	152 1 things. That suggests that the mapping 2 transformations of Claim 1 might involve other 3 things as well. 4 Q What other things are involved in Claim 5 1? 6 A Well, the eyes match transformation is 7 not a vertical flip about a vertical axis or a 8 projection transformation. It is not a rotation 9 or a resize. I don't believe it's an optic 10 distortion correction. It might be a polynomial 11 mapping, but I'm not sure. So I would regard the 12 eyes match transformation as an example of a 13 transformation that is certainly in Claim 1 but 14 not in the list in Claim 2. 15 Q So is it your opinion that Claim 1 16 requires the eyes match transformation? 17 A That's not what I said. You asked me for 18 an example, and I gave one. 19 Q Does Claim 2 provide examples of the 20 transformation in Claim 1? 21 A Claim 2 refers to wherein the mapping 22 transformation. The mapping transformation is --

153 1 okay. This is a point of claim interpretation, 2 where I may not have the legal background to be 3 sure. But the mapping transformation refers to at 4 least the mapping transformation in the last 5 element of Claim 1, and may refer to the adaptive 6 transformation mapping in the third element. 7 The – I would interpret Claim 2 to mean that at 8 least the mapping transformation of the last 9 element of Claim 1 must also comprise a 10 combination of at least two of the list of 11 transformations. 12 MS. SAPUTO: I have a standing objection 13 to the line of questioning as to Claim 2. 14 Dr. Forsyth has opined as to Claim 1. 15 Q So, Dr. Forsyth, you have no opinions as 16 to Claim 2? 17 A I do believe that Claim 2 is described in 18 my declaration. This is '109? '110? I'm sorry, 19 I'm getting muddled. 20 Q This is '110. 21 A '110. I do not believe Claim 2 is 22 described in my declaration.	155 1 A I think there is no detailed opinion 2 about any other limitation except to the extent 3 that if the art doesn't meet Claim 1, then the 4 dependent claims, it doesn't meet them either. 5 Q And switching to your '109 declaration. 6 Is it fair to say that you provide no opinions as 7 to any other claim limitations other than 8 Limitation 1(c) and 1(h)? 9 A (c)? (h)? With the same caveat, I 10 believe that is correct. And the caveat is that 11 there's detailed discussion of Claims 1(c) and 12 1(h), and then on the grounds – in the paragraphs 13 on the grounds, it mentions that if one doesn't – 14 if the art doesn't invalidate 1, then it doesn't 15 invalidate the dependent claims either. 16 Q Okay. Let's turn to your '110 17 declaration at Paragraph 112. 18 A 112. The paragraph leads, "It is my 19 opinion that any assertion." 20 Sorry, am I at the right paragraph? 21 Q Yes. And in the middle of the paragraph 22 you stated, "Although these optical properties of
154 1 Q So you gave no opinions as to any claim 2 other than Claim 1? 3 A The – I will look at the – no. There 4 are opinions as to 1 through 6, 8, 11, and 17. I 5 think – do I have the right declaration? No. 6 It's the wrong declaration. I apologize. 7 There are the – there are the ground 8 refers to 1 through 6, 10, 12, 16, and 17. The 9 declaration has opinions about 1(f), 1(c), and 10 1(e). Ground 2 covers 1 through 6, 10, 12. But 11 the declaration has opinions about 1(f), 1(c), and 12 1(e). Ground 3 asserts invalidity of 1 through 13 18, and the declaration has opinions about 1(f), 14 1(c), and 1(e). 15 I believe the situation is that I have 16 opinions about 1, and there are several dependent 17 claims where if one doesn't practice 1, then one 18 isn't practicing the dependent claim. 19 Q So is it fair to say that you did not 20 provide opinions as to other claim limitations, 21 other than these limitations in Claim 1, 22 Limitation 1(f), 1(c), and 1(e)?	156 1 conventional mirrors likely have been known for 2 millennia, it is my opinion that a POSITA reading 3 Rosenberg and Park would not have considered the 4 relative importance of including these optical 5 properties beyond simple inversion." 6 Correct? 7 A It says that. 8 Q And the optical properties you discussed 9 here are the reversed reflection double the 10 distance, same as properties as we discussed 11 earlier. Correct? 12 A That's correct. 13 Q And what do you mean by "relative 14 importance" in this sentence? 15 A Well, Rosenberg and Park – sorry, 16 Rosenberg clearly understands that it is important 17 and helpful to do a left-right flip. Rosenberg 18 does not understand that a user's image appears at 19 roughly the same size regardless of user's 20 distance to the camera. And his invention 21 describes a number of different ways in which that 22 property is and should be violated. Park does not

