UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL APPEAL BOARD

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APPLE, INC.,

Petitioner

v.

QUALCOMM INCORPORATED,

Patent Owner

Case IPR2018-01250

Case IPR2018-01251

U.S. Patent No. 8,447,132

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Deposition of

ALAN BOVIK, PhD

Thursday, March 28, 2019

Reported by:
KIMBERLEE SCHROEDER, CSR, RPR, CCRR
License No. 11414
Job No.: 2019-69200

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I N D E X

DEPOSITION OF ALAN BOVIK, PhD

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EXHIBITS

BE IT REMEMBERED that on Thursday, March 28, 2019, commencing at the hour of 9:11 a.m., at the Law Offices of Fish & Richardson, P.C., 111 Congress Avenue, Suite 801, Austin, before me, KIMBERLEE SCHROEDER, a Certified Shorthand Reporter in and for the State of Texas and California, duly authorized to administer oaths pursuant to Section 28(a) of the Federal Rules of Civil Procedure and 602.002 of the Texas Government Code, personally appeared

ALAN BOVIK, PhD,

called as a witness herein, who, having been duly sworn, was thereupon examined as hereinafter set forth.

P R O C E E D I N G S

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ALAN BOVIK, PhD,

after being first duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. ROBINSON:

Q. Thank you for being here today.

A. Thank you.

Q. Have you been deposed before?

A. I have.

Q. Approximately how many times?

A. I think this is my 40th.

Q. Fortieth. All IPRs?

A. No, all kinds of cases. All previously patent-related, district cases, ITC cases, IPRs, the gamut.

Q. Between those three, can you give me a rough breakdown, just approximate?

A. Oh, of depositions?

Q. Yes, please.

A. Percentages, this will just be in something I haven't calculated. I'll make my one best guess. I'd say probably 10 or 12 IPR depositions. You know, could be more. An ITC, probably a smaller fraction of the

rest than the district cases. I don't know. Probably three or four.

Q. Fair enough. It's not your first rodeo?

A. Not at all.

Q. I won't spend too much time on preliminaries then. The one thing I ask if I ask a question and you don't understand, please ask me to clarify.

A. Fair enough.

Q. Let's try not to talk over each other. Other than that, I think you know more or less how this works.

You understand that we are here today on the 1250 and 1251 IPR proceedings concerning US patent 8,447,132.

A. That is correct.

Q. And so if I refer to the '132 patent or '132 patent, you'll understand what I'm referring to?

A. Yeah, sure.

Q. What is a digital image?

A. Well, Counselor, before I start answering questions, I'm going to request a copy of the '132 patent and my two declarations just as a matter of course. If you don't have a copy, I brought copies.

Q. Okay. I have copies, and I'll get those out for you at an appropriate time. Right now, I'm just asking you based on your years of experience in this

field --

A. M-hm.

Q. -- how you would define a digital image?

A. Well, since this is an IPR deposition, really your questions are kind of limited to the four corners of my report. And so, I mean, the term "digital image processing" is a general term. But, you know, this and other questions I would like to be able to cast against the content of my reports.

And so just as a matter of precedent, I would like to begin. I'll ask my counsel to hand it to me so I have my copies, and then you can -- I can refer to them, if you don't object. And --

Q. Mr. Bovik, I would ask that you not refer to those just yet at this point.

Do you understand your report is from the perspective of a person of ordinary skill in the art?

MR. GRAUBART: Objection. Form.

THE WITNESS: My report is, you know, reflects my beliefs about this case. And I do express opinions about what a person of ordinary skill in the art may believe and so on.

MR. ROBINSON: Q. What is your opinion about what a person of ordinary skill in the art would understand a digital image to be?

A. So I'll give you the simple answer, and keep in mind that this answer, since you haven't pointed to anything in the patent or in my reports, I'll set my answer outside of that. So it's in some sense it's outside of this case, my answer. It's out there in the world instead and doesn't really have a bearing on any of the salient matter within the report.

A digital image is an image which is -- has been digitized or was captured in a native digital format.

Q. Is that your understanding of what a POSITA what think a digital image is as of 2009?

A. Oh, that wasn't what my answer was, because POSITA is in something that is within the four corners of my report, and you're drawing me that way. I haven't really tried to create a construction of that term yet within the context of this.

The answer I gave would not be in consummate with what a POSITA would believe. But I haven't tried to, you know, create a construction.

Q. Dr. Bovik, would you refer to -- I'll hand you what's been marked as Exhibit 1001, which is the '132 patent? '132 patent.

(Exhibit No. 1001 was marked for identification.)

THE WITNESS: Do we need to put stickers on them?

MR. ROBINSON: They've already been marked.

THE WITNESS: They've already been marked. Okay.

MR. ROBINSON: Q. Would you please refer to claim 1, column 11?

A. I think you gave me two copies. One for you.

MR. ROBINSON: One for counsel.

THE WITNESS: I'll hand this one back. Yeah.

MR. ROBINSON: Q. Would you please refer to claim 1, column 11?

A. Yeah. Line 1 of column 11.

Q. Claim 1 of column 11.

A. Oh, claim -- m-hm. (Reviewing document.)

Q. What would a POSITA as of 2009 understand a digital image data recited in claim 1 to refer to?

MR. GRAUBART: Objection. Form.

THE WITNESS: And I'm going to ask you also to, since you were kind enough to give me a copy of the '132 patent, and since, once again, I'm going to remind you these proceedings are about what I already have expressed, I'll cast my answers against what I already declared.

MR. ROBINSON: I'll hand you what's been

marked as Exhibit 1003. It's a copy of your declaration.

(Exhibit No. 1003 was marked for identification.)

THE WITNESS: Oh, so you already have the exhibit numbers on? Okay. Whatever. You're going to give me 1017 also?

MR. ROBINSON: I'll hand you 1017. It's already been marked.

(Exhibit No. 1017 was marked for identification.)

THE WITNESS: (Reviewing document.) Okay, thank you. And repeat the question.

MR. ROBINSON: Q. What would a POSITA as of 2009 understand the digital image data resided in claim 1 referred to?

MR. GRAUBART: Objection. Form.

THE WITNESS: POSITA would understand that this is image data that's in a digital form.

MR. ROBINSON: Q. What would that image data include?

A. It could include a lot of things. It's going to include visual information that's in a digital form that's intended usually for a cumulative view, but not always. Sometimes a computer algorithm may process it.

Q. How is that visual data defined?

MR. GRAUBART: Objection. Form.

THE WITNESS: It depends on the context. You know, if you want to point me to a concern context, then in that context, I'll be able to answer.

MR. ROBINSON: Q. What are some examples of how that digital image data could be defined in the context of claim 1 of the '132 patent?

MR. GRAUBART: Objection. Form.

THE WITNESS: Well, you're using the word "defined," okay. And I don't really know how to answer that. I mean, I already kind of gave you an answer. It's image information that's in a digital format.

So --

MR. ROBINSON: Q. Does that image information or visual information, which I believe you referred to it earlier, include component parts?

A. It could. But again, we need a context there to understand what exactly we're talking about.

Q. What type of context would help you understand what I'm talking about?

A. Whatever context you want to ask your questions within a certain framework.

Q. Are there different image systems that would help you understand the context?

MR. GRAUBART: Objection. Form.

THE WITNESS: Well, I would say that, you know, these documents contain examples of, you know, concepts and systems and so on that involve digital images. If you want to draw me to a particular thing, then I can answer kind of specific questions that way.

MR. ROBINSON: Q. What if it were an RGB image?

A. Is that a question?

Q. Yes. Would that context help?

A. It would inform me that the image data is in RGB form.

Q. Would you explain what RGB form is?

A. Well, there's multiple types, actually. There's RGB that we sometimes called raw, but I'm not going to limit it, you know. Any terminology I use outside, since we're not really talking about anything specific within the specification of claims, I'm talking out there in the world, and anything I say from this moment until the end of this answer doesn't necessarily apply to anything in here.

But it's red, green and blue. Typically, in some scenarios, you have a, say, a camera which has a color filter array superimposed on a array of sensors which limit bandwidths to red range, green range, or

blue range. So some pixels get red, some get green, some get blue.

And that's what we call the output of that. Then once it's digitized, we often call a raw RGB image. And I say that because following that, a very typical operation is to interpolate that data, so that instead of having just a red sample or a green-valued sample or blue, you have a red and a green and a blue sample. It becomes a multivalued digital image then.

That's called color-interpolation or demosaicing. That kind of thing. Then you might call that an RGB image also.

So those are some examples of RGB. But everything I said before, I'm not really talking about the patent here or my report. You haven't -- I'm not finished, sir. You haven't drawn me there yet.

Q. Would anything about that answer change if I asked you to answer from the perspective of a POSITA in 2009?

MR. GRAUBART: Objection. Form.

THE WITNESS: I don't know. You just say a POSITA, but I think you're not really asking me a question about anything specific.

I mean, if there was a POSITA in 2009 and he was unaware of these patents, I think he might agree

with what I just said.

MR. ROBINSON: Q. So if there was a POSITA in 2009 and he was unaware of these patents, he would agree with what you just said?

A. Yeah, I'm not saying he would disagree if he was familiar with those patents. I'm just saying that my answer is divorced from these patents because you aren't casting within the context of them. I'm merely answering the question out there independent of material relevant to this case, meaning specific language in the patents, specific language in the references, specific language in my reports, specific language in the petitions. You asked me a question about out here in the real world.

And language is important, because in a minute you may point me to language in the specification or prior art and say, "Is that what you meant?" And my answer is no, I was talking about outside the four corners of my report and these other documents.

Q. What did you do to prepare for your deposition testimony here today?

A. Well, as you already know, there had been a previous expert, Professor Larry Davis, who had been engaged in this and had to leave the case on, I guess, short notice. I don't know the details or why.

Counsel contacted me somewhere between two and three weeks ago and said, "We need help on this. We need your opinions on this case." And since then, I have been reviewing all the documentation in the case, the patents, the prior art, Professor Davis's declarations, the petitions, responses, et cetera.

I've had multiple conversations with Counsel. I've done a lot of independent thinking to understand all of this and to come to my own conclusions.

Q. Approximately how much time did you spend reviewing the documents?

A. Oh, well, I haven't broken it down into review of documents versus discussion with Counsel versus, you know, sitting and reviewing my notes or whatever. But I believe that everything collectively here is approaching around 30 hours of effort.

When I -- when Counsel approached me, I told them they were lucky because I had a lull in my activities and was able to focus myself during that period

Q. Thank you.

Would you please refer to Exhibit 1003 at paragraph 7.

