UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

- - - - - - - - - - - - - -x

APPLE INC., :

Petitioner, :

v. : Case IPR2023-00471

: Patent No. 6,844,990

IMMERVISION, INC., :

Patent Owner.

- - - - - - - - - - - - - - -x

Videotaped Deposition of DAVID KESSLER, Ph.D.

CONDUCTED VIRTUALLY

Thursday, February 15, 2024

8:55 a.m.

Job No.: 524618

Pages: 1 - 74

Reported By: Brooklyn E. Schweitzer, RPR, CRR

IMMERVISION EX. 2006
Apple v. ImmerVision
IPR2023-00471

Videotaped Deposition of DAVID KESSLER, Ph.D., conducted virtually.

*** ALL PARTIES ATTENDED REMOTELY. ***

Pursuant to Notice, before Brooklyn E. Schweitzer, Registered Professional Reporter, Certified Realtime Reporter, and Notary Public in and for the Commonwealth of Pennsylvania.

A P P E A R A N C E S

ON BEHALF OF THE PETITIONER:

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Micah Hardin, Technician

C O N T E N T S

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By Mr. Murray 6

E X H I B I T S

EXHIBIT PAGE

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| | | |
|---|---|---|
| 1 | P R O C E E D I N G S | 00:03:37 |
| 2 | VIDEOGRAPHER: Here begins Video File | 08:55:13 |
| 3 | No. 1 in the video deposition of David Kessler, | 08:55:14 |
| 4 | Ph.D., in the matter of Apple, Inc., versus | 08:55:18 |
| 5 | ImmerVision, Inc., in the United States Patent and | 08:55:21 |
| 6 | Trademark Office, Case No. IPR2023-00471. | 08:55:24 |
| 7 | Today's date is February 15th, 2024. Time | 08:55:31 |
| 8 | on my video monitor is 8:54 -- 8:55 a.m. Eastern | 08:55:37 |
| 9 | Time. My name is Robert Leonard. I'm the video | 08:55:43 |
| 10 | specialist. I represent Planet Depos. | 08:55:46 |
| 11 | This deposition is being taken via Zoom | 08:55:48 |
| 12 | online. Will counsel please identify themselves | 08:55:51 |
| 13 | verbally and state whom they represent. | 08:55:56 |
| 14 | MR. MURRAY: Good morning. It's Stephen | 08:55:57 |
| 15 | Murray, Panitch Schwarze, representing patent | 08:55:59 |
| 16 | owner. | 08:56:04 |
| 17 | MR. JHURANI: Good morning. My name is | 08:56:04 |
| 18 | Karan Jhurani. I'm with Fish & Richardson | 08:56:06 |
| 19 | appearing today on behalf of petitioner, Apple | 08:56:09 |
| 20 | Incorporated. | 08:56:13 |
| 21 | VIDEOGRAPHER: The court reporter today is | 08:56:13 |
| 22 | Brooklyn Schweitzer. She also represents Planet | 08:56:15 |

Depos. Will the court reporter please swear in the witness. 08:56:17 08:56:17

DAVID KESSLER, Ph.D., 08:56:17

was called, and having been duly sworn, 08:56:17

testified as follows: 08:56:31

EXAMINATION 08:56:31

BY MR. MURRAY: 08:56:32

Q Good morning, Dr. Kessler. 08:56:32

A Good morning. 08:56:34

Q Do you recall being deposed last October in connection with an IPR for another ImmerVision patent? 08:56:34 08:56:39 08:56:43

A Yes. 08:56:43

Q And since that deposition, have you been deposed in any other cases? 08:56:43 08:56:47

A No. 08:56:48

Q Have you testified in any other cases since then? 08:56:49 08:56:52

A Testified? No. 08:56:53

Q I'm just going to quickly just go over the ground rules we have from the last deposition. 08:56:56 08:57:01

When I ask you questions, please answer 08:57:03

out loud. That's for the benefit of our court reporter as she cannot take down head nods or shaking or anything of that nature. 08:57:07 08:57:11 08:57:14

If you don't understand a question, could you please ask me to rephrase it? 08:57:15 08:57:17

A Okay. 08:57:23

Q Okay. If you don't ask me to rephrase it, I will assume that you have understood the question. Is that fair? 08:57:23 08:57:28 08:57:30

A Okay. 08:57:31

Q All right. Is there any reason you can't give your full, fair, and honest testimony today? 08:57:32 08:57:35

A No. 08:57:37

Q Okay. And do you understand that the oath you just took is the same as you would in a court of law? 08:57:38 08:57:43 08:57:46

A Could you repeat it slowly? 08:57:46

Q Yeah, sorry. Sorry. Do you understand that the oath you just took is the same that you would take in a court of law? 08:57:48 08:57:51 08:57:54

A Yes. 08:57:55

Q Okay. And during the testimony, your 08:57:55

attorney may object for the record, but unless he instructs you not to answer, you must answer. Is that okay? 08:58:00 08:58:03 08:58:05

A Yes. 08:58:06

Q All right. And if you need a break, please let me know. We will try to take a break every hour or so. I just ask that if you ask for a break, that a question not be pending. Is that okay? 08:58:06 08:58:10 08:58:14 08:58:16 08:58:19

A Okay. 08:58:19

Q All right. What is an image disk? 08:58:20

A What is an imaging disk? 08:58:25

Q Image disk? 08:58:29

A Image disk. Image disk, I would say in optics it would be a round image. 08:58:33 08:58:38

Q Okay. What is the image plane of an objective lens? 08:58:41 08:58:48

A It is the plane where the image will be. Or is. 08:58:49 08:58:56

Q All right. In a digital camera, for example, the image sensor is placed at the image plane; is that right? 08:58:57 08:59:05 08:59:09

A Yes. 08:59:10
Q Why is that? 08:59:13
A That's where the image is clear and 08:59:15
focused. That's where you put your sensor. 08:59:19
Q And similarly in old cameras that used 08:59:22
film, film would be placed at the image plane; is 08:59:33
that right? 08:59:36
A Yes. 08:59:36
Q And the image plane will exist regardless 08:59:37
of whether there's an image sensor, correct? 08:59:42
MR. JHURANI: Objection to form. 08:59:48
A It's a very general question. In cameras, 08:59:53
for example, or lenses for cameras, that's true. 08:59:58
Some lenses don't have an image plane. Afocal 09:00:02
lenses do not have an image plane. So can have an 09:00:08
image plane, can be everywhere. 09:00:12
Q Okay. That's a -- that's a fair point. 09:00:14
So -- but in a digital camera, as you state as an 09:00:17
example, the image plane will exist regardless of 09:00:21
whether the image sensor is present? 09:00:25
A Yeah. 09:00:27
Q Okay. 09:00:28

MR. MURRAY: Micah, could you pull up Exhibit 1023 and mark it as Deposition Exhibit 1, please? 09:00:33 09:00:36 09:00:42

TECHNICIAN: Stand by. 09:00:43

(Kessler 1 was marked for identification and is attached to the transcript.) 09:00:45 09:00:53

TECHNICIAN: And, Counsel, do you want that labeled Deposition Exhibit 1, or is Kessler 1 okay? 09:00:53 09:00:55 09:01:00

MR. MURRAY: Kessler 1's fine. 09:01:01

TECHNICIAN: Okay. 09:01:03

MR. MURRAY: Thank you. 09:01:04

MR. JHURANI: Counsel, while that's coming up, I'll just note that, I believe, and Dr. Kessler can correct me if I'm wrong, he has paper copies unmarked that he had responding to this declaration and some of the other exhibits. 09:01:22 09:01:23 09:01:25 09:01:29 09:01:32

So is it fine for him to refer to those as well as you're asking questions? I just want to make sure that you're aware of that. 09:01:35 09:01:38 09:01:40

MR. MURRAY: Yeah, that's fine if he's looking at it, if he could just let us know where 09:01:42 09:01:44

he's looking so we can all be looking at the same thing. 09:01:47 09:01:49

THE WITNESS: Okay. 09:01:51

BY MR. MURRAY: 09:01:54

Q Okay. So hopefully you see on your screen that's been marked as Kessler 1. Do you see that, Doctor? 09:01:55 09:01:57 09:02:02

A Yes. 09:02:02

Q Okay. And do you recognize this document? 09:02:03

A Yeah. Looks like my second declaration. 09:02:05

Q Okay. Can we turn to Page 42, please? 09:02:09

Okay. Is that your signature? 09:02:17

A Yes. 09:02:23

Q And this declaration relates to U.S. Patent No. 6,844,990; is that right? 09:02:23 09:02:35

A Yes. 09:02:37

Q And is it all right if I refer to that as the '990 patent? 09:02:38 09:02:41

A Yes. 09:02:43

Q Okay. And is it all right if I refer to this document, Kessler 1, as your second declaration? 09:02:46 09:02:48 09:02:52

A Yes. 09:02:53

Q Okay. Did you draft this second declaration yourself? 09:02:53

A Yes, with help. 09:02:59

Q What do you mean by with help? 09:03:00

A In mostly through stuff from counselor. 09:03:01

Q Okay. Did you form the conclusions set out in your second declaration independently? 09:03:07

A Yes. 09:03:14

Q Okay. So if we could turn to Paragraph 72 of your declaration. Starts on Page 30. 09:03:16

Okay. In this paragraph, you give some examples where an image sensor is sized so it's diagonal is the same image of the image circle's diameter; is that correct? 09:03:21

A Right. 09:03:31

Q Is image circle the same thing as image disk? 09:03:53

A We don't really use the term image disk, but the -- if you refer to the yellow round image which represents the image of the panoramic lens, then if you call it image disk, fine with me. 09:03:57

Q Okay. So you would prefer to call it image circle? 09:04:30 09:04:33

A Yeah. 09:04:34

Q Okay. In each of these options shown at the top of Page 31, portions of the image circle do not fall on any pixel of the image sensor; is that correct? 09:04:36 09:04:48 09:04:55 09:05:01

A Yes. 09:05:01

MR. JHURANI: Objection to form. 09:05:02

Q So these areas of the image circle in A, B, and C don't -- withdrawn. 09:05:04 09:05:11

So these portions of the image circle which don't fall on the image sensor will not be captured; is that correct? 09:05:15 09:05:18 09:05:23

A Yes. 09:05:24

Q And at the bottom of that Paragraph 72, you note that each of the options allows using all or most pixels of the image sensor; is that correct? 09:05:25 09:05:53 09:06:00 09:06:03

A Yeah, the options. Yes. 09:06:03

Q And just to be clear, options meaning A, B, and C at the top of the page? 09:06:07 09:06:10

A Right. 09:06:12

Q Okay. In your personal experience, have you ever designed any optical systems using fisheye lenses? 09:06:13 09:06:23 09:06:26

A Yes. 09:06:27

Q What types of systems have you designed in that fashion? 09:06:28 09:06:43

A Okay. The term fisheye lens refers to a lens which has a very large field of view, and where does the fisheye start? It's 60 degrees or 80 degrees semifield. It's kind of smooth. It's kind of not really well defined. 09:06:43 09:06:48 09:06:55 09:07:01 09:07:07

So I've done an optical system with very large field, which some people may call fisheye lenses. 09:07:11 09:07:14 09:07:18

Q Did you actually design the lens yourself in those situations? 09:07:18 09:07:21

A In one case, yes. In other cases, I analyzed others. 09:07:22 09:07:30

Q Let's talk about the case where you designed the actual lens. Did you actually put the system together with the image sensor? 09:07:31 09:07:40 09:07:45

A In this case, I had a preferred sensor. 09:07:48

Q And in that -- I'm sorry? 09:07:56

A The customer had a preferred sensor, and I designed with the sensor in mind. 09:08:02 09:08:04

Q Do you recall what the field of view was for that particular lens? 09:08:08 09:08:15

A Maybe plus/minus 50 or 60 degrees. 09:08:16

Q And when the system was assembled, did the image circle provided by that lens fall on a sensor according to any of the Options A, B, or C at the top of the Page 31 of your second declaration? 09:08:25 09:08:43 09:08:51 09:08:55 09:08:58

A Yeah. I was -- like, Option B, which is the most common one. 09:08:59 09:09:04

Q Is that the same for other systems that you've analyzed that had very large field of view lenses? 09:09:05 09:09:13 09:09:16

A Yeah. Most large field lenses had radial, round image, and the most common sensors are rectangular sensors with aspect ratios. Used to be 4 by 3, the old ones, like in the movies. Now it's mostly 16 by 9, but they're rectangular. 09:09:17 09:09:29 09:09:37 09:09:44 09:09:47

So the situation shown on the second -- on Option B is, I would say, the most common. 09:09:51 09:09:55

Q All right. If we could go down to Paragraph 74 and 75, which are on Page 32. 09:09:58 09:10:06

Do you see those paragraphs? 09:10:12

A Yeah. 09:10:18

Q Okay. And here, is it fair to say you're seeking to discredit Mr. Munro's assertion that underfilling of image sensors is another possibility for image capture? 09:10:19 09:10:26 09:10:30 09:10:33

MR. JHURANI: Objection; form. 09:10:37

A Could you repeat the question? 09:10:44

Q So in Paragraphs 74 and 75 of -- 09:10:45

A Yes. 09:10:50

Q -- your declaration -- 09:10:51

A Yeah. 09:10:54

Q -- are you here trying to discredit Mr. Munro's assertion that underfilling of image sensors is another possibility for image capture? 09:10:54 09:10:56 09:10:59

MR. JHURANI: Objection to form. 09:11:05

A I don't think I'm trying to discredit anything. I -- I understand this figure is -- 09:11:05 09:11:10

Munro, you'll witness, said in his deposition has nothing to do with the sensor. It's just -- the square is just showing that he deflected image and things like that. It's not related to the sensor. 09:11:22 09:11:27 09:11:34 09:11:40

Q Okay. But do you agree that there are applications where underfilling of the image sensor and capturing the whole image circle are desirable? 09:11:43 09:11:45 09:11:48 09:11:52

A Few. I designed for those two, actually, and yeah, they are -- they are there, but they are usually not in the domain of panoramic or fisheye lenses. 09:11:53 09:11:58 09:12:05 09:12:08

Q So you say they're not in the domain of panoramic or fisheye lenses. 09:12:09 09:12:21

A Mm-hmm. 09:12:24

Q What domain would they be in? 09:12:25

A Well, this year I designed a system for eye surgery, for retina surgery, in which it was important to use the whole disk, the whole, what you call the image disk. Okay? And the loss of pixels was secondary. So, yeah, there are cases. 09:12:27 09:12:35 09:12:40 09:12:47 09:12:53

Q So there are cases, but you would say they 09:12:56

don't apply to fisheye lenses? 09:13:07

A I'd say I'm not aware and I have not had 09:13:09

in my experience the situation. It's a whole disk 09:13:14

is outside of the common domain. The common 09:13:18

domain is that the detector, the sensor is 09:13:23

circumscribed within the image. 09:13:25

MR. MURRAY: Okay. Micah, can you pull up 09:13:33

what's marked as Kessler 2, the document U.S. 09:13:37

6865028? 09:13:41

TECHNICIAN: Stand by. 09:13:45

(Kessler 2 was marked for identification 09:13:46

and is attached to the transcript.) 09:14:23

MR. MURRAY: Thank you. 09:14:23

BY MR. MURRAY: 09:14:24

Q And can you see that, Dr. Kessler? 09:14:24

A Could be larger, but -- Christopher -- 09:14:26

MR. JHURANI: Counsel, is this an exhibit 09:14:33

in the record of this proceeding? 09:14:35

MR. MURRAY: It is not. 09:14:37

THE WITNESS: So do you want me to opine 09:14:41

on this? 09:14:43

BY MR. MURRAY: 09:14:44

Q I just want to make sure first that you can see the screen. That's all. 09:14:44 09:14:46

A Yeah. Right now I can see better, yeah. 09:14:47

Q Okay. Do you recognize this document? 09:14:50

A No. 09:14:51

Q All right. For the record, this is U.S. Patent No. 6,685,028. This is Kessler 2. 09:14:51 09:14:57

A You mean it's my exhibit? 09:15:08

Q It's -- Kessler 2 is just an exhibit for the deposition. 09:15:10 09:15:14

Okay. Can we go to the second page? And particularly, do you see Figure 2, Dr. Kessler? 09:15:21 09:15:32

A Figure 2, yes. Yes. 09:15:36

Q Okay. Does this look familiar at all? 09:15:41

A Not really. I don't recall that. 09:15:45

Q Could we go back to Kessler 1 briefly? 09:15:49

You see in Paragraph 74, there's a similar image in your declaration, correct? 09:16:01 09:16:15

A Yes. 09:16:18

Q Okay. That image comes from the '990 patent? 09:16:18 09:16:22

A Yeah, I think so. 09:16:22

Q And this is the image where you point out that dark edges do not represent the image sensor, correct? 09:16:29 09:16:34 09:16:40

MR. JHURANI: Objection to form; misstates testimony. 09:16:42 09:16:44

A I -- I actually said I don't think -- and I think it was confirmed by your expert -- that the square represents a sensor. 09:16:48 09:16:52 09:16:57

Q Okay. Can we go back to Kessler 2 now? If we could go to Page 11 of the document, and if we go down the text in Column 1 starting around line 30 -- 09:17:03 09:17:16 09:17:30 09:17:38

MR. JHURANI: Counsel -- so we -- since we don't have this document, can you provide it to us since it's not part of the record and not something that we have in front of us? 09:17:42 09:17:44 09:17:48 09:17:50

MR. MURRAY: Yeah. Micah -- Micah, can we -- I think you guys can -- 09:17:54 09:17:56

TECHNICIAN: Drop it in the chat? 09:18:00

MR. MURRAY: Yeah. Thank you. 09:18:02

TECHNICIAN: It's in the chat. 09:18:24

MR. JHURANI: Okay. I was able to access 09:18:39

it. Dr. Kessler, were you able to access it as well? 09:18:41 09:18:44

THE WITNESS: I didn't try. I'm reading what's here on the screen. 09:18:44 09:18:46