157 1 discuss that property at all. 2 So they don't reveal the property, and 3 they should have known it. So if they knew it and 4 didn't reveal it, then they did not believe it was 5 important or they were unable to implement it. 6 Q Why do you think they should have known? 7 A Why do I think they should have known? 8 And what I'm referring to there is double the 9 distance to the mirror and roughly the same size. 10 Because those had been known for millennia and 11 they're standard simple exercises in geometry. 12 Q Is the relative importance part of the 13 test for motivation to combine? 14 A That sounds to me like a legal question. 15 I have no idea. 16 Q Is part of your analysis for considering 17 whether a person of ordinary skill in the art 18 would be motivated to combine Rosenberg and -- 19 A The analysis rests on the fact that 20 Rosenberg teaches away from incorporating the 21 property and Park does not disclose it at all. 22 Q So when you say "relative importance,"	159 1 I think it's an indicator that although 2 people must have known the geometry, they didn't 3 think it was significant. 4 Q So it's your view that if the prior art 5 discloses a number of options, that prior art's 6 disclosure of relatively not important features 7 teaches away from using those relatively -- sorry, 8 I'll rephrase that question. 9 So the POSITA, sorry, a person of 10 ordinary skill in the art, would only consider 11 combining prior art options that are most 12 relatively important? 13 A I don't think I offer an opinion about 14 that. 15 Q And would you turn to Paragraph 113 to 16 119 of your '110 declaration. 17 A '110, 113 to 119. I am there. 18 Q And here you discuss Limitations 1(c) and 19 1(e) of the '110 patent. Right? 20 A That's correct. 21 Q And your discussion of Limitation 1(c) 22 and 1(e) in this paragraphs you discussed only
158 1 you're referring to your contention that Rosenberg 2 teaches away from those optical properties. 3 Correct? 4 A Relative importance? No, they are not 5 the same thing. A POSITA reading Rosenberg and 6 Park would not have considered the importance or 7 relative importance of including these properties, 8 because Park doesn't have them and Rosenberg 9 teaches away from them. 10 Q Is relative importance part of your 11 evaluation of whether a claim would have been 12 obvious over the prior art? 13 A Is relative importance -- the prior art 14 offered against these patents has a number of 15 errors and descriptions of mirrors or teaches 16 away. I find that puzzling. Haan misstates what 17 mirrors do and misstates projective geometry. 18 Rosenberg very specifically does not want 19 you to grow -- to have fixed size as you move 20 backwards and forwards from the mirror and offers 21 you ways to break that property. I think that's 22 puzzling.	160 1 Rosenberg. Correct? 2 A In Paragraph 113. I'm sorry. Or do you 3 mean the whole subsection? 4 Q Yeah, 113 to 119. 5 A 113 to 119. That's correct, I see no 6 discussion of Park. That's Rosenberg only. 7 Q So you don't discuss any other prior art 8 references in these paragraphs. Correct? 9 A I do not discuss prior art references in 10 these paragraphs, other prior art references in 11 these paragraphs. 12 Q And moving on to another document. 13 MS. ZHANG: If you would like to take a 14 break, please let me know. 15 THE WITNESS: I think a break might be a 16 good idea if you -- if this is a natural place. 17 MS. ZHANG: Sure, we can take a short 18 break. Ten minutes. 19 (A recess was taken.) 20 MS. ZHANG: So I have uploaded a new 21 document. This is Exhibit 1011 of the '110 IPR. 22 (Exhibit 1011, IPR2024-00810, previously

1 marked, not attached.) 2 MS. ZHANG: And also Exhibit 1016 of the 3 '109 IPR. 4 (Exhibit 1016, IPR2024-00856, previously 5 marked, not attached.) 6 BY MS. ZHANG: 7 Q This is the Park reference. Let me know 8 when you see it. 9 A I need to refresh. 10 It is here. I need to find the right 11 one. Here we go. This is Park. And I have it 12 open. 13 Q Do you recognize this Park reference? 14 A I do. 15 Q And you have reviewed this reference 16 before? 17 A I have. 18 Q And you have reviewed the entire 19 document? 20 A I have. 21 Q And you understand the disclosure in this 22 document?	161 1 transformation to correct that distortion. Right? 2 A That's correct. 3 Q And that transformation is based on a 4 camera angle. Correct? 5 A That is correct. 6 Q And the POSITA, sorry, a person of 7 ordinary skill in the art, would have recognized 8 that a transformed image would appear to be 9 captured from a different point of view in Park. 10 Correct? 11 A That's not correct. 12 Q Why not? 13 A Because in – Park offers a 14 transformation to deal with the fact that – Park 15 essentially rotates the image plane around the 16 focal point. The point of view hasn't changed. 17 Q After transformation in Park, does the 18 image appear to be captured from a different point 19 of view? 20 A At this point we need to be very careful 21 of what "a different point of view" means. The – 22 the image appears to be captured from the
162 1 A I do. 2 Q If you could take a look at your '110 3 declaration, please, at Paragraph 71. 4 A '110 declaration, at Paragraph 71. 5 I have that. 6 Q Park discloses an image capturing 7 apparatus and method for fixing distortion. 8 Correct? 9 A That's correct. 10 Q And it discloses fixing perspective 11 distortion. Correct? 12 A It discloses fixing a particular form of 13 perspective distortion. 14 Q It is described as a tilt distortion. 15 Correct? 16 A Yes. It's a distortion based on the 17 tilt. And I believe Park describes it as a tilt 18 distortion. 19 Q And is Park a computer vision 20 application? 21 A Park is. 22 Q And Park discloses performing	163 1 viewpoint that is rotated around the focal point. 2 And if that's covered by different -- sorry. It 3 appears to be captured with a camera that has been 4 rotated about its focal point. And if that meets 5 the definition of different viewpoint, then yes. 6 But Park does not cover the case when the focal 7 point moves. 8 Q But it covers the case that a camera 9 rotate. Correct? 10 A That the camera rotates about the focal 11 point. And it's a particular kind of rotation 12 rather than a generic one. 13 Q Does that rotation changes the angle of 14 the camera? 15 A Does that rotation change the angle of 16 the camera? I would say yes. 17 Q Could we turn to the '110 declaration, 18 Paragraph 120 to 128. 19 A 120 to 128. 20 I'm at 120. 21 Q In these paragraphs you describe -- you 22 discussed the Limitations 1(c) and 1(e) of the

1 '110 patent. Correct? 2 A That's correct. 3 Q And you discussed the motivation to 4 combine Rosenberg and Park for these limitations. 5 Correct? 6 A That's correct. 7 Q And the only discussion with respect to 8 Park is that Park discloses a wholly computer 9 processing-based solution to changing image 10 perspective and angle. Correct? 11 A Together with a series of quotes from 12 Park. 13 Q Okay, I'm moving on to next document. 14 A Okay. 15 Q Introducing Exhibit 1006 in the '109 IPR. 16 (Exhibit 1006, IPR2024-00856, previously 17 marked, not attached.) 18 MS. ZHANG: Sorry, Exhibit 1007, which is 19 the translation of 1006. 20 A Here we go. 21 Q You recognize this is the certified 22 translation of Nakazawa reference. Right?	165 1 whole body. 2 Q So does Nakazawa's change of 3 magnification apply only to the user's face in 4 image? 5 A Let's look at Nakazawa and check that 6 point. Yes. 7 Q So can you look at Figure 3 of Nakazawa. 8 A Figure 3 of Nakazawa. 9 I see Figure 3 of Nakazawa. 10 Q Is it your opinion that in this figure 11 the change is only to the face in the image? 12 A Figure 3, let's be sure we're looking at 13 the same figure, Page 8 of 11, the label is at the 14 top of the figure. Right? It shows the face. 15 There is some neck in the picture. Faces are 16 usually regarded as having necks attached to them. 17 But it shows only a face. 18 Q You can see that Figure 3 has Figure 3(a) 19 and Figure 3(b). Correct? 20 A I do. 21 Q And if you compare Figure 3(a) and Figure 22 3(b), it gives you the area at the bottom of the
166 1 A I do. 2 Q Have you reviewed this document before? 3 A I have. 4 Q And you have reviewed the entire 5 document? 6 A I have. 7 Q And you understand the disclosure in this 8 document? 9 A I do. 10 Q Let's turn to your '109 declaration. 11 A '109 declaration. 12 I have that document. 13 Q And if you could turn to Page 148, or 14 Paragraph 446. 15 A 446. 16 I am at Paragraph 446. 17 Q Is it your opinion that Nakazawa is 18 limited to the user's face, not the body? 19 MS. SAPUTO: Objection. Vague. 20 A It says here, with quotes, that 21 Nakazawa's disclosure of magnifying the user's 22 image is limited to the user's face and not the	167 1 image is smaller in Figure 3(b). Correct? 2 A That's correct, yes. 3 Q Is that area limited to the user's face? 4 A On Nakazawa's invention is described as 5 being attached to the face. And Nakazawa in 6 Figure 2 shows how his camera is used to view a 7 face and adjust. The transformation that Nakazawa 8 applies could be applied to anything, but it 9 mostly wouldn't work unless the object was 10 relatively small in extent compared to the field 11 of view of the camera. 12 Q I am introducing another document. 13 (Exhibit 1008, IPR2024-00856, previously 14 marked, not attached.) 15 A Okay. 16 Q This is Exhibit 1009 of the '109 IPR. Do 17 you see it? 18 A I see it. It's just downloading and I'll 19 open it. Here we are. I have it. 20 Q Do you recognize this is the certified 21 translation of the Hatanaka reference. Right? 22 A I do.
168	168

169 1 Q And you have reviewed this reference 2 before. Correct? 3 A I have. 4 Q And you have reviewed entire document? 5 A I have. 6 Q And you understand the disclosure in this 7 document? 8 A I do. 9 Q And if you could take a look at your '109 10 declaration, please. Paragraph 485. 11 A '109, Paragraph 485. 12 I'm there. 13 Q Are you there? 14 A I am there. 15 Q Here you stated, "A POSITA would have 16 regarded Hatanaka as being concerned with varying 17 the parameters of an encoder so that it encodes 18 content to have different resolutions, frame rate, 19 quantization step size, compression ratio and so 20 on to reduce throughput." 21 Correct? 22 A That's correct.	171 1 rate in units? 2 A The standard unit for frequency is hertz. 3 Q By fixed rate do you mean performing a 4 fixed number of steps per second? 5 A No. I mean performing whatever it is you 6 do, at fixed intervals in time. 7 Q So here do you mean performing image 8 processing at a fixed interval in time? 9 A Yes. So if I image process at a fixed 10 rate, I might, for example, process an image every 11 tenth of a second, but what happens to that image 12 might change. The rate has not changed. 13 Q So if you process an image every tenth of 14 a second, do you process ten images per second? 15 A Not necessarily. You might be processing 16 the same image ten times. 17 Q If you process a video, a real-time 18 video, to obtain images at every tenth of a 19 second, do you process ten images per second? 20 MS. SAPUTO: Objection. Incomplete 21 hypothetical. 22 A So the -- you were asking me about if I
170 1 Q You continued. "A POSITA would have 2 known that each of these variations in encoder 3 parameters can be achieved with image processing 4 at a fixed rate." 5 A That's correct. 6 Q What do you mean by "a fixed rate"? 7 A At a fixed rate. I suppose what it says. 8 Occurring at a fixed and known frequency. 9 Q What is that frequency? 10 A I'm sorry, are you asking for the actual 11 value of the frequency in hertz, or are you asking 12 for a description of the frequency? 13 Q In your view, how do you describe the 14 fixed rate of image processing? 15 MS. SAPUTO: Objection. Vague. 16 A It's image processing that occurs at a 17 fixed frequency or rate. The timing between -- it 18 is a property of such image processing that the 19 timing between steps is fixed, and the equivalent 20 would be the number of steps per second or minute 21 or hour is fixed. 22 Q So how do you describe this frequency	172 1 happen to have video where there is one frame 2 of -- there are ten frames per second, and I 3 process each frame in turn, am I necessarily 4 processing at a fixed rate. 5 Is that the question? I think I've lost 6 track of where the question is going. 7 Q That's okay. Rephrase the question. 8 If you process a real-time video images, 9 and that video image has a certain frame rate, 10 does reducing the frame rate reduce the amount of 11 data that need to be processed per second? 12 A If I'm processing real-time video, does 13 reducing the frame rate -- reducing the frame rate 14 of the video reduce the amount of data I have to 15 process. Reducing the frame rate of video does 16 reduce the amount of data that I have to process 17 if I'm processing the video in real-time. 18 Q I'm sending you another document. 19 This is Exhibit 1040 of '109 IPR. It is 20 uploaded. 21 (Exhibit 1040, IPR2024-00856, previously 22 marked, not attached.)

173 1 A Ah, here we are. I see this document. I 2 am just downloading it and opening it. 3 I have the document. 4 Q So you recognize this document is the 5 Tripathi reference you discussed in your 6 declaration? 7 A I do. 8 Q And you have reviewed this document 9 before? 10 A I have. 11 Q And you have reviewed the entire 12 document? 13 A I have. 14 Q And you understand the disclosure in this 15 document? 16 A I do. 17 Q Would you please turn to Paragraph 78 of 18 your '109 declaration. 19 A Seventy-eight of '109. 20 I have that paragraph. 21 Q So here you stated "Tripathi is directed 22 to adjusting display frame rate in response to	175 1 Q Sure. You can look at Column 5, Line 65 2 to Column 6, Line 3 of Tripathi. 3 A Line 5. He says "may result in a higher 4 perceived display resolution," bottom of Column 5. 5 Q Uh-huh. So do you agree that Tripathi 6 discloses increasing the display frame rate 7 improves the perceived display resolution? 8 A Improves the perceived display 9 resolution, I do. 10 Q And it continues, to disclose reducing 11 the display frame rate reduces power consumption? 12 A It continues to say something like that, 13 yes. 14 MS. ZHANG: I may be almost done, but I 15 would like to take a quick break and we can come 16 back to it. 17 (A recess was taken.) 18 BY MS. ZHANG: 19 Q Dr. Forsyth, during any of the breaks we 20 took during this deposition did you discuss the 21 substance of your testimony with counsel? 22 A I did not.
174 1 power status of the device, content type (e.g., 2 dynamic or static), and/or affirmative user 3 input." 4 Correct? 5 A That's correct. 6 Q So do you agree that Tripathi teaches 7 adjusting the display frame rate in response to 8 power status of the device? 9 A I agree that Tripathi is directed to 10 adjusting display frame rate in response to power 11 status of the device. 12 Q And do you agree that Tripathi discloses 13 adjusting display frame rate in response to 14 content type? 15 A I agree that Tripathi is directed to 16 adjusting frame rate in response to content type. 17 Q And Tripathi discloses increasing the 18 display frame rate improves the perceived display 19 resolution. Correct? 20 A I do not believe he talks about it in 21 terms of resolution. You might direct me at the 22 paragraph.	176 1 MS. ZHANG: I have no further questions. 2 MS. SAPUTO: No redirect. 3 (Off the record at 6:27 p.m. EDT.) 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Transcript of Dr. David A. Forsyth
Conducted on May 21, 2025

45 (177 to 180)

177 1 ACKNOWLEDGMENT OF DEPONENT 2 I, DR. DAVID A. FORSYTH, do hereby 3 acknowledge that I have read and examined the 4 foregoing testimony, and the same is a true, 5 correct and complete transcription of the 6 testimony given by me, and any corrections appear 7 on the attached Errata sheet signed by me. 8 9 _____ 10 (DATE) (SIGNATURE) 11 12 13 14 15 16 17 18 19 20 21 22	179 1 I further certify that I am not related to 2 any of the parties to this action by blood or 3 marriage, I am not employed by or an attorney to any 4 of the parties to this action, and that I am in no 5 way interested, financially or otherwise, in the 6 outcome of this matter. 7 8 IN WITNESS WHEREOF, I have hereunto set my 9 hand this 22nd day of May, 2025. 10 11 My commission expires: 12 October 31, 2027 13 14 15 16   17 E-NOTARY PUBLIC IN AND FOR THE 18 COMMONWEALTH OF VIRGINIA 19 20 21 22
178 1 C E R T I F I C A T E 2 I, Debra Ann Whitehead, E-Notary Public in and for 3 the Commonwealth of Virginia, do hereby certify: 4 5 That DR. DAVID A. FORSYTH, the witness 6 whose deposition is hereinbefore set forth, was duly 7 sworn by me before the commencement of such 8 deposition and that such deposition was taken 9 virtually and is a true record of the testimony 10 given by such witness. 11 12 I further certify that the adverse party, 13 EYESMATCH LTD., was represented by counsel at the 14 deposition. 15 16 I further certify that the deposition of 17 DR. DAVID A. FORSYTH occurred virtually, on 18 Wednesday, May 21st, 2025, from 12:03 p.m. to 6:27 19 p.m. EDT. 20 21 22	

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