A. 1003 is my declaration. One of my declarations. Paragraph 7, you said?

Q. Yes.
A. M-hm. I'm there.
Q. So on paragraph 7, you define who you believe to be a person of ordinary skill in the art, or POSITA, with respect to the '132 patents field or art.
A. Yeah.
Q. I would like to ask you a series of questions from the perspective of that POSITA.
A. Okay.
Q. What is a correction in the context of digital imaging?
A. So, you know, again, you're asking me a correction in the context of digital imaging. You're not asking me a correction in the context of the '132 patent or Needham or the other prior art pieces or what I expressed in my report.
Do you mean to narrow the range to, you know, the corners in documents in this case? Or do you mean for me to speculate what it might mean in some other context?
Q. Did you consider what a POSITA would understand a correction to be independent of the '132 patent?
A. Correction -- I'll answer this outside the patents, to help you understand.

The term "correction" is not a term that means anything specific in the field of digital image processing. Could be mean a number of things. Could mean a lot of things. And those tend to be context-specific. Okay.

So a correction could mean -- could mean, for example, I'm outside the patents and all the documents in this case again. It could mean that an image is too dark, so you brighten it. Or it's too bright and you darken it. Or it's noisy and you try to remove -- you know, remove the noise. Well, you can't actually remove the noise; you can reduce it. Typically, when you talk about noise removal, you mean noise reduction. Okay. It's impossible to remove.

You might try to improve the appearance of a face in an image or something like that. All those answers, I could go on for a very long time to give you examples of different contexts, and we wouldn't be any closer to understanding necessarily what is specifically meant in these documents.

Q. Is "correction" a term that was used in the art as of 2009?

MR. GRAUBART: Objection. Form.

THE WITNESS: I would say that "correction" is a term that has been used in the art, but it doesn't

mean it's used the same way each time it's used because people have different applications. Okay? Different reasons for using the term and so on.

It's not something where you just know immediately what somebody means. If I say "image correction" to a colleague, they'll say, "Correcting what? What do you mean? What's the context? What field are you working in? What application?"

You have to understand, you know, in science and engineering, we're visual creatures. So image processing pervades medicine, biomedicine, science, physics, astronomy. And all these application have different goals. And so correcting an image in astronomy may mean something different than correcting it in the digital mammography area, which I've worked in, by the way.

So, you know, I could just say, "Look, Counselor, you're asking me these hypothetical, speculation things. I'm choosing to answer you, but I think we're not getting anywhere with regards to the specifics of correction in this case."

Q. Is there a common thread between all those examples in that each of them involve modifying digital image data to try to improve the image?

MR. GRAUBART: Objection. Form.

THE WITNESS: I would say that, you know, when you're correcting an image, you're processing the image some way or another. That's fair enough. Again, I'm not thinking about anything specific at all.

MR. ROBINSON: Q. So a POSITA in 2009, before looking at the '132 patent, would have some experiences of their own and knowledge of this art; correct?

MR. GRAUBART: Objection. Form.

THE WITNESS: Of which art, Counselor?

MR. ROBINSON: Q. Let's go back to Exhibit 1003 at paragraph 7.

A. (Reviewing document.)

Q. Your definition of a POSITA specifically references the field of digital image and/or image processing.

A. Yeah.

Q. Is that the art that you consider to be relevant to the '132 patent?

A. Sure. Sure.

Keep in mind that, you know, any definition of a POSITA here, it's been expressed in six lines. It's just an attempt to capture what that person's characteristics ought to be. But sure.

Q. Now, I've asked you a number of questions with reference to this POSITA that you've defined in this

art. You've repeatedly said you would have to speculate to tell me what that POSITA would know or think or understand about different terms.

Are you able to explain today what that POSITA's beginning perspective and knowledge base would have been before encountering the '132 patent?

MR. GRAUBART: Objection. Form.

THE WITNESS: Counsel, I have to confess, I don't really understand your question or where it's aimed.

MR. ROBINSON: Q. Are you able to answer questions about that POSITA's perspective without speculating?

A. Naturally, if I'm asked a question that isn't speculative.

Q. Would a POSITA have any understanding of image correction independent of context?

MR. GRAUBART: Objection. Form.

THE WITNESS: A POSITA would understand that there are methods for image correction that are directed towards context with different goals. You know, sometimes those goals would be broadly speaking -- again, outside, you know, the art, the patent here -- broadly speaking towards visual improvement of the picture. But it might not be.

It might be instead to make a computer vision algorithm more efficacious when processing the image that has been corrected, or it might be to make the image yield more information to a certain kind of image expert, like say a fingerprint reader. Okay?

Or, or, or. Okay?

You'll understand there are a huge range of possibilities for what image correction could mean. Certainly, you know. And he would also realize that if you selected a particular application, he might have a better idea of what image correction might be in that particular context.

Once again, all this answer is -- has nothing specific to do with the '132 patent.

MR. ROBINSON: Q. Would a POSITA have believed that there was any difference between image correction and image processing?

A. "Image processing" is a very broad term. You take an image, and you process it. Okay? Correction would be one way of processing an image. I mean, when I say "one way," one slice of that huge cloud of possibilities, which there's not one way. There's many ways within that slice.

Q. So a POSITA would not have understood the terms "image processing" and "image correction" to be

coextensive?

MR. GRAUBART: Objection. Form.

THE WITNESS: If you mean by "coextensive," you mean synonymous? Is that what you meant? I got to confess I don't use the word "coextensive" very often. Sounds like a lawerly word I should learn.

If mean synonymous, I don't think they're quite synonymous because there are tasks in image-processing where you're doing something different than correction.

MR. ROBINSON: Q. Would a POSITA have understood image correction and image adjustment to be synonymous?

A. I don't see any reason why they would have that thought. I mean, an adjustment could be part of a correction. But you might adjust for some other reason.

Again, that answer is outside the '132 patent and the other documents in this case because you haven't drawn me to anything in these. So if asked later, you know, "Dr. Bovik, were you talking about the '132 patent," my answer will be, "No, I was asked about things, in my mind, unrelated."

Q. I'll tell you what, if you want me to just agree to that so you don't have to keep saying it, it might save us a little bit of time.

A. Well, Counsel, I'm careful in a legal proceeding. Maybe I'll try to find a shorthand. I'm not trying to burn time. I'm just being careful.

Q. So your answer a moment ago, not in the context of '132 patent, just from the perspective of a POSITA, was that -- I'm going to quote, "I mean, an adjustment could be part of a correction, but you might adjust for some other reason."

A. M-hm.

Q. Is it accurate to say then that a POSITA would have thought a correction to be an adjustment, but that an adjustment might not be a correction?

MR. GRAUBART: Objection. Form.

THE WITNESS: That's not what I said. I won't agree to that.

MR. ROBINSON: Q. Okay. Let's break it down.

An adjustment could be part of a correction, but you might adjust for some other reason?

A. Well, again, my usual caveats, okay, about '132. I don't know what you mean by an "adjustment." Okay? Image adjustment is not a term of the art. I'll say that right now. So I'm giving you a little bit of leeway in that you know it means modifying the image in some way or another, something, I suppose. Okay?

And yeah, I will say that a correction -- an

adjustment in that sense could be part of some correction, again, with my caveat.

Q. Is "image correction" a term of the art?

MR. GRAUBART: Objection. Form.

THE WITNESS: You see the term quite a lot, but it is always within a context. If somebody just reads the term "image correction," they won't know what it specifically means. If I pick up a book and I just blindly close my eyes and put my finger and it happens to land on image correction, and I read nothing else, I won't know what's being done to the image, other than for some tasks, some tasks it's being modified for some reason. Again, with my caveats.

MR. ROBINSON: Q. Would a POSITA have recognized the terms preprocessing and post-processing in connection with image processing?

MR. GRAUBART: Objection. Form.

THE WITNESS: A POSITA would have encountered those terms. And again, they're very general terms. I can't speculate. I mean, I could speculate on what they might mean, and my usual caveats about outside the '132, but preprocessing is a term of an image you see a lot. So is post-processing. Sure. It doesn't mean any very specific algorithm or anything.

MR. ROBINSON: Q. Generally speaking, what

would a POSITA have understood preprocessing to refer to?

MR. GRAUBART: Objection. Form.

THE WITNESS: Well, the term "preprocess" -- and again caveats -- you know, it's got the prefix "pre." So it's processing that comes before, say, some other processing.

MR. ROBINSON: Q. Is there an event or other processing prior to which a POSITA would have understood preprocessing to have occurred?

MR. GRAUBART: Objection. Form.

THE WITNESS: Well, you know, because I don't know the context, I don't know one way or the other. But there could be.

MR. ROBINSON: Q. In the context of a POSITA's knowledge and experience, was there an event or other processing to which that POSITA would have understood preprocessing to occur in advance?

MR. GRAUBART: Objection. Form.

THE WITNESS: I don't know what you mean by "event" here. If you tell me what you mean by "event," I can maybe give you a better answer.

MR. ROBINSON: Q. Dr. Bovik, you referred to the prefix pre, which I think you said refers to before something. What's the something that a POSITA would

have understood to have happened after processing?

MR. GRAUBART: Objection. Form.

THE WITNESS: Well, what I said was -- and it's really just an example because we have zero context, and it's outside the patents or any documents associated with it. It's processing that occurs before, an example I gave, was some other processing. Okay?

So you know, you might -- I'll leave it there.

MR. ROBINSON: Q. What are some examples of the other processing that a POSITA might have expected to come after preprocessing?

MR. GRAUBART: Objection. Form.

THE WITNESS: Wait. Run that by me again.

MR. ROBINSON: Q. What are some examples of the, to use your term, other processing that a POSITA might have expected to come after preprocessing?

MR. GRAUBART: Objection. Form.

THE WITNESS: So I mean, you might compress an image before you transmit it. So the compression of an image might be, you know, before, you know, steps of processing that are taken like packetization to transmit an image. And that doesn't have much to do with what we're talking about today. But it's one processing before another.

MR. ROBINSON: Q. Could a POSITA have

understood preprocessing to precede storage of digital image data after it's generated by a sensor?

MR. GRAUBART: Objection. Form.

THE WITNESS: You could have scenarios like that, I suppose. Sure. Why not?

MR. ROBINSON: Q. Could a POSITA have understood post-processing to follow storage of digital image data generated by a sensor?

MR. GRAUBART: Objection. Scope. Form.

THE WITNESS: Perhaps, in some scenario. Once again, this answer and the last one are both outside the scope of the patents here. There could be processing, which you could call post-processing, which is after storage.

I mean, it hasn't described what other events may have occurred along the chain there either and what the "post" is referring to. So you might modify an image, store it, then post-process it and then do something else and something else.

I mean, there's nothing special being applied to these terms. There's no -- there isn't anything, you know, again, I'm speculating. My answers are just speculation here because I don't -- we have no anchor. We don't have anything tying this to any reality.

MR. ROBINSON: Q. So a POSITA wouldn't have

had any idea what post-processing or preprocessing meant in this field without more context?

MR. GRAUBART: Objection. Form.

THE WITNESS: I would say a POSITA would know that, given a context, he might have some idea. He would know that there is a very large variety, vocabulary, set of context, applications, so on, for which there are different and diverse and variegated methods of preprocessing and post-processing, because it's true.

MR. ROBINSON: Q. Would a POSITA have had no idea what preprocessing meant in this field without additional context?

MR. GRAUBART: Objection. Form.

THE WITNESS: It's not what I said. My previous answer fills in.

I'll just point out, again, Counselor, I don't feel I've been asked a question relevant to the '132 patent yet at any point today other than your first question about the digital image data.

MR. ROBINSON: Q. Dr. Bovik, your declaration includes a number of opinions about what a POSITA would have understood and believed.

Are you telling me that the baseline understanding of the POSITA, the context of their

knowledge and experience would have no bearing on the formation of those opinions?

MR. GRAUBART: Objection. Form.

THE WITNESS: Oh, not at all.

MR. ROBINSON: Q. Then certainly you can understand why it's important to explore that baseline knowledge and understanding, that baseline perspective of a POSITA prior to reading the '132 patent; can you not?

A. Oh, I can understand that, but I'm not sure I would quite agree that the questions you've been asking me are doing just that. But that might be a matter of opinion.

Q. A moment ago when I asked whether a POSITA would have any idea what post-processing or preprocessing meant in this field without context, you said, "I would say a POSITA would know a given context -- that given a context, he might have some idea."

I'm asking you whether the converse of that is true, specifically, that a POSITA would have no idea without more context?

A. I'm not sure there's a well-faring question, so I'll answer it my own way.

If you merely said if a POSITA was asked what's post-processing, then that POSITA would probably

say, "Well, I need a context to understand what 'post-processing' might mean." I think a POSITA would react in a same way as I am reacting.

Q. Without context, would a POSITA be unable to formulate any explanation of what post-processing meant in this field?

MR. GRAUBART: Objection. Form.

THE WITNESS: He would say it's processing that comes after something else. He would be able to say that. But not much else.

MR. ROBINSON: Q. Would a POSITA be able to give any examples of what post-processing might follow?

A. He could give you examples. Probably just pull something out of his head. They might be different examples from another POSITA. I think if you ask a hundred POSITAs, they would probably all come up with a different example if you asked them for one example because they might be leaning towards some application.

Somebody -- one POSITA might be a, you know, an engineer working at Apple and smartphones. Another one might be work anything in a biomedical laboratory with microscope images. And another one might be working at Google in the Cloud, you know. And each one would have their own perspective. If you asked each for one example, you would probably get a different example

for each one.

Q. Do you have experience working with POSITAs in each of those areas you just listed?

A. Actually, yes.

Q. What are the examples those POSITAs might have given?

MR. GRAUBART: Objection. Form.

THE WITNESS: Post-processing -- you know, Counselor, what I'm going to do is I'm going to help us out here because that question is outside the confines of my report. I'm not going to answer it because I think we need to stick to the subject matter.

MR. GRAUBART: Would you like my view on this?

I don't want to speak on the record and interrupt the deposition unless you would like me to.

MR. ROBINSON: Have at it.

MR. GRAUBART: I think we've been going a long line of questioning that are completely outside the scope of his direct testimony that aren't tethered to the context of the '132 patent or his declarations, expressly by the scope of the questions, not tied to those.

I've been letting it go forward and noting my objection. At some point we will reach a point we might need to ask the Board to intervene to suspend the

deposition to keep it within the scope. I tend to agree with Dr. Bovik's position here that his answer -- the question doesn't call for anything that's within the scope of his direct exam.

I'm not going to instruct him not to answer. It's his decision. I think I agree with his take on this.

MR. ROBINSON: So you're going to tell me a POSITA's understanding of terms used in the art before reading the '132 patent are irrelevant to how that POSITA would understand the '132 patent?

MR. GRAUBART: The terms you're asking about aren't ones he's offered an opinion on, nor are you asking about a POSITA's view of those terms in the context of the '132 patent, its intrinsic record, or the art. You're asking more abstractly about terms he didn't opine on without context in the record.

MR. ROBINSON: I'll ask you this: If the '132 patent doesn't redefine these terms, is a POSITA's understanding of the terms in the art relevant?

MR. GRAUBART: A POSITA's understanding of terms in the patent are going to be governed by their usage in the context of the patent, if that's what you're asking me. And the only terms that are within the scope of Dr. Bovik's direct examination are the ones

that he opined on. I don't believe you have been asking about any of those.

MR. ROBINSON: It's the meaning in the art informed by the patent; right? The baseline is the meaning of the art. And a lot of these opinions depend on language in the claims despite the fact he didn't offer explicit construction.

So, at this point, I'm just trying to understand what a POSITA would have understood these terms are before coming to the patent? What was the POSITA's baseline? So far, he's essentially sidestepped every question.

MR. GRAUBART: I think he's offered you his understanding the best he can, noting expressly that it's not something he's considered or offered an opinion on, and that it's outside the scope of what he's previously testified. So I think that's where we are.

MR. ROBINSON: All right. We'll try to power through here. At some point, I mean, I'm either going to have to call the Board and ask that he answer questions directly or ask for more time on the depo. We'll try to get through it.

Q. Would a POSITA have recognized gain in the context of image processing?

MR. GRAUBART: Objection. Form.

THE WITNESS: Before I answer the question, I just want to make clear that I'm trying to assist the Court as much as possible by directing my questions in a way that inform the Court about this case. I'm not trying to be evasive in any way. I think it's proper for me to point out when questions are being speculative or outside the scope or not confined within the boundaries of my report or anything else.

That's with all due respect. I'm not trying to difficult in any way.

With that said, you asked me about would they know what gain is. Outside the scope of the '132 patent, again, it would depend on the situation. I can give a few examples, but it wouldn't exemplify in any way necessarily what's relevant to this case.

So a person of ordinary skill in the art might understand there's a gain associated with a photosensor or processing the data following the photosensor. That is one possible example. Or it might be a gain in an algorithm to amplify or attenuate some information. Those are just broad examples.

They wouldn't think anything specific, necessarily. You know, if they read the '132, they would see the term "gain," and they would begin to understand the context, okay, for it. Then they would

understand what is meant by "gain" there perhaps.

But out there, you know, it could mean a lot of things.

Q. What would a POSITA understand the word "gain" to mean in the context of the '132 patent?

A. Oh, so, for example, in column 3, where I'm referring to the -- of the '132 specification, column 3, line 3, this is just talking about some aspect of processing on image data within an image that is not associated with a face.

It says -- I'll just read this -- "For normal," parenthesis, "e.g. non-face," end parenthesis, "image data, the DRC unit applies a digital gain to any given pixel depending upon whether it is part of such a specified type of object and the image. For example, a higher gain may be applied to pixels that are part of a face than for other pixels of the image."

If you were to go on, it might be that the gain means a brightening of the face, for example, make it more prominent and visible. That's just, you know, in reading this, this is what they will understand.

Q. You said it might be that the gain means a brightening of the face. Is that what the gain means in the context of the '132 patent? Or no?

MR. GRAUBART: Objection. Form.

THE WITNESS: It doesn't have to be. It could be. I mean, there could be something else that to which a gain is applied. It's part of the process.

If we look at claim second, all right. And I'm talking about, again, the '132 now. In claim second, which depends upon claim 1. It says, the second limitation, just pick something out. "Determining a different amount of gain to apply to the second portion than an amount of gain determined for the first portion."

So these are different portions of the image. It could be a brightening. But it could be, you know, a gain on something else. It could be local contrast, for example. It could be something related to color. The claim does not limit that. And the specification is just, you know, trying to help a POSITA understand the claims basically.

Q. You used the term brightness a moment ago.

What would that have meant to a POSITA in the context of the '132 patent?

A. If you look at column 9, near the bottom, okay, say, line 62, the inventor of the '132 basically defining brightness to be the same as luminance. Luminance in this context is being equated to brightness.

Luminance is a scientific term. So if you ask me what luminance is, this is a term where a POSITA would understand what it means. Okay?

Luminance is a perceptual quantity. It's a quantitative number that is, in the context of RGB images, it's a linear combination of the R and the G and the B components, giving greater emphasis to green wavelengths, because the human visual system is more sensitive to that. Lesser to red and even lesser to blue. Okay?

And if you form that linear combination -- it's a sum; it's adding up those components but with different weights -- you get luminance. And that is, you know, a weighted kind of how many photons were collected. So it also relates to the very intuitive sense of brightness. And here, the inventor is choosing to equate them.

That's a very specific answer.

Q. Thank you.

You reference photons collected. Is that an indication of the photons that are reflected to the human eye given a particular color or combination of colors?

A. Well, I was talking in the context of, you know, the digital image analysis and processing that's

occurring here. So instead it would be the photons collected by the photo sensor in the camera, say, for example.

Q. Okay. Which then relates to how the image is subsequently perceived by the human eye?

A. Only if this processing is intended for a human eye at some point. Not every digital camera output ever reaches a human eye.

I'll give you an example.

Q. The emphasis of the green is a reference to the human eye's greater perception of green; correct?

A. Yes, yes. Would you like me to clarify that?

Q. By all means.

A. Okay. So an algorithm might have a luminance computed using this usual weighting which is derived from perceptual principles, longstanding, to create an image that has a luminance component and then to chromatic components. That might still be processed by algorithms which create representations and do whatever without it ever reaching a human eye, even though there is that perceptual element.

Q. When you use the term "perceptual," what do you mean by that?

A. Relating to perception in this context, visual perception.

Q. Is there a difference between --
A. Could be a machine perception, too, but in that previous context, I was relating to the human perception.
Q. Okay. You reference perceptual principles. Are there also non-perceptual principles or approaches?
A. Yeah, sure.
Q. Can you give me an example of how those two things would differ, perceptual and non-perceptual?
A. Well, I'm going to preface it by saying when I'm using "perceptual," it is related to an image, say, that's eventually meant for a human to watch. Okay? Again, I'm outside -- I'm moving outside the patents here because I don't see any tie here to the '132 patent that I've been asked about or anything.

You can have an algorithm that is intended to, you know, is based on a perceptual design. Okay? Maybe you have a model of how people see. Okay? You might have an algorithm that is not. It may, nevertheless, you know, create an algorithm, a picture that is somehow beneficial for the viewer, even if it wasn't based on a perceptual model.

I'm not defining "perceptual," by the way, I mean, from the context of the '132. So if you want to bring me towards that, then I can try to relate it to

what's in the '132.

Q. I'm just trying to understand the words you, yourself, are using, Dr. Bovik.

Is there an example of a non-perceptual algorithm or non-perceptual approach to image processing?

A. If you have an image that is, you know, of one size, say, you know, a thousand by a thousand, and it's X-Y dimensions, okay, and if you reduce it to another image that's smaller, okay, just by subsampling to a smaller image that's say 500 by 500, that is an example of processing. In doing that, you may or may not use perceptual principles. Usually, it's not perceptual. You're just down sampling it using an interpolation.

Q. Thank you.

How would a POSITA understand the term "chromaticity" in the context of the '132 patent?

A. Do you want to point me to where it's used in the '132, just to save me time?

Q. Sure. Column 3, roughly line 28 to 32.

A. Column 3, line what?

Q. 28 to 32.

A. (Reviewing document.) So the inventor doesn't explain what he means there. And he doesn't explicitly define the term "chromaticity" anywhere. So I will say

that in my mind, I think he's just talking about color-related.

If you look at column 5, he talks about a couple of color spaces around lines 39 and 40. He talks about the YCbCr space, the YUV space. These are color representations. You'll also notice he mentions R, G and B. These are all color spaces.

Broadly speaking, I think he's using it in the sense of related to color. I will point out the YCbCr and YUV spaces are often called chromatic representations. It's been transformed from RGB to luminance and then to so-called chromatic components, Cb and Cr or UNV.

Color-related.

Q. Is that how a POSITA would have understood the term "chromaticity" outside the context of the '132 patent but in the field?

A. I think that a POSITA would, if they just said -- heard the word "chromaticity," they would know that it's related to -- and they knew we were talking about digital image processing, they would know that it's related to color and color representations and such in the broadest possible sense.

Q. How would a POSITA have understood the term "intensity dynamic range" in the context of digital

image processing?

MR. GRAUBART: Objection. Form.

THE WITNESS: Again, this -- you want to show me where that appears? I know it's in here somewhere.

Keep in mind when I recognize terminology that appears in the patent, I'm going to ask you for that so I can speak to it.

MR. ROBINSON: Q. To begin with, I'm asking you independent of this patent whether a POSITA would have had some understanding of intensity dynamic range based on their own experience and knowledge?

MR. GRAUBART: Same objection.

THE WITNESS: Oh, sure. Again, my answer has nothing to do with '132. But they may understand intensity is loosely equated with brightness, okay. How many pixels strike a sensor, for example. That's not a formal definition, necessarily.

Sometimes it's defined by some authors as R plus G plus B, which is different than luminance which is a weighted R, G and B when they're added together. You see intensity like that. A POSITA might understand it that way. But they might not. They might just understand oh, it's like brightness or gray level. Okay?

If they heard "intensity dynamic range," they

would understand probably, well, in some context, which they don't understand, it might mean the range of values that that intensity can take in some context.

MR. ROBINSON: Q. All right. In the context of the '132 patent, "dynamic range" is used throughout the description. Starting with the title, how would a POSITA have understood "dynamic range" in the context of the '132 patent?

A. In reading the patent, you know, it is used in different ways in different places, different embodiments. Figure 4 is an embodiment. So if I look in column 8 and find a specific example, you know, here he's talking about some blending operation, and he talks about -- this is line 63, the dynamic range of the blending process. So that's a range of values that can occur in the blending process.

By the way, I just want to point out, I happen to notice at column 6, line 9 -- I forgotten about this -- the inventor sort of defines chromaticity to be color balance, column 8, line 9. I think I would stick with my idea of related to color. I'm okay with him saying the chromaticity is a balance of colors.

I just want to point that out for completeness.

MR. GRAUBART: Counsel, we've been going a

little more than an hour. I don't need a break, but I mention it in case Dr. Bovik would need a break.

THE WITNESS: Do you have a break point coming? I don't have to break this second.

MR. ROBINSON: We can take a break now if you want. I'm flexible.

THE WITNESS: Sure.

(Recess taken: 10:15 a.m. - 10:23 a.m.)

MR. ROBINSON: Q. Dr. Bovik, would you refer back to Exhibit 1001, the '132 patent.

A. I've got it.

Q. The title of "Dynamic Range Correction Based on Image Content" --

A. M-hm.

Q. -- how would a POSITA understand that "dynamic range correction"?

A. He would understand it by reading the patent and thinking about it, reading the claims and specification.

Q. You've done all of those things; haven't you, Dr. Bovik?

A. Yeah, sure.

Q. Based on that review and your knowledge of a POSITA, what would a POSITA understand "dynamic range correction" to mean in that context?

A. Well, I mean, it's a range of some values which are being modified for the purpose of, you know, correcting them. He talks about a lot of things in here. He talks about contrast. He talks about brightness.

Keep in mind, I can give you a better answer if you point me to something, especially in the claims, which is what this is really all about.

Q. Let's start with column 4, lines 15 through 25.

A. Column 4, 15 through 25. (Reviewing document.) M-hm, question?

Q. To what does that dynamic range refer?

A. Well, it's fairly nonspecific. It does talk about, you know -- first of all, just so we understand the context of that, that paragraph begins with, "The various embodiments presented below," meaning that there is multiple contexts that is being referred to here. Okay?

It does refer to, as is shown in Figure 1 of the patent, that, you know, they're assuming this happens after demosaicing or color-interpolation process, as is mentioned above there also. I mean, he describes, you know, that it could be a single gain factor applied to the pixel to change, obviously, its

values.

But it could also be something else, such as changing, you know, chromaticity which would mean maybe more than one gain factor. It could be, you know, enhancing image details. It could be brightness, could be color, could be some combination. And as he talks about contrast later, it could be that.

If you look at the bottom of column 3, lines 59 through 64, which comes right before what you referenced me to, but gain adjustment or DRC, where DRC is dynamic range correction. Other types of corrections or adjustments, he's just giving examples, contrast enhancement, color manipulation, sharpness adjustment, okay, it falls under noise reduction, skin smoothing, you know.

So that's why I've been saying, you know --

Q. Are you saying --

A. I'm not finished. That's why I've been saying, even within the specification here, it's pretty broad, these terms.

Q. Are you saying all of those things you just listed are examples of dynamic range correction?

A. What I'm saying is the inventor of the patent is teaching that his types of corrections could be made based on these and adjusting these. That's what I'm

saying. He's the one writing it.

Q. I'm asking you about dynamic range correction.

Specifically in column 4, lines 15 through 25, to what does dynamic range refer?

A. He's kind of nonspecific. You see? He's -- he mentions chromaticity or other factors as well or pixel gain. I mean, he's -- I'm depending upon the inventor to explain that.

And, you know, keep in mind, we're just plucking these words out of the title. I mean, what is important here is what are the claims about. Are they even about dynamic range correction regardless of the title of the patent?

Q. Would a POSITA have been able to offer any explanation of what dynamic range means in the context of column 4, lines 15 through 25?

A. A POSITA -- I mean, I'm limited to this here in my answer; I accept that -- would understand that it could involve one or more pixel-dependent gain or attenuation factors or other factors such as changing chromaticity, okay, which could enhance perception of image details in this broad description that involves multiple embodiments. Okay?

So a POSITA can only be as specific to the context given is what's written is the context.

Q. Line 25, it refers to the extreme ends of a systems dynamic range. Would a POSITA have had an understanding of what that meant?

A. He would have to guess a little bit because it doesn't explain it. It doesn't say the systems dynamic range is this or that. So he may guess at things like, well, you know, the range of brightnesses or the range of luminances or the range of colors or the range of chromaticities that are allowed by that system. Okay? Et cetera.

Q. So a POSITA, in 2009, would have understood that dynamic range could have referred to any of those factors you just listed?

A. Could be, but we're talking about the systems dynamic range. The word "system" is modifying the term "dynamic range" here. I think that's a difference dynamic range than dynamic range correction.

So the implication being that it's not clear to me that we're -- this patent is intending to correct the systems dynamic range or anything like that, whatever, you know, what's specifically intended there.

Q. My question specifically related to the meaning of the systems dynamic range. In response, you listed things like range of brightness, range of luminance, range of colors or range of chromaticities

that are allowed by that system.

Would a POSITA have understood that the dynamic range of a system could include any of those?

MR. GRAUBART: Objection. Form.

THE WITNESS: Just for clarity, I said "et cetera." Okay. I don't know, at least I said "et cetera." You would have understood, well, it might be one of those that's being referred to. But because in the words prior to that, it's talking about gain of pixels, chromaticity, and image details, you wouldn't really know which one it is specifically.

As I said, I'll use the word guess. He would guess that it's one of these, you know, things or something related to it. I think the patent has failed to explain what is meant by it.

Q. I think so the answer is yes, a POSITA could have understood that the dynamic range of a system could have included any of those four things that you specifically listed?

A. My answer is my answer. I'm not agreeing to what you said. I needed to elaborate a bit and clarify it.

Q. Let's refer to column 5, lines 53 -- 52 to 53, where it says, "Figure 7 illustrates an example of the effects of dynamic range correction such as may be done

by using the gain lookup table 207."

A. M-hm.

Q. Does Figure 7 help you understand what is meant by dynamic range in the context of the '132 patent?

A. Figure 7 is an example involving intensity. So, you know, again, this is part of an embodiment, I presume, as part of the specification. It's teaching a POSITA to understand the claims, generally, how to practice them. I don't think he's defining dynamic range here. I think he's modifying intensities using a gain lookup table to do a kind of dynamic range correction. One of many possible.

Q. Would you please refer to column 9, 54 through column 10, line --

A. Column 9, 54.

Q. Through column 10, line 28. If you would briefly review those, let me know when you're done.

A. So 54 up to 28 here. Okay. (Reviewing document.) Okay.

Q. Does that portion of the '132 patent give any guidance to a POSITA what is meant by dynamic range?

A. It gives an example. As it says, it's an example. It's part of, you know, it's an embodiment as expressed through this figure. So here, histograms of

luminance or brightness are being manipulated.

Certainly, you can do a type of dynamic range correction in such a scenario. It's not limiting other types of dynamic range correction that might involve color chromaticity, contrast, or something else. It's teaching by example.

Q. What does it mean to maximize a dynamic range?

A. You want to point to where it's used, and I can give you a context? Otherwise you're getting --

Q. Let's start with the component parts of that phrase. What would a POSITA, based on their own experience and education, have understood maximizing a value to involve?

MR. GRAUBART: Objection. Form.

THE WITNESS: You know, I don't really see that being pointed to anywhere here. And you know, I don't see any context.

You know, if you're maximizing something, you're in the broadest sense -- again, we're outside this case -- you're trying to make a value as large as possible. It might be subject to some constraints and conditions or something else. So it's hard to say anything global, you know, that's globally true about that.

You need the context, Counselor.

MR. ROBINSON: Q. Are there different ways of adjusting dynamic range.

MR. GRAUBART: Objection. Form.

THE WITNESS: I would say regardless of how you are defining dynamic range and of what, I would say that there are different ways of adjusting a dynamic range of a quantity.

Again, this is outside the patent. It might be a dynamic range of some quantity unrelated to images, even. So even if it's images, there are different ways.

MR. ROBINSON: Q. In your previous answer, you said that dynamic range could involve contrast enhancement.

A. It could.

Q. Could a POSITA have understood there to be different ways of adjusting the dynamic range of contrast?

MR. GRAUBART: Objection. Form.

THE WITNESS: Yes, certainly.

MR. ROBINSON: Q. Can you give me an examples that a POSITA would have been aware of?

A. For example, if they took my class, I would teach them something called a full-scale contrast stretch. And that is a classic way, one amongst many, of adjusting a dynamic range of contrast. And

brightness too, or color, you know.

Q. To be clear, when I ask about a POSITA, I'm referring to a POSITA in 2009 that you defined in paragraph 7 of Exhibit 1003. Would your answer just now about your class have been the same as of that timeframe?

A. Oh, sure.

Q. Okay.

A. That's only an example. It's not meant to limit it. There are many ways of doing it.

Q. Are there other ways that a POSITA would have been aware of of adjusting the dynamic range of contrast?

A. Sure.

Q. Can you give me another example?

A. There's many. You can do -- you can choose to do a local operation, you know, adjust it on a local basis as opposed to a global basis, for example. The entire image, you can try to change the contrast of the whole image or you can try to change it locally, for example. That's only an example.

Q. Are there any other examples that a POSITA would have been aware of?

A. I think many. He would realize there are lots of ways. Not linear. I mean, there's a lot of ways.

Q. Would a POSITA have been aware of ways to adjust the dynamic range of color manipulation or adjust color?

A. He may not understand until he read this what, you know, if you want to point me to something. This is language from the specs somewhere. If you want to point me there, I can tell you what he would have understood about that.

Q. Let me rephrase that a little bit.

Your answer earlier related to column 4, lines 15 through 25, said that dynamic range could refer to the range of colors or range of chromaticities.

Start with more basic question.

Is there a difference between the range of colors and the range of chromaticities that might be allowed by a system?

A. This was column what again? I gave a series of answers. I didn't -- you asked me to read that, and not every answer I gave after that was necessarily referring to that, that segment that you at one point in time asked me to read.

To be clear, my follow-on answers I wasn't necessarily thinking about those columns, except immediately the preceding following answer.

Q. You're right. Let's be clear. Line 25 --

A. Of.

Q. -- refers to the extreme ends of a systems dynamic range, column 4, line 25.

The question was: Would a POSITA have had an understanding of what that meant?

Your answer was, "He would have to guess a little bit, because it doesn't explain it. It doesn't say the systems dynamic range is this or that. So he may guess at things like, well, you know, at the range of brightness or the range of luminance or the range of colors or the range of chromaticities that are allowed by that system. Okay? Et cetera."

In your answer to that question, about column 4, line 25, is the range of colors and the range of chromaticities allowed by a system two different things?

A. So my answer -- first, I, want to point out, we're talking about the systems dynamic range of what it allows. Okay. I'm not sure where it says "allows" in the spec. It does say "extreme ends."

I don't think the patent is teaching changing in that dynamic range. I'll be very definite about that. I think it's talking about changing the dynamic range of images in whatever sense of the word you want to use for that.

So when we're talking about the systems

dynamic range, we're talking about something else. I don't think the patent is teaching changing that.

So with that, you know, important prefatory remark, you asked me is changing the systems dynamic range of chromaticity versus the systems dynamic range of color, are they the same? Is that what you're question was?

I'm trying to reconstruct.

Q. Yes.

A. I mean, the system may not specify dynamic range of chromaticity. Or of color. Or it might.

So chromaticity and color are related, I will say. I already talked quite a bit about how chromaticity is ordinarily defined in a scientific sense, meaning it's a transformation from an RGB space to a chromatic space. But in the broadest sense, a POSITA would understand, well, he's talking about related concepts when he's talking about chromaticity and color.

I already also mentioned that I do want to point out, at least in the context of an embodiment, if not the whole specification, the inventor stated that chromaticity is color balance. And I didn't think if that's actually a definition. I want to point that out, column 8, line 9. Anyway, they're related.

Q. Would it be possible for a system to have a dynamic range of colors that differs from a dynamic range of chromaticities?

A. You know, I don't know what system you're talking about. Secondly, I didn't say that color and chromaticity were synonymous.

Q. Would it be possible for a system to have a dynamic range of colors that is separately identifiable than its dynamic of chromaticity?

MR. GRAUBART: Objection. Form.

THE WITNESS: Well, Counselor, I'm going to -- just because I want to be careful and I want to be as informative to the Court as possible, I don't really know what in the context of your question how "chromaticity" is being defined.

When I've talked about chromaticity, it's been outside the '132 patent. I don't want to give an incorrect sound bite about what chromaticity is or how it relates to a color dynamic range. So it's very difficult for me to answer that question in an informative way. It would require a speculative answer.

MR. ROBINSON: Q. Dr. Bovik, I'm asking you to clarify your words that you used in response to a question about column 4, line 25, of the '132 patent.

You would have to speculate to clarify the

words that you used in that answer? Is that what you're telling me?

A. Oh, no.

I merely pointed out that the dynamic range could be expressed in terms of a variety of factors. I was just giving some examples. I wasn't nailing them down to how they were defined in the context of the '132 patent. I think that's important.

We're talking about the '132 patent here. So if you're going to ask me about some system, you know, and its dynamic color range and its dynamic chromaticity range, I don't know what you're talking about. That's why I can't answer it.

Q. Dr. Bovik, column 4, lines 15 through 25 of the '132 patent use the term "chromaticity." I believe that's what we were referring to in that series of questions in which you gave that very specific response to column 4, line 25.

When you said "dynamic range of colors" and also referred to a dynamic range of chromaticities, were you saying that those two things were identical, or were you saying that those two things could be different?

A. The only thing I've said about -- first of all, it says, "such as changing chromaticity." It's not saying this is what, you know, changing dynamic range

is. Just "such as."

Secondly, the only thing I said about color chromaticity is that they're related. Okay. I've been very clear about that.

Thirdly, I pointed out a number of times that the inventor here uses -- I'll just say it this way -- the inventor seems to use "chromaticity" rather loosely, okay, in the spec. And I think that's important, because he talks about chromaticity in the context of chromatic spaces, he gives examples of chromatic spaces, he talks about chromaticity as color balance, which is kind of unusual to just call it that.

So I think he's using the term "chromaticity" to mean color-related. That's not the same as saying that chromaticity equal color. I'm struggling here like you to understand what he means by "chromaticity."

Q. I'm asking you what you meant by the words that you used. So, again, in response to the question, line 25, it refers to "extreme ends of a system's dynamic range." Would a POSITA have had an understanding of what that meant?

You answered you would have had to guess a little bit because it doesn't explain it. "It doesn't say the system's dynamic range is this or that, so he may guess at things like, well, you know, the range of

brightness or the range of luminance or the range of colors or the range of chromaticities that are allowed by that system."

A. Et cetera.

Q. "Okay. Et cetera."

I'm simply asking you in that list of four things that you listed as things that a POSITA might guess at in the context of dynamic range, would a POSITA have thought a dynamic range of colors was identical to the dynamic range of chromaticities, or could those be two different dynamic ranges?

A. So are we talking about a POSITA who's reading this patent, or a POSITA who has never seen this patent?

It matters.

Q. The question was in the context of line 25 of the patent. It is a POSITA reading the patent. I'm asking you about your words you offered in response to that question.

A. My point was that a POSITA would wonder what the heck is meant here. Okay? That was the nature of my answer. So a POSITA would wonder, well, is he talking about brightness, luminance, chromaticity, color. And you know, if he's a knowledgeable POSITA, meaning a real POSITA, he would not equate color and chromaticity, necessarily. He would understand that,

you know, you can have a chromatic space that involves, say, color differences, for example.

Color differences don't necessarily have the same dynamic range as colors. Okay? Unless you transform them to have the same dynamic range. So there's not enough information here.

Q. So a dynamic range of colors could be different than a dynamic range of chromaticities?

A. Yes, both in the context of outside the patent and within, because I don't know what chromaticity is in the patent except when he calls it color balance, which at other times he calls it pixel characteristics. And the problem here is that the patent is just not explanatory, so one is left wondering.

Q. Are there different ways of adjusting a dynamic range of colors that a POSITA would have been aware of?

MR. GRAUBART: Objection. Form.

THE WITNESS: A very large range of possibilities.

MR. ROBINSON: Q. Would a POSITA have been aware of different ways of adjusting dynamic range of chromaticities?

A. Absolutely. A wide range of possibilities.

Outside the '132 patent for both of those

answers.

Q. Would a POSITA have been aware of different ways of adjusting the dynamic range of brightness?

MR. GRAUBART: Objection. Form.

THE WITNESS: Again, we're talking outside the patent. I don't know if he's read this patent or thinking about anything specific. Given that, a POSITA would know different ways of changing within an image.

Let's backtrack that to all my answers. I'm not talking about a system dynamic range here. I don't see the point of that. The POSITA would know different ways of changing the dynamic range of brightness of images.

MR. ROBINSON: Q. So along that same vein, to be clear, when I ask about changing the dynamic range of image characteristic, I'm not suggesting that this is changing the system's dynamic range. But instead, asking about changing the dynamic range of a characteristic within the available dynamic range of a system. Is that consistent with the way you've been answering the question?

A. So I think that you're importing a lot into column 4 I don't see there. I don't see anything about, you know, the characteristic of dynamic ranges. I'm not sure what you're associating that with. I don't see its

relationship to a system's dynamic range.

Q. Let's break that down. I was literally just trying to summarize the same clarification you just offered.

Column 4, line 25, talks about the system's dynamic range. I believe you stated earlier that a system's dynamic range is the maximum range available within a system. Essentially the limits.

MR. GRAUBART: Objection. Form.

THE WITNESS: I don't think I said that.

MR. ROBINSON: Q. How would you describe a system's dynamic range?

A. I think I've said it a few times. He hasn't explained what he means.

Q. Would a POSITA have understood what he meant by "the extreme ends of a system's dynamic range"?

A. A POSITA, as I've said, because of everything it says before that, a POSITA would wonder. I've said that five or six times now. Maybe not that many.

A POSITA would wonder what's he is talking about. Is he talking about chromaticity, color, brightness, luminance, contrast, whatever. He doesn't explain it here. Okay.

Q. Would a POSITA --

A. We don't know what the system is. We don't

know if what sort of numerical attributes the system has. I mean, the '132 patent operates in a rather broad space.

And I'm still answering the question.

Let's look at column 1. I'll give a couple examples of other reasons why column 4 is not explanatory when it says "system's dynamic range." Okay? Column 4, line 22, it talks about a limited dynamic range of an image sensor.

Q. I think you might have misspoke. Column 4, line 22?

A. I'm sorry, column 1, line 22. Thank you.

Q. Okay.

A. It also talks about a dynamic range of the display device. Okay? So I don't know what part of the system is even being referred to in column 4. It's just not explanatory. It's not explanatory in terms of range of what nor of where. So I don't know.

Q. So setting aside for a moment the characteristic to which the dynamic range refers, would a POSITA have at least understood the dynamic range of a system referred to the difference or range of values for a particular characteristic between the minimum and maximum available for that system?

MR. GRAUBART: Objection. Form.

THE WITNESS: You know, I'm not going to import something it doesn't say. I don't know if they would think that or not. It's just a -- I would have to be speculating. Again, you know.

MR. ROBINSON: Q. A person of ordinary skill in the art, as of 2009, with a bachelor of science degree in computer science or similar technical field, three to five years of educational practicum or work experience in the field of computer vision and/or image processing, would have no idea what the term "dynamic range" means in the context of the '132 patent?

MR. GRAUBART: Objection. Form.

THE WITNESS: That's not at all what I said, and completely mischaracterizes all my prior testimony.

MR. ROBINSON: Q. How would the POSITA understand the term "dynamic range" in the context of the '132 patent?

MR. GRAUBART: Objection. Form.

THE WITNESS: Well, the POSITA would understand that the patent specification is guiding him with a teaching of various embodiments towards how, you know -- at least this is the intention of the specification -- to give examples of how dynamic range might be, you know, used and so on for correction.

You know, if you look at claim 2, for example,

okay -- first of all, claim 1 doesn't even talk about a dynamic range correction. Claim 2 does. It says where the correction comprises a dynamic range correction.

I don't think that the specification is trying to limit to a specific, you know, type of dynamic range of any specific kind of quantity. It's giving examples here. Okay? So could that dynamic range have a maximum and minimum that are clearly defined?

Are we talking about an image, first of all? I assume so. Will that image dynamic range, you know, is it what's allowed for, or is it the dynamic range of the image in its current state? All right. So I think we need to be more specific.

MR. ROBINSON: Q. Let's start with the dynamic range that's allowed for.

MR. GRAUBART: Object to form.

MR. ROBINSON: Q. If you have a system, be it -- let's start with the image sensor in column 1, lines roughly 22, 23. If that image sensor has a dynamic range that it allows for, what's that referring to?

A. Well, I mean, an image sensor when it captures pixels, it may only allow for, you know, a certain amount of pixels to be counted, so to speak, which later converts to a brightness.

But I don't see how this relates to the claims

or limitations. There's nothing about limitations of a sensor or how many photons it can pick up or anything like that. It's just saying, like in claim 2, wherein the correction comprises a dynamic range correction, there isn't anything about that.

Q. Let's go to a second example in column 1, line 23, where it talks about a limited dynamic range -- excuse me -- line 22 to 23 in column 1, where talks about a limited dynamic range of a display device.

MR. GRAUBART: Object to form.

MR. ROBINSON: Q. What would a POSITA understand that to be?

A. Broadly speaking, a display device is a given pixel and at any given setting might only be able to give out a certain amount of photons. It also talks here in more technical language, with regards to displays, that you know, and sensors that, you know, image sensors have contrast ratios of about 200 to 1. Okay? Meaning range of contrast as opposed to range of brightness or chromaticities or anything like that.

And again, you know, I don't see how this relates to the claims in any way. I don't think it does really.

Q. What is your understanding of the use of "i.e.," i, period, e, period?

A. I think it means "in effect."

Q. Does the sentence, "For example, current image sensors provide contrast ratios in the range of 200 to 1, i.e., a dynamic range of about 46 decibels," help a POSITA understand what is meant by dynamic range in the context of the '132 patent?

A. I think it only is, in a very limited example only of column 1, lines 19 to 26, where he happens to be talking about an image sensor. And he's just giving example.

Q. Would it help POSITA -- sorry, go ahead.

A. You know, I don't think it's teaching anything about how practice the claims, really.

Q. Do you think it would help inform a POSITA's understanding of the use of the term "dynamic range" in the claims?

MR. GRAUBART: Object to form.

THE WITNESS: I think a POSITA would know, understand, that image sensors that have different image sensor dynamic ranges would capture images that might have different image dynamic ranges.

So a sensor might be a poor sensor that has a very limited dynamic range in some characteristic, and maybe that's why he wants to, you know, might create images that have image dynamic ranges that are limited

in some sense of the word. And that might be a reason for wanting to do some kind of dynamic range correction in some sense of the word, which isn't really -- I mean, I think that a POSITA would understand that. I mean that in the broadest sense possible.

MR. ROBINSON: Q. Let's take a look at the last clause of that sentence, specifically the sentence that spans column 1, line 23 to column 1 to column 26.

The sentence concludes, "Whereas, the human visual cortex has a dynamic range approaching 80 decibels."

Does that help inform a POSITA's understanding of the use of dynamic range in the '132 patent?

MR. GRAUBART: Object to form.

THE WITNESS: I think it's just a statement of something that he drew from some literature.

Noting your earlier discomfort in my answers, I've given you significant leeway in the questions being asked of me and even my answering them. There's nothing in the recent line of questions that has anything to do with my report and the opinions I've given, and really, this proceeding is intended to be about what the opinions I've expressed and what's contained in my report.

I'm just going to point out that, going

forward, I'm going to be a little bit more insistent about you asking me about the opinions I've rendered rather than things outside of that, which is correct, I believe, for an IPR proceeding in a deposition.

Q. I'm sorry, Dr. Bovik, are you objecting to my line of questioning now?

A. I'm only making an observation, Counselor.

Q. Okay. You would agree, wouldn't you, you've offered a number of opinions on the '132 patent?

A. Certainly.

Q. And a number of opinions on the meaning of various terms within the '132 patent?

MR. GRAUBART: Object to form.

THE WITNESS: If you show me a term that I've talked about, I'm happy to talk about it in the context of my report.

MR. ROBINSON: Q. In your comparison of the claims of the '132 patent in the prior art, did you at least consider what those terms in the '132 patent claims meant to a POSITA?

A. Of course.

Q. Even if you didn't issue an explicit opinion on the meaning of the term?

A. I certainly did, but nevertheless, you know, your questioning here is really limited to the opinions

I've expressed in the document.

Q. Dr. Bovik, are you telling me that in saying that something in the prior art falls within the scope of a claim or the terms of a claim that I'm not entitled to ask you about the meaning of the terms if you didn't offer explicit instructions?

MR. GRAUBART: Object to form.

THE WITNESS: I didn't say anything like that.

MR. ROBINSON: Q. Okay. Would a POSITA understand the meaning of the term "intensity" in the context of digital image?

MR. GRAUBART: Object to form.

THE WITNESS: I answered that one already. You asked me that a long time ago. Same answer.

MR. ROBINSON: Q. Would a POSITA have understood the term "contrast" in the digital image?

MR. GRAUBART: Object to form.

THE WITNESS: Oh, we're talking outside the patents, just if they never approached this patent and were just sitting there thinking about contrast?

MR. ROBINSON: Q. Yes, just based on their education and years of experience.

A. Contrast, if the contrast -- contrast is defined in a number of ways. For example, there's the Michelson contrast. If you have an image or a piece of

an image, it's the difference of the largest value and the smallest value of typically luminance or brightness in that patch divided by the sum of the two.

Or it might be you may measure the average value of brightness in that patch and compute the squared error of all the pixels within the patch, and average that squared error over that patch. That's called the RMS contrast.

Those are two solidly defined contrast definitions he might any think of just sitting here.

Q. Any other examples?

A. You know, that's -- those are good scientific answers. If he was thinking scientifically, he would probably think of one of those two first. But, again, that's outside the '132 patent.

Q. How would your answer to that question differ in the context of the '132 patent?

A. I mean, a POSITA would still carry that with them. A POSITA would understand that, you know, the '132 inventor is using their own terminology. So a POSITA would -- I think I'm going to ask you to point me to a use of the word "contrast." Maybe, I don't know, we've almost completely avoided the claims in the prior art in our discussion so far, which is what this proceeding is really supposed to be about.

But, you know, I mean, in claim 8, okay, a POSITA would read, you know, practice, you know, the method in claim 7, which depends upon claim 1 and all that's in there, "We're determining the amount of gain to apply to the first portion of the digital image data comprises, determining the amount of gain to apply to the first portion of the digital image data so as to maintain local contrast of the first portion of the digital image data."

So, here, a POSITA would read, "Oh, a local contrast." So he would understand that's some measurement of contrast in a local region. He would probably think about contrast that is at least similar to the kinds of contrast that I scientifically define without actually writing equations.

He would go to the specification and say, "Well, what do I mean? What does he mean," you know, by this "maintaining contrast." He might turn to column 9, okay. Column 9, lines 33 through 35, it says, "The local contrast may be controlled by selectively using various sections in a cascade."

I mean, I -- when I try to understand "maintain," you know, what did claim 8 mean by "to maintain local contrast," I searched the entire specification because it didn't explain it. And I think

that the only reference to "local contrast" is here in column 9, where -- where the maintaining is controlling it.

That controlling could be to make the contrast, you know, more visible, you know, maintaining a contrast might be making it more visible or more amenable or more -- down in the same column 9, lines -- line 40, you know, it could be based on spatial measurements taken together with the user preference for the amount of local contrast that I also think is maintaining local contrast.

I think in all those, the contrast would comport, if not in the equation form, because the specification doesn't state the equation for contrast, it would at least comport with the spirit of the amount of variation of the values locally relative to perhaps the average value.

Q. Did you consider the explanation at column 3, lines 28 to 32?

A. I did, yes. I think that, you know, again, referencing, just so we have some sort of handle, claim 8 where we're talking about maintaining the local contrast, you know, here it describes making object edge detail more visible to improve local contrast.

I think this is another example of controlling

or maintaining the local contrast. And you know, if you have an image and you apply some process that improves the contrast using the science definitions I've given, typically, it may make edge detail more visible. And it also may have negative effects. They make noise more visible, for example.

Q. Would a POSITA have an understanding of the term "wrinkle-reducing parameters"?

MR. GRAUBART: Object to form.

THE WITNESS: Wrinkle-reducing parameters?

First of all, can you point that to me in the '132 patent?

MR. ROBINSON: Q. At this point, I'm just asking if a POSITA based on their years of education and experience in this art would have an understanding of this term.

MR. GRAUBART: Object to form.

THE WITNESS: So I think earlier I answered the question. I forget what the question was. I mentioned in my answer often there are algorithms which attempt to reduce or remove noise. Sometimes they're called noise removal algorithms, but it's impossible to actually remove, but they're still called that. And we still say it's noise removal, even if it's just reducing it.

I would say that reducing wrinkles would be an attempt to make the wrinkles less evident, which would include trying to eliminate them entirely in an image. Or in other words, to remove them. I think that remove and reduce here could be -- I would say reduce would at least include remove in that regard.

Q. Would a POSITA, given that term alone, understand how to apply wrinkle-reducing parameters to a digital image?

A. Do what?

Q. Would a POSITA, in 2009, have understood just how to apply wrinkle-reducing parameters to an image, would have understood how to do that?

A. They would probably have some ideas in mind of how to do that. I think more specifically, if they're given an invention for reducing wrinkle parameters, they would understand how to read, you know, the teachings about wrinkle-reducing. Wouldn't be beyond a POSITA to understand how somebody's invention for wrinkle reduction or removal would work.

Q. So let's go back to chromaticity for just one moment. Would a POSITA, in 2009, based solely on their education and experience, have understood the term "chromaticity distribution"?

MR. GRAUBART: Object to form.

THE WITNESS: I mean, broadly speaking, they would need a context. But broadly, just to understand, you know, exactly how distribution is being used, but, you know, typically distribution is often used to refer to if it's in an image. And we're talking about image here.

It's referring to, you know, an empirical, you know, I'll just use the word empirical probability distribution of whatever color feature is being measured here. Okay? Could be the colors themselves, the R, G and B, or some color-derived features. In other words, that kind of distribution is, you know, usually called a histogram. But it's also called a distribution.

Q. If a POSITA, in 2009, were told to analyze a chromaticity distribution, would a POSITA know what to do?

MR. GRAUBART: Object to form.

THE WITNESS: If they knew what the purpose of the analysis was for, then they likely would have understood that there's a suite of approaches they could deploy. I'm being speculative here again because I don't know what the context is that we're talking about necessarily.

But in a normal situation where they had a context, I would think they would understand that

there's some general approaches or broad set of methods to deploy to analyze.

MR. ROBINSON: Q. So column 3, lines 31 to -- 30 to 32, talk about "making object edge detail more visible, i.e., to include local contrast."

A. M-hm. I see that.

Q. Would blurring decrease local contrast?

A. Blurring can affect local contrast, and it can reduce local contrast. It doesn't necessarily.

Q. Can you give me an example of a blurring function that would not decrease local contrast?

A. Well, first of all, there's a lot of blurring functions. Let's just go down here and look at line 39 where he mentions something called a two-dimensional low-pass filter. That's an example of a blurring, a way of blurring. Okay. Not the only way, but it's a way of blurring.

So suppose I supply that filter with an image that's constant. That constant image has zero contrast using all the definitions I gave you. In other words, every value in the image is constant. Let's say it's a luminance or a grayscale image.

Low-pass filtering has no effect on that image nor on its contrast. That's an extreme example. There may be part of the image that is so smooth, that the

low-pass filtering either, you know, effectively has no effect on the contrast.

Q. What do you mean by "smooth" when you describe part of an image?

A. Smooth in terms of images is pretty much -- this is just an intuitive sense. I mean, if an image is smooth in a region, it's not changing very fast. It may be intrinsically that way. Like a picture of the sky without clouds is very smooth. Or it may be that you apply a, you know, an appropriately designed smoothing filter by selecting the appropriate parameters of that filter to smooth, smooth the image.

Q. Is it correct then to say that "smooth" indicates relatively little contrast, at least with respect to some reference that has more contrast?

A. Can be. I mean, you need a context here. I wouldn't limit it to that.

Q. Your answer a moment ago said there may be part of the image that's so smooth, the low-pass filtering either effectively has no effect on the contrast.

I think that suggests a link between smooth and contrast. I'm just trying to understand that link.

A. It's just meant as an example. I gave an example of a constant image. I haven't, you know --

actually, I forget what the question is. My apologies.

Q. Is there an inverse relationship between smooth and contrast, meaning smoothness increases as contrast decreases?

MR. GRAUBART: Object to form.

THE WITNESS: No. The definition of contrast is not meant to be specifically a measure of smooth. It's meant to be a measure of contrast.

I'm trying to be explanatory. I didn't mean to mislead by saying, you know, smoothing is specifically for contrast reduction. You can reduce the contrast of a picture without doing any smoothing. There's nothing synonymous here.

MR. ROBINSON: Q. Does smoothing necessarily reduce the contrast?

A. I already said no. I think I said no. I said something like no. You asked me if blurring reduces the contrast. I think of, you know...

Q. All right. Just to make sure we're clear, are you using smoothing as synonymous with blurring?

A. Smoothing can be blurring.

Q. Is smoothing necessarily blurring?

A. No. We haven't defined smoothing. I think an author could define smoothing how they want and what they're smoothing. No, I don't think it necessarily

means that. I can think of examples where you're smoothing something, but you're not necessarily blurring.

Q. Can you give me one of those examples, please?

A. Yeah. I mean, in classical image video compression standards, there's something called an in-loop filter. What it's meant to do is to remove blocking artifacts. Okay?

But it's meant to do that without changing the content of the video. So the video looks the same, but the blocking artifacts are removed. A deblocking algorithm is an example of, you know -- I forget the question again here. I'm getting a little tide up with smoothing and blurring. I'll finish my example.

MR. ROBINSON: Q. An example of where you're smoothing but not necessarily blurring.

A. That's what I thought. Okay.

So in that case, you're removing the blocks, but you're not blurring the image. That's an example. So I think removing blocks from an image could be viewed as smoothing. That's just one interpretation. I'm not trying to define smoothing here. I think you need a context to define smoothing.

Q. Would a POSITA have understood smoothing to include that block removal example you just gave?

A. Oh, sure, a very famous example of an in-loop filter.

Q. M-hm. Can you give me an example in the context of editing a still digital image of something that involves smoothing but would not necessarily involve blurring?

A. Deblocking a still image, just to stay on the same vein.

Q. What is deblocking in the context of a still image?

A. Still images get compressed too, particularly by an algorithm called jpeg. If you compress too much, you get blocking artifacts. You can apply a deblocking algorithm to try to remove those blocking artifacts.

Q. What is a blocking artifact in that context?

A. The image looks blocky.

Just to give you some context, in jpeg, you break the image in little pieces, which are typically 8x8 size, and then you transform them to another domain. And that other domain, which is called a discrete-cosine-transform domain, you actually eradicate information. You quantify it. And then you transform back. And there may be some other steps, but not so relevant.

Because of that loss of information, those

little blocks you may notice they are indeed separate little blocks with little sort of visible boundaries that appear between them.

Q. So...

A. And that's a very unpleasant experience deblocking.

Q. This is probably a stupid question. I know it's not my first of the day.

Does blocking artifacts refer to something that might be more colloquially referred to as pixelated edges?

A. Oh, they're broadly related. I would say pixelation is a kind of different, you know, blocking that occurs than what occurs in jpeg.

Q. Would a POSITA have been aware of any ways of blurring that did not involve smoothing?

MR. GRAUBART: Object to form.

THE WITNESS: You know, again, if an image is already smoothed, for example, if you blur it, you're not smoothing it. It's already smooth. Say a constant image, picture of the sky and I blur it, maybe nothing happens or at least nothing visual happens.

MR. ROBINSON: Q. Does the effect of a blurring function depend on the input image?

MR. GRAUBART: Object to form.

THE WITNESS: I'm sorry, one more time?

MR. ROBINSON: Q. Just to tie back to your last answer, you said, "If an image is already smoothed, for example, if you blur it, you're not smoothing it. It's already smooth. Say a constant image, a picture of the sky and I blur it, maybe nothing happens or at least nothing visual happens."

I just want to understand that. I think that means that the effect of a blurring function on an image depends on the image that you start with.

A. Depends on what we mean by "blur" here, too, Counselor. We haven't really said what we mean by "blur." I've kind of gone along with this.

I think that, you know, a blur can be linear or nonlinear. It can be arise from many different things. It may or may not be processing. It may be part of a photographic process. You know, it's -- it may be something undesirable. It maybe something desirable.

You know, so, we're kind of in the land here of nonspecifics.

Q. Would a POSITA have understood the term "blurring" in the context of digital image processing?

MR. GRAUBART: Object to form.

THE WITNESS: Everything, all the examples I

just gave are in the context of digital image processing. That's why I'm putting out this very -- we need to get a little bit more specific.

MR. ROBINSON: Q. Maybe we can start with an answer to my nonspecific question.

Would a POSITA have understood the term "blurring" in the context of digital image processing?

MR. GRAUBART: Object to form.

THE WITNESS: A POSITA would have understood that that could mean a lot of things. It could have been, you know, an intentional blur, an unintentional blur. It could have arisen from a defocusing of a camera. It could have arisen from an algorithm. It could have arisen from a lot of different things.

He would have a broad notion of many possibilities. Again, I'm not assigning this within the context of anything either in the '132 patent nor in any of the prior art references that I've brought forth in the context of the '132 patent. It's outside all of those prior references as well as the '132.

MR. ROBINSON: Q. Would a POSITA have understood the term "blurring" in the context of an intentional function performed on a digital image?

MR. GRAUBART: Object to form.

THE WITNESS: Well, I mean, maybe you want to

point to me where it's used. Okay? I mean, because there are so many ways of applying intentional blur that have different purposes. I really do need some context.

MR. ROBINSON: Q. Okay. The POSITA you've defined would also need that context.

A. Oh, yeah.

Q. To understand the meaning of blurred in the context of an intentional function performed on a digital image.

A. He would understand that there's a variety of ways of blurring and a variety of different purposes for blurring. That would modify the nature of the blur. If it was intentional, okay. It may not have anything to do with producing images that are meant to be viewed.

Q. I want to tie back to some of the questions I asked earlier about an image correction.

A. M-hm.

Q. I think it's fair to say that a POSITA would have understood that an image correction involves some change to an image?

I'm not limiting that to a particular purpose. I'm just saying it involves some change to an image.

MR. GRAUBART: Object to form.

THE WITNESS: If you have an entire image and you're correcting it in some manner, I don't have a

problem with some changes being applied to the image.

MR. ROBINSON: Q. In the context --

A. I mean.

Q. Sorry. Go ahead.

A. Let me just say a correction algorithm, when applied, might turn out nothing changes. I just want to make sure. Just because I don't know if the person knows what image is coming or not, for example, or whether it needs to be corrected.

Q. So the output -- make sure I'm using the same words. The output of a correction algorithm depends on the image that's coming in or the input image?

A. I think generally if you have say an algorithm, the output of the algorithm depends upon the input, if that's what you're asking. Generally speaking, yeah.

Q. Okay. Is it a fair inference from that that a correction algorithm -- that a POSITA would have understood that a correction algorithm in this image processing context that we're talking about specifies some change relative to the input image?

MR. GRAUBART: Object to form.

THE WITNESS: No. I mean, your algorithm may not know anything about the input image until he receives it. I don't really know where that's going.

MR. ROBINSON: Q. Well, the -- excuse me.

The correction algorithm can't do anything to an input image until it receives the input image; right?

A. I think we can agree to that.

Q. At that point, to the extent that an algorithm depends on the input image, it knows what it needs to act on the input image; is that right?

A. I don't agree that the algorithm depends upon the input image.

Q. Let me repeat the question.

Once the input image is received, to the extent that an algorithm depends on that input image, the algorithm should know what it needs to act on that image?

A. I don't know what you mean by the algorithm depending upon the image, whether it's to an extent or otherwise. When an algorithm is operating on an image, the output depends upon the image.

You know, it could be that the algorithm -- I mean, there exist algorithms that self-modify, depending upon the image or the algorithm that maybe adapt in some way. I don't see anything like that in your question. It's not generally a truth.

Q. All right. I'm not trying to be clever here. I'm just going to ask you one simple clarification on a

statement you made in your last answer.

"When an algorithm is operating on an image, it's the output that depends on the image." When you refer to "the image" in that sentence, are you saying that when an algorithm is operating on an image, it's the output that depends upon the input image that it's operating on?

MR. GRAUBART: Object to form.

THE WITNESS: Again, this has nothing to do with the patents, prior art, reports. I think it's fine to say that if I have an image and I applied an algorithm to it, then the output depends upon the input. And depends on the algorithm, too. I mean, otherwise you got to point me to specific stuff in these documents.

MR. ROBINSON: Q. Would anything about that last answer change if I asked you specifically about the perspective of a POSITA in 2009?

A. I think a POSITA would understand if you have an algorithm that's meant to operate on images, then the output would depend on the algorithm and on the image in some sense of "depend." We haven't even said what "depend" means.

I mean, that's how speculative and hypothetical these questions are. It's hard for me to

give you anything. I want to be specific. I want to help.

Q. Would a POSITA have understood the meaning of the word "depend" in the context of this?

MR. GRAUBART: Object to form.

THE WITNESS: I don't see "depend" anywhere in here. Point me to "depend," and I'll tell you whether a POSITA would understand "depend."

MR. ROBINSON: Q. Do you mean to suggest that a POSITA would need to see it in print to understand the meaning of "depend" in the context that we've been discussing, an algorithm depending on an input --

A. Yes. "Depend" could mean many things.

Q. What could "depend" mean in this context of an algorithm's output depending on its input?

A. A lot. It could mean, for example, the algorithm is adaptive to the input, okay, in some way. So it would change the nature of the dependency, okay. I could conceive an algorithm that does nothing. Okay?

Well, then the output very much depends on the algorithm but not the input, okay, because -- let's suppose an algorithm just outputs zeros, all right, then you know, the output depends only on the algorithm. Doesn't matter what you feed it. Okay.

I don't know what "depend" means here. You

got to explain, Counselor. Otherwise, I'm just throwing hypothetical meaningless answers out there, which don't tie in any way to this case

Q. Can you give me an example of any algorithm in this art that a POSITA would have used or been aware of that just output zeros and input with a digital image?

A. No, but I'm trying to show how your questions are ill-posed. That's why I give an answer. It's not meant to be difficult. It's meant to say that you're just pulling this word out of the air that's out of the air and you're not pointing to me its use, either in my own report, which is what this proceeding is about, nor is it in the patent, which this proceeding is about, nor is it in the petitions or the prior art that I presented, which we haven't even talked about, really, at least not in any direct way. I think we've talked about material in some of the prior art without actually stating it to be so.

Q. Would you agree the word "depend" is a well-understood and commonly used term in the English language?

MR. GRAUBART: Object to form.

THE WITNESS: I think "depend" is used a lot in the English language, and it has different contexts, you know. Something might depend weakly or strongly.

You know. We're not just talking about the English language here; we're talking about very specific technology. We're failing to get into the specifics.

MR. GRAUBART: Counsel, we've been going about an hour and a half since our last break. We're getting close to noon. I'll put it to Dr. Bovik.

THE WITNESS: Let's take a break, and I mean, I'm here all day. Let's take a break and think about lunch maybe around 1:00-ish, if Counselor is okay with that.

MR. ROBINSON: Eat lunch at 1:00 or take a lunch break now and come back at 1:00?

THE WITNESS: Eat lunch around 1:00, unless you're like ravenous now or something.

MR. ROBINSON: No, I'm good.

MR. GRAUBART: That works.

MR. ROBINSON: Take 10, come back at noon.

MR. GRAUBART: That's fine with me.

(Recess taken: 11:49 a.m. - 12:00 p.m.)

MR. ROBINSON: Q. Dr. Bovik, during the break we just concluded, did you discuss with Petitioner's counsel your testimony today?

A. I did not discuss anything substantive about this case.

Q. Did you discuss any nonsubstantive aspects of

your testimony?

A. Well, I wondered about whether or not I will continue to consider, you know, questions that are outside the case. And that's all.

Q. Were you given any instructions in that regard?

A. I absolutely was not.

Q. During the previous break, did you have any discussions with counsel for petitioner about your testimony today?

A. I did not.

MR. ROBINSON: Let me hand you what's been marked as Exhibit 1004.

(Exhibit No. 1004 was marked for identification.)

MR. ROBINSON: Q. Do you recognize this, Dr. Bovik?

A. Yeah. This is one of the prior references.

Q. This is the Needham reference; correct?

A. That's correct.

Q. In the context of this Needham reference, how would a POSITA have understood the term "intensity dynamic range"?

A. (Reviewing document.) For example, in paragraph 3, talks about, "Rescaling may work well when

the cause for poor digital photo quality, e.g., small intensity dynamic range, is responsible for the overall degradation of the entire digital photo."

So referring to a dynamic range of intensity. I think long ago I said dynamic range could be interpreted range of values it might take.

Q. Would a POSITA understand the intensity dynamic range then to be range of values that intensity might take.

A. What was the first part of the question?

Q. Would a POSITA understand the intensity dynamic range to be a range of values that intensity might take?

A. Or at least related to it, I would say that would be fine.

Q. All right. Are you able to answer this question with a yes or no: Would a POSITA understand the intensity dynamic range as used in the Needham reference to be a range of values that intensity might take?

A. A POSITA might have that understanding.

Q. Are you able to say definitively what understanding a POSITA would have of that term in the context of the Needham reference?

A. (Reviewing document.) You see, I'll tell you

what, I'll just say yes to that.

Q. All right. Would you please say definitively how a POSITA would understand the term "intensity dynamic range" in the context of the Needham reference?

A. Well, I -- I think it's pretty much what I said earlier when you asked me about what dynamic range means. It's a range of values that intensity would take -- or does take. I mean, if it's an image that has an intensity dynamic range, then I would say it's the range of values the intensity is taking in that image.

Q. You mean the range from the lowest intensity in the image to the highest intensity in the image?

A. That would be one way of measuring it. I don't object to that as something we might use as an example.

Q. Is there another way of measuring or defining the intensity dynamic range of an image?

A. That would be the most common.

Q. Are there any other ways that a POSITA would have known of in 2009?

A. Well -- (Reviewing document.)

Again, I'm not trying to be in any way elusive here, I'm just recognizing that you're not pointing to any use of the term "intensity dynamic range" in Needham. It's mentioned many times, okay. And I'm just

pointing out, you know, why don't you point me to a use of it in Needham. It appears in multiple places.

That way, I can opine upon how that POSITA would understand the use of the term "intensity dynamic range" in Needham, rather than giving a blanket statement that Needham might modify someplace or might be in some subtle way even contradictory to that understanding that I gave.

I mean, specifics matter here. They really do.

Q. Approximately how many hours have you spent studying the Needham reference?

A. I didn't measure how many hours I spent that. I can tell you the term "intensity dynamic range" appears multiple times throughout it. I mean, for example, it appears in paragraph 28. It appears in paragraph 32 where it says, you know, "As another example to enhance the contrast 740 of an image feature, an intensity dynamic range may be specified as an operational parameter so that the contrast in the detected image feature will be scaled to the specified dynamic range."

So this is a dynamic range. It's a target for that image, which some algorithm may produce. I just think it's appropriate when answering questions about a

reference and a term that's in that reference that you direct me to where it's used. I'm happy to be as specific as you want there.

Q. I'm going to object to everything after the first sentence of that answer as nonresponsive.

Would you say that you've thoroughly reviewed the Needham reference?

A. Yes.

Q. