UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

JUMIO CORPORATION,	)	
	)	
Petitioner,	)	Patent Nos. 10,776,471;
	)	11,157,606; 11,693,938;
vs.	)	11,874,910
	)	
FACETEC, INC.,	)	Inter Partes Review
	)	Nos. IPR2025-00106;
Patent Owner.	)	IPR2025-00107; IPR2025-00108;
	)	IPR2025-00109

DEPOSITION OF MATTHEW A. TURK, Ph.D.

Goleta, California

Thursday, January 8, 2026

Volume I

Reported by:
NADIA NEWHART, CSR No. 8714
Job No. 7811277

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Jumio EX1059 Page 1
Jumio v. FaceTec IPR2025-00109

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Deposition of MATTHEW A. TURK, Ph.D., Volume I, taken on behalf of Petitioner, at 401 Storke Road, Goleta, California, beginning at 9:00 a.m. and ending at 3:35 p.m. on Thursday, January 8, 2026, before NADIA NEWHART, Certified Shorthand Reporter No. 8714.

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Goleta, California, Thursday, January 8, 2026
9:00 a.m.

THE REPORTER: This is Nadia Newhart, California CSR number 8714.

Please raise your right hand, and I will swear you in, Doctor.

Do you solemnly swear or affirm that the testimony you're about to give in this deposition will be the truth, the whole truth and nothing but the truth under the penalty of perjury?

THE WITNESS: Yes, I do.

(Pause in the proceedings.)

MATTHEW A. TURK, Ph.D.,
having been first duly sworn, was examined and testified as follows:

EXAMINATION

BY MS. NGUYEN:

Q Okay. Good morning, Dr. Turk.

A Good morning.

Q Please state and spell your full name for the record.

A Matthew Alan Turk, M-a-t-t-h-e-w, A-l-a-n, T-u-r-k.

Q Okay. And do you understand that you have taken an oath to tell the truth today?

A Yes, I do.

Q Is there any reason you cannot give complete and accurate testimony today?

A No.

Q Okay. So you're here to give a deposition. I will be asking a series of questions. Please give verbal responses, no nods or any gestures that the court reporter cannot pick up.

Do you understand?

A Yes, I do.

Q And if there's a question that I ask and you're not -- it's not clear, please let me know. If you provide an answer, I will assume you understood my question. Is that okay?

A That sounds good.

Q Have you served as an expert at any prior cases?

A Yes, I have.

Q How many?

A I don't know the number but probably several dozen.

Q Okay. Ten?

A More than that. Several dozen.

Q Okay. More than 20?
A I'm pretty sure it's more than 20, yes.
Q More than 30?
A Probably, but I don't know for sure.
Q Okay. And has a court or agency ever excluded an opinion that you've offered?
A Not that I'm aware of.
Q Has a court or agency ever criticized an opinion that you've offered previously?
A I'm not sure how to determine criticized, so I'm not really sure.
Q Okay. Has a court or agency ever disagreed with an opinion that you've offered previously?
A Not that I'm aware of.
Q And in these prior cases, 30-plus cases where you served as an expert, would you say you represented plaintiffs more than defendants?
A I'm not sure. Some of each, but I don't have a good sense of the distribution.
Q Do you think it's 50 percent plaintiff, 50 percent defendants?
A I really couldn't guess. I just don't know offhand.
Q Okay. And what did you do to prepare for your deposition today?

A I reviewed my declaration and the materials cited in my declaration, met with the attorney here that I've been working with, primarily those things.

Q Okay. What is the name of the attorney that you primarily worked with in preparation for today's deposition?

A Mr. Christopher Johns.

Q Okay. Are there any other attorneys that you worked with to prepare for today's deposition?

A There have been other attorneys involved in some of our meetings. I don't recall the names offhand.

Q Okay. And were these meetings in person?

A Those meetings were remote.

Q And how many times did you meet with counsel to prepare for today's deposition?

A Explicitly, preparation meetings, there was one in person and maybe two virtually.

Q And do you know how much time in total you spent meeting with counsel to prepare for today's deposition?

A Some number of hours. I don't have a reasonably accurate guess on the top of my head, I guess.

Q Okay. Would you say maybe five hours?

A I could say maybe that, but again, I'm not sure how many.

Q Ten hours?

A Same answer, I guess. I'm not sure.

Q 50 hours?

A Would you like me to think through it and compute what I can remember right now or --

Q Just a general guess.

A Any of those is a reasonable general guess.

Q Okay. So it could be five hours; it could be 50 hours?

A It's definitely not 50 hours, but --

Q Okay. So less than 50 hours?

A Yes.

Q Okay. And earlier, you mentioned reviewing your deposition and -- sorry, your declaration, and all the materials cited in your declarations.

Were there any other documents that you reviewed?

A No, I don't think so.

Q Okay. And are there any materials that you reviewed that you did not identify in your declaration?

A No, I don't think so.

Q So let me hand you an exhibit, and this is Appendix 1 of your declaration.

Dr. Turk, do you recognize Appendix 1 of your declaration?

A Yes, I do.

Q What is it?

A It's my CV.

Q Okay. And you are a professor at the University of California, Santa Barbara; is that correct?

A A professor emeritus, yes.

Q Got it. And in that role, you teach courses in subject matter that you're familiar with; is that right?

A I have done that for the past many years, yes.

Q So if we could turn to page 7 of your CV.

At the bottom of page 7, it says "Teaching Experience."

Do you see that?

A Yes.

Q And the first thing listed under "Teaching Experience" in your CV are graduate courses that you taught between 2000 to 2019; is that right?

A That's right.

Q So now, if we continue to page 8, at the top of page 8, there's one course called Mobile Imaging.

Do you see that?

A Yes.
Q Is this course about mobile devices?
A It included mobile devices. It was primarily about imaging-related topics.
Q Imaging-related topics for mobile devices or --
A Mostly for mobile devices --
Q Okay.
A -- but a lot of them were general imaging topics that were then discussed how they applied to mobile devices.
Q Okay. So would you consider yourself familiar with mobile devices in 2014?
A Yes.
Q And were you aware of any mobile devices in 2014 that included wide-angle lenses?
A How wide do you mean?
Q Any sort of wide-angle lenses.
A There are a variety of lenses on cameras and on cameras at that time. I don't recall how wide the fields of view of those lenses were in particular.
Q Was there a big variety in the width of field of view for lenses at the time of 2014?
MR. JOHNS: Objection; form.
THE WITNESS: In the consumer mobile devices

that I was most aware of at the time, I don't recall there being a huge range, but they certainly were not all the same.

BY MS. NGUYEN:

Q Okay. And are you familiar with those clip-on wide-angle lenses that you clip onto the camera of your mobile device in 2014?

A Somewhat. I have not used one, but I'm somewhat familiar with them.

Q But they existed in 2014; is that right?

A I expect that they probably did. I haven't thought about that. I would need to confirm that, but --

Q Okay.

A -- to my best recollection, they probably did.

Q Okay. So taking a look back at your CV, I see in your CV, at several locations, that it says you have experience working with face detection; is that right?

A Face processing, including face detection, yes.

Q Okay. What is the difference between face processing and face detection?

A Face detection typically refers to determining whether or not there is a face in an image and maybe also where it is in the image.

But there are many other aspects of face processing, including recognizing who that face belongs to, the identity of that face, understanding the facial expressions, the movement of the face, other things.

So face detection is one of the many things involved in face processing.

Q I see. And so would it be fair to say that face processing, including face detection, was known to a POSITA in 2014?

MR. JOHNS: Objection; form.

THE WITNESS: To a POSITA for these patents, a POSITA as defined in my declaration, is that what you mean?

MS. NGUYEN: Correct.

THE WITNESS: Then yes.

BY MS. NGUYEN:

Q Let me hand you Exhibit 1008, and this is the Tahk reference.

Dr. Turk, before your work on this case, were you familiar with the Tahk reference?

A I don't recall being familiar with it.

Q Okay. And did you review Tahk when forming your opinion?

A Yes.

Q How much time, about, did you spend reviewing

Tahk?

A I don't know.

Q Would you say perhaps five hours?

A I really don't recall, so I'm not sure that I want to estimate it.

Q Okay. And did you review the entirety of Tahk?

A Yes, I did.

Q Did you understand everything described within Tahk?

A I didn't research and independently check everything in there, so I didn't reach that level of understanding, but I do believe I understood everything in Tahk.

Q Okay. And could there be things in Tahk that you didn't understand?

MR. JOHNS: Objection; form.

THE WITNESS: I think there could be things in everything that I don't understand, so yes.

BY MS. NGUYEN:

Q Okay. And is there anything in Tahk that you understood but disagreed with?

MR. JOHNS: Objection; form.

THE WITNESS: It's possible, but I don't recall disagreeing with anything in particular right

now.

BY MS. NGUYEN:

Q Okay. Dr. Turk, can you explain to me the process you took when you reviewed Tahk?

A Well, in general, when I review new patents like this -- and I presume this is what I did when I first saw Tahk -- I will look at the first page and try to understand generally what it's about from the abstract and the first image on that page.

I will look at the publication date and the filing date. I will see if there are other publications or any information about continuations or anything like that that would tell me anything right away about priority date. So, again, a general sense of it from the cover page.

And then I will thumb through the diagrams, the figures, and then I will typically quickly look through the introduction of the patent, introductory section or sections and then go to the claims and look over the claims. And then having done that, I'll start back and go through the whole thing in more detail.

Q Okay. So when reviewing a prior art reference -- let me just make sure I understand this -- you review the abstract, all of the figures, the claims and the specification; is that right?

A Well, I will review everything. So if that's everything, yes.

Q Okay. And you do this in order to understand the prior art reference; is that right?

A Yes.

Q Okay. And is this something, in your opinion, that a POSITA would do as well?

A A POSITA would do in what circumstance?

Q Let me ask the question a little bit more clearly, but a POSITA, when reviewing a reference, would -- in order to understand the reference, would review the abstract, all of the figures, the claims and the specification; is that right?

A I can't presume to know what any other person would do to try to understand a document, but it sounds like they would do something like that.

Q Okay. So you're not sure what a POSITA would do; is that what you're saying?

A I don't know the exact procedure anyone else would take in trying to understand a document. I was describing to you my -- my process.

Q Okay. And you believe you are a POSITA; is that right?

A For this case, yes.

Q Okay. So let's take a look at Figure 8A of

Tahk.

Do you see Figure 8A?

A I do, yes.

Q And what does this figure show?

A It looks to me like it shows a cell phone displaying an image of a person.

Q And does it show a user interface to obtain an image of a user's face?

A I would have to go back into the patent to determine that. I don't remember everything about Tahk right now.

Q Okay. But based on what Figure 8 shows, does it show a user interface that's obtaining an image of a user's face?

A Again, it shows what looks to be a cell phone displaying a picture of a face. Whether it shows a user interface is not as obvious to me right now looking at this out of context, so I'd have to go into the patent to determine if that's what it is claiming to show there.

Q Okay. Perhaps I can give you more context and refer you to paragraph 141.

Let me know when you've had a chance to review paragraph 141.

A Okay. I have.

Q Okay. Would you agree that Figure 8A shows a user interface for obtaining an image of a user's face?

A That's how it's described --

Q Okay.

A -- there.

Q And looking at Figure 8A, would you agree that the user interface shows an oval?

A Yes, it does seem to display an oval there.

Q Okay. And the figure, Figure 8A, also displays a phrase at the bottom that says (as read):

"Please step back" -- sorry, "Please step further back and then photograph."

Do you see that?

A I do see that.

Q And would you agree that this oval in Figure 8A is used as guidance information to position the user?

A I would guess that that's what it's there for.

Q Okay. So let's take a look at Figure 8B, right below it.

A Uh-huh.

Q Does Figure 8B show a user interface to obtain an image of the user's face?

A Yeah, according to the specification, it does.

Q Okay. And would you agree that Figure 8B shows an oval as well?

A Yes.

Q Would you agree that the oval is used to position the user?

A I would presume that that's what it's used for.

Q Okay. So now with Figure 8B, the phrase at the bottom says (as read):

"Please step further forward and then photograph."

Do you see that?

A I do, yes.

Q And looking at both Figure 8A and Figure 8B, the user in Figure 8B is further away from the device than she is in Figure 8A, right?

A That does look to be right, yes.

Q Okay. So the phrase "further back" in Figure 8A and then "further forward" in Figure 8B, would it be fair to say that it was known in the art to use ovals to obtain images of a user at two different distances?

A I don't know offhand exactly what the -- how the ovals are used here, but I would say this does give an example of ovals as references in taking images of

people.

Q Taking images of a person at two different distances from the mobile device; is that right?

MR. JOHNS: Objection; form.

THE WITNESS: Yes, what is shown here is someone at two different distances, and there are ovals in both of the images.

BY MS. NGUYEN:

Q Okay. So you would agree that it was known to use ovals in two different images, having the user at two different distances to obtain images?

MR. JOHNS: Objection; form.

THE WITNESS: I would want to go back to the specification here and remind myself exactly what the ovals were used for, but your description sounds reasonable, looking at these figures.

BY MS. NGUYEN:

Q Okay. Previously marked, let me hand you Exhibit 1006, and Exhibit 1006 is the Zhang reference.

Dr. Turk, before your work in this case, were you familiar with the Zhang reference?

A Not that I recall.

Q Okay. And you reviewed Zhang in its entirety when forming your opinion; is that right?

A Yes, I did.

Q And is there anything in Zhang that you, if you recall, did not understand?

A I don't think so.

Q Is there anything in Zhang that you disagree with?

MR. JOHNS: Objection; form.

THE WITNESS: I don't recall disagreeing with anything in it.

BY MS. NGUYEN:

Q So let's walk through Zhang's process labeled 300.

If I could have you go to paragraph 27 of Zhang. And in paragraph 27, it begins with "in process 300."

Do you see that?

A Yes.

Q Okay. So process 300 begins with Zhang extracting feature points from two images of the user's face; is that right?

A Yes, that's right.

Q And Zhang provides examples of feature points. He says "such as a corner of an eye, a corner of a mouth, a tip of a nose, and so forth."

And these are extracted from the first and second images, right?

A Those are examples of things that are -- that can be extracted, right.

Q Okay. And then if we move on to the description of act 304 in paragraph 28, the extracted feature points are matched across the first and second images, right?

A That's right.

Q Okay. And Zhang states that this matching of feature points refers to identifying the location of the same feature points in each of the two images.

Do you see that?

A I do, yes.

Q Okay. So then if we move on to 0029, in paragraph 0029, a homography matrix is generated in act 306 based on the location in the first image and the location in the second image?

MR. JOHNS: Objection; form.

BY MS. NGUYEN:

Q Yes?

A Yes.

Q Okay. And with the term "location," Zhang refers to the feature points extracted in the matched -- and matched in act 304 that we talked about previously?

MR. JOHNS: Objection; form.

BY MS. NGUYEN:

Q Would you agree?

A Yes.

Q Okay. So now, if we go on to paragraph 30, paragraph 30 (as read):

"A warped image is generated by warping the first image with a homography matrix H."

Is that right?

A Yes.

Q Okay. And that is act 308, yes?

A Yes.

Q Okay. So then moving on to paragraph 31, in paragraph 31, Zhang determines the image difference between the warped image and the second image, yes?

A Yes.

Q Same paragraph 31, Zhang then describes the difference in color or intensity values being at the same pixels or, in other words, location, as he's placed in parentheticals, of the feature points that were extracted and previously matched.

MR. JOHNS: Objection; form.

BY MS. NGUYEN:

Q Would you agree?

A Sorry. Can you please repeat the question?

Q Sure. So I said, same paragraph 31, Zhang then describes the difference in color or intensity values being at the same pixels or, in other words, location, as he's placed in parentheticals, of the feature points that were extracted and previously matched?

MR. JOHNS: Objection; form.

THE WITNESS: Can you tell me where it says "of the feature points" like you just said?

BY MS. NGUYEN:

Q Well, it says "at the same pixels" and then parentheticals, "locations."

Do you see that?

A Yeah, but this is not at the same locations as the feature points that we talked about earlier.

Q Okay. Which locations is it referring to?

A When it says "the same locations," it means a location in the warped image is being compared to the same location in the second image. And that's being done at a number of locations, but those locations are independent and separate from the earlier determination of locations that we discussed, the feature locations.

Q Okay. So if we take a look at paragraph 32, Zhang talks about locations that are part of a face.

A Where, specifically?

Q It is eight lines from the bottom.
A I see that.
Q Okay. And he mentions the eyes, mouth and nose as parts or subregions within the face.
Do you see that as well?
A I do, yes.
Q Okay. So wouldn't it be fair to say that when Zhang uses "the locations," he's referring to parts of the face?
MR. JOHNS: Objection; form.
THE WITNESS: He is here, in paragraph 32, but these are not the same locations and parts of the face as the ones we described earlier in an earlier paragraph.
BY MS. NGUYEN:
Q Okay. Is there a reason why Zhang used "location" for both?
A Yes. Because in an image, every piece of information, every pixel, is at a location. So we're pretty much always talking about locations in images when we talk about image data.
But the first set of locations that we talked about is related to doing the matching we discussed. The locations here, in paragraph 32, are about comparing the two images. So they're different parts

of Zhang's process.

Q But both parts refer to locations?

A They use of the word "locations," yes, but they're referring to different locations, or not -- not necessarily the same locations.

Q Okay. So let's keep going to paragraph 34.

In paragraph 34, Zhang then determines whether the image difference meets the threshold value. And if it does, then it determines the face in the first and second images as a live face in act 304; is that right?

A That's right.

Q Okay. So would you agree that Zhang anticipates there to be an image difference when there is a live face being imaged?

A No, I wouldn't say Zhang anticipates anything. Zhang calculates, as we've gone through briefly the homography matrix, does a warping, does a comparison and then checks to see if that comparison is above or below a threshold.

Q And this threshold is a predetermined threshold; is that right?

A I believe so, yes.

Q Okay. And this predetermined threshold is used to determine whether the face is a live face, right?

A That's right.

Q Okay. So by having a predetermined threshold, doesn't that mean that Zhang anticipates that in certain instances, the face would be a live face?

MR. JOHNS: Objection; form.

THE WITNESS: Well, I would not describe it that way. Again, I would describe it the way I did. Zhang goes through a process, comes up with a number that is essentially a comparison of two images and, based on that number, decides whether it should be considered live or not.

MS. NGUYEN: Okay.

THE WITNESS: I think that's the best way to describe it.

BY MS. NGUYEN:

Q And when you say "that number," you're referring to whatever is being compared to the predetermined threshold?

A Yes.

Q And if it is -- if the difference meets the threshold, it's a live face?

A If the value computed exceeds the threshold, it's considered a live face. If it does not exceed the threshold, it's considered flat and, therefore, not live.

Q Okay. And these two conditions are conditions that Zhang has determined could exist prior to calculating the difference; is that right?

MR. JOHNS: Objection; form.

THE WITNESS: Again, I'm not sure that I or anyone in the field would describe it that way. Again, it's a -- it's a binary decision based on a number that was computed. That's the way I would describe it.

BY MS. NGUYEN:

Q Binary decision based on a number that was computed, but this binary decision, just like the threshold, is predetermined, right?

And maybe I can say -- perhaps maybe not binary. Can I say binary condition? Is that a better way to phrase it, or do you prefer -- I feel like "decision" is after.

MR. JOHNS: Objection; form.

THE WITNESS: I don't think there's much difference between the two terms --

MS. NGUYEN: Okay.

THE WITNESS: -- in this context.

So, sorry, what's the question?

BY MS. NGUYEN:

Q Sure. So just like how the threshold is predetermined, would it be fair to say that the binary

decision is predetermined?

A I think those are basically the same things, those two phrases.

Q Okay.

A Predetermined in the sense that a threshold was determined to be used.

Q Yes.

A There was a number.

Q The number was predetermined?

A A number was predetermined, yes.

Q Got it. Okay. Great.

And when Zhang determines there's a live face, this means the image has three-dimensionality; is that right?

MR. JOHNS: Objection; form.

THE WITNESS: It means that that's the best guess of the process.

BY MS. NGUYEN:

Q Okay. So when there's an image of a live face, it's an indication of three-dimensionality?

MR. JOHNS: Objection to form.

THE WITNESS: Presumably, yes.

BY MS. NGUYEN:

Q Okay. And in Zhang, the determination of the face being a three-dimensional structure, that's used

in its authentication process, right?

MR. JOHNS: Objection; form.

THE WITNESS: You're asking about in Zhang's authentication process?

MS. NGUYEN: Correct, correct.

THE WITNESS: I don't recall offhand if Zhang actually has an authentication process or just does the live in this test. I would have to look over Zhang briefly to remind myself of that.

BY MS. NGUYEN:

Q Sure. Okay. Maybe I can refer you to the abstract and have you review that.

Let me know when you're done, and I can ask the same question when you're done.

A Okay. I'm done.

Q Okay. So back to my question. In Zhang, the determination of the face being a three-dimensional structure is used for its authentication process; is that right?

A So it's a little bit of a complicated question.

If by "authentication process," you mean what someone in biometrics typically refers to as a biometric authentication, then no, Zhang is not -- Zhang is doing things before that. Zhang is not

teaching a biometric authentication.

But Zhang uses the word "authentication" to say that the liveness of a user can be authentication -- authenticated, not the identity of the user.

Q Right. I don't think my question asked about identity.

A Okay. That's the typical way a POSITA would understand "authentication" in this context, so that's why I wanted to clarify.

Q Okay. Got it. So just looking at Zhang, right -- and I referred you to the abstract --

A Yes.

Q -- going back to my question, in Zhang, the determination of the face being a three-dimensional structure is used in its authentication?

A It's used to determine if we can authenticate the user or we can't authenticate the user. It's not used to authenticate the user.

Q Okay. Now, let's take a look at paragraph 45 of Zhang.

And let me know when you've had a chance to review paragraph 45.

A Okay.

Q Okay. Can you explain to me what paragraph 45

is describing.

MR. JOHNS: Objection; form.

THE WITNESS: My opinion of it is that it's not the clearest paragraph in Zhang.

MS. NGUYEN: Right.

THE WITNESS: But I believe it's talking about taking information that has been computed, that may be three-dimensional information about the scene, comparing it to a flat plane that's been fitted to the data and basically looking at deviations from that flat plane.

For example, there are points that could be on a nose or on an eye or something, above that flat plane, below that flat plane, in that flat plane, and how that might relate to other points in the face and their relation to the flat plane. It's related to those kinds of comparisons.

BY MS. NGUYEN:

Q Okay. And in paragraph 45, Zhang talks about -- in the middle of paragraph 45 -- feature points. It specifically says feature points -- sorry, let me start with a full sentence. It says (as read):

"These various facial components or feature points can be, for example, eyes, corners of eyes, corners of

mouths, noses, tips of noses, and so forth."

Are these feature points being used to determine whether or not to authenticate the user?

A Again, I don't think this paragraph is too clear or too specific, but he seems to indicate these as possible characteristics or possible data that can be used to help determine liveness, to authenticate liveness.

Q Of a user?

A Of a user.

Q Okay. And paragraph 45 also talks about comparing ratios.

Do you see that?

A I do, yes.

Q So if I understand, the ratio is calculated of the first value and the second value; is that right?

MR. JOHNS: Objection; form.

THE WITNESS: A ratio is a comparison of two things.

MS. NGUYEN: Okay.

THE WITNESS: So in a sense, that's right.

BY MS. NGUYEN:

Q Okay. What does the ratio represent?

A In this paragraph, it's not clear to me

specifically what ratios he may or may not be including. So he's using the concept of ratios but not much detail about it.

Q Well, he says "calculating a ratio of the first value to a second value." And in that same sentence --

A Sorry. Can you tell me where you are?

Q Oh, sure. Six lines from the bottom of paragraph 45.

A I see. Thank you.

Q And then that same sentence, in the middle, he talks about the first value being a maximum distance from a particular feature, e.g., tip of a nose.

Do you see that?

A I do.

Q Okay. And then he says (as read):

"...a second value is the distance between two facial components on the plane (e.g., the distance between the eyes or between the corners of the eyes)."

So given that content, when he calculates the ratio of the first value to the second value, what does that ratio represent?

A It represents the ratio of the first value to

the second value.

Q Okay.

A He's saying there are various things that can be measured as ratios, but he's not much more specific about that.

Q But in your opinion, if you take the ratio of the maximum distance from a particular feature to the distance between two facial components on the plane, what information would that represent?

A It would be -- I would consider it a feature. It is a function of some of the information that has been calculated.

Q And what would a POSITA do with this information that is being calculated?

A It depends on what the POSITA's goal is.

It's unclear to me exactly what Zhang will do with this information in this paragraph.

Q Uh-huh, because then in paragraph 46, he then talks about whether the analyzed characteristics meet the threshold and provides more detail about the characteristics being greater than a threshold value.

And then in paragraph 47, it says (as read):

"If the analyzed characteristics meet the threshold value, then the face in the first and second images is

determined to be a live face."

So do you have an opinion as to whether -- sorry.

Do you have an opinion as to what that ratio represents with respect to the threshold value?

MR. JOHNS: Objection; form.

THE WITNESS: Based on how this is written, I have only been able to guess at what the details could be, but I think really what it's saying is that you can take a bunch of measurements and compute ratios, and that may be useful in determining a live face. I don't think there's much more technical detail beyond that here.

BY MS. NGUYEN:

Q Okay. But if you were to explain to one of your students -- let's pretend I'm your student, and I said, What does this ratio really mean? How would you explain it?

A Well, I don't think there is any meaning as it's written here, because there's not enough detail.

So what I would do with a student, for example, is say, Here's a general idea. Can you look into this, try some things, experiment with it, see if there are ratios that are useful, see if there are features and points that are particularly useful?

Can you take this and do some experiments and figure out if it might be useful for this goal of determining liveness?

Q Uh-huh. Okay. So let's pivot away from Zhang. And I actually want to talk about claim construction.

Dr. Turk, what is your understanding of how a POSITA construes patent claims under United States patent law?

A Should we look at my declaration --

Q Sure.

A -- where I do believe I have some opinions about that?

Q Sure. It's very large. Okay. So this is Exhibit 2061.

Dr. Turk, do you recognize your declaration?

A I do, yes.

Q And you signed your declaration; is that right?

MR. JOHNS: 223, I think.

MR. NGUYEN: Thank you.

THE WITNESS: Yes, I did.

BY MS. NGUYEN:

Q Okay. Is there anything about your declaration that you would like to change?

A There were some minor typos that I noticed later, but nothing significant.

Q Nothing substantive; is that right?

A That's correct.

Q Okay. So going back to my question, what is your understanding of how a POSITA construes patent claims under United States patent law?

A Generally, I think a POSITA, understanding the field of a patent, tries to understand what the important technical terms mean specifically, as specifically as is needed to be used in the way they're used in a patent.

So I think that's the main thing, what does a particular term mean in general in the field and especially in the context of this patent?

Q Okay. And just to make sure we're on the same page, when I use the term "FaceTec patents," you understand that I mean the '471 patent, the '606 patent, the '938 patent, and the '910 patent?

A Yes, I do.

Q Okay. So in performing your analysis of the FaceTec patents, did you consider all of the claims of the patents?

A I did, yes.

Q Okay. And in determining the meaning of the

claim terms, are you required to consider the specification of the patents?

A Yes.

Q Are you required to consider the prosecution histories of the patents?

A Yes, the relevant parts.

Q Okay. And in performing your analysis of the claims and the claim terms, are you required to consider dictionary definitions of the terms in the claims?

A Not necessarily, if they're not needed.

Q When are they not needed?

A If the terms are clear enough in the field and in the POSA's knowledge of the field, then that would not be needed.

Q Okay. But if a dictionary term defines a claim term, then would that claim term have the same meaning as set forth in the dictionary definition?

A Not necessarily. It depends on the field, the context of the knowledge of the area of the patent and the -- and the language of the patent, both the specification and the claims.

Q Okay. And construing claim terms, are you required to construe claims from the perspective of an expert?

MR. JOHNS: Objection; form.

THE WITNESS: My understanding is that claims are construed from the perspective of a person of ordinary skill in the art.

BY MS. NGUYEN:

Q Okay. And if a patent specification describes an example of the invention, then must the claims cover that example?

A If the specification describes something, the claims don't necessarily have to cover everything in the specification.

So if I'm understanding your question correctly, I think the claims don't have to cover everything that's mentioned in the specification.

Q Okay. If the specification describes an example of the invention, are the claims limited to that example?

MR. JOHNS: Objection; form.

THE WITNESS: I don't believe the claims would be limited to only one example that is in the specification, no.

BY MS. NGUYEN:

Q Okay. And for the FaceTec patents, do you believe that each term should be given its ordinary and customary meaning?

A That is the way I have approached them.
Q Okay.
A I don't particularly have an opinion on what should be done there, but in order to understand the patents, that is how I have taken it.
Q Okay. So just to make sure I understand this, in performing your analysis and in rendering your opinion, you gave the claim terms the ordinary and customary meaning for the FaceTec patents; is that right?
A I believe so, yes.
Q Okay. Do you believe the term "face" should be given its ordinary and customary meaning?
A As it's used anywhere in these patents, do you mean?
Q In the FaceTec patents, yes.
A Yes, I believe so.
Q Okay. And in your opinion, what is the meaning of the term "face"?
A I don't have a specific definition or meaning off the top of my head at the moment.
Q Okay. How would you describe what the term "face" means?
A Generally, I would describe it as the part of -- assuming we're talking about humans here, the

part of the human's head that is on the front side of the head, in general, and includes what people tend to refer to as features, such as eyes, nose, mouth, eyebrows, forehead and such, but I don't have an exact definition in mind at the moment.

Q Okay. That's okay.

So if an image shows the user's eye, would you say the image shows the user's face?

A Well, generally, outside of any particular context, I would say that image shows a piece of a user's face.

Q What about if the image shows the user's mouth? Would you say the image shows the user's face?

MR. JOHNS: Objection; form.

THE WITNESS: I would probably first say the image shows the user's mouth, but then if I had to relate it to the face, I would say it's showing a part of the face.

BY MS. NGUYEN:

Q Okay. And what if the image shows, let's say, the ear, eye and mouth? Would you then say it shows the user's face?

A An ear, an eye and the mouth, I would say it's showing part of the user's face.

Q Okay. Now, for the term "biometric data," do

you believe biometric data should be given its ordinary and customary meaning?

A Ordinary and customary in the field, yes.

Q Okay. And what is the meaning of the term "biometric data" in your opinion?

A Again, I don't have a precise definition at the top of my -- tip of my tongue right now, but in general, it means -- very broadly, it means data about a human, human biology or body or something.

In the context of biometrics, and especially biometric security, it means data about a human or derived from a human that can be used for identity -- to determine identity.

Q Okay. So is it a requirement that biometric data be used to identify a user?

MR. JOHNS: Objection; form.

THE WITNESS: Well, again, the more broad general definition of the word "biometric," just meaning about a body or about a human or about biology, there would be no such requirement there.

MS. NGUYEN: Okay.

THE WITNESS: And if we're talking about biometrics, the field of biometrics, including biometric security, biometric data in that context should be useful for identification.

BY MS. NGUYEN:

Q Okay. Is it a requirement -- and when I say the term "biometric data," just to give more context, I mean biometric data in the context of the FaceTec patents.

A Okay.

Q So is it a requirement that biometric data, in the context of the FaceTec patents, be used to identify a user?

A For the term itself, outside of any context, I would say the requirement is that the data must be useful for the identification, not necessarily -- someone may choose not to use it, for example, but it needs to be useful and perhaps effective for identification.

Q And could there be a system that analyzes biometric data that is not useful for identifying a user?

A This gets back to the -- kind of two different broader and more focused view of biometric data.

But you mean biometric data in the patents?

Q Yeah, in the proceedings, maybe.

A Well, in the proceedings, both terms come up. That's why I'm --

Q Oh, okay.

A -- I'm asking about this.

So maybe repeat the question or tell me which one you mean --

Q Yeah, let's --

A -- or if you mean both.

Q I do mean both. So maybe let's take it one by one.

So biometric data -- in the context of the FaceTec patents, could there be a system that analyzes biometric data that is not useful for identifying a user?

MR. JOHNS: Objection.

THE WITNESS: The data not being useful?

MS. NGUYEN: Correct.

THE WITNESS: I'm not sure that I thought about this before, but I think the way you're asking it, I would say the patents would not call that biometric data, if it's not useful or at least potentially useful for identifying someone.

BY MS. NGUYEN:

Q Okay. So then going back to -- we talked earlier about biometric data as applied to the proceedings versus the patents, right?

A Yes.

Q Going back -- and we focused first on the

FaceTec patents. So now going to the other one, the proceedings. Biometric data in the context of the IPR proceedings, could there be a system that analyzes biometric data that is not useful for identifying a user?

A I believe if in that case you mean biometric data more broadly and -- and any -- any measure of a human would -- would count for that, like the angle of my elbow --

Q Okay.

A -- then there can be systems that -- I'm forgetting your exact wording, that deal with that data, and that data is not useful for determining identity.

If you could repeat the exact --

Q Yeah.

A -- question so I can answer it more precisely.

Q So in the context of the proceedings, could there be a system that analyzes biometric data that is not useful for identifying a user?

A Yes. And the reason I'm giving the answers that I'm giving is not at all to be evasive, but I just want to be clear that I believe some of the data that Dr. Daft discusses in his background is broadly -- can broadly be referred to as biometric data, because it's

data about a body, about a human but not useful for identity -- determining identity.

And so I think that's an example for which I'd say yes to your question, but I would say that is not biometric data as the patents refer to biometric data.

Q Because it's not useful for identifying a user?

A Correct.

Q Do you recall which data Dr. Daft was talking about?

A I don't recall offhand. I can look in my declaration and see if I mention it in particular.

Q If you can find it quickly.

A So I discuss this in general around paragraph 51 and 52 of my declaration, but the details are in Dr. Daft's declaration, I believe, of how he has dealt with securing data that is biometric in the broader sense, as I was describing earlier. But that data is not biometric in the sense that the patents use the phrase, use the word.

Q Okay. Is there a requirement that the term "biometric data," as used for the FaceTec patents, be used for authentication?

A I think we discussed this before. I think that data should be useful for identification. Whether

it's used or not is a different question.

Q Okay. So, in your opinion, it's a requirement that biometric data, as used in the FaceTec patents, be useful for authentication?

MR. JOHNS: Objection; form.

BY MS. NGUYEN:

Q Is that right?

A Yeah, I think that's a fair summary.

Q Okay. And do you know whether any of the FaceTec patents discuss the meaning of the term "biometric data"?

A I don't recall offhand if they do or not.

Q Okay. I'm going to hand to you Exhibit 1001 in the 106 proceeding. This is the '471 patent.

Do you see that?

A Yes, I do.

Q Okay. So if I could have you turn to column 6, starting at line 37. Let me know when you're there.

A Okay.

Q Okay. And column 6, line 37, I won't read it in its entirety, because it's rather long, but it starts with -- the sentence starts with "The term biometric data may include."

Do you see that?

A Yes.

Q And then the next sentence says (as read):
"Examples of path parameters..."
Do you see that as well?
A Yes.
Q And then the sentence after that says (as read):
"Other data may also be included such as GPS data, device identification information and the like."
A Yes.
Q Okay. So, Dr. Turk, do you agree with the description of biometric data as provided in the specifications of the FaceTec patents?
A Yes, I do.
Q So let's turn back to your declaration, paragraph 472.
Okay. Do you see the images above the label "FaceTec software" in paragraph 472?
A Yes, I do.
Q And in your opinion, do the images above the label "FaceTec software" include biometric data?
A The images -- technically, the images themselves are not biometric data. Biometric data would be derived from images.
Q Okay. But the images include biometric data;

is that right?

A No. The biometric data is derived from, computed from, so it's separate. It's not included in the image itself.

Q I see. I see the distinction.

Okay. So then if we can go to the next page, page 225 of your declaration.

Do you see the images above the label "petitioner software"?

A Yes, I do.

Q Okay. And from the images above the label "Petitioner's Software," would biometric data be derived from these images?

A Biometric data could be derived from images like this.

Q Okay. And can you briefly describe what's in the images above the label "Petitioner's Software"?

A There are three separate images adjacent to each other. They're of the same person --

Q Okay.

A -- who looks like, on the left, the face fits relatively nicely in an oval. On the far right, the face fits relatively nicely on a larger oval. And in the middle, it seems like perhaps the oval is in the process of getting larger before the face has moved, so

it's not such a good fit between the face and the oval.

Q Okay. So let me hand to you the '471 patent owner response.

Do you recognize this document?

A I have seen this, yes.

Q Okay. So if you could please take a look at page 9 of the patent owner response for the '471 patent.

Okay. Are you there?

A Yes.

Q At the top, it states "the Jumio difference."

Do you see that?

A Yes.

Q And on page 9 of the patent owner response for the '471, it shows three images.

Do you see that?

A Yes.

Q Okay. So I'd like to focus on the leftmost captured image.

Can you briefly describe what's in the leftmost captured image, just to make sure we're on the same page?

A It looks like a picture of someone holding up a California driver's license.

Q Okay. Is there anything else in the image,

the leftmost image?

A There are some houses maybe in the background, perhaps a little bit of a sky, some of the -- some of a person's hand and wrist. Maybe there's a -- there's a car, it looks like. And there's some text towards the bottom.

Q Okay. Great. It sounds like we're on the same page.

In your opinion, does the leftmost captured image on page 9 of the '471 patent owner response include biometric data?

A Well, similar to my answer before, the way I view these terms, that's merely an image. So the image itself does not include biometric data.

Q Okay. Maybe going off of that, let me rephrase my question to be a bit more precise.

In your opinion, does the leftmost captured image on page 9 of the '471 patent owner response have data that includes biometric data?

MR. JOHNS: Objection; form.

THE WITNESS: From what I can tell here, all of the data is image data --

MS. NGUYEN: Okay.

THE WITNESS: -- which is different from biometric data. So I'd say no, it's not -- it's an

image. It's not biometric data.
BY MS. NGUYEN:
Q But the image data includes biometric data?
A Image data is image data. Biometric data is different.
Q What's the difference?
A We discussed this earlier. Biometric data may be computed from image data --
Q Okay.
A -- but it's not included in the image data. They're different things.
Q Okay. So let me ask the question one more time.
In your opinion, does the leftmost captured image on page 9 of the '471 patent owner response have image data to which biometric data can be computed from?
MR. JOHNS: Objection; form.
THE WITNESS: I don't know if the face is large enough and detailed enough -- first of all, I think if so, it would only be the face or faces in that image that could produce the biometric data, or the biometric data could be computed from only those.
And I don't know if those three faces in that image are large enough or have enough detail in them to

compute meaningful biometric data. So I'm not sure, given this.

BY MS. NGUYEN:

Q So are you saying biometric data needs to come from an image of a face that has a particular size?

A It needs to have enough resolution to be able to compute the biometric data from it.

Q Okay. And is that consistent with the description as provided in the '471 patent specification that we talked about earlier?

A Remind me of where that was.

Q Sure. '471 patent, column -- sorry, yes, column 6, starting at line 37, do you see anything in there that talks about resolution with respect to the meaning of biometric data?

A No. I -- resolution is not sort of in the meaning of biometric data, but in order to produce useful biometric data, you have to -- you have to start with something that is going to be effective to produce such data.

For example, if you wanted to produce fingerprint data and the input was an image of a finger seven miles away, there would not be enough information to produce reasonable biometric data from that. But if the image were from the finger 2 inches away, you

might.

Now, that's not part of the definition of biometrics, but it's just part of the practical reality of producing biometric data, in this case from an image that you're asking about.

Q Okay. In your opinion, what is the meaning of the term "expected differences"?

MR. JOHNS: Objection; form.

THE WITNESS: I think it's just differences that are, for some reason, expected.

BY MS. NGUYEN:

Q And in your meaning, what is the meaning -- or I'm sorry. In your opinion, what is the meaning of the term "expected distortion"?

MR. JOHNS: Objection; form.

THE WITNESS: I'd say in general, it's distortion that is expected.

BY MS. NGUYEN:

Q Okay. In your opinion, what is the meaning of the term "perspective distortion"?

MR. JOHNS: Objection; form.

THE WITNESS: "Perspective distortion" is a technical term that specifically means the distortion that people observe that is caused by the perspective geometry of imaging.

BY MS. NGUYEN:

Q Okay. And does the term "expected distortion" have the same meaning as "perspective distortion"?

MR. JOHNS: Objection; form.

THE WITNESS: They are different terms, but in the context of these patents, expected distortion is referring to perspective distortion.

BY MS. NGUYEN:

Q And outside of the context of the FaceTec patents, does the term "expected distortion" have the same meaning as "perspective distortion"?

A Not in general, no.

Q Okay. And in your opinion, does expected differences have a meaning that is different from expected distortion?

MR. JOHNS: Objection; form.

THE WITNESS: In general -- excuse me -- expected differences can include a wide number of things. And, for example, the patent specifications describe other things besides perspective distortion that can be expected.

But when used in the terms -- in the claims in that context, it's clear that the expected differences are the perspective distortion, the differences due to perspective distortion.

I hope I answered your question.

BY MS. NGUYEN:

Q So in the context of the claims of the FaceTec patents, is it your opinion that expected differences and perspective distortion have the same meaning?

A No. I would say expected differences and expected distortion has the same meaning in the context of these claims.

Q Okay. But earlier, you said that expected distortion has the same meaning as perspective distortion.

Do you recall that?

A The expected distortion in these claims is perspective distortion. That's what's expected.

Q Okay.

A And the claim describes that as either expected distortions or expected differences.

Q So going back to your previous answer, when I asked you what's the meaning of the term "perspective distortion," your response was, "Perspective distortion is a technical term that specifically means the distortion that people observe that is caused by the perspective geometry of imaging."

A That sounds right.

Q Can you explain that a bit more to me?

MR. JOHNS: Objection; vague.

THE WITNESS: The projective -- the way cameras work --

MS. NGUYEN: Okay.

THE WITNESS: -- and optics works, when you go from the real world to an image, using a pinhole camera or a camera with a lens or whatever, the geometry that describes how you get from some point in the world to some point in the image, that's known as projection in general.

You're projecting things in the world onto an image, and the particular kind of projection and geometry of that is specifically known as perspective projection.

So when you take a picture with a camera, a typical camera, that's really what's happening. That's a way to describe the geometry of what's happening. For the 3D world to become a 2D image, that's perspective projection.

Perspective distortion is, because of that perspective projection, things can seem a little odd when you compare something far away to something close, the same object far away and close. It causes relative sizes, distances, et cetera, to -- to change.

MS. NGUYEN: Uh-huh.

THE WITNESS: That's sort of the perspective distortion effect.

And maybe that didn't help, but it's hard to do without a blackboard or something, slides.

MS. NGUYEN: Right.

THE WITNESS: I can give you one more little example if you'd like.

BY MS. NGUYEN:

Q Well, so I'm a very visual person. Perhaps -- let me know if I'm understanding this correctly, but let me give you Exhibit 1007. This is Tanii.

(Discussion off the record.)

BY MS. NGUYEN:

Q Okay. So if we could turn to Figures 3A, 3B, 4A, 4B, on the same page of Tanii.

Let me know when you're there.

A I'm there.

Q Okay. So would you agree that Figures 3A, 3B, 4A and 4B of Tanii show perspective distortion?

A I believe that's what they're intended in Tanii, if I may pronounce it that way.

Q Okay.

A That's the way I say it.

Q Okay.

A And yes, I think it's a reasonable depiction

of that.

Q And when you were explaining how optics works, you were talking about real world, putting projected onto a 2D image.

It sounds like this concept of perspective distortion and its impact on how a captured image looks like was a concept that was known to a POSITA at the time of 2014; is that right?

A That concept in general has been known for centuries, yes.

Q All right. Let me hand you, actually, a blank piece of paper. And I know -- it sounds like you like to be visual like I do.

Perhaps you can draw out what you were trying to explain to me earlier.

A And what am I -- what's the goal here? What am I trying to explain?

Q What --

A Perspective distortion?

Q Correct, correct.

A Okay.

Q Feel free to talk as you're drawing, if that helps.

A Maybe I'll just draw first and then talk.

Q Okay.

A This may not be the best diagram in the world, but here's a camera.

Q Okay. Wait. Can you add labels to the lines?

A Okay. Yeah.

Q Let's say, for example, line A, line B, et cetera.

A All right. So this is the lens of a camera. And so the middle of this is sort of the central point of the camera, I guess. And so you can imagine the camera body being here, some objects out in the world, the light from those objects. They go all around the place, but among other places, they're going through this lens to the actual sensor in the back of the camera, or film in a film camera, okay?

So it's not to scale necessarily but --

Q Okay.

A So this would be much smaller, you know, if it were to scale, but...

So then out in the world, over here, there's some object of a certain height, size. That object is going to project through the center of this lens -- really, all through the lens, but this is sort of -- this encapsulates the main projection to this point on the sensor plane.

Q Okay. Hold on. Can you write the world -- or

write the word "world." I know you mentioned "world."

A Okay.

Q And I know you mentioned the word "height."

A Yeah. Okay. And this is a side view.

Q Okay.

A Side view of a camera.

Q Okay. And then I think -- I see two different lines. One says "object at distance 1." "Object at distance 2." Can you label those, for example, line A, line B. I think it will just be easier --

A Okay. So --

Q -- or "ray A, ray B"?

A Yeah, they're actually not lines. So let me --

Q Okay.

A -- do this --

Q Ray?

A -- put a little -- put a little substance to it.

These are actual things. Imagine like a person standing there, okay?

Q Okay.

A Maybe it's a little person.

Q Sure. Two people.

A Yeah.

Q Okay.
A A person at distance 1 standing this far away from the camera.
Q Distance 1 away?
A And the person at distance 2, this far away from the camera.
Q Okay.
A So the person at distance 1 is going to be imaged, projected, into the camera sensor plane basically between this point here and -- and this point here.
Q Can you label those two points? Sorry.
A Yeah.
Q Maybe point A, point B or point 5.
A Let me see if this will work.
I'll do the next one in a minute, but...
So this, from here to here, is just saying this is the height of object 1, that is, person number 1. Person number 1 who in the real world is this tall is going to be imaged in the image plane, in the image, being this tall.
Q Being the height of object 1 as labeled --
A From here to here.
Q Yes. Okay.
A So the real-world height is that. That's how

tall the person is. This is how tall that person shows up in the image.

Q So what you've labeled as "object at distance 1" will be different than what you've labeled as "height of object 1"?

A Yes.

Q Okay.

A And this -- Dr. Daft refers to this as magnification.

Q Oh.

A So it's a fundamental part of imaging. You know, a 6-foot person in the real world is not going to be 6 feet in the back of the camera sensor plane. He's going to be, you know, a couple millimeters or something like that.

Q Okay.

A But there are a whole bunch of pixels in there, and so that's fine. They're going to register that person in the image --

Q Okay.

A -- okay? So that's sort of part one.

Part two, let's move this person further away. We could have started it further away, either way. But another situation is that same person who's still 6 feet tall --

Q At distance 1?

A -- is -- at distance 1 -- is still 6 feet tall, but he's further away now.

Q At distance 2?

A Yeah. And now, when the camera takes a picture of this person, it's not going to be as tall. It's going to just go to here. So now I'll label this "height."

Q And say "height 2"?

A Yeah.

Q Okay.

A "Height of object 2."

Q Can you label the two humans object 1, object 2, just so...

Okay. Great. That helps. Sorry.

A All right. So even though they're the same person who's just moved in this example scenario, we're going to say, this person at this distance shows up at this larger height.

Q Yeah.

A And when he moves further back, he's going to show up at a shorter height, and -- and --

Q Wait, wait. Hold on.

A Okay.

Q So object 1 at distance 1 will have the height

of object 1?

A Right.

Q Same person, same height in real life.

Moving to distance 2, further back, referred to as object 2, would have a shorter height?

A It's going to look smaller.

Q It's going to look smaller to the camera. It's a shorter height?

A Yeah.

Q Okay.

A And just as a very simple analogy, think of the moon. If you see a full moon at night, okay, it's a certain size up in the sky, right? You could take a picture of that, and it's a certain size.

If the moon, instead of being 200,000 miles away, were suddenly moved to be two miles away from the earth, it wouldn't look the same size in the image, would it? It would look -- it would take up the whole image, right, because it would -- this huge thing would be really close to you, and it would -- it would just be magnified by a gazillion times. Maybe that wasn't so obvious, but --

Q But it's the same size, is that the point?

A The real thing is the same size --

Q Oh, I see.

A -- but it looks different in the image, that's the point, yes.

Q I see. Okay. Okay. So going back to perspective distortion, can you --

A And to be clear, since you brought up Tanii here, Tanii is all about, presumably -- whether it works or not is another question -- but Tanii is all about this effect of perspective distortion and trying to undo it.

Q Okay.

A What I haven't shown here is that also, the person's face is going to look a little different between image 1 and image 2 because of this distance, and that's what's actually really relevant to our patents.

Q And by looking different, is it just a matter of size?

A It's a matter of the distance from the camera. So we started with this. The difference from the camera of this person made a difference in how he showed up in the image --

Q Okay.

A -- right?

Now, the difference -- when I take a picture of your face, the tip of your nose is a little bit

closer to my camera than the bottom of your left ear --

Q Right.

A -- okay?

And also, then, your cheekbone or something. There are differ- -- there are distance differences in this direction when I take your picture in your face. It's not a flat thing, right?

Q Uh-huh.

A And those differences are kind of like these differences in the sense that they cause differences over here in the image.

And those differences, when they're extreme, when this image is like really close to the camera, that's when you get an effect like this, where it kind of looks strange compared to, you know, a more normal-looking picture.

So this is all the effect of moving this person closer to the camera and things looking bigger when they're closer compared to looking smaller when they're farther away.

So your nose is going to look bigger than your earlobe in a really close-up picture, relatively bigger, because your nose is closer to the camera than your earlobe is.

Q Okay. So I know -- I have a daughter, and I

take lots of pictures of her. And when I take pictures of her using my phone, I know I have to kind of play around to get whatever I want captured in focus.

A Uh-huh.

Q When you're taking a picture of a face, would your nose and ear be in focus at the same time?

A It can be. That's a different aspect of imaging.

Q Okay. But it can also be out of focus, right?

A It can also be out of focus. It depends on the depth of focus of the particular camera setup at the moment.

Depth of focus basically means that there -- there's some range in the world that's going to look in focus, and outside of that, it's going to look various degrees of out of -- out of focus.

Q So what happens if everything looks in focus?

A Everything is then in focus. What do you mean "what happens if"?

Q Does that mean I'm imaging like a three-dimensional object versus a two-dimensional picture?

A No. They're just sort of independent issues. If everything is in focus, then you probably have a very small aperture of the camera. There are so many

components of a camera that are related to these issues to some degree or can be related, but -- yeah, so it's -- the amount of focus and this perspective distortion effect are two different issues.

Q Okay. Let me think about that.

So then what is the meaning of -- I saw this term in the patent, "fisheye distortion." What's the meaning of fisheye distortion?

A Fisheye can mean a particular kind of lens distortion that, as Dr. Daft discussed in his declaration, is a function of radial distance in the image.

So it's not a function of how far away an object is from the camera. It's just a function of where -- where in the image any particular point is.

But there's also -- the term "fisheye" has been used more generally, I would say a little more loosely by people, to describe both of these effects that we've been discussing, the perspective distortion effect that looks like it's, you know, causing distortions in someone's face, for example, and the lens distortion that's technically called radial distortion, fisheye distortion, some other terms.

Those are different things. But over the years, people have often used the term "fisheye" kind

of informally or a little loosely to describe both of these effects or either one of the effects.

Q Hold on. So can you clarify again? What are the two effects you're referring to?

A One is perspective distortion, the effect of perspective distortion, which we see in the Tanii figure that you brought up. The other -- another is the effects of lens distortion --

Q Oh, I see.

A -- also known as radial distortion, also known as barrel or pincushion distortion.

These are two completely different things, the lens distortion, like barrel or pincushion, and the perspective distortion. They're caused by different things. Geometry causes the first one I talked about, perspective distortion. Lenses cause the second one, only lenses.

Q Okay. So perspective distortion is not the same -- does not have the same meaning as fisheye distortion?

A Again, people have used, over the years, the word "fisheye" to refer to a number of things.

Q Okay.

A So whenever we use "fisheye," then we have to sort of specify, what really do you mean by this?

So it's hard for me to answer that question without further, you know, information. But lens-based radial distortion, such as pincushion and barrel distortion, is a completely different thing than perspective distortion.

Fisheye can sometimes be used to talk about one or the other or both, but that's -- that's sort of informal and loosely -- loose.

Q Okay. So then if radial distortion is different from perspective distortion, then that means fisheye distortion is not the same as perspective distortion in all instances?

MR. JOHNS: Objection.

Go on.

THE WITNESS: In all instances, fisheye distortion does not mean the -- in every instance --

MS. NGUYEN: Sorry. In every.

THE WITNESS: It's not true that in every instance, fisheye distortion means the same thing as perspective distortion.

MS. NGUYEN: Okay.

THE WITNESS: But it is true that fairly often, when people say "fisheye distortion," they do mean perspective distortion.

BY MS. NGUYEN:

Q That it's lens-based?

A No. That's the non-lens-based.

Q Okay. So fisheye distortion is non-lensed-based; is that right?

A Again, you have to keep in mind, "fisheye distortion," that phrase, is often used kind of loosely, so if we really want to be precise about things, let's not even use that term. Let's just talk about the two different things, and the terminology is pretty clear on these two different things. One is perspective distortion, and the other is lens-based radial distortion, such as pincushion or barrel distortion.

When we bring in the term "fisheye," then we have to be very careful about, what exactly do we mean in this occurrence of the word "fisheye"? The context matters, in other words.

Q For fisheye?

A For fisheye.

Q Okay.

MR. JOHNS: Before we move on, would you be all right with a quick break?

MS. NGUYEN: Yeah, can I finish up the module? Is that okay?

MR. JOHNS: Yeah.

Is that all right with you?

THE WITNESS: Yes.

MR. JOHNS: Okay.

BY MS. NGUYEN:

Q Let me show you -- this is Exhibit 1001 in the 108 proceeding, which this is also the '938 patent.

Dr. Turk, can you look at claim 1 of the '938 patent.

So I am still trying to understand.

So claim 1 of the '938 patent, which is column 38, line 39, it uses the words "fisheye-type distortion."

So in the context of the '938 patent, claim 1, what does fisheye-type distortion mean?

A Here, in this context, it's clearly referring to the perspective distortion that I described, and one way to easily know that is because two lines down, it says, "and due to the three-dimensional nature of the human face," lens-based radial distortion, such as barrel distortion and pincushion distortion, is not due to the three-dimensional nature of anything it images. It's part -- it's a property of the lens.

Q So fisheye-type distortion, as used in the '938 patent, claim 1, is not based on the lens; is that right?

A That's right. It's not fundamentally lens-based distortion. It's fundamentally geometry-based distortion aka perspective distortion.

Q Geometry, not referring to the lens?

A Not? Sorry, not?

Q Referring to the lens.

A That's correct.

Q Okay. I think I understand that.

A And the reason why this is admittedly hard to grasp for someone who hasn't spent a lot of time on this is also the reason why people over the years have used the term "fisheye" kind of loosely to cover both, because you really have to go into the details, you know, to really be a hundred percent -- to -- anyway, it can be a little mushy. And oftentimes, it's just easier for people to use the general term "fisheye" than to go deep into the weeds.

Q Okay. The last question before we -- before the end of my -- before we can break.

So would you -- we're talking about expected difference and expected distortion. I know we pivoted to perspective distortion and fisheye, but going back to expected differences and expected distortion, are those indicia of the user's three-dimensionality?

MR. JOHNS: Objection; form.

THE WITNESS: I'm sorry. Are what indicia of the user's three-dimensionality?

BY MS. NGUYEN:

Q Expected differences and expected distortion.

A In the context of these patents, yes.

MS. NGUYEN: Okay. Great. I think we can take a break. Thank you.

MR. JOHNS: Of course.

(Recess.)

MR. ARJOMAND: Great. So before the break, Dr. Turk, you were basically writing on a blank piece of paper. We'll mark that as Exhibit 1058 for the record.

(Exhibit 1058 was marked for identification and is attached hereto.)

EXAMINATION

BY MR. ARJOMAND:

Q So, Dr. Turk, do you have your declaration in front of you?

A Probably, yes.

Q I'm going to be asking you some questions about your declaration.

In your declaration, you refer frequently to 3D liveness detection. What do you mean by that?

A Generally, I mean determining whether a user is real or not.

Q In your use of the term "3D liveness detection," does it include anything other than determining whether the user is three-dimensional?

A In general, in the field, it can include lots of different things. It can include things besides that, yes.

Q But what I'm trying to get at is your use of the term "3D liveness detection" in your declaration.

So maybe it would help you to direct you to paragraph 456 of your declaration.

Let me know when you're there.

A I'm there.

Q So if you'd take a look at paragraph 456 for a minute and read it to yourself, and then I can ask you a follow-up question.

A Okay. Okay.

Q So do you see how on page 212, you refer to 3D liveness detection with respect to FaceTec software?

A Yes, I do.

Q So I was trying to get at that.

What is your understanding of 3D liveness detection?

A It is determining if the user is a real user

or not.

Q And how is it determining if a user is a real person or not?

A In the patents, the FaceTec patents we've been talking about, it does it by determining if the face is a planer structure or a three-dimensional non-planer structure.

Q Does 3D liveness detection, as set forth here in your declaration, include anything other than determining whether the user is three-dimensional?

A 3D liveness detection can include several other ways of providing evidence to come to that conclusion.

Q What are those other ways?

A I'm not sure if I know all of them off the top of my head, but looking for motion in the face has been done, looking for reflections off the face or parts of the face that would indicate a real face has been done, asking the user to perform some actions has been done. So a number of things.

Q But in the context of paragraph 456, when you're referring to the functionality of FaceTec software, specifically 3D liveness detection, is that only directed to determining whether the user is three-dimensional?

A What I'm referring to here, the core functionality of FaceTec software is indeed what is in these claims of the patents we're looking at, determining whether the face is three-dimensional or not.

But I do -- I think that FaceTec software may have other methods as well, but I think this is the core one.

Q So when you're -- just so we're all clear, because I think we want to make sure we're all on the same page in terms of terminology, when you're referring to 3D liveness detection in your declaration, such as in paragraph 456, you're referring to determining liveness based on determining whether the user or the user's face is three-dimensional?

A Here I am, yes.

Q All right. Well, now let me turn your attention to paragraph 455. It's the paragraph before the paragraph we were discussing. Take a minute to read that paragraph to yourself and let me know when you're done.

A Okay.

Q So in this paragraph, you state that you understand that nexus may be presumed when the objective evidence of nonobviousness is tied to a

specific product and that product embodies and is coextensive with the claim features.

Do you see that?

A Yes.

Q What specific product did you utilize in performing your analysis of nexus in your declaration?

MR. JOHNS: Objection; form.

THE WITNESS: My comments related to nexus are based on considering materials that were provided to me about FaceTec software that I -- that I reviewed.

BY MR. ARJOMAND:

Q So the product that you considered in determining nexus was based on documents that were provided by counsel to you regarding FaceTec software. Is that fair?

A Yes.

Q Did you review any code of FaceTec software in performing your analysis on objective evidence of nonobviousness?

A No, I didn't.

Q Do you recall which documents you reviewed in performing your objective evidence of nonobviousness analysis with respect to the specific product of FaceTec?

A I believe they would all be cited in this

section on pages 211 and following, so it was those citations.

Q As you sit here today, do you recall any other documents that you relied upon in performing your objective evidence of nonobviousness analysis that are not cited in your declaration, beginning at paragraph 455?

A Unless I accidentally omitted any, citing any, no, I don't think there are any others.

Q Okay. So turning back to paragraph 456, Dr. Turk, you refer to FaceTec software. What do you mean by that?

A What I mean by that is what's in the citations. I believe the software is called ZoOm. I forget if there are other names or other versions but basically that.

Q Would your use of the term "FaceTec software" encompass the FaceTec device software development kit, or SDK?

A Presuming that you're including the functionality of the SDK and not just the calling layer of it, then yes, I believe so.

Q Okay. And would your use of the term "FaceTec software" encompass the FaceTec server SDK?

A I don't recall exactly what I looked at

regarding the server, but I presume it would also include that.

Q Have you ever yourself used FaceTec software to confirm your three-dimensional likeness?

A I used a publicly available demo app that they have, I think, once to do that, yes.

Q Okay. Let's -- do you recall -- strike that.

Do you recall what that publicly available demo app was?

A Do you mean the name of it?

Q Yes.

A Not specifically. I think it probably had "FaceTec" in it, but I don't remember exactly.

Q Okay. Fair enough.

Let's have you watch a little video that's an exhibit in this proceeding -- in all of these proceedings, and then we can discuss some questions regarding that video, okay?

(Pause in the proceedings.)

MR. ARJOMAND: Back on the record.

So we're back on the record. We're going to have Dr. Turk review Exhibit 2069. That's a video. We'll have him watch the video, and then after the video is played, we'll proceed with our questions.

We won't be asking the court reporter to

transcribe the video in real time, mercifully.

Q And just to give you a heads-up, Dr. Turk, I think the most important part of the video for me, in terms of the questions that I'll be asking you, is about 20 seconds in to about 45 seconds in, okay?

A Okay.

Q So focus on that portion as you watch the entire video.

(Discussion off the record.)

(Whereupon a video clip was played.)

MR. ARJOMAND: Back on the record.

Q So, Dr. Turk, we just watched Exhibit 2067 [sic], a video by Josh Rose, and we watched a portion of it again from timestamp about 20 seconds to about 45 seconds.

Have you seen this video before, Dr. Turk?

A Yes, I have. It's listed in my list of references.

Q Okay. So in your declaration, when you refer to the FaceTec product or the FaceTec software for your objective indicia of nonobviousness analysis, are you referring to the software that's associated with roughly timestamp 20 to timestamp 45 where Mr. Rose clicks the 3D liveness check section until he gets confirmed as being live?

A Yes, I believe that's the core part that I was referring to.

Q Okay. So would that FaceTec software cover any code that is on Mr. Rose's handheld device?

MR. JOHNS: Objection; form.

THE WITNESS: I'm not sure I understand the question. What is "that" software you're referring to?

BY MR. ARJOMAND:

Q Well, I just -- I'm trying to understand or help us define the FaceTec product that you reviewed for the objective indicia of nonobviousness analysis. And what I'm referring to is the software code that is associated in Exhibit 2067 from timestamp 20 to about timestamp 45. That's what I'm referring to.

Does that make sense?

A Yes, yes. And in general, that's what I'm referring to as well, the capabilities that are shown there.

Q Okay. Perfect. And then the video in that time portion shows Mr. Rose using a handheld device; is that correct?

A That's right.

Q And is it your understanding that FaceTec would have software associated with the functionality that's shown in that time frame in Exhibit 2067 on that

handheld device?

A Yes, that's my understanding.

Q And would you also have the understanding that FaceTec would have software associated with that functionality that's shown in the time frame in Exhibit 2067 with a server?

MR. JOHNS: Objection; vague.

THE WITNESS: I -- I expect that there is server functionality that could be invoked during the use that you're describing in that video, but I'm not sure exactly the details that's going on there.

BY MR. ARJOMAND:

Q Do you recall Mr. Rose saying that -- something along the lines the server confirming or it's confirmed via the server in that portion of the video that we reviewed?

A I don't recall that portion specifically.

MR. ARJOMAND: Maybe we can watch that portion one more time. Let's go off the record.

(Whereupon a video clip was played.)

BY MR. ARJOMAND:

Q So we just watched the portion of Exhibit 2069 -- I apologize. I've been referring to it as Exhibit 2067, but it's actually Exhibit 2069.

And in that section, from timestamp 20 to

about timestamp 45, he refers to -- Mr. Rose is first evaluating on the server.

How do you understand that, Dr. Turk?

A Yeah, I would understand that comment as -- at least in that demo application, or that application, whether it's demo or whatever -- something is being evaluated on a server.

Q Would it be your understanding, Dr. Turk, that the code associated with the functionality that is shown in Exhibit 2069 from timestamp 20 to timestamp 45 covers the generation of ovals on Mr. Rose's handheld device interface?

MR. JOHNS: Objection; vague.

THE WITNESS: The software on the device that he's using in that video does seem to generate the ovals.

BY MR. ARJOMAND:

Q Do you know, Dr. Turk, if the code associated with the functionality that is shown in Exhibit 2069 from timestamp 20 to timestamp 45 covers the encryption of the data that is captured by Mr. Rose's handheld device?

MR. JOHNS: Objection; vague.

THE WITNESS: If I recall correctly, I think he mentions encrypted data being sent, so I presume so.

BY MR. ARJOMAND:

Q Okay. So I'm going to have you watch that portion of Exhibit 2069 one more time, but specifically I want to have you focus on timestamp 37. There's a reference in the video to "camera security verified."

(Whereupon a video clip was played.)

(Discussion off the record.)

(Whereupon a video clip was played.)

BY MR. ARJOMAND:

Q Did you see the "camera security verified"?

A On the device?

Q No. On the screen.

Let's go back to --

A You mean text on the screen that says that?

Q Yes, exactly.

A I didn't notice that.

MR. ARJOMAND: Okay. Let's go back to that. I'm sorry.

(Whereupon a video clip was played.)

THE WITNESS: I still did not see any text that said "liveness confirmed," but he said that.

BY MR. ARJOMAND:

Q No, not "liveness confirmed." I meant "camera security verified."

A I didn't see any text that said that.

MR. ARJOMAND: Okay. Let's play it one more time, and I'll point it to you.

Maybe, Marley, you can stop it at 37 seconds. Play it again one more time.

(Whereupon a video clip was played.)

MR. ARJOMAND: Maybe it was a little bit before. Yeah, there we go. 34 seconds.

Q Do you see that now, Dr. Turk?

A I see the text in the bottom right corner of the screen that says "camera security verified."

Q And that was at 34 seconds, roughly; is that correct?

A Yes, that's right.

Q Do you know what that's referring to, Dr. Turk?

A Not specifically. I note that it's not actually being displayed by the app. It's a separate overlay. So I don't know who put that in and what it's exactly meant to mean.

Q Are you aware of deep fake injections, Dr. Turk?

A In general --

MR. JOHNS: Vague.

THE WITNESS: In general, yes.

BY MR. ARJOMAND:

Q And what are they?

A Deep fakes are typically videos -- it could be audio or other things -- that are made intentionally to pretend to be someone but are actually not.

And injections, in this context, are that kind of media that's presented to a biometric security system in an attempt to spoof it.

BY MR. ARJOMAND:

Q And are you aware of FaceTec trying to prevent deep fake injections by controlling a camera that's being held by a user with a handheld device or having a handheld device?

A I'm aware of FaceTec caring significantly about this issue. I think it's more than just controlling a camera, but they do things that do involve controlling a camera, towards that end.

Q Okay. Having provided that testimony, do you think that the portion of Exhibit 2069 that we reviewed that refers to "camera security verified" relates to trying to prevent deep fake injections?

A I don't know if that specific behavior shown in the video there is intended to do that. It could, but in general, it's intended for liveness detection, which is related.

Q Okay. So earlier, you testified that you

obtained an understanding of the product by FaceTec for the analysis of non-indicia of obviousness from documents that counsel provided you; is that correct?

A Yes. And if I didn't say before, it was also discussions with counsel regarding those documents.

Q Okay. Perfect. And what I wanted to understand is, do you have a sense of the -- strike that.

Do you know what year the FaceTec software that you were considering originated?

MR. JOHNS: Objection; vague.

THE WITNESS: I have probably seen that somewhere, but I don't recall.

BY MR. ARJOMAND:

Q I guess what I want to understand from you is, you would understand that FaceTec software has gone through a number of version updates; is that correct?

A I would expect that's the case.

Q And so if that's the case and you were looking at certain documents provided by counsel regarding FaceTec software, as you sit here today, do you know which version you were looking at?

A Is the question which version we were looking at in that video?

Q No. In terms of your analysis in your

declaration, for non-indicia factors of nonobviousness or -- objective indicia of nonobviousness, I should say?

A Yeah, I don't recall how much version information was in the documents I reviewed at this point. I don't recall any of my opinions being specific to a specific version.

Q So is it -- strike that.

When do you understand that the FaceTec software launched?

MR. JOHNS: Objection; vague.

THE WITNESS: I have probably seen that in some of the documents, but I don't recall.

BY MR. ARJOMAND:

Q Okay. And would it be fair to say that you reviewed for your analysis of objective evidence of nonobviousness the functionality that was shown in Exhibit 2069 from timestamp 20 to about timestamp 45 irrespective of the year of the software?

MR. JOHNS: Objection; vague.

THE WITNESS: I did review that video, including the portion we've watched. And again, I don't recall what version information I have viewed specifically, so I don't know how that video relates to any particular version.

BY MR. ARJOMAND:

Q But let's assume that for the purposes of the functionality that we saw in Exhibit 2069 that FaceTec software launched in 2018 and that functionality continues to 2025.

Would it be your understanding that your analysis of that functionality is not tied to the specific year of FaceTec software?

MR. JOHNS: Objection; vague.

THE WITNESS: Well, I think there is some aspect of the timing, the year, the dates, in my analysis, because, for example, at some point, people exhibited surprise that their software was functioning well in certain ways, and prior to that point, they weren't, but I don't remember the specific dates right now.

BY MR. ARJOMAND:

Q But outside of that context of people expressing surprise, the functionality that we saw in Exhibit 2069, that functionality that you focused on is not really tied to any specific software version from FaceTec that you reviewed, as you sit here today?

MR. JOHNS: Objection; vague.

THE WITNESS: I'm not sure what "tied to" means in this context. It's not exclusive to any

specific version, I don't believe. My expectation is that all of the versions that at least I have heard about in my review have similar functionality.

I'm not sure that I can answer more than that.

Q Okay. Let me turn to a different exhibit now. This has been previously marked as Exhibit 2067 in these IPR proceedings, and it's marked "Protective Order Material, Attorneys' Eyes Only."

MR. JOHNS: Yeah.

MR. ARJOMAND: And I'll be asking questions about that, so maybe we can mark this portion of the deposition transcript confidential.

THE REPORTER: Bound separately or just with a blurb?

MR. ARJOMAND: I think bound separately.

(Whereupon the following portion, pages 95 -115, is designated highly confidential - attorneys' eyes only and is bound under separate cover.)

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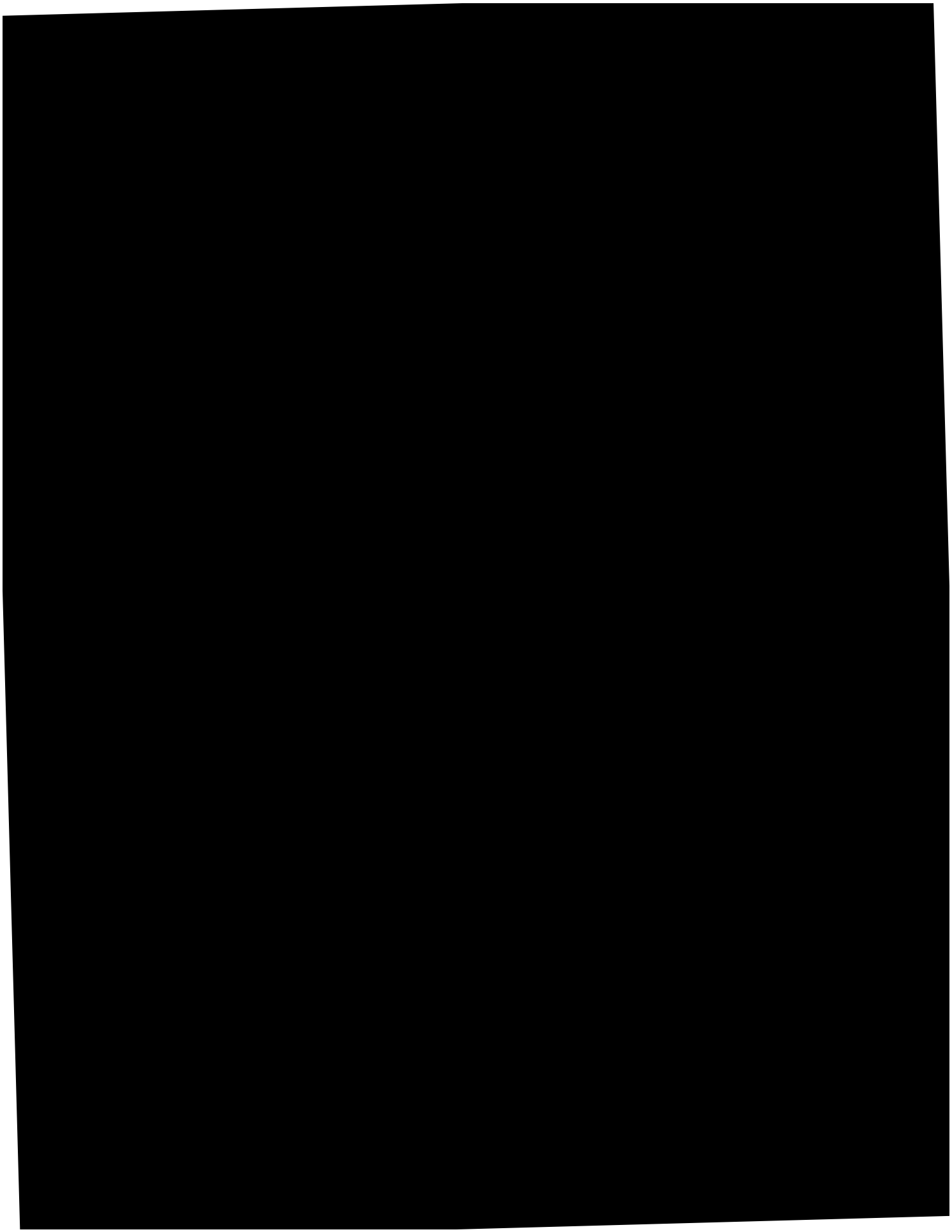

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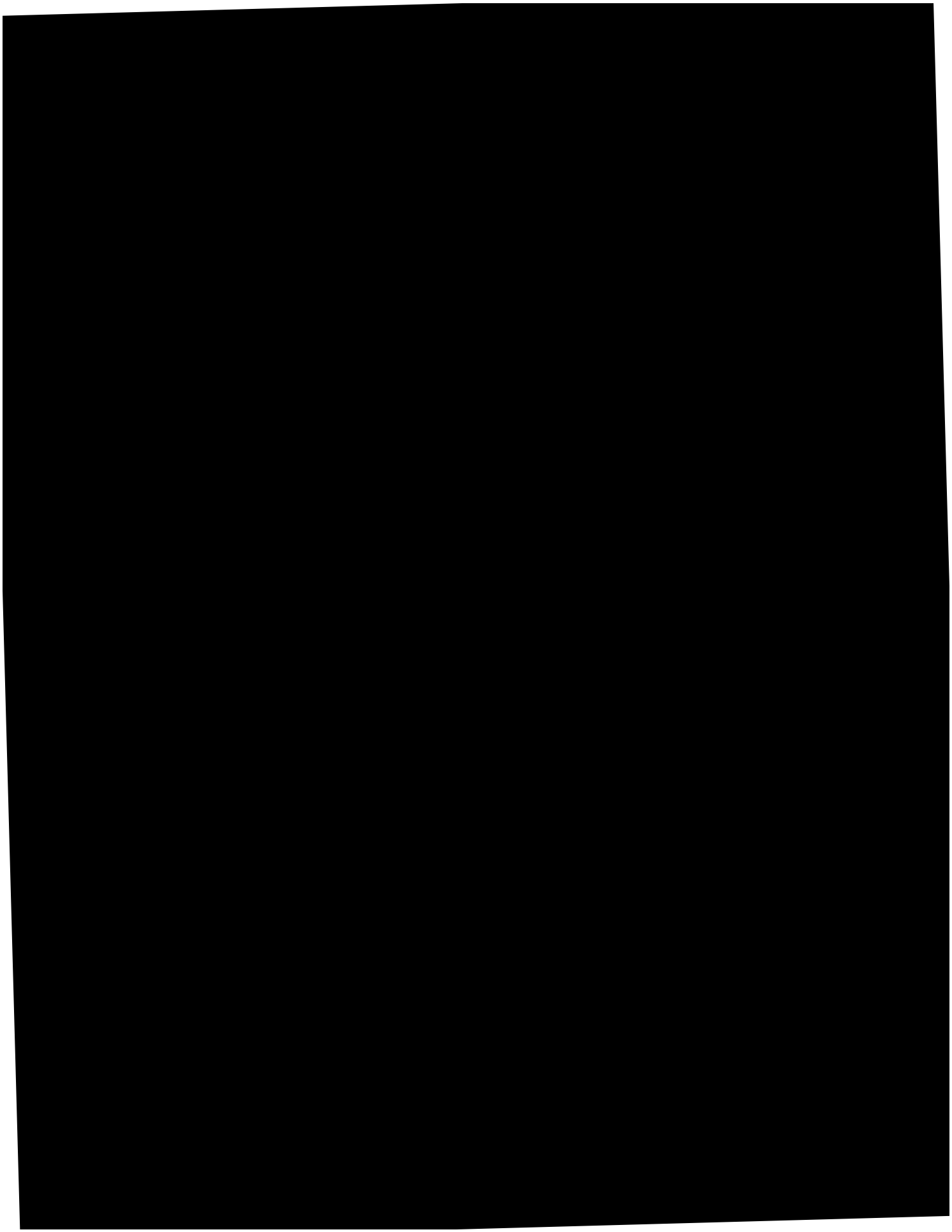

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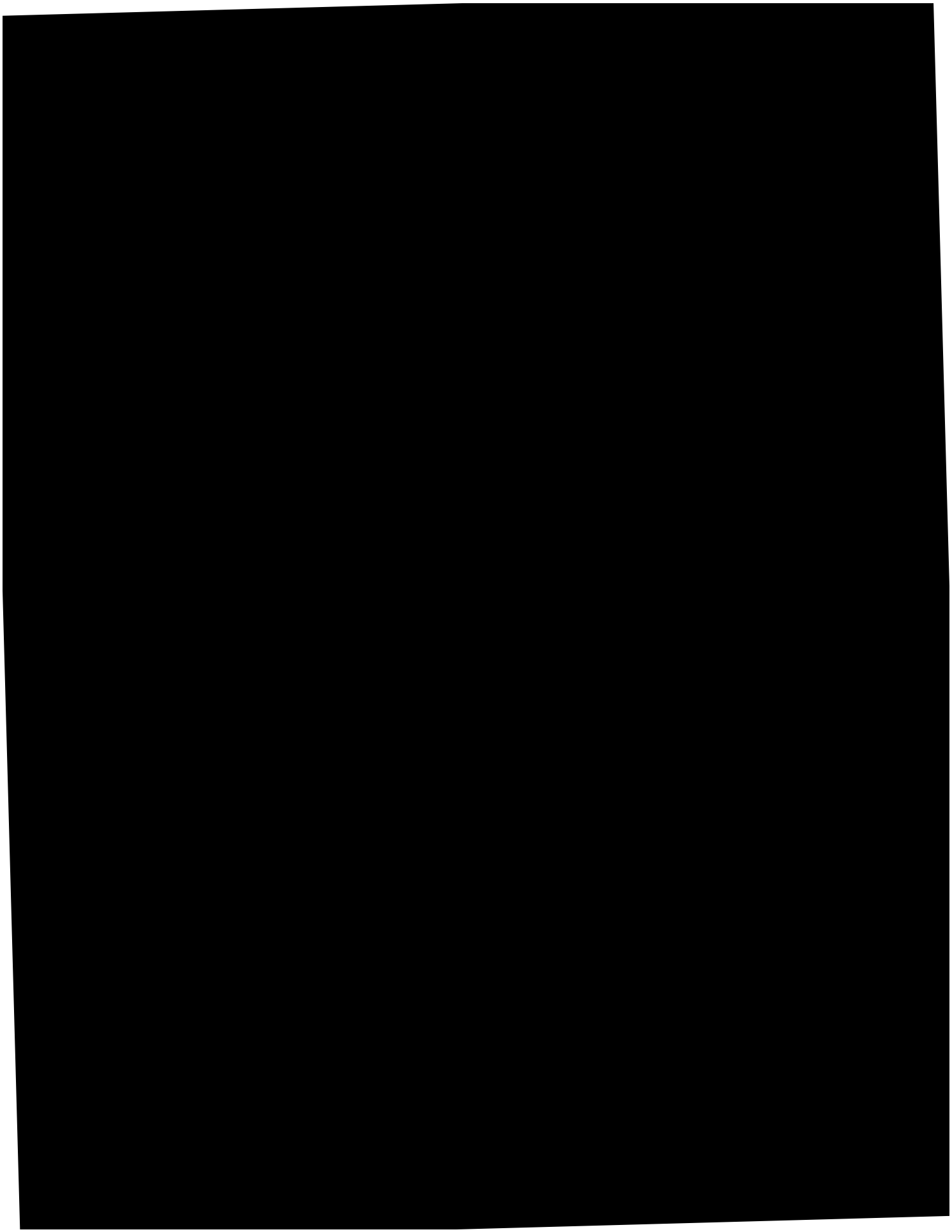

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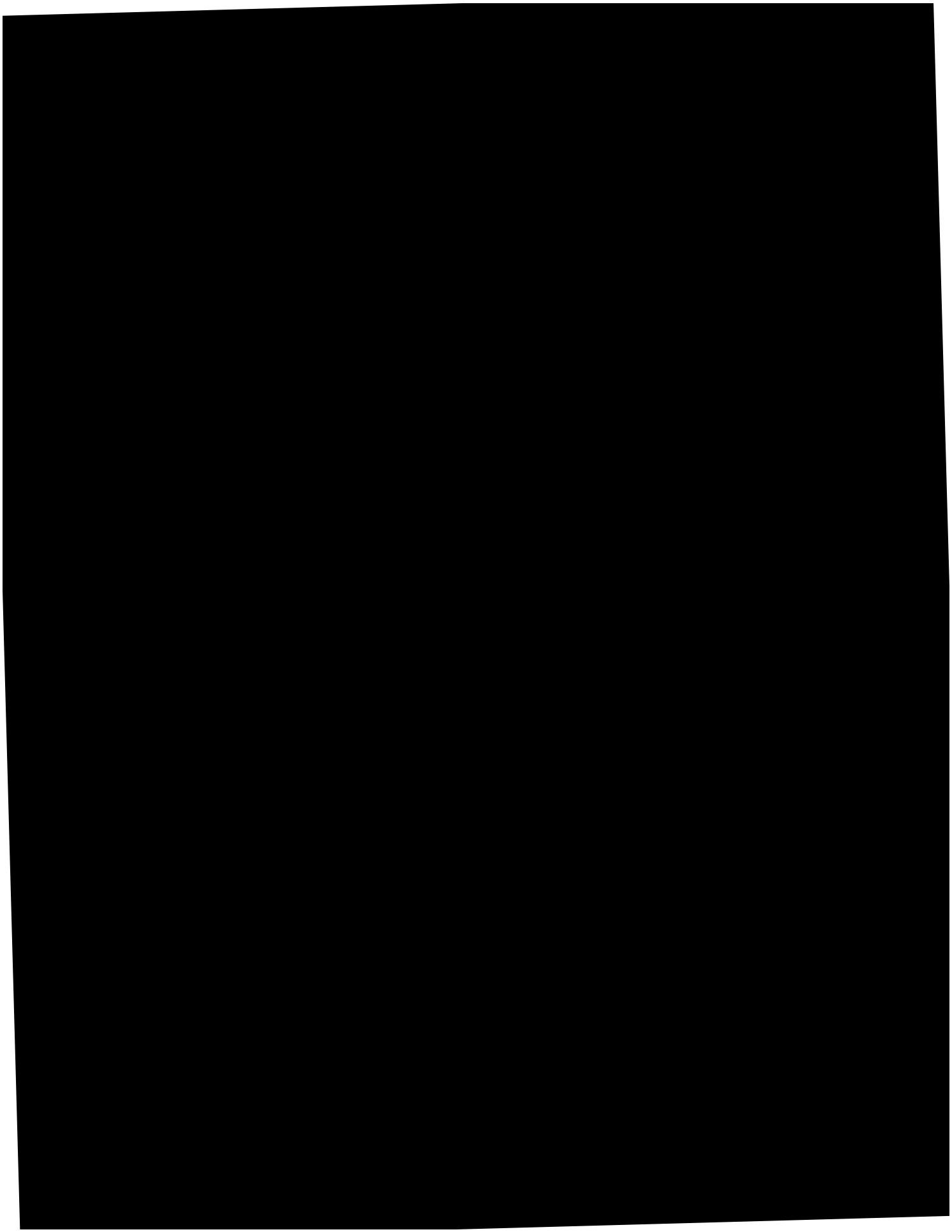

[redacted]

BY MR. ARJOMAND:

Q So let me direct you back to your declaration at paragraph 456.

A Okay.

Q Do you see the citation to Exhibit 2059 in paragraph 456 --

A Yes.

Q -- around of the middle of page 212?

A Yes, I do.

Q Do you know what Exhibit 2059 is?

A Yes. It's the declaration of Josh Rose, who I believe is the CTO of FaceTec.

Q Did you review Exhibit 2059 before you prepared your declaration, Exhibit 2061?

A Yes, I did.

Q Okay. And do you know if you reviewed a final version of Exhibit 2059 when you did that review? By "final," I mean a signed version.

A I don't recall.

Q Did you speak to Mr. Rose in preparing your declaration, Exhibit 2061?

A No, I didn't.

Q Did you independently verify any of the statements that Mr. Rose made in his declaration, Exhibit 2059?

A Yes, in the sense that some of the statements were referring to other references that are listed in my list of references, and so I did go to some of those.

Q So let me direct you to paragraph 457 of your declaration.

Do you see the sentence that begins with "further"? It's the second sentence in the paragraph.

A Yes.

Q You say that the FaceTec software detects the reflection of the image on the user's face.

Do you see that?

A Yes, I do.

Q Why does it do that, Dr. Turk?

A I don't think I discuss the purpose of that in my declaration, but off the top of my head, I think it's an additional bit of information to help the -- that could at least be used to help the liveness determination.

Q Okay. Going back to paragraph 456, right before the first citation to Exhibit 2059, do you see that you testified (as read):

"... and analyze data from images for expected differences in, for example, perspective distortion"?

Do you see that?

A I do, yes.

Q You used "e.g." That means for example; is that correct, Dr. Turk?

A Yes.

Q Does that inform your opinion on whether expected difference is the same as perspective distortion?

A My opinion in general or my opinion in a particular context?

Q Well, I'm stating it in the context of your declaration, Exhibit 2061.

I believe earlier today, you testified that expected differences, expected distortion and perspective distortion are the same in the context of the four challenged patents; is that correct?

A I believe I said in the claims of the patents, but we could go back and double-check on that, but that's -- that's what I mean, in the claims of the patents.

Q In the claims of the patents, there's a reference to expected differences, at least in the context of claim 1 of the '471 patent; is that correct?

A Yes.

Q And there is a reference or recitation of

expected distortions in claim 1 of the '471 patent; is that correct?

A You asked about expected distortion?

Q Yes.

A Yes, that's correct.

Q So since you have claim 1 of the 471 patent in front of you, expected differences is recited as well as expected distortion.

Do you see that?

A Yes.

Q And are you saying that your understanding is that those two terms are the same?

A I think in this claim, they are referring to the same thing, so yes.

Q Okay. And do you have the '938 patent in front of you, by any chance?

A Yes.

Q So take a look at claim 1, around line 38 and 39.

A Uh-huh.

Q It says (as read):

"...wherein the expected differences result from fisheye-type distortion."

Do you see that?

A Yes.

Q Is it your understanding that expected differences and fisheye-type distortion are the same in that claim?

A They're not the same. Distortion is a phenomenon. The differences are differences that result from that phenomenon.

Q Okay. So in that claim, claim 1 of the '938 patent, expected differences is different from fisheye-type distortion?

A Well, I think I just described it the most appropriate way. Expected differences are what's resulting from fisheye distortion.

Q Okay. And going back to claim 1 of the '471 patent, after taking a look at claim 1 of the '938 patent and your paragraph 456 referring to expected differences in, for example, perspective distortion, your view still is that expected differences and expected distortion in claim 1 of the '471 patent are referring to the same thing?

A Well, as I described it with respect to the '938, they're referring to -- oh, sorry, scratch that, please.

Expected differences and expected distortion, that's what you asked about?

Q Yes.

A In general, expected differences can be a wider set of things, and many are described in the specification or at least a handful of described in the specification of this patent.

I don't remember exactly my analysis of this limitation, starting with the word "comparing," but I believe that expected differences in that limitation are referring to the expected distortions -- wait just a second -- expected distortion in the last limitation of claim 1.

Q Of the '471 patent?

A Yes.

Q Okay.

A But I don't think that precludes other kinds of expected differences in the next to last limitation.

Q What are the other expected differences, Dr. Turk? It seems like in paragraph 456 of your declaration, you refer to perspective distortion as one example of expected differences.

What would be other expected differences?

A Okay. The '471 patent mentions a handful. Yeah, they might take a while to find. I don't remember them offhand, but I think there are other kinds of differences that the specification talks about, but the claims are focused on the perspective

distortion differences.

MR. ARJOMAND: Okay. Let's take a break.

(Lunch recess.)

FURTHER EXAMINATION

BY MS. NGUYEN:

Q Welcome back, Dr. Turk. During the break, did you speak with counsel at all about the proceeding or any of the contents of the proceeding?

A No, I didn't.

Q Okay. So let me hand to you Exhibit 1010. This is the Hoyos reference. Do you recognize it?

A Yes, I do.

Q Okay. So let's go to paragraph 18 of the Hoyos reference.

Okay. Ready?

A Yes.

Q Paragraph 18 starts off with saying, "In some embodiments."

Then it discusses the light emitted by the computer screen as the first image is reflected by the user, obtaining a second image and determining whether at least a portion of the second image is reflected by a curved surface consistent with the human eye.

Do you see that?

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A Yes.

Q So the reflection of the curved surface of the eye is determined only for the second image in the embodiment of paragraph 18; is that right?

A Will you repeat the question, please.

Q Sure. My question was, so the reflection of the curved surface of the eye is determined only for the second image in the embodiment of paragraph 18; is that right?

A That is my understanding, yes.

Q Okay. So let's go to paragraph 35. And in paragraph 35, it states (as read):

"The system expects to see a change primarily on the cornea, where a sharp image of the screen is reflected."

Do you see that?

A Yes.

Q And by expecting to see a change primarily on the cornea, doesn't that mean that most of the change comes from the cornea but not all the change?

A All of the change could indeed come from the cornea. This says that the system thinks there could be other change. It doesn't preclude all of the change being on the cornea.

Q Okay. So it could come from somewhere else,

not only the eye; is that right?

A Yes.

Q Okay. Let me hand to you --

A If I can modify that.

Yes, that the system expects that. Whether it could actually do it and get any useful information about it is another question. But yes, the system can expect that.

Q Okay. Let me hand to you Exhibit 1005. This is the Derakhshani reference.

Dr. Turk, you're familiar with Derakhshani; is that right?

A Yes, I am.

Q Is there anything in Derakhshani that you disagree with?

MR. JOHNS: Objection; vague.

THE WITNESS: I don't recall specifically disagreeing with anything in it, so not that I recall.

BY MS. NGUYEN:

Q Okay. And similar to some of the references earlier that we talked about, I'd like to walk through Derakhshani's process.

So starting with Figure 6, so Figure 6 shows all the steps involved in Derakhshani's authentication process, right?

A I believe it does.

Q Okay. And the first step is to obtain one or more images in step 602; is that right?

A Yes.

Q Okay. And then in step 604, Derakhshani's authentication process involves determining a liveness score from the images, yes?

A Yes, that's correct.

Q And the details of determining a liveness score is provided in the process 700 of Figure 7; is that right?

A Yes.

Q And the process for determining the liveness score, as shown in Figure 7, step 710, includes determining the liveness metrics for the images, and part of the liveness metrics includes the spatial metric as part of determining the liveness score; is that right?

A That's right.

Q Now, determining the spatial metric is step 714 of Figure 7.

Do you see that?

A Yes.

Q And the spatial metric is determined based on the distance from a sensor to a landmark that appears

in a plurality of captured images. Does that sound right?

A It at least includes that, yes.

Q Okay. Now, Derakhshani teaches that landmarks are not always the user's eye; is that right?

A Those landmarks used in the spatial metric are not necessarily all in the user's eye, that's correct.

Q Okay. And so Derakhshani's determination of the spatial metrics is not solely based on characteristics of the user's eye?

MR. JOHNS: Objection; form.

THE WITNESS: It does not have to be, that's correct.

BY MS. NGUYEN:

Q Okay. And by determining the spatial metric based on distances in the plurality images, that means Derakhshani compares the data between the two images -- or between the plurality images to each other?

A If I recall properly, Derakhshani is not necessarily comparing them to each other but comparing them to a plane or a known shape.

Q Okay. Maybe I can point you to column 16, line 66.

Let me know when you're there.

A Okay.

Q It says (as read):

"By comparing the degree of focus for a landmark in images."

Isn't that comparing data from a plurality of images?

A What you just read is about determining the distance.

Q Okay.

A And it does describe that process to determine a particular distance to a landmark.

Q Uh-huh.

A So, yes, that's different from the subsequent liveness determination, however.

Q Okay. But regardless of the liveness assertion, just with respect to the data from the images, that distance information is from the data in the images; is that correct?

A That's correct, data from the landmarks --

Q Yes.

A -- yes.

Q And the comparison talked about is comparison of the degree of focus, right, which is from data from the images?

A For a particular data point, yes --

Q Okay.

A -- not comparing between data points, but a single data point, comparing different focuses on that data point.

Q Okay. Great. And then going back to Figure 6 and Figure 7, so this determination of the spatial metric that we've been talking about all along, that's part of step 604 of Figure 6, right?

A Yes, it is.

Q Okay. Sorry to jump around so much, but let's go to column 17, line 12.

So in column 17, line 12 -- let me know when you're there.

A Yes.

Q -- Derakhshani teaches a spatial metric being a measure of deviation from a two-dimensional plane.

A Let me find that. Oh, yes.

Q Okay. And then same column, 17, line 22, he then talks about how a high value for the spatial metric indicates three-dimensionality.

A I see that.

Q Okay. So, in other words, Derakhshani teaches authenticating the three-dimensionality of the user; is that right?

A Yes, in the sense that that means determining the three-dimensionality of a user, a binary decision,

yes.

Q Okay. Now, if we could go back to Figure 6, step 620 and feel free to just look at it briefly. But I also want to talk about column 11, when you get a chance, starting at line 42. Sorry, line 46.

A 40?

Q -6.

A Okay.

Q Okay. And column 11, line 46, talks about the same step, 620.

Do you see that?

A Yes.

Q And it states right before that (as read):

"If the liveness score indicates a high likelihood that live eye is depicted in the images, the one or more images are accepted 616 and subjected to further analysis to complete the authentication process,"

okay?

A Yes.

Q Are you still with me? Okay.

And then continuing on, back to line 46, it talks about the captured images being segmented to identify the best views of the vasculature in the white

of an eye, yes?

A Yes.

Q So, in other words, the images of the eye vascular are used in step 620, which is a step that is performed after determining the liveness score, step 604, would you agree?

A That's correct, yes.

Q Okay. So, now, if we can move on to column 13 and step 624, on line 9, Derakhshani describes determining features in the images in the eye vascular in step 624, right?

A Could you repeat that, please.

Q Sure. I said, now, if we can move on to column 13 and step 624 on line 9, Derakhshani describes determining features in the images in the eye vascular in step 624.

A Yes, that's right.

Q Okay. And these features are compared in step 626, talked about in column 13, line 62, and the features are compared to corresponding features from a reference record used to determine the match score; is that right?

A That's right.

Q Okay. So we talked about steps 620, 624 and 626. Those steps involve images of the eye vascular

used as part of determining the match score, right?

A 620, 622 and 624 is what you said? Yes, that's correct.

Q Okay. Then in step 628, that step involves checking the match to determine whether there is a match between the captured images and the reference record?

A I would say that's really 626, and 628 is just showing that there is a decision point based on the outcome of 626.

Q Okay. I guess, Derakhshani, if you'd look at column 14, line 25.

Let me know if you think this is a typo in Derakhshani. It says (as read):

"The match score may be checked 628."

A I -- that's right. And I may have misspoke, then. Yes, 626 is determining the score, and then 628 is checking it, yes.

Q Okay. And then as we keep going, if there is a match, the user is accepted in step 632, and if not, the user is rejected in step 630?

A Yes.

Q So we just talked about steps 620, 624 -- sorry, 620 to 632, and all of those steps are part of determining the match score as part of Derakhshani's

authentication process --

MR. JOHNS: Objection --

BY MS. NGUYEN:

Q -- right?

MR. JOHNS: -- vague.

THE WITNESS: They're part of determining or acting on the match score, that's correct.

BY MS. NGUYEN:

Q Okay. And does Derakhshani determine the spatial metric as part of determining the match score?

A No. That's a separate process.

Q And, Dr. Turk, we talked a little bit about this, but do you remember Derakhshani talking about a reference record?

A Yes, a bit.

Q Okay. What is a reference record?

A Can you remind me where that shows up in this specification?

Q Sure. So, for example, column 7, line 20.

A In general, the reference record discussed here is prior information that can be used to determine identity.

Q Okay. Is it data?

A Everything's data.

Q Okay.

A So, yes.

Q Okay. And is the data in the reference record derived from the captured images?

MR. JOHNS: Objection; vague.

THE WITNESS: I don't recall Derakhshani saying anything about where that comes from. It's possible I just don't remember it, but it's -- in general, it's not part of the process we just went through. That process I think at least implicitly implies you already have that.

MS. NGUYEN: Okay.

THE WITNESS: What did we call it? The process data -- reference data.

BY MS. NGUYEN:

Q The reference data. Okay.

So then going back to column 7, line 20 -- maybe you can help me understand this -- it says (as read):

"A reference record may include data derived from one or more images of the white of an eye for a registered or authorized user of the secured device 450."

So is the data in the reference record derived from the captured images?

MR. JOHNS: Objection; vague.

THE WITNESS: Yes, it can include that.

BY MS. NGUYEN:

Q Okay. And then if we go to -- sticking with Derakhshani, column 17, line 33. Let me know when you're there.

A Okay.

Q He talks about the positions of the landmarks on a user's face used to generate a three-dimensional model that is stored as part of the reference record, right?

A Yes, I see that.

Q So is it correct to say that information about the landmarks are stored as data in the reference record?

A It does not say that the information about the landmarks is stored. It says the information about the landmarks may be used to generate information that is stored.

Q Well, information used to generate information is still information, correct?

A It is information, but it's not stored information necessarily. I think that's what you asked about, is it stored.

Q Okay. So putting aside the stored part,

information about the landmarks used to generate -- sorry. Is information about the landmarks used to generate information that is stored?

Is that a better way of --

A Yes.

Q Okay.

A And to be clear, these landmarks we're talking about here are the anatomical landmarks, which are different from the landmarks used in the liveness detection.

Q Okay. These are the landmarks, as it says, on a particular user's face?

A I don't know what you're referring to there.

Q Oh, the same column 17.

A They will be on a face, yes.

Q Okay. Okay. So now, if we go back to column 9, line 63, it talks about extracting features from the captured images and comparing the features to a reference record.

A Yes.

Q Okay. So there's a comparison of the extracted features to the reference record, and the reference record is data, so that means the extracted features must also be data; is that right?

A Everything is data. So yes, they're

definitely data.

Q Got it. Okay. And going back to this concept of landmarks, Derakhshani talks about the landmarks having different focus distances.

Do you remember that?

A Yes. Those are the landmarks used in the spatial metric --

Q Yes.

A -- not the anatomical landmarks that are used later.

Q Right. And Derakhshani names example landmarks. He says a nose, an ear, a mouth and a background object, right? Those are examples Derakhshani gives?

A Correct.

Q And if Derakhshani captures images that have a nose, ear, mouth or background object, then it must be capturing images that includes more than the user's eye; is that right?

A It can capture images that include things that are not part of the user's eye --

Q Okay.

A -- for example, the background, parts of the background.

Q Okay. And Derakhshani also teaches capturing

images having multiple landmarks within the same image, right?

A I believe so.

Q Okay. So if Derakhshani is capturing an image that has an ear, nose, mouth and eye, what type of image is it capturing?

A Well, I don't think Derakhshani ever says that it will capture images that include all of those.

Q Uh-huh.

A So they may well just be individual examples that would never be in the same image.

If Derakhshani were to capture something with all of those, it would be an image that is generally different than the images that are shown in Derakhshani, because those images generally don't cover larger parts of the face that would include such features.

Q Okay. And going back to the focus -- I guess we'll call it focus distance approach. I feel like that's a term that's been used in the papers and in the declarations.

That approach requires different distances between the camera and the landmark, right?

A In order to be determined a real face, it does require that, yes.

Q Okay. And the focus distance is the distance from the center -- sorry, from the sensor to a perfectly in-focus point in the image, right?

A I would say reasonably well focused.

Q Reasonably well focused. Okay.

A Perfectly, I probably wouldn't say. I don't remember if Derakhshani says that.

Q He does. I'm happy to point you to that.

A So maybe that's something I would slightly disagree with.

Q Okay. Got it. So the landmarks having different focus distances, how much difference in distance would be required between the two images in order for there to be a difference in focus distance?

MR. JOHNS: Objection; vague.

THE WITNESS: That all depends on the imaging setup --

MS. NGUYEN: Okay.

THE WITNESS: -- which I don't believe is specified in Derakhshani.

MS. NGUYEN: Okay.

THE WITNESS: So I don't know exactly how to answer that for this.

BY MS. NGUYEN:

Q In your experience, what is typical with

respect to the difference in distance required for two images to have different focus distances?

A So it really depends on how difference would qualify as different. For any difference at all, I think people would generally not use that, because there's so much noise in these real imaging systems that even measurements for the same object, the same camera setup, the same distance would give you slight -- different answers.

Q Okay.

A So it's really more of a practical question about where somebody would set the threshold about distance being sufficient that they're confidence -- that they're confident, it is enough for -- for what they're trying to measure.

So it's a very -- it's a difficult question to answer precisely.

Q Okay. So going back to your -- I love the word "confidence." So going back to what is the distance that's sufficient such that -- and you said "they're." I'm guessing you mean a POSITA is confident.

What would that distance be in your experience?

A I think that would be experimentally

determined.

Q Okay. And in your experience, have you done that experiment -- those types of experiments?

A Not systematically, no.

Q Okay. Do you have a general sense?

MR. JOHNS: Objection; vague.

THE WITNESS: I think it depends so much on the specific situation and the goals of the process that, no, I don't really have a general sense.

BY MS. NGUYEN:

Q Okay. So then let's talk about a specific situation and goals. Let's say we have Derakhshani's focus distance approach. If you recall, Derakhshani talks about capturing a plurality of images, and in one image, the landmark will be in focus, and the next image, it will be blurry.

So in that situation, what would you expect the difference in distances between the sensor and the landmark to be?

A It would depend on the sensor, the lens, the general imaging characteristics --

Q Okay.

A -- and the confidence required by the -- whoever is, you know, implementing the system, what they -- what they want.

So, again, I think it depends on a lot of things that I don't know, so it's hard for me to say.

Q Okay. In your declaration, you talked a bit about sensors known in 2014. So would you be able to answer the question based on a sensor known in 2014?

A Given any one of those sensors known in 2014, I would want to do experiments to determine the answer. I don't think there would be a very good estimate that I could give in advance of that.

Q Okay. Let's look at column 16, line 51, of Derakhshani.

Let me know when you're there.

A I'm there.

Q Okay. So column 16, line 51, it talks about identifying a landmark in the plurality of images.

Do you see that?

A Yes.

Q Okay. And so since the landmarks are identified in the image, that means the landmarks are present in the image, right?

A Image values are determined to be a landmark. So those image values are present in the image --

Q Okay.

A -- and assigned with a particular landmark's identity, I guess.

Q Okay. So let's go -- same column, 16, line 57. There, Derakhshani explains that the degree of focus is a measure of the extent the image of a landmark is blurred, right?

A Yes.

Q And it then explains that when a landmark is in focus, there are more high-frequency components, when not in focus or, in other words, blurred, there's a low degree of focus with smaller high-frequency components, right?

A Yes.

Q What does it mean if the landmarks are blurred?

A Say it again.

Q What does it mean for a landmark to be blurred?

A To be displayed in the image of that landmark in a way that is not as sharp in the image as it could be.

Q Okay. So if it's not as sharp, it's harder to see; is that right?

A It's not harder to see the presence of --

Q Okay.

A -- but it might be hard to determine certain things about it.

Q Okay. For example?
A If I blur an image of some text --
Q Okay.
A -- a little bit, say, I have no problem determining there is still text there, so I don't have any problem seeing it, but I may have a problem reading some of the text because now it's blurry and it wasn't before.
Q Uh-huh.
A So there's some things that might be more difficult.
Q So it's as if the landmark is not as well defined, is that --
A That's a good --
Q -- a fair way --
A -- description, yes.
Q Okay. So it's got, I'll say, like a reduced definition?
A It's got a reduced resolution.
Q Okay.
A But definition is okay, too.
Q Okay. Okay. In that instance, going back to -- or staying with the focus distance approach and Derakhshani capturing a plurality of images, one where the landmark is in focus and another one where it's

blurred, would that be the case given that there are differences in distances between the images?

A I'm having a hard time parsing that.

MR. JOHNS: Objection.

MS. NGUYEN: Okay. I can phrase that slightly differently.

Q Okay. So Derakhshani's focus distance approach captures a plurality of images with different distances, right? We talked about that earlier.

A Yes.

Q Okay. And in that, would Derakhshani be capturing one image where a given landmark is in focus, and in another image, that same landmark is then blurry?

A That is my understanding of how he's describing that process.

Q Okay.

A And this is a process well known in the literature as depth from defocus --

Q Depth from --

A -- or depth from focus.

Q Okay. So Derakhshani didn't invent the focus distance approach?

A No. That's been known for a long time.

Q Okay. And Derakhshani talks about comparing

this degree of focus for a landmark with different focus distances, right?

A He does describe that, but to be clear, there may not be different focus distances if it's, in fact, a spoof.

Q Yes, sorry. Yeah, for a three-dimensional object?

A Yes, yes.

Q Okay. And this comparison of the degree of focus for a landmark, it's part of determining the spatial metrics?

A That's correct.

Q Okay. So then going back to what you just said, you said, "To be clear, there may not be different focus distances if it's, in fact, a spoof."

Does that mean if Derakhshani is imaging a photograph, a two-dimensional photograph, that there wouldn't be a difference in focus distance?

A If the photograph is oriented perpendicular to the camera, then yes, it means that.

Q Okay. Okay.

A If it were slanted, it would be a little more complicated.

Q Okay. And then moving on to Derakhshani's parallax approach, let's look at column 17, line 45.

Column 17, line 45, Derakhshani describes determining parallax of the landmarks that appear in a plurality of images.

Do you see that?

A Yes.

Q And if the landmark appears in the image, that means the landmark is present in the image; is that right?

A Yes.

Q And then at column 17, line 53, Derakhshani talks about measuring the parallax effect.

Do you see that?

A Yes.

Q What steps does Derakhshani have to take to measure the parallax effect?

A I don't recall Derakhshani giving any details about those steps. You could perhaps remind me if there are details, but I would assume that there's some determination of points matching and the changes in distance that would be required to make those points match, and that would help to determine distance and depth.

Q Okay. And what would you expect those changes of differences to be in order to determine the distance and depth?

MR. JOHNS: Objection; vague.

THE WITNESS: So it would be hard to know, without knowing more about the particular imaging setup here.

So I don't know if I'd expect anything, but I'd run a process of stereo vision, essentially, which is very well known, and it's been around for many decades, to do what Derakhshani is proposing here.

Q Okay. Perhaps we can look at column 17, line 52.

A Okay.

Q It talks about the parallax effect being measured. And then in column 17, line 55, Derakhshani says (as read):

"If all the landmarks in the images undergo the same apparent displacement due to relative motion of the sensor, i.e., the difference in the parallax effect for the landmarks is small, then the subject viewed by the camera has a higher likelihood of being a two-dimensional spoof attack," right?

A Yes.

Q So what difference in parallax effect would be considered small such that it would be a

two-dimensional spoof attack?

A I don't believe Derakhshani gives any information about that, but I think in general, that would be experimentally determined.

Q Okay. So you wouldn't be able to tell me now, sitting here today, what difference I should expect such that it would be considered small in Derakhshani's point of view?

A I think that very much depends on the system and experimental outcome.

Q Okay. Now, Derakhshani, as we talked about earlier, talks about the landmark being a background object, right?

A That that's one example of what a landmark could be, yes.

Q Okay. What is a background object?

A I would say it's anything that's not part of the main object being imaged, which in this case is the eye.

Q Okay. So it would be -- would it be attached to the human?

A Derakhshani doesn't define it, but I think typically, in this context, it probably is referring to something not attached to a human.

Q Okay. For example, a painting behind you?

A I think that's a good example.

Q Okay. And how far away would Derakhshani's sensor need to be in order to capture your eye and the painting as the background object, for example?

A I don't know if there's an exact distance or distance range, but when I look at some of Derakhshani's images, they're not very explicit. But it seems that there can be -- even in a small portion of an eye, there can be things in the background that were included in that image.

So I don't know how to say, you know, specifically what parameters would be required for that.

Q When you say "required for that," do you mean to be able to capture the eye and let's say, for example, the painting as a background object in this image?

A Right. So, for example, in Figure 4, if you look at the upper left part of that image where there is an eye, it seems pretty obvious that there could be something just to the right of the eye and nose part that is a painting in the background, for example.

Q Okay. I understood Figure 4 to be a block diagram, not representative of what's actually being imaged. Do you agree?

A And I'm just giving this as an example.
Q I see. Okay. Okay. So let's take a look at column 19, line 26.
So in column line -- sorry, column 19, line 26, there's discussion about reduced dynamic range for the sensor.
How do you reduce the dynamic range for a sensor?
A Generally, by a filter.
Q Okay. A filter in front of the sensor?
A Yes, it would definitely be in front of the sensor. It could be at different distances from the sensor in different implementations.
Q Okay. How would you do that if your sensor were inside of a cell phone?
A Well, the cell phone could be built with that, or you could put a add-on to your phone as -- such a filter. There might be other ways too.
Q Like a clip-on?
A Like a clip-on.
Q Okay. And Derakhshani talks about doing this to achieve a finer resolution, right?
A A finer intensity resolution, yes.
Q Well, finer resolution in intensity?
A Yes.

Q Okay.
A Not spatial resolution. That was my --
Q Oh, I see.
A -- distinguishing point.
Q Could you achieve this dynamic range for the sensor by adjusting the parameters of the sensor?
A Potentially. I think it depends on the sensor in the system.
Q Okay. What's one example primarily that you would adjust to change your dynamic range?
A In a typical consumer camera, and certainly professional camera, you can change things like overall brightness. You can change the brightness curve of a camera. You can cut off at a certain low level or high level of intensity.

There are various things that can be done in the camera settings themselves --
Q Okay.
A -- but it depends on what kind of effect you want, whether those kind of settings would be enough or you need an additional filter or something like that.
Q So it could be performed in software; is that right?
A Well, so we need to be specific about what the "it" is, then, for this question.

Q Oh, dynamic range.

So could you adjust the dynamic range using software?

A Dynamic range of an image can definitely be adjusted using software, but it will not reveal more detail, because the information has already been captured in this case, and the software will not change the information in the image.

Q Oh, I see. Okay.

Okay. So let's take a look at paragraph 91 of your declaration. I think you have it in front of you.

A Okay.

Q And there, you say (as read):

"And the type of sensors used to capture eye vasculature."

And you go on to talk about simultaneously capturing the vasculature of an eye and a face with enough precision.

Do you see that?

A Yes.

Q Okay. Can you point me to where Derakhshani talks about capturing both the eye vascular and face with enough precision in a single image?

A I don't believe Derakhshani talks about capturing the face at all, so -- so no, I can't.

Q Okay. Let's turn to Tanii, or Tanii. I think you have it already.

MR. ARJOMAND: Do you want to take a break?

MS. NGUYEN: Sure. Okay. Let's take a break.

(Recess.)

FURTHER EXAMINATION

BY MR. ARJOMAND:

Q Let me place in front of you Exhibit 2040, Dr. Turk.

Dr. Turk, do you recognize this exhibit?

A Yes, I do.

Q What is it?

A I haven't looked at this for quite a while, but the title is a blackbox engagement for the 2024 FaceTec SDK by Praetorian, which I believe is a company that was either using or testing their system. I don't recall.

Q So can you explain to me what this document is directed to?

MR. JOHNS: Objection; vague.

MR. ARJOMAND: Well, scratch that. Let me ask the question differently.

Q Do you understand this document, Exhibit 2040, to be a certification of some type?

A Yes, I mentioned this in paragraph 460 of my declaration, so I do believe it's a certification of testing by Praetorian.

Q And what is Praetorian testing, in your opinion?

A Well, I believe this document explains it's testing some security aspects of FaceTec's software, and they call it, in particular, application penetration test and mobile penetration test.

Q Do you know what the application presen- -- strike that.

Do you know what the application penetration test is?

A I don't know what the specific one is. In general, I think these kinds of -- this kind of language in these kinds of agreements are describing testing some aspect of spoofing ability, but I don't know specifically what this one is doing.

Q And do you know what the mobile penetration test is?

A Same, same answer.

Q It's referring to, in Exhibit 2042, FaceTec's SDK testing.

Do you see that?

A Sorry. In --

Q Exhibit --
A In this document?
Q Yes, Exhibit 2040.
A FaceTec's SDK testing, yes.
Q What do you think they mean by FaceTec's SDK here?
A Again, I don't know many details about this test, but off the top of my head, I think they mean that they were given some -- they were given access to some of FaceTec's software, and that's what they were testing.
Q So would it be fair to say that they're testing a version of FaceTec's SDK between March 11th and March 27th, 2024?
A That sounds reasonable. I don't know how much of the SDK, but yes.
Q Okay. And as you sit here today, do you know if you studied that version of FaceTec's SDK between March 11th and March 27th, 2024?
A I didn't study a particular version of their SDK, no.
Q Okay. Do you know if this type of security evaluation performed by Praetorian is a paid evaluation?
MR. JOHNS: Objection; vague.

THE WITNESS: I don't know. I know that there are a number of evaluations of these kinds of software systems or these kinds of systems. There are several that, for example, were started by NIST, the National Institute of Standards and Testing.

And at least some of those, I believe, are unpaid or there's no fee for them, or maybe there's just a small documentation kind of fee. I believe there are also companies that do this as their business, or at least a part of their business, that are paid to do it. I don't know for this one in particular.

Q "This one" being Praetorian?

A Yes.

Q Okay. Is it typical for an evaluation such as this to be a single page, as set forth here in Exhibit 2040?

A I wouldn't call this an evaluation. I would call this a certification or an attestation.

Q Uh-huh.

A And I do think that a single page is not uncommon for that.

Q But as you -- strike that.

Did you see any documents associated with the security evaluation or attestation that's in

Exhibit 2040 in preparing your declaration?

A Exhibit 2040?

Q That's this document.

A Oh. So, I'm sorry, please repeat the question.

Q Sure. Did you see any documents associated with Exhibit 2040 in preparing your declaration?

A I believe I saw comments about it. I didn't see, that I recall, any other documentation about this.

Q What do you mean, "comments"?

A If I recall correctly, the CTO of FaceTec mentions this in his declaration, but I'd have to go back and double-check on that.

Q Okay. But you didn't see any of the underlying documentation that Praetorian may have associated with certification as shown here in Exhibit 2040?

A I don't recall seeing anything else.

Q Okay. All right. Let me place in front of you Exhibit 2038.

Do you recognize this exhibit?

A Yes, I do.

Q And what is it?

A It's a letter of confirmation from BixeLab, about the testing they did.

Q And is it "Bixel Lab" or "Bixie Lab"?
A I don't know how to pronounce it.
Q Okay. Let's just say BixeLab, because I think that's probably easier to pronounce.
Previously, you testified that some of these organizations are in the business of performing certifications. Do you know if BixeLab is one of those organizations?
A I don't recall, no.
Q Okay. Is it your understanding that Exhibit 2038 was associated with some kind of testing done by BixeLab?
A That is my understanding, yes. I don't know for sure if BixeLab did it or if they hired someone to do it or what, but in general, yes.
Q And what is it that they tested, Dr. Turk?
A Well, it says here, near the top (as read):
"Presentation attack detection level 2 evaluation of BRYK.ID with FaceTec server version 9.6.30."
Q What does BRYK.ID with FaceTec server version 9.6.30 mean to you?
A I don't recall what BRYK.ID is. It seems like I may have seen that in some of the other documents, but I don't recall offhand. I think the rest of it is

a version of some of FaceTec's software.

Q Do you recall reviewing FaceTec server version 9.6.30?

A Not offhand. It may have been mentioned in some of the other documents that I reviewed.

Q Okay. And Exhibit 2038 refers to "Presentation attack detection (PAD) level 2."

What is that?

A I don't recall the details of it, but in general, it's a set of tests to determine, is this potentially unsecure attack of a biometric system or a component of a biometric system successful or not?

And it tends to do many different tests and many different examples of trying to spoof the system or find an unsecure hole in the system, essentially, and then reports on its results.

Q Okay. The exhibit refers to a level A presentation attack. Do you know what that is?

A I think I knew that at some point, but I don't remember.

Q Okay. And do you know what a level B attack is, as mentioned in the exhibit?

A Same answer. I think the level B is more sophisticated or a harder attack, but I don't recall the details.

Q Let me place in front of you Exhibit 2039.
Do you recognize Exhibit 2039, Doctor?
A Yes.
Q And what is it?
A It's a letter of confirmation from BixeLab about testing that was done on some of FaceTec's software.
Q And the letter of confirmation refers to "BRYK.ID Extension version 9.60.30."
What does that refer to?
A I don't know for sure. I presume it's a version of FaceTec software, but I'm not sure.
Q Comparing that phrases in Exhibit 2039 with BRYK.ID with FaceTec server version 9.60.30 in Exhibit 2038, can you explain the difference?
A No, I don't know the difference -- sorry. Between those particular lines?
Q Yes.
A No, I don't know the difference.
Q Okay. Exhibit 2039 also refers to "match-3d-2d-face-portrait API."
Do you see that?
A Yes.
Q What does that refer to?
A I believe it's part of FaceTec's API, part of

their software, and I believe it's a part that -- a part that matches a 2D image, like on a driver's license, like we saw in the video we looked at earlier today, with an actual person.

But I'm really just going on the name of it for that. I don't recall any details specifically about it.

Q Okay. So going back to Exhibit 2038, the first BixeLab letter of confirmation that I showed you --

A Yes.

Q -- it refers to an attack presentation classification error rate, sort of in the middle of the page.

A I see that.

Q What do you think that refers to?

A It's a statistic that I think is used fairly commonly in these kinds of testing. And I believe it probably refers to when there is a certain kind of attack that is being presented to in the test, what is the error rate; that is, how often does -- do those kinds of presentations produce errors in terms of, for example, liveness or non-liveness.

So, for example, in the first line below that, it says 0 percent, so no errors in the level A attacks,

and then 0 percent, no errors in the level B attacks in the testing.

Q Do you know the difference between attack presentation classification error rate and attack presentation non-response rate, as shown in Exhibit 2038?

A In general, I don't know specifically if BixeLab is using it the same way that I would, but in general, I think that refers to there are times when no decision is the output in this kind of testing, and that's a different category than a real face or not face.

And so I believe that the letters below this, the little a and little b, saying level a attacks, there were 0 percent no decision outputs, and there were .83 percent -- or, actually, I may not be interpreting this correctly.

So I'm not really sure how they're using it. I -- similar language is used in the field, but I'd have to actually think a bit to actually get it right.

Q Okay. Do you know, as you sit here today, what bona fide presentation classification error rate and bona fide presentation non-response rate mean in Exhibit 2038?

A I don't know specifically except that in this

kind of testing, the lower the better. So the 0 percents are good outcomes.

Q Okay. So now turning to Exhibit 2039, it talks about the (as read):

"...following metrics were measured at a matching threshold of 5."

Do you see that?

A Yes.

Q What does it mean, "a matching threshold of 5"?

A So sort of like some of the patent discussion we had earlier today, in a binary decision of, for example, real person or not, there is often first a value that gets computed, and that value is compared to a threshold.

So in this case, 5 is the threshold being used for the value that has been computed to then decide, am I saying it's a match or not or am I saying it's a live face or not a live face?

Q So 5 is reflecting what? Is it a -- sorry.

A Yeah, I don't know what the specific coordinate system is in this -- in these numbers, 5 and 6.

Q Okay. Do you know what a false match rate is?

A Yes. It's the rate of incorrect matches.

Q So do you know what a false non-match rate is?
A It's the rate of incorrect non-matches.
Q Okay. The letter of confirmation refers to ISO/IEC 19795-1 and -2 standards.
Do you see that?
A I see the dash 2.
Q If you look right under where we were discussing regarding --
A Oh, yes.
Q -- the metrics, do you see the reference to those two standards?
A Yes.
Q Dash 1 and dash 2?
A Yes.
Q Do you know what those stand for?
A No, not specifically.
Q Okay. And turning back to Exhibit 2038, it refers to, at the top, "ISO/IEC 30107-3."
Do you see that?
A I do, yes.
Q Do you know what that refers to?
A Not specifically, but like the others, it is some standard that is -- I believe is used in the industry for these kinds of evaluations, but I don't know specifically what the standard is for these.

Q Okay. Let me now direct you to Exhibit 2037.
Do you recognize Exhibit 2037, Dr. Turk?
A Yes, I do. I've seen this.
Q And what is Exhibit 2037?
A It's another letter stating testing that had been done on the FaceTec system.
Q Okay. And in this case, they're testing FaceTec ZoOm version 6.9.11; is that correct?
A Yes, that's what it says.
Q Okay. So are the letters of confirmation certifications that we've looked at to date, are they all testing the same software, Dr. Turk?
And if we can just go back, remember Praetorian referred to SDK testing. That's Exhibit 2040. Exhibit 2038 referred to FaceTec server version 9.60.30. Exhibit 2039 referred to a BRYK.ID extension version 9.6.30, and this Exhibit 2037 refers to a FaceTec ZoOm version 6.9.11.
MR. JOHNS: Objection; vague.
THE WITNESS: So, sorry, the question is?
BY MR. ARJOMAND:
Q Are they all testing the same software, Dr. Turk?
MR. JOHNS: Objection; vague.
THE WITNESS: I don't know exactly what is

covered by the way the software is titled in these documents. I believe -- given what the CTO of FaceTec had to say about these, I believe that they are testing aspects of FaceTec software related to liveness detection, but I don't know anything about the versioning.

BY MR. ARJOMAND:

Q So when you say "I believe they are testing aspects of FaceTec software related to liveness detection," what did you mean by that?

A I meant that. Maybe you could ask something else.

Q Okay. Can you expand on what you meant by "testing aspects of FaceTec software related to liveness detection"? Do you know what those aspects are?

A Not specifically. I know that FaceTec software includes liveness detection, and it's an important part of it. It, like any software, includes other things, many of which would be very mundane and not relevant to biometrics testing, but I believe these tests are related to liveness detection.

Q Okay. Let me direct your attention back to Exhibit 2037. It was the last exhibit that I gave to you.

So do you see that third paragraph from the bottom that begins with "The 6 artifacts"?

A Yes.

Q So it says (as read):

"The 6 artifacts or species used in the test effort were two life-like dolls, two realistic latex masks, one custom-made resin mask and one realistic silicone mask with a cost of up to $300 each."

Do you see that?

A Yes.

Q So is it your understanding that they used these artifacts or species to attempt to spoof the FaceTec ZoOm version 6.9.11?

A It seems like that's what they did, yes.

Q Okay. Do you know what level 2 PAD test effort means? It's in the second to last paragraph.

A I don't know the details about what defines the different levels. Generally, I believe the larger the number for the level, the more severe the test.

But in general, it's testing presentation attacks, more or less spoofing attempts of the system.

Q All right. Let me place Exhibit 2078 in front of you.

Do you recognize this document, Dr. Turk?

A I do, yes.

Q And what is this document?

A It's like the last one, information about testing of FaceTec software.

Q Okay. So in the fourth paragraph from the bottom, it refers to "The subjects for the test were cooperative."

Do you see that?

A I do, yes.

Q And it says that they were, quote (as read):

"...willing and able to provide any and all biometric samples, including high quality photos and videos of their likeness."

Do you see that?

A Yes.

Q And then at the end of that paragraph, it says (as read):

"This is considered a Level 11 PAD test effort (first of three levels)."

Do you see that?

A Yes.

Q Now, comparing Exhibit 2078 with Exhibit 2037, the other iBeta letter, does this help you understand

better the difference between a level 1 PAD test effort and a level 2 PAD test effort?

A I think it's consistent with what I -- with my understanding of it that I described before, that the higher the number, the more severe the test.

Q So would it be fair to say that a level 1 PAD test effort is directed to two-dimensional attacks, such as photos and videos of a person's likeness?

A I don't know if it's limited to that. I expect it includes that.

Q Okay. And would you understand that a level 2 PAD test would be directed to three-dimensional masks and dolls compared to a level 1 PAD test effort which would be focused on photos and videos that are two-dimensional?

A I don't recall seeing a full description of the levels, so I'm not sure if those are necessarily fully contrasting to, but it does seem like level 2 includes, for example, lifelike dolls and masks. I don't know if level 1 includes those kinds of things or not.

And again, I was not involved in these tests directly, so I'm just looking at what's written here.

Q I see. Why do you think, Dr. Turk, that iBeta is -- strike that.

Why do you think iBeta, Dr. Turk, is utilizing one level of tests that's focused on 2D photos and videos for its certification in Exhibit 2078 and utilizing or focusing on three-dimensional masks and dolls for a second level of certification in Exhibit 2037?

A Not knowing the details of the testing, my guess off the top of my head is that the things mentioned in the 2037 exhibit are considered more severe, more tests, more difficult to pass, thus it was a higher level.

Q What makes it more severe or difficult to pass?

A Not knowing everything that's in level 1 and everything that's in level 2, I don't know if I can say in general what makes everything more difficult.

Q Well, what -- is there an increase in complexity -- strike that.

Is there an increase in the severity of the test between utilizing a 2D photo or video to spoof a system as opposed to utilizing a 3D doll or a mask?

A I think -- it's hard to say without knowing more about the system, but I think in general, the image or video has for a long time been the most common method of trying to spoof a system, and so people have

worked very hard to -- to counterattack that. And so to me, that would be a natural first level for testing.

And then the things that less frequently show up, which might be more difficult but might just be less frequent, would be in a separate level.

Q I see. So Exhibit 2078 that has the iBeta certification that is directed to photos and videos was issued on August 20th, 2018; is that correct?

A Yes.

Q And then Exhibit 2037 that was directed to lifelike dolls, masks and -- yeah, and masks issued on February 7th, 2019; is that correct?

A Yes.

Q So would it be fair to say that FaceTec is seeking to ensure that its system is not spoofed by evolving types of attacks such as from utilizing 2D photos and videos to 3D dolls and masks?

MR. JOHNS: Objection; vague.

THE WITNESS: I think any company would want to be evolving their system to meet the latest kinds of attacks that they might be facing.

BY MR. ARJOMAND:

Q And in citing all of these exhibits that we've been discussing with regard to FaceTec software, specifically Exhibit 2037, 2038, 2039, 2040 and 2078,

did you ever go back and look to these companies' testing protocols?

A I don't believe I looked at their testing protocols.

Q Okay. And we had previously discussed that some of these organizations are in the business of providing certifications.

Do you know if iBeta is one of those?

A I don't know for sure what their status is.

Q Okay. You seemed to hesitate on that one.

A I wouldn't read into that. I didn't mean anything by hesitating.

MR. ARJOMAND: Okay. Fair enough.

Okay. Let's take a break.

(Recess.)

MS. NGUYEN: Back on the record.

FURTHER EXAMINATION

BY MS. NGUYEN:

Q Okay. Dr. Turk, if we could take a look at Tanii, paragraph 5.

Okay. So in paragraph 5, it talks about a description of related art.

Let me know when you're there.

A I'm there.

Q Okay. And Tanii is related to image processing of captured images that have image warp, would you agree?

A Yes.

Q Okay. And then paragraph 6 explains that image warp is caused when the three-dimensional face of a person comes closest to the camera, yes?

A Yes, that's describing the perspective distortion we talked about earlier.

Q Okay. And now turning to paragraph 47, Tanii explains this concept (as read):

"Three-dimensionality is determined because when the object, main object and cellular phone are close together, the result is an unnatural image having an exaggerated perspective,"

right?

A Yes.

Q And if there's image warp present in the camera, then the object in the image is three-dimensional when close up, correct?

MR. JOHNS: Objection; form.

THE WITNESS: I would say it's not that simple, so I'm not sure I would agree with that statement.

BY MS. NGUYEN:

Q Okay. Well, let's take a look at figures 4A and 4B of Tanii.

And do you see that there's image warp present in the captured image relative to Figure 3B?

A I see that there is perspective distortion, warp, in 4B relative to 3B.

Q Okay. So here, the perspective distortion warp is due to the object in the image being three-dimensional, would you agree?

A Yes.

Q Okay. Now, let's go to paragraph 74.

And paragraph 74 discloses a size detector 204 that detects the size of the image of the main object.

Do you see that?

A I do, yes.

Q And if we go to paragraph 61, paragraph 61 states (as read):

"The image of the main object, particularly the image of the face of the user who's holding the cellular phone one is captured."

So would you agree that the main object in Tanii is a user's face?

A Here, it's described that way. In a lot of

other places in this reference, it's just referred to as the object.

Q Okay.

A It seems like it could be other things.

Q Okay. And so in order for Tanii to detect the size of the user's object, would it need to be able to detect the face?

A Not necessarily. It would need to be able to detect an object. That object may happen to be a face, but it may not be detecting a face specifically.

Q Okay. But it needs to detect the object in order to determine the size of the object. Is that fair?

A Yeah, I think so.

Q Okay. So let's look at paragraph 101.

And in paragraph 101, it talks about measuring the distance from the main object to the cellular phone. Do you agree?

A Yes.

Q And same paragraph (as read):

"If the distance between the main object and the cellular phone is greater than or equal to a threshold value, then Tanii does not perform image correction," right?

A That's correct.

Q Okay. And if the distance between the main object and the cellular phone is between threshold values D1 and D2, then a low degree of correction is applied, right?

A That's right.

Q And if the distance between the main object and the cellular phone is greater than the threshold D2, then a high degree of correction is applied, yes?

A That's what it says, yes.

Q Okay. So Tanii determines the distance between the main object and the cellular phone and then applies different levels of correction depending on the distance, yes?

A That's how it's described here, yes.

Q And different distances may have different degrees of distance-induced distortion, right?

A It's -- that's also a complicated question.

The distortion that's being talked about here is not a function of the distance to the object. It's a function -- it's a function of the distances within the object. For example, if it were a face --

Q Okay.

A -- the various parts of the face are at a different distance to the camera.

Q Right.

A It's those differences that causes this effect, not the distance to the object.

Q Because the object is three-dimensional?

A The three-dimensionality of the object is those differences in terms of how far your -- the tip of your nose is or how far away your cheek is or how far away something else is --

Q Okay.

A -- not the general distance to the face.

It's the relative distances that cause this perspective effect.

Q Okay. So let's -- just to make this a little simpler for me, let's talk about, let's say, the nose, right? Let's talk about a part of the object, the nose of the user's face.

So what different distances between the cellular phone and the nose lead to different degrees of distortion in Tanii?

A The distortion would be there geometrically in any case, but when you move the object closer to the camera, you could say the degree of the distortion -- of all the distortions are made larger.

So the cause of the distortions is the 3D structure of the face, but those distortions get larger

when some things move closer to the camera.

Q So the distortion changes with respect to distance; is that right?

A They change as a function of distance, but they are not caused by distance.

Q I see. Okay. I see. I understand.

When you say "they change," you mean there's different degrees of distortion?

A I would say the effects are different, are larger.

Q The distortion effects?

A The distortion effects are larger, the perspective distortion effects.

Q Okay.

FURTHER EXAMINATION

BY MR. ARJOMAND:

Q So, Dr. Turk, let me direct you back to your declaration.

And I want to direct you to paragraphs -- strike that.

I want to direct you to your declaration at Exhibit 2061 at paragraph 466. So this paragraph is in a section relating to iProov and Jumio copying FaceTec software that begins on the previous page, page 214.

Do you see that?

A Yes.

Q So in paragraph 466, you say (as read):

"In my opinion, iProov software replicates key features of FaceTec's technology, including the use of facial images captured at varying distances to verify three-dimensionality, further supporting a finding of copying and reinforcing the nonobviousness of the claimed inventions."

Do you see that?

A Yes.

Q Do you recall what iProov software you reviewed in providing your opinions on copying in your declaration, Exhibit 2061?

A Offhand, I don't recall all of them necessarily. Some of it, I believe, is laid out in the appendix -- I forget what appendix number it is -- that compares FaceTec and Jumio and iProov, I believe.

Q Uh-huh. Okay. So here, in paragraph 466, you're citing to Exhibit 2059, which I will tell you is the declaration of Mr. Rose.

So did you rely on that declaration for making statements regarding iProov's alleged copying?

A I did, yes.

Q Okay. And then if you move to paragraph 468, you refer to Exhibit 2060.

Do you recall what that exhibit is?

A Not offhand.

Q Having looked at the exhibit listing in your declaration, does that refresh your recollection as to what Exhibit 2060 is?

A Yes. I haven't looked at this for a while, but I think it's a one-page declaration that's -- that's, I think in some sense, validating the existence of the web page that is listed here.

Q Okay. And let me now direct you to Appendices A through D where you go through the iProov product with respect to the claims.

And if you can just go through those pages -- there's a fair number of pages -- and let me know what else you've cited, in terms of exhibits, beyond what we've just discussed, which is Exhibit 2059 and Exhibit 2060.

I will tell you that I've done that process, and the only other exhibit that I saw was Exhibit 2071, but I would appreciate if you could confirm that.

A Do you mean overall in Appendices A through D or just in the iProov column?

Q Just in the iProov column, for Appendices A through D.

A Okay. I had a quick perusal.

I think I would agree with what you said.

Q Okay. Dr. Turk, did you create these eight appendices that are attached to your exhibit?

A No, I didn't. And I don't claim to have done that in the declaration. This was provided to me.

Q Okay. And you just reviewed it for accuracy and agreement?

A Yes, that's correct.

Q Okay. So would it be fair to say that in determining whether the claims of the challenged patents are embodied -- strike that.

Would it be fair to say that whether the iProov product is embodied in the claims of the challenged patents you looked at, Exhibit 2059, which was Mr. Rose's declaration, Exhibit 2060, which was that declaration that attached a document, and Exhibit 2071, which is a video, I believe?

A I believe that's correct.

Q As you sit here today, do you recall reviewing anything else in preparing or reviewing Appendices A through D for the iProov analysis?

A I don't think so.

Q Okay. Now, let me direct you to paragraph 471 of your declaration.

So paragraph 471 relates to the alleged copying of Petitioner Jumio with respect to FaceTec software.

Do you see that?

A Yes.

Q And in this section, beginning with paragraph 470 and going to paragraph 473, you're citing, again, Mr. Rose's declaration and the video that is Exhibit 2077.

Do you see that?

A 2077?

MR. ARJOMAND: Actually, strike that. 2077 is not a video. I think it's a document. It's a document, and Exhibit 2072 is the video.

THE WITNESS: Yes, I see that.

BY MR. ARJOMAND:

Q Okay. So by my count, you're considering Exhibit 2059, Exhibit 2077 and Exhibit 2072 in this portion of your declaration; is that correct?

A The portion you're referring to is these paragraphs here or --

Q Yes.

A Okay.

Q Actually, let me go back.

Specifically, paragraph 470 also refers to Exhibit 2073.

Do you see that?

A Yes.

Q So with respect to paragraphs 470 through 473 of your declaration, at least to me, it appears that you're relying on Exhibits 2059, 2072, 2073 and 2077; is that correct?

A That seems right, yes.

Q Okay. I hate to ask you this, but can you go through your appendices -- I guess it would be the last four -- and let me know if there are any other exhibits that you relied on with respect to Jumio?

A Appendices E through H?

Q That's correct.

A Does anybody know on what page Appendix E starts?

Q I have page 374.

A Thank you.

Q And if you want to call out the exhibits that you see that are different from what I just listed, that's fine. And most of them are likely at the end.

A I'll call them all out, if that's okay.

Q Yeah, that works too.

A 2070, 2059, 2072, 2076, 2074, 20- -- I said 2059.

Q Yes.

A I believe that's all, if I didn't miss any.

Q Okay. So I have you stating Exhibits 2059, 2070, 2072, 2074 and 2076; is that correct?

A It sounds right.

Q Okay. And then there were two additional exhibits that were mentioned in your declaration at paragraphs 470 through 473. Those would be Exhibits 2073 and 2077.

Does that sound right to you?

A In paragraph 473?

Q In paragraph 470, you refer to Exhibit 2073.

A I see it.

Q And in paragraph 471, you also refer to Exhibit 2077.

A That's correct.

Q So in total, I have Exhibits 2059, 2070, 2072, 2073, 2074, 2076 and 2077 that were either referenced in your declaration with regard to the alleged copying by Jumio or referenced in Appendices E through H.

Does that sound right?

A I will take your word for it, yes.

Q Okay. And so would it be fair to say that in

determining whether Petitioner Jumio's product embodied the challenged claims of the patent, you looked at Exhibits 2059, 2070, 2072, 2073, 2074, 2076 and 2077?

A Yes, I think that's correct.

Q And did you look at any other exhibits in doing that analysis, Dr. Turk?

A I don't think I did.

Q Okay. Now, let me direct you to Appendix C. It's on page 306 of the declaration, if that would be helpful to you.

A Appendix C on 306?

Q Page 306.

A Page 306. Oh, it's not the beginning of Appendix C. It's in Appendix C, right?

Q Yes, it's showing element 1[d].

A Okay. Thank you.

Q So if you can just read element 1[d] to yourself. It expands -- it goes from page 306 to page 312.

Do you see that?

A I do, yes.

Q So if you could read those pages, specifically the claim language and what you provided in terms of analysis with respect to iProov, and then I'll ask you a few questions.

I should note that with respect to iProov, you cite to Exhibit 2071, which is a video. We can certainly play that video if you need to review it.

A And just to be clear, as I said, I don't cite to these. This appendix cites to them. And I review and agree with the appendix.

Q Okay.

A Okay.

Q Okay. So I want to ask you how you believe the image that's on page 308 from Exhibit 2071 meets the claim limitation 1[d].

A So the claim limitation is about comparing biometric data from two images at two different distances. The image there, from Exhibit 2071, is showing a face in an oval. And I presume from that, that there is an oval of a different size that is shown here before or after this and the user is adjusting for that -- for his face to fit that oval.

And the video there talks about biometric profile and using a face to log in. There's biometric information being referred to, and it seems like a reasonable inference to me to say that -- to believe that biometric information may well be compared here, similar to the claim limitation.

Q But do you know if biometric information was

actually compared?

A I don't know that for sure. I'd be interested to look more closely at iProov's system to determine that for sure --

Q Okay.

A -- but it seems possible and perhaps probable.

Q And taking a look at limitation 1[d], it says (as read):

"...when the expected differences result from fisheye type distortion."

Where would that be disclosed in Exhibit 2071, as shown here in your declaration?

A Of course, this is only one frame from that exhibit here, but when capturing information from faces at two different distances, which I believe this oval is representing one of those distances, the changes that will happen are due to what the patent here is calling fisheye distortion, what I also call perspective distortion.

Q So fisheye distortion is not a type of perspective distortion?

A As we discussed earlier today, fisheye has been used quite frequently over the years by people to refer to either one or -- either one or perhaps both of the kinds of distortions we discussed this morning,

lens-based radial distortion, like pincushion or barrel distortion, or, alternatively, perspective distortion.

So in the context of these claims, when it uses the word "fisheye" here, it is referring to perspective distortion.

Q Okay. Dr. Turk, let me direct you to page 246 of the appendices in your declaration.

A Okay.

Q So page 246 sets forth claim 1 limitation D6, which is a comparing step.

Do you see that?

A Yes.

Q And take a look at what you cited for iProov with respect to that limitation.

A Okay.

Q So with respect to this limitation, does iProov's product -- strike that.

With respect to this limitation, does what you've cited in Exhibit 2071 show the actual comparing step?

A You're asking if the image there that is shown here shows the comparison step?

Q That's correct.

A I don't believe the image itself shows that step. I think the inference from this image and

actually the whole video that this image comes from is that it seems to me that it's very likely that's what's happening.

Q What would you need to review to confirm that inference?

A Ultimately, iProov software.

Q All right. Let me direct you to page 451. It's in the appendices of your declaration.

A Okay.

Q All right. So page 451 sets forth limitation 1[d] for the '938 patent. In this case, there's analyses with respect to Jumio's product.

So if you could just take a minute to review that analysis, and I'll have a few questions for you regarding that.

A Okay.

Q So does what you cited for this limitation with respect to Jumio actually show the determination step or element of 1[d] of the '938 patent?

A I believe the video, Exhibit 2072, provides good evidence that that's probably what's happening.

Q You say, "probably what's happening."

Is that, again, sort of what you previously testified as an inference?

A Yes, in the sense that I have not seen their

software and been able to analyze exactly how their system works.

Q Okay.

A But from what I can tell, it seems very likely.

Q So in both cases, with respect to iProov and Jumio, you haven't reviewed the underlying software of the products that you believe embodied the challenged claims; is that -- the challenged patents; is that correct?

A That's right.

MR. JOHNS: All right. Let's take a break.

(Recess.)

MR. ARJOMAND: We have no further questions on cross-examination. We pass the witness, and we reserve the right to recross Dr. Turk if you have further redirect.

MR. JOHNS: Sounds good. If we could have a couple minutes just to look things over and see what I have.

MR. ARJOMAND: Okay. Sounds good.

(Recess.)

MR. JOHNS: I have no other questions, so I think we're done.

(TIME NOTED: 3:35 p.m.)

I, the undersigned, a Certified Shorthand Reporter of the State of California, do hereby certify:

That the foregoing proceedings were taken before me at the time and place herein set forth; that any witnesses in the foregoing proceedings, prior to testifying, were administered an oath; that a record of the proceedings was made by me using machine shorthand which was thereafter transcribed under my direction; that the foregoing transcript is a true record of the testimony given.

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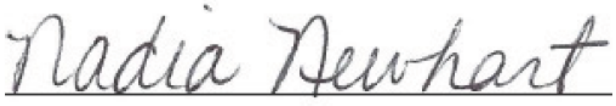
I further certify that I am neither financially interested in the action nor a relative or employee of any attorney or any party to this action.

IN WITNESS WHEREOF, I have this date subscribed my name.

Dated: January 9, 2026



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Janaury 9, 2026

RE: Jumio Corporation v. Facetec, Inc.

1/8/2026, Expert Matthew A. Turk , Ph.D. (#7811277)

The above-referenced transcript is available for review.

Within the applicable timeframe, the witness should read the testimony to verify its accuracy. If there are any changes, the witness should note those with the reason, on the attached Errata Sheet.

The witness should sign the Acknowledgment of Deponent and Errata and return to the deposing attorney. Copies should be sent to all counsel, and to Veritext at (production-ca@Veritext.com).

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Jumio Corporation v. Facetec, Inc.

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Jumio Corporation v. Facetec, Inc.

Expert Matthew A. Turk, Ph.D. (#7811277)

ACKNOWLEDGEMENT OF DEPONENT

I, Expert Matthew A. Turk , Ph.D., do hereby declare that I have read the foregoing transcript, I have made any corrections, additions, or changes I deemed necessary as noted above to be appended hereto, and that the same is a true, correct and complete transcript of the testimony given by me.

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