Let's see. Should I open the chat? Let's see. 09:18:50 09:18:54

Okay. I opened it. 09:19:12

BY MR. MURRAY: 09:19:25

Q All right. So in Column 1 starting at line 30, do you see where it says Figure 2 schematically represents the appearance of a Panoramic Image 4 projected onto -- 09:19:25 09:19:28 09:19:32 09:19:34

A Which line is that? 09:19:38

Q I'm sorry. It starts around line 30. It starts Figure 2 schematically. 09:19:39 09:19:48

A Line 30? 09:19:52

Q In Column 1. 09:19:54

A You're talking about the limited resolution of the image sensor which is generated much slower -- is that -- 09:20:05 09:20:06 09:20:09

Q No, the column on the left. Column 1. 09:20:10

A Okay. 09:20:13

Q It starts Figure 2. 09:20:14
A Okay. Appearance -- okay. 09:20:15
Q Do you see it says -- 09:20:20
A Yeah. 09:20:22
Q -- schematically represents the appearance 09:20:22
of a Panoramic Image 4 -- 09:20:25
A Okay. 09:20:28
Q -- projected onto a digital image 09:20:28
Sensor 3 -- 09:20:31
A Yeah, I see that. I see that. 09:20:32
Q And this also talks about the image sensor 09:20:34
as rectangular in shape? 09:20:39
A Yes. 09:20:41
Q And it says the entire image on the 09:20:42
rectangular image sensor -- this is down around 09:20:47
line 40. The entire image on the rectangular 09:20:51
image sensor therefore has dark edges. It will be 09:20:54
removed when digitally processed subsequently. 09:20:58
A Okay. Okay. 09:21:02
Q So would you agree that Figure 32 shows an 09:21:03
example of underfilling of an image sensor? 09:21:07
A Yeah. 09:21:10

MR. JHURANI: Objection; scope. 09:21:11
Objection; scope, form. 09:21:12
A Yeah. 09:21:14
Q And you also -- in your original 09:21:14
declaration, you cite a reference named Baker, 09:21:28
correct? 09:21:31
A Would you repeat the question? 09:21:31
Q In your original declaration, you cite to 09:21:33
a reference called Baker? 09:21:36
A Right. 09:21:37
Q Okay. And Baker is another example where 09:21:38
the full image circle should be captured on the 09:21:43
image sensor, correct? 09:21:46
A Actually, I don't recall. I'd have to go 09:21:48
and look what he did. I am very familiar with 09:21:50
Baker, but I don't remember which figure you're 09:21:55
talking about. 09:21:58
MR. MURRAY: Can we go back to Kessler 1, 09:22:00
Micah, which is your second declaration? And if 09:22:07
we go to Paragraph 76. 09:22:11
Q And in this paragraph, you mention Baker 09:22:23
teaches edge detection, correct? 09:22:25

A Right. 09:22:27

Q And you're using it to say that Baker would detect the edge of the image on the image sensor? 09:22:28 09:22:32 09:22:35

A Yes. 09:22:37

Q So there would have to be an edge to detect in order to use the edge detection, right? 09:22:38 09:22:42

A Yes. 09:22:44

Q And so Baker, then, must be underfilling at least a portion of the sensor in order to have an edge, correct? 09:22:49 09:22:53 09:22:55

MR. JHURANI: Objection; form. 09:22:56

A Edge detection -- you're saying that he wouldn't be able -- I don't understand what is the point of the question. 09:22:57 09:23:12 09:23:14

Q So you're talking about edge detection in -- 09:23:15 09:23:18

A Yes. 09:23:18

Q -- Paragraph 76 -- 09:23:19

A Yes. 09:23:20

Q -- to say it would be used to detect the edge of the image circle; yes? 09:23:21 09:23:29

A Yes. It's an indication that in Baker's processing, he takes into account the image size, L, N190, and he's demonstrated by the fact that he's looking for the image size and using it in his algorithms. 09:23:33 09:23:39 09:23:48 09:23:55 09:23:58

The edge detection means that he incorporated image size. So -- so what is the point here, I guess? I don't understand. 09:24:01 09:24:02 09:24:07

Q So my question is if edge detection is necessary, there must be an edge to detect; yes? 09:24:10 09:24:15

A Actually, edge detection indicates that he used the information. Okay? Probably he knew about that anyway, but he used edge detection, and that means he took into account in his processing the size of the image. 09:24:19 09:24:26 09:24:32 09:24:39 09:24:42

He could -- how he did it, how did he find the edge in terms of what pixels did he use in the sensor? I didn't opine on that. 09:24:45 09:24:51 09:24:54

Q Well, if -- let's look at the paragraph here. Starting in the second line on Page 33, you have a quote here from Baker, correct? 09:24:57 09:25:01 09:25:10

A Line 30 -- 09:25:13

Q No, Page 33. 09:25:16
A Line -- 09:25:19
Q Second line. 09:25:20
A Okay. 09:25:21
Q You have a quote that starts "one feature"? 09:25:21
A Yeah. 09:25:25
Q This is from Baker, correct? 09:25:26
A Yeah, from his -- yeah, transform process. Yeah. 09:25:27
Q If we go down -- five lines down, it starts, thus. 09:25:31
A Mm-hmm. 09:25:36
Q Edge detection of the unused areas outside the circular image of Figure 4 can alert the system to ignore these values. 09:25:37
Do you see that? 09:25:43
A Yeah. Can you put up Figure 4 again? 09:25:47
Q All right. 09:25:50
MR. MURRAY: So, Micah, can you mark Exhibit 1006 as Kessler 3? 09:25:51
TECHNICIAN: Stand by. 09:25:54
09:25:59
09:26:01
09:26:04

(Kessler 3 was marked for identification and is attached to the transcript.) 09:26:05 09:26:18

THE WITNESS: Now, actually, I have Baker. I'm looking at Baker. 09:26:18 09:26:24

BY MR. MURRAY: 09:26:42

Q All right. And you recognize the exhibit marked as Kessler 3 up on the screen now as Baker? 09:26:43 09:26:44

A Yeah. 09:26:48

Q Okay. So if you could go to Page 7 of the document, which has Figure 4 on it? 09:26:49 09:26:52

A Yeah. 09:26:54

Q Okay. And the quote from Baker, we read from your declaration, said edge detection of the unused areas outside the circular image of Figure 4 can alert the system to ignore these values. 09:27:04 09:27:17 09:27:20 09:27:24 09:27:27

A Okay. 09:27:28

Q Okay. So in Baker, there are unused portions of the image sensor, correct? 09:27:28 09:27:36

A Looks like it, yeah. 09:27:39

Q And Baker, I believe, has a half field of view of 90 degrees; is that right? 09:27:41 09:27:47

A It's large. I don't recall what it is. 09:27:49

Q Is it -- would you consider it a fisheye lens? 09:27:54 09:28:01

A Yeah. And his Figure 3 doesn't go all the way to 90, but it's large. 09:28:01 09:28:14

Q Just to be clear, because there's Figure 3AA. Which figure are you referring to in Baker? 09:28:15 09:28:25

A Yeah. Figure 3 -- I think it's 3BA. 09:28:28

Q 3BA. Okay. 09:28:41

A Yeah. I'm just looking at the rays coming out. It's not going all the way to 90. That's all. It's a fisheye lens. 09:28:43 09:28:48 09:28:51

Q All right. Can we go back to Kessler 1, please? And turn to Page 24, Paragraph 57. 09:28:54 09:29:02

Do you see that? 09:29:27

A Yes. 09:29:28

Q Okay. The first sentence of Paragraph 57 says, such normalization of image size (and other parameters, e.g., focal length) to 1 was well known and common in optics. 09:29:29 09:29:32 09:29:41 09:29:45

Do you see that? 09:29:47

A Yes. 09:29:48

Q What is focal length? 09:29:49

A What is focal length? 09:29:56

Q Yes. 09:29:58

A What is focal length? Focal length is a measure of the optical power of a lens. 09:29:59 09:30:02

Q What is optical power of a lens? 09:30:04

A Well, when you go to the optometrist, he will tell you that you need 3 diopters. That's optical power. 09:30:16 09:30:22 09:30:26

Q When you go to an optometrist, can you explain that in a little more detail? 09:30:35 09:30:41

A Optical power is the power of a lens to deviate the light. Okay? So it's measured in different ways. Triopters, focal lens, lens power. I mean, all kind of terminology is used. Okay? 09:30:44 09:30:52 09:30:56 09:31:02 09:31:07

If a collimated beam comes into a lens, it would be focused at a distance of f, the focal length from the lens. 09:31:07 09:31:13 09:31:17

Q Okay. Focal length is different from image size, right? 09:31:26 09:31:28

A Of course, but they are related. Image 09:31:29

size is focal length times the field of view. 09:31:34

MR. MURRAY: Micah, can we mark 09:31:50

Exhibit 1024 as Kessler 4, please? 09:31:52

TECHNICIAN: Stand by. 09:31:57

(Kessler 4 was marked for identification 09:31:58

and is attached to the transcript.) 09:32:27

BY MR. MURRAY: 09:32:27

Q Okay. Dr. Kessler, do you recognize the 09:32:27

document that we have marked as Kessler 4? 09:32:29

A Momiyama, yeah. It's been a while since I 09:32:32

looked at it. Yeah. 09:32:40

Q Just for the record, this is U.S. Patent 09:32:41

No. 4,364,642, which is APPLE-1024 in this 09:32:44

proceeding. 09:32:50

A Okay. 09:32:51

Q And you cited this document in Paragraph 09:32:51

57 of your second declaration that we were just 09:32:54

looking at. 09:32:57

A Okay. 09:32:59

Q And you cite Figures 1 to 3. Can you go 09:32:59

to -- 09:33:08

TECHNICIAN: Counsel, you cut out there. 09:33:15

What page? 09:33:16

MR. MURRAY: I think it's the next page. 09:33:17

Yep, that's the one. 09:33:20

BY MR. MURRAY: 09:33:21

Q And here -- do you see Figures 1 to 3 09:33:21

here, Dr. Kessler? 09:33:24

A Yeah. 09:33:25

Q Okay. Figures 1 to 3 are -- appear to be 09:33:26

cross sections of different -- is that correct? 09:33:29

A Yeah. Your sound is a little broken. Can 09:33:33

you say it again? 09:33:36

Q Yeah, sure. 09:33:37

A There are three -- yeah. 09:33:37

Q So Figures 1 to 3 here in -- I'll withdraw 09:33:38

that question. 09:33:44

Is it okay if we refer to this as 09:33:44

Momiyama? 09:33:47

A Yeah. 09:33:48

Q So Figures 1 to 3 of Momiyama that you 09:33:48

cited, these show cross sections of different 09:33:52

lenses; is that correct? 09:33:56

A Yeah. 09:33:57

Q And Figures 1 to 3 of Momiyama don't show the image produced by any of these lenses; is that right? 09:34:01 09:34:06 09:34:08

A Yes. 09:34:08

Q Okay. Can we go to Page 6 of the exhibit? And if you could zoom in on Column 2 there. 09:34:09 09:34:28

So right under -- in Column 2 where it says description of the preferred embodiments -- 09:34:39 09:34:42

A Right. 09:34:46

Q -- Figs 1, 2, and 3 show embodiments of respective lenses whose lens data normalized for a focal length equals 1 are as follows. 09:34:46 09:34:51 09:34:54

Do you see that? 09:34:59

A Yeah. 09:34:59

Q And you cited this passage in your second declaration in Paragraph 57, correct? 09:35:00 09:35:06

A I vaguely remember, yeah. I use Momiyama, but I don't remember if they were. Okay? 09:35:09 09:35:15

Q All right. If we could go back to Kessler 1. 09:35:21 09:35:24

I see four lines down it says APPLE-1024, Figures 1 to 3. 09:35:24 09:35:38

A Yes. 09:35:40
Q You used Figures 1 to 3, correct? 09:35:41
A Okay. Yeah. I used that reference just 09:35:43
to show that normalization is done in optics, 09:35:45
yeah. 09:35:48
Q Okay. In the passage we just read said 09:35:48
that the focal length is normalized to 1, correct? 09:35:51
A Okay. Okay. 09:35:55
Q And so this goes to your statement above 09:35:56
about other parameters being normalized; is that 09:36:04
right? 09:36:09
A Yeah. Normalization in general is common. 09:36:09
Can be image size, can be focal length, can be 09:36:16
total track, namely the whole size of the lens. 09:36:20
Yeah. 09:36:25
Q Right. And in Momiyama, the normalization 09:36:26
is on the focal lens? 09:36:28
A Right, right. 09:36:30
Q Okay. Momiyama doesn't show a normalized 09:36:30
image size? 09:36:33
A It doesn't show. I have to go and check, 09:36:34
but you cannot -- as I said, the image size is 09:36:40

focal length times field of view. So in this case, let's say the field of view is 1 radion, 57-degree semifield. Then in that case only, the image size will be focal length 1 times 1 radiant. It will be 1, but only for this field of view. 09:36:46 09:36:50 09:36:56 09:37:02 09:37:08

So the focal length -- when you choose normalization by focal length, you don't choose normalization by image. You have to choose one or the other. Is the image normalized to 1 or the focal length normalized to 1? And you can derive one from the other easily. 09:37:11 09:37:14 09:37:17 09:37:20 09:37:25 09:37:30

In other words, you don't normalize image and focal to 1 together. That's usually not done because then you fix the field of view. 09:37:37 09:37:40 09:37:43

Q Okay. You also cite in this Paragraph 57 APPLE-1009, which is the Fisher lens; is that correct? 09:37:45 09:37:56 09:38:01

A Fisher, yeah. Okay. 09:38:01

Q And you say here starting at the third line of the paragraph referring to Fisher, Fisher shows a normalized image height, correct? 09:38:03 09:38:09 09:38:14

A If I brought it in there, probably it is. 09:38:17

Maybe I should look at Fisher and just verify, but I guess so. 09:38:22 09:38:28

MR. MURRAY: Micah, can we mark Exhibit 1009 as Kessler 5, please? 09:38:33 09:38:35

TECHNICIAN: Stand by. 09:38:39

(Kessler 5 was marked for identification and is attached to the transcript.) 09:38:40 09:39:07

BY MR. MURRAY: 09:39:07

Q Okay. And you recognize what we've marked as Kessler 5, Dr. Kessler? 09:39:07 09:39:10

A Yes. 09:39:12

Q And just for the record, this is Fisher U.S. Patent No. 3,953,111, Exhibit 1009 in this proceeding? 09:39:13 09:39:17 09:39:25

A Yeah. 09:39:26

Q Okay. Can we go to Figure 3 of this document, please? 09:39:26 09:39:37

And you would agree, Dr. Kessler, looking at the non-linear lens curve, the solid line in Figure 3, the captured image would need to be adjusted prior to display, correct? 09:39:38 09:39:54 09:39:59 09:40:02

MR. JHURANI: Objection to form. 09:40:06

A Where are you reading from? 09:40:08
Q I'm looking at Figure 3. 09:40:10
A Okay. 09:40:14
Q It shows a non-linear lens -- 09:40:15
A Right. 09:40:18
Q -- curve? 09:40:19
A Yeah. Right. 09:40:21
Q Would that have to be adjusted before it gets displayed? 09:40:22
MR. JHURANI: Objection; scope. 09:40:27
A I don't fully understand what your question is. 09:40:27
Q Well, all right. So let me ask it this way: Does Fisher correct that non-linearity before it displays the image? 09:40:37
A I am not opining on that. I'm just saying he is showing different distribution curves. Okay? And he shows the linear curve, the fisheye lens, together with the non-linear -- to other non-linear curves, which might be common. I mean, the one at the bottom is the most common one, conventional camera lens. Your cameras, your 09:40:48 09:40:54 09:41:00 09:41:08 09:41:11 09:41:15 09:41:18

phone, you have that. That's all the point is, 09:41:22
that there is -- there are lenses out there with 09:41:24
non-linear distribution curves. Some of them 09:41:29
correct for it; some of them don't. 09:41:35
Q Well, in Fisher -- Fisher corrects for it 09:41:37
prior to display, doesn't it? 09:41:40
A I don't recall what Fisher does with it. 09:41:42
I felt I brought the reference to show the 09:41:46
different ones. I would have to re -- I didn't 09:41:49
prepare with Fisher on this one, so I have to go 09:41:53
and look at it again. Or maybe you can show the 09:41:57
reference for it. 09:42:02
Q Well, can we go to Page 6? And 09:42:03
specifically I want to look at -- in Column 3 on 09:42:16
the left starting around line 48. 09:42:21
A Line 38 on the left column? Okay. 09:42:33
Q Well, actually, let's -- let's back up. 09:42:37
Let's go -- let's start around line 44 where it 09:42:40
says that viewing system basically comprises. 09:42:46
MR. JHURANI: Sorry. What line did you 09:42:54
say? 09:42:56
MR. MURRAY: It's, like, 44. 09:42:56

MR. JHURANI: Column 3, line 44? 09:42:59

MR. MURRAY: Yeah. Yeah, starting there 09:43:02

at the end -- or the end where it says "that," and 09:43:05

then viewing system basically comprises. 09:43:12

THE WITNESS: Yeah. Okay. 09:43:16

BY MR. MURRAY: 09:43:17

Q Okay. And it says a television camera at 09:43:17

the remote location, a projector at the observer 09:43:20

location -- 09:43:23

A Right. 09:43:24

Q -- transmission system linking the camera 09:43:25

and projector in both directions. 09:43:27

Do you see that? 09:43:29

A Yeah. 09:43:30

Q Okay. So the next sentence says, both the 09:43:31

camera and projector are fitted with non-linear 09:43:34

lenses having identical distortion 09:43:38

characteristics. 09:43:41

Do you see that? 09:43:42

A Mm-hmm. 09:43:43

Q And then it says -- this is line 50 -- 09:43:43

however, the projector lens is mounted just the 09:43:46

reverse of the camera lens so that it rectifies the distortion created by the camera lens. 09:43:50 09:43:53

A Okay. 09:43:56

Q Okay. So what is that saying? 09:43:57

A It says that he tried to capture a large field and he used lenses which are having a lot of distortion, as shown on the figure that you showed before, and that he attempts to correct it so the display, by using a projection lens, with the reverse distortion curve. 09:44:00 09:44:04 09:44:09 09:44:12 09:44:17 09:44:20

Q Well, is it a lens with a reverse distortion curve, or is it the same lens just oriented backwards? 09:44:24 09:44:34 09:44:37

A No. A camera lens and a projection lens usually are different. It's a different design. They have different focal length; they have different locations for the stops, but they can be designed for one to compensate optically for the other. 09:44:39 09:44:41 09:45:04 09:45:08 09:45:10 09:45:13

Q All right. Can we go back to Kessler 1 again, please? 09:45:27 09:45:29

All right. And you also cite an exhibit 09:45:35

APPLE-1026 here, correct? 09:45:37

A What line is that? 09:45:41

Q Two, three, four -- five lines down in Paragraph 57. 09:45:43 09:45:48

A Okay. 09:45:49

Q And you have Page 53, you say it shows full field normalized to 1.0? 09:46:02 09:46:08

A Same place? 09:46:16

Q Yes, same place. So you cite APPLE-1026, Page 53. 09:46:17 09:46:21

A Mm-hmm. 09:46:22

Q Full field normalized to 1.0. 09:46:23

A Okay. 09:46:26

Q And then Page 199, showing full field/image size normalized to 1 and showing the image height of obtained image -- 09:46:26 09:46:31 09:46:35

A Mm-hmm. 09:46:37

Q -- references as GIH or Gaussian image height as 52.94 millimeters. 09:46:38 09:46:42

Do you see that? 09:46:46

A Okay. 09:46:47

Q What is Gaussian image height? 09:46:47

A Gaussian is a confusing term, but Gaussian image height is the basic model, some call it paraxial model. It's a little different. 09:46:50 09:46:57 09:47:04

But each square -- basically all the parameters are very much linear. In other words, it's not an accurate model, but it's the basic model on which we build the actual models. It's a simplified model of how a lens works. 09:47:05 09:47:11 09:47:17 09:47:21 09:47:27

And when you look at the image size, you'll call it Gaussian image size, not to be confused the Gaussian lasers and other Gaussian entities, and sometimes market it as GIH, Gaussian image size. In a reference I brought for Smith, he used the same terminology. 09:47:38 09:47:41 09:47:44 09:47:49 09:47:54 09:47:59

And the image size itself can be a little bit different in actual life, but that's the very first model for image size. 09:48:01 09:48:04 09:48:09

MR. MURRAY: All right. Can we mark Exhibit 1026 as Kessler 6, I think we're up to? 09:48:20 09:48:22

TECHNICIAN: Stand by. 09:48:28

(Kessler 6 was marked for identification and is attached to the transcript.) 09:48:30 09:48:56

BY MR. MURRAY: 09:48:56

Q Okay. And when you said Smith, you're 09:48:56

referring to what's been marked as Kessler 6? 09:48:59

A Yes. 09:49:03

Q Okay. So you recognize what's been marked 09:49:03

as Kessler 6, correct? 09:49:05

A Yes. 09:49:09

Q Which, for the record, the APPLE-1026 in 09:49:10

this proceeding. 09:49:12

This is excerpts from a textbook entitled 09:49:13

Modern Lens Design? 09:49:18

A Yes. 09:49:20

Q Is this your textbook? 09:49:21

A Yeah. 09:49:24

Q Okay. If we could go to -- it's Page 6 of 09:49:30

the PDF exhibit, but it's Page 53 of the textbook. 09:49:37

And you said in your second declaration 09:49:46

this page shows full field normalized to 1.0. 09:49:48

A Right. 09:49:53

Q What were you referring to here on 09:49:54

Page 53? 09:49:55

A The whole point is to show that 09:49:56

normalization is very common in optics. Okay? 09:49:59
And on graphs like this one, you can actually 09:50:05
normalize whatever you want, and the most common 09:50:11
way is to normalize the field S1, okay, in the 09:50:14
presentation. 09:50:23
So when it says in the top on the left 09:50:23
meridional 1.0, to proceed we understand that this 09:50:29
is to be the separation curve, the transverse 09:50:34
separation curve for the full edge of the field at 09:50:37
the edge of the image disk. Okay? That would be 09:50:40
the performance. And then .7 would be an 09:50:43
intermediate field. Okay? 09:50:46
Also, we tend to normalize the apertures, 09:50:48
which is on the X axis, and full aperture will be 09:50:52
1 and so forth. Okay? On the graphics, you can 09:50:58
normalize whatever you want. 09:51:01
Q All right. So let's talk about that plot 09:51:08
upper left-hand meridional 1.0 full field. 09:51:12
A Yes. 09:51:21
Q What is the X axis of this plot? 09:51:22
A That's the aperture size, aperture. Exit 09:51:25
aperture of the lens. 09:51:35

Q Okay. And what's the Y axis? 09:51:37

A It's deviation of the -- of the ray. For example, if you look at the right-hand side of the top figure, you can see that that's the largest number there, that the ray is -- has a certain height. This height is usually marked in microns, and it's deviation of the ray from its ideal position on the Gaussian model. So let's say this way. Okay? 09:51:39 09:51:49 09:51:53 09:52:00 09:52:03 09:52:06 09:52:15 09:52:18

So in proceeding to look at those curves, we do two things. You say, well, is that acceptable, this deviation in terms of operations, v. what is the nature of the operation? If he sees a parabolic curve, he'll know that the certain operation that he is suffering from coma. Okay? 09:52:18 09:52:21 09:52:24 09:52:29 09:52:31 09:52:35 09:52:39

If he looks at the .7 and he sees this angulating, more complex curve, he'll say, oops, I have circular operation. So it's a very good tool for design. 09:52:39 09:52:49 09:52:53 09:52:56

Q And the 1.0 full field, this is measuring rays at the edge of the field of view? 09:52:56 09:53:00

A Yes. 09:53:02
Q At different positions in the exit 09:53:03
aperture? 09:53:06
A Right. 09:53:07
Q Okay. And .7 is 70 percent field of view, 09:53:08
essentially? 09:53:12
A Right. 09:53:13
Q All right. What about the bottom one? Is 09:53:14
that the center -- 09:53:17
A On axis. 09:53:19
Q And why are there three different lines on 09:53:20
each of those curves? 09:53:25
A Okay. Usually the different lines -- 09:53:26
okay. First of all, there's meridional and 09:53:33
sagittal, all right, left and right curves. And 09:53:42
basically the differences are usually due to 09:53:45
color. 09:53:47
Q So the three -- 09:53:51
A Yeah. You can see wavelength in microns 09:53:52
at the middle bottom. So you see three different 09:53:56
lines for the three different colors. The solid 09:54:06
line is the green, the dashed line is the blue, 09:54:09

and the other dashed line is the red. 09:54:13

So the differences between the lines tells the designer if he's color corrected or not. 09:54:15 09:54:19

Q And then in the axis 0.0 curve at the bottom left -- 09:54:25 09:54:31

A Yes. 09:54:32

Q -- that scale equals 0.2? Is that the same scale used in the two plots above it for the meridional? 09:54:32 09:54:40 09:54:45

A Well, he's just expanding the scale there, because operations on axis are small. So he expanded the scale. Okay? 09:54:45 09:54:50 09:54:55

It doesn't say here what is the Y scale. It just tells you in terms of microns. Okay? But on axis, he goes and expands whatever scale he used for the other field points because separation was small and still wants to show them. 09:54:56 09:55:04 09:55:07 09:55:10 09:55:14

Q And what's the -- what's the difference between meridional and sagittal? 09:55:17 09:55:23

A When -- we are talking about symmetrical -- radially symmetrical optical systems, like fish lenses. They're radially -- 09:55:26 09:55:30 09:55:35

radially symmetrical. Right? 09:55:40

So when we talk about the field, it's 09:55:40

arbitrary. We go -- usually go to the Y axis and 09:55:42

say the field is in the -- vertical in the Y axis. 09:55:45

Okay? 30 degrees in the Y axis, or whatever. 09:55:49

And then you have fans of fray that you 09:55:52

are trying to figure out if you are focused or not 09:55:56

and where they go. So you use two kinds of fans. 09:55:59

Fans along the Y direction, which are called 09:56:04

tangential, and ray's perpendicular to it, which 09:56:08

you call sagittal. 09:56:13

And they -- if they focus a different 09:56:14

location, you say, oops, I got astigmatism. 09:56:16

Q All right. For completeness, what is the 09:56:20

field curve -- or, I guess, the top right one is 09:56:27

LA? 09:56:31

A Yeah. That's usually a longitudinal -- 09:56:33

that's basically -- okay. Yeah, you have three 09:56:43

curves. The top one is usually not actually used. 09:56:47

We usually use the field curvature ones and the 09:56:53

distortion curves, were the -- now, they 09:57:00

basically -- the fields are plotted on the Y axis, 09:57:09

and like in the distortion curve at the bottom, you have a curve that is inclined, meaning there's distortion. 09:57:17 09:57:23 09:57:28

Q All right. Let's go to the last page of this document, which is Page 199 of the text. 09:57:29 09:57:37

A Yeah, yeah. 09:57:41

Q If you go to the bottom there with the curves -- 09:57:43 09:57:48

A Yeah. 09:57:49

Q Okay. This is showing similar meridional ray fan plots that we saw on Page 53? 09:57:49 09:57:55

A Yeah. The point here is to show that why do we normalize, usually, quantities. Like we talk about field of view of 1 on the curves on the left. We always have in mind what is the real image like? 09:57:58 09:58:03 09:58:08 09:58:13 09:58:19

The GIH at the top, GIH, Gaussian image height, it says it's 52.94. Now, it doesn't even say dimensions, but if it doesn't say dimensions, you use millimeters. Okay? 09:58:21 09:58:27 09:58:33 09:58:40

And, also, it tells you that the half field of view is 27.9 what? Doesn't mention 09:58:42 09:58:45

degrees. Okay. Okay? Also tells you what the 09:58:49
focal length is, what the best focal length is, 09:58:53
all those numbers. 09:58:57
So why we -- the actual numbers are there 09:58:58
on the display to explain how the lens works, we 09:59:00
tend to use the normalized numbers. 09:59:06
MR. JHURANI: So we've been going for a 09:59:36
little over an hour. Is it a good point to take a 09:59:38
break? 09:59:43
MR. MURRAY: Yeah, I was just about so 09:59:43
suggest that. Ten minutes okay? 09:59:45
THE WITNESS: Sounds good. 09:59:47
VIDEOGRAPHER: We're going off the record 09:59:48
at 9:59 Eastern Time. 09:59:50
(A recess was taken.) 09:59:52
VIDEOGRAPHER: We're going back on the 10:12:22
record at 10:11 a.m. Eastern Time. 10:12:24
BY MR. MURRAY: 10:12:27
Q Welcome back, Dr. Kessler. Did you speak 10:12:27
to anyone over the break? 10:12:34
A No. 10:12:35
Q All right. I'd like to quickly go back to 10:12:36

your second declaration. 10:12:42

TECHNICIAN: Counsel, is that Exhibit 1? 10:12:49

MR. MURRAY: Yes, Kessler 1. My 10:12:52

apologies. 10:12:54

BY MR. MURRAY: 10:12:55

Q And if we could go to Paragraph 59 on the 10:12:56

next page. 10:13:03

And if you look about five lines into the 10:13:13

photograph, Dr. Kessler, you cite Smith, 10:13:17

APPLE-1026 again. Do you see that? 10:13:21

A Yeah. 10:13:24

Q And on the next line, you cite Pages 53 10:13:24

and 57 with the explanation that it describes 10:13:29

scaling and adjusting lens designs for actual 10:13:34

applications. 10:13:37

Do you see that? 10:13:38

A Yes. 10:13:39

Q All right. If we could go back to 10:13:40

Kessler 6, which is the Smith reference. If we go 10:13:43

to Document Page 7, which should be Text Page 57. 10:13:56

And right under the heading 5.4 there, it says, a 10:14:06

lens prescription can be scaled to any desired 10:14:10

focal length simply by multiplying all of its dimensions by the same constant. 10:14:14 10:14:20

Do you see that? 10:14:21

A Yes. 10:14:22

Q What is a lens prescription? 10:14:23

A It's a list of the element parameters and distances. Sometimes called lens tech. Yeah, it's basically a -- a patient given a lens prescription can take it and put it on his favorite kit and start analyzing it. 10:14:27 10:14:31 10:14:37 10:14:42 10:14:46

MR. MURRAY: Can we go to the next page, which is Text Page 199? 10:14:49 10:14:51

Q Right there at the top of what's shown in the display, is that a lens prescription? 10:14:54 10:14:58

A Yes. 10:15:02

Q And is that how a lens prescription is typically given? 10:15:02 10:15:05

A Sometimes they're more extensive, but this is the very basic list of parameters. Namely radii of the lenses, the thicknesses, the materials they're made of, and -- yeah, and usually sometimes aperture size of the element. 10:15:06 10:15:09 10:15:13 10:15:17 10:15:21

Yeah. 10:15:25

Q Is that SA there on the right-hand column? 10:15:25

A Yeah, most likely. Semi aperture, 10:15:30

probably. 10:15:33

Q The index of the third column from the 10:15:33

right, that's index of refraction for the 10:15:38

material? 10:15:41

A Right. Yes. 10:15:41

Q And V number, what is that? 10:15:43

A Which one? 10:15:48

Q The second column from the right, it says 10:15:49

V-NO? 10:15:51

A That's called the AB number. ABBE, which 10:15:52

tells you what is the dispersion, namely how does 10:15:59

that lens behaves in terms of different colors or 10:16:04

whatever colors you have. Okay? 10:16:08

The larger the number, the more the 10:16:10

lens -- the less dispersion, deviations between 10:16:14

blue and red, say, are happening to this glass. 10:16:22

Okay? 10:16:25

The smaller it is, if it's 20, means this 10:16:26

is a lens of high dispersion and would create 10:16:28

color problems. 10:16:33

Q Okay. Is this prescription given on Page 199 normalized? 10:16:34 10:16:38

A This one? No. The prescription is usually -- this one is not normalized. 10:16:40 10:16:45

Q How can you tell that? 10:16:49

A Hm? 10:16:51

Q How can you tell that? 10:16:53

A How can I tell that? 10:16:54

Q Yeah. 10:16:58

A How can I tell that? Because this is a reasonable number of design. Again, the default is -- if it doesn't say anything, it's millimeters. Okay? 10:16:59 10:17:02 10:17:07 10:17:14

And then if I -- if it was normalized, the question is what are the two more frequent normalizations? It would be focal length or image size. Okay? 10:17:17 10:17:19 10:17:22 10:17:26

Now, this one here is -- actually, it says the effective focal length is 99.88. Okay? If -- if there would be a number, like, 100 there, I would say, oh, he normalized the design to 10:17:26 10:17:33 10:17:38 10:17:41

100 millimeters. Okay? 10:17:44

But in this case, I don't see -- and also 10:17:46

the image size is an odd number, 52.94. Doesn't 10:17:50

look normalized. So there was no attempt to 10:17:54

normalize here. 10:17:57

Q Okay. I want to switch gears here. 10:17:58

MR. MURRAY: Micah, if you could mark 10:18:11

Exhibit 1012 as Kessler 7? 10:18:15

TECHNICIAN: Stand by. 10:18:20

(Kessler 7 was marked for identification 10:18:21

and is attached to the transcript.) 10:18:53

BY MR. MURRAY: 10:18:53

Q Dr. Kessler, you recognize this document 10:18:53

we've marked as Kessler 7? 10:18:56

A Yeah, the Shiota. Yeah. 10:18:58

Q Shiota, which, for the record, the 10:19:00

European patent, EP 1,028,389? And it's okay if 10:19:04

we refer to it as Shiota? 10:19:10

A Okay. 10:19:12

Q Okay. And Shiota discloses the algorithm 10:19:12

use units for image transformation; is that 10:19:21

accurate? 10:19:25

A Yes. 10:19:26

Q Okay. If we could go to Paragraph 27, 10:19:26

which starts on Page 4, or his Page 4. 10:19:29

This is -- it says here there are two 10:19:46

steps for this image transformation? 10:19:50

A Yes. 10:19:54

Q Okay. And the first step, according to 10:19:55

Paragraph 28, is to obtain coordinates for the 10:19:58

point P prime. Do you see that? 10:20:08

A Yes. 10:20:10

Q What is point P prime? 10:20:10

A In his first step -- I mean, the two steps 10:20:12

are using an intermediate circle surface. First 10:20:19

step is from his rectangular plane image, which is 10:20:23

what's going to be eventually displayed to the 10:20:31

circle intermediate surface. 10:20:34

And the second step is from the spherical 10:20:39

surface to the image of the panoramic lens. The 10:20:45

way he does it is shown on Figure 1. His first 10:20:52

attempt is to go from P, which is on the display 10:21:00

plane image, which the '990 calls display window, 10:21:09

and to the circle surface, which point P prime is 10:21:19

on. 10:21:23

Q All right. 10:21:25

MR. MURRAY: Micah, is it possible to get up side-by-side this page along with the figure, just so we can kind of look at them at the same time? 10:21:26 10:21:28 10:21:35 10:21:38

TECHNICIAN: Yes. What document will the figure be on? 10:21:38 10:21:41

MR. MURRAY: Same document. 10:21:43

TECHNICIAN: Same document. And can you remind me of the figure number? 10:21:44 10:21:46

MR. MURRAY: Figure 1, yeah. 10:21:48

TECHNICIAN: Okay. Stand by. 10:21:49

Counsel, I'm not seeing where Figure 1 is. 10:22:25

MR. MURRAY: The European patents are backwards. They're kind of at the end. 10:22:29 10:22:32

TECHNICIAN: Okay. 10:22:33

No, Counsel, I'm not sure if Adobe will allow me to show the same exhibit on two different -- maybe I can do that. Stand by. 10:22:48 10:22:52 10:22:54

Okay. So you want Figure 1, and then what paragraph? 10:22:56 10:23:13

MR. MURRAY: It was -- well, it was the Page 4. 10:23:15 10:23:17

TECHNICIAN: Page 4. Okay. 10:23:21

All right. Let me know if this works for you. 10:23:36 10:23:38

MR. MURRAY: I can see it. 10:23:41

BY MR. MURRAY: 10:23:42

Q Dr. Kessler, can you see that? 10:23:42

A Yes. 10:23:44

Q Okay. All right. So we were -- excuse me. 10:23:44 10:23:47

We were talking about P prime, which is shown in Figure 1 on that hemisphere. 10:23:47 10:23:51

A Yes. 10:23:55

Q And that P prime corresponds to point P on that rectangle, you said? 10:23:56 10:24:00

A Yes. 10:24:02

Q Okay. The hemisphere that's shown in Figure 1 has a radius of 1. 10:24:03 10:24:09

A Yes. 10:24:14

Q Okay. And point P prime is given by coordinates X2, Y2, Z2. Do you see that? 10:24:14 10:24:22

A Yes. 10:24:30

Q And what do those coordinates represent? 10:24:30

A The X, Y, Z coordinates of P1 on the 10:24:34

spherical surface. P prime. 10:24:42

Q Okay. And so are X2, Y2, and Z2 10:24:45

normalized? 10:24:52

A Yes. 10:24:53

Q Okay. Now, if we look at -- in 10:24:53

Paragraph 29, it says that point P coordinates X1, 10:24:57

Y1, and Z1. 10:25:06

Do you see that? 10:25:09

A Yeah. You're talking about the equations 10:25:10

for X1, Y1, and Z1? 10:25:21

Q Yeah. At the beginning of Paragraph 29, 10:25:26

it does say the X, Y, Z coordinates of point P are 10:25:28

X1, Y1, and Z1, but then they're given -- 10:25:31

A Yeah, yeah. 10:25:37

Q Okay. 10:25:37

A For P, yeah. 10:25:38

Q Okay. And now you're looking at those 10:25:39

equations for X1, Y1, and Z1. What are X0, Y0, 10:25:42

and Z0? 10:25:51

MR. JHURANI: Objection; form and scope. 10:25:54

A Can you repeat the question, please? 10:26:04

Q Yes. What are X0, Y0, and Z0? 10:26:06

MR. JHURANI: Same objections. 10:26:11

A It's a part of his algorithm, and he's showing -- well, I don't know if I should opine on those items. 10:26:12 10:26:29 10:26:32

Q All right. Well, let's look at the equation for X1 in Paragraph 29. It says -- 10:26:38 10:26:39

A Paragraph -- yeah. 10:26:46

Q Yeah. All right. So X1 equals X0. 10:26:47

A Mm-hmm. 10:26:54

Q Do you know what X0 is? 10:26:55

A I would assume it's the position at the center of the plane -- plane image where P is. 10:26:57 10:27:01

Q Okay. Going on, it says X0 plus U1. What is U1? 10:27:09 10:27:19

MR. JHURANI: Objection; scope. 10:27:23

A He doesn't specify what U1 is, so I'm not going to opine on that. 10:27:24 10:27:39

Q Why don't we look at Figure 1. Do you see U1 in Figure 1? 10:27:41 10:27:45

A Figure 1? 10:27:47
Q Yes. 10:27:49
A Yeah. U1 and V1 he shows as the 10:27:58
coordinates of P. 10:28:02
Q Okay. 10:28:04
A So here, he's -- okay. 10:28:07
Q Okay. Then U1 is multiplied by DUX. Do 10:28:09
you see that? 10:28:18
A Yeah. 10:28:18
Q What is DUX in Paragraph 29? 10:28:19
MR. JHURANI: Objection; scope. 10:28:26
A It's the derivative of U versus the X 10:28:32
axis. That's my interpretation, but... 10:28:38
Q Why do we need the UX in this equation? 10:28:43
MR. JHURANI: Objection; scope, form. 10:28:52
A I don't want to opine on the details of 10:28:54
his transformation on these particular details, 10:29:02
why he -- why is he doing it and so forth. He's 10:29:07
trying to go from the display plane image to the 10:29:14
circle and then from the circle to the image. 10:29:20
Okay? And he is trying to do those 10:29:22
transformations and implement them in hardware. 10:29:26

The details as to how he does that, I don't know if I should opine on that. I don't think it's material. He explains what they are in Paragraph 35. 10:29:31 10:29:36 10:29:38 10:29:44

Q I'm sorry. Which paragraph did you say? 10:29:45

A He's talking about, in 35, necessary parameters as shown, X0, Y0, Z0, indicate the center origin of the plane image, which I said, and that -- and then when he explores from the center of the plane image, the displayed plane image, left, right, up, down, he -- he uses derivatives as shown here. 10:29:50 10:30:00 10:30:07 10:30:10 10:30:18 10:30:22 10:30:28

So he starts from the origin and starts exploring up, down, left, right, with X1, Y1, Z1. Okay? 10:30:34 10:30:36 10:30:42

Q Is -- let's just take DUX and change them out. DUX, for example, is that a fixed number? 10:30:43 10:31:08

MR. JHURANI: Objection; form, scope. 10:31:16

A I didn't opine on that. I didn't look at that, if it's a fixed or non-fixed. 10:31:18 10:31:28

Q So you don't -- you don't know what DUX means? 10:31:32 10:31:34

A It's a derivative of U -- delta U over delta X. 10:31:35 10:31:40

Q But you don't know what -- how it's being used in this -- 10:31:41 10:31:43

MR. JHURANI: Objection. 10:31:48

A I know -- as I said, I didn't opine on that, why is he doing this exact relations. But in a way, it's general. When you talk about location or any function, at the different location -- at the different coordinates. So you have Y is FX and you want to know why it's an adjacent spot, then you do the derivative of Y over X times delta X. That's what he's trying to do. 10:31:49 10:32:03 10:32:11 10:32:15 10:32:23 10:32:25 10:32:29 10:32:36 10:32:40

Q All right. Let's go to Paragraph 30. And you said earlier X2, Y2, Z2, that's coordinates of P prime and X, Y, Z, right? 10:32:40 10:32:53 10:32:59

A Yeah. 10:33:03

Q Okay. So we get that by multiplying X1, Y1, and Z1 by K1 in this equation? 10:33:03 10:33:10

A Yes. 10:33:14

Q What is K1? 10:33:15

A K1 is a number that he derived and -- 10:33:17
derived it for every viewing angle. As you can 10:33:29
see on Figure 1, he is -- the display plane image 10:33:33
can be evaluated -- can be at a different viewing 10:33:42
angles. It's like when you have a panoramic of 10:33:46
certain scenery and you want to look within this 10:33:49
panoramic image at sectors of the image. So you 10:33:54
change the field of view. 10:33:59
And basically what happens is the usual 10:34:00
way of doing transformation from plane to a sphere 10:34:04
is using functions like sine, cosine, whatever, 10:34:10
what are hard to implement in hardware. 10:34:19
Instead, since Shiota wants to do his 10:34:21
transformations all in hardware for the purpose of 10:34:30
speed, he tries to avoid geometric equations, 10:34:34
which is the norm, and that's what '990 does in 10:34:43
the situation on his second algorithm. 10:34:48
So instead he derived those relationships 10:34:52
between the sphere and the plane beforehand and 10:34:57
put it in a look-up table, and K1 is now 10:35:00
representing a number that he will get from the 10:35:04
look-up table enabling him to move from P to P 10:35:07

prime. 10:35:12

Q Now, that we have X2, Y2, and Z2, we go to the second step, which is to acquire when it's P1 and Q1 on the fisheye image, correct? 10:35:13 10:35:23 10:35:28

A Yep. 10:35:35

Q Okay. And if we look at Paragraph 34, it refers to a zenithal angle theta 1. Do you see that? 10:35:37 10:35:43 10:35:51

A Yeah. 10:35:52

Q And it derives that angle theta 1 from Z2? 10:35:52

A Yeah. 10:36:01

Q I guess, first of all, what is a zenithal angle in this instance? 10:36:02 10:36:06

A Well, once data is shown for the O axis, which is the angle spanned by the line going from O to P1 with the line OZ, namely the optical axis. So that's the azimuth. 10:36:08 10:36:13 10:36:19 10:36:28

Q When you say P1, you mean P prime? 10:36:29

A No. I'm saying the theta -- the theta line is actually also marked. So it's the angle between OP prime to OZ. 10:36:34 10:36:38 10:36:40

Q Okay, yeah. You just said P1. I just 10:36:44

want to make sure -- 10:36:47

A P prime. 10:36:48

Q P prime. Okay. And why do we need the zenithal angle for Step 2? 10:36:50 10:36:54

A Well -- 10:36:56

MR. JHURANI: Objection to form. 10:36:57

A It's the common -- 10:36:59

MR. JHURANI: Sorry, Doctor. Let me just interpose my objection. Objection to form and scope. 10:37:00 10:37:02 10:37:05

THE WITNESS: Should I answer? 10:37:09

MR. JHURANI: You can answer if you can. 10:37:11

A Okay. We have a sphere at the top, and we have a plane at the bottom. This is the old time issue converting a sphere to a plane, and the -- one of the ways is projection. You take the sphere and you just project down to the base of the sphere where Q resides. 10:37:14 10:37:17 10:37:22 10:37:27 10:37:31 10:37:37

Okay? So now you've got yourself a sphere-to-plane transformation. And then later on, you have to transfer that plane to the other plane, which is the image of the panoramic lens. 10:37:43 10:37:46 10:37:49 10:37:52

Okay? 10:37:57

So he needs the theta because the 10:37:58

projection is basically just using cosine of 10:38:04

theta. 10:38:09

Q Okay. Now, on Paragraph 35, it says the 10:38:09

azimuth of the point W is the same as that point P 10:38:14

prime. Do you see that? 10:38:19

A Wait, wait, wait. 35? 10:38:20

Q 35. 10:38:31

A Point -- yeah, the point W. Okay. 35. 10:38:31

Yeah. So what is the question? 10:38:49

Q Yeah. So what is -- what does it mean 10:38:50

that the azimuth of the point W on the image 10:38:53

pickup face is the same as the point -- as that of 10:38:56

the point P prime -- 10:39:00

A Actually, I think -- I think he means 10:39:02

actually that the -- there's no -- there's no 10:39:05

theta at the bottom of point. There's only phi. 10:39:11

So basically, I guess he calls phi as azimuth. 10:39:18

Okay. 10:39:22

So the phi angle shown is the same. Okay? 10:39:23

So all he has to do is to project point P prime 10:39:28

using the cosine, using theta to point Q. Now the question is what about the phi? And he says it's the same. I think that's what he says. 10:39:33 10:39:40 10:39:43

Q Okay. And then in Paragraph 35, we're finding P1 and Q1 by multiplying X2 and Y2 by a K2. Do you see that? 10:39:47 10:39:51 10:39:59

A Yes, yes. 10:40:01

Q What is K2? 10:40:02

A Same as in K1. That's a K for the second transformation from the -- from the hemisphere or the projected hemisphere to the image plane of the panoramic lens. A little bit confusing because he used the term plane image for both the rectangular at the top and the bottom, but he knows it's confusion -- confusing, so he adds the term plane image of the fisheye. 10:40:03 10:40:07 10:40:16 10:40:20 10:40:26 10:40:30 10:40:32 10:40:37

And he does the same thing here. He -- well, never mind. 10:40:43 10:40:50

Q Paragraph 36, we have now Shiota sets H equal to capital F of theta 1. Do you see that? 10:40:52 10:40:59

A Yes. Yeah. 10:41:05

Q What does that equation represent? 10:41:07

A Well, in this case, this is the usual -- 10:41:09
that's coming up from the panoramic lens, which is 10:41:18
in a theta lens. Therefore, the image height, H, 10:41:27
is f-theta. 10:41:31
Q Does Paragraph 37 below it give two 10:41:33
examples of -- 10:41:40
A Yeah, two different possibilities. I 10:41:41
mean, basically Shiota is mostly talking about a 10:41:46
theta lens of above, but he puts in there there 10:41:53
doesn't have to be a theta. This is more general 10:41:58
than that, and that he can use also other 10:42:01
transformations like agicle, you know, 10:42:03
stereoscopic projection. Okay? Which is a 10:42:11
non-f-theta. 10:42:13
Q Now, just for clarity, little f in 10:42:18
Paragraph 37 is not the same thing as capital F in 10:42:21
Paragraph 36, right? 10:42:24
A No, I didn't look at that, but it's true. 10:42:26
Yeah, it's -- f-theta is sort of a functional 10:42:31
form. Okay? And which encompasses both curves. 10:42:37
Okay? In the case f-theta is a more functional 10:42:41
form. H is some function of theta. Can be the 10:42:47

theta lens, the fisheye -- linear fisheye lens, or it can be a stereoscopic fisheye lens. 10:42:52 10:42:57

So both are possible. And little f is the real focal length. 10:43:00 10:43:04

Q All right. And H is normalized here? 10:43:06

A Yes. 10:43:10

Q All right. If we go to -- can we scroll down to the page -- or Paragraph 38, please? 10:43:11 10:43:15

Okay. You see Equation 4 there, which is H equals big F -- 10:43:19 10:43:27

A Yes. 10:43:31

Q -- cosine of Z2? 10:43:32

A Yeah. 10:43:36

Q And that's just substituting theta 1 in the equation we were looking at earlier for -- to get that in terms of Z2; is that right? 10:43:36 10:43:40 10:43:46

A Yeah, in terms of Z2 to P prime, which was projected, as we said, down to the Q, and -- yeah. 10:43:47 10:43:52

Q And in Paragraph 39 -- 10:43:56

A In other -- in other words, he's now equating -- he's using theta in -- maybe I shouldn't go into that. 10:43:59 10:44:04 10:44:13

Okay. Yeah. But he derives this H also in terms of Z2, yes. 10:44:14 10:44:18

Q And then in Paragraph 39, we're finding R. What is R? 10:44:20 10:44:26

A R is -- R is shown on figure -- on Figure 1 at the bottom. It's a normalized number showing the distance of Q from O. 10:44:27 10:44:36 10:44:42

Q All right. And then in Paragraph 40, we define K2 as equal to H over R, correct? 10:44:51 10:44:54

A Yes. 10:44:58

Q All right. And then you said K2 is provided by a look-up table in this, Shiota? 10:44:59 10:45:04

A Yeah. He precalculates those numbers, yeah. 10:45:10 10:45:14

Q Okay. And K2 was also normalized? 10:45:15

A Is K2 normalized? Yeah, it looks like it. It's a ratio of H over R, and -- yeah, it's a ratio. It's -- is it normalized? I don't know, but it's a -- it's a dimensionals number. 10:45:20 10:45:28 10:45:41 10:45:44

Q Okay. And to get -- if you look at Paragraph 41, to get P1, you multiply X2 by K2? Is that right? 10:45:48 10:45:52 10:45:59

A Yeah. 10:46:01

Q And to get similarly Q1, you multiply K2 by Y2? 10:46:06 10:46:11

A Why do you see Q1? 10:46:13

Q Should be right under P1 equation. 10:46:15

A Q1 and Q1, yeah. 10:46:18

Q What did you do to prepare -- what did you do to prepare for today's deposition? 10:46:25 10:46:27

A I read my declarations. I read Shiota. I read the '990. Went over Baker. I looked also at the patent owner response. Let's see. I think that's it. 10:46:29 10:46:39 10:46:50 10:46:57

Q All right. Pending any redirect, I have no further questions. 10:46:57 10:47:05

A Can you say again? 10:47:06

Q Pending redirect, I have no further questions. 10:47:07 10:47:10

A Okay. 10:47:10

MR. JHURANI: Okay. Why don't we take 15, 20 minutes, if that's okay, and then we'll come back and see if we have redirect. 10:47:13 10:47:15 10:47:18

MR. MURRAY: Okay. That's fine. 10:47:20

VIDEOGRAPHER: We're going off the record at 10:46 a.m. Eastern Time. 10:47:21 10:47:23

(A recess was taken.) 10:47:25

VIDEOGRAPHER: We're going back on the record at 11:16 a.m. Eastern Time. 11:17:17 11:17:18

MR. JHURANI: All right. Thank you. We don't have any further questions at this point. 11:17:28 11:17:29

MR. MURRAY: All right. Thank you, Dr. Kessler, for your time. We appreciate it. Have a good weekend. 11:17:34 11:17:34 11:17:36

VIDEOGRAPHER: If there are no more questions, this marks the end of the video deposition of Dr. David Kessler. We are going off the record and ending his deposition at 11:17 a.m. Eastern Time. Thank you. 11:17:36 11:17:37 11:17:40 11:17:43

(Off the record at 11:17 a.m.)

ACKNOWLEDGMENT OF DEPONENT

I, DAVID KESSLER, Ph.D., do hereby acknowledge that I have read and examined the foregoing testimony, and the same is a true, correct and complete transcription of the testimony given by me and any corrections appear on the attached errata sheet signed by me.

_____ _____

(DATE) (SIGNATURE)

CERTIFICATE OF SHORTHAND REPORTER-NOTARY PUBLIC

I, Brooklyn E. Schweitzer, the officer before whom the foregoing deposition was taken, do hereby certify that the foregoing transcript is a true and correct record of the testimony given; that said testimony was taken by me stenographically and thereafter reduced to typewriting under my direction; that reading and signing was not requested; and that I am neither counsel for, related to, nor employed by any of the parties to this case and have no interest, financial or otherwise, in its outcome.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this 20th day of February, 2024. My commission expires: May 20th, 2026.

Brooklyn E. Schweitzer, RPR, CRR

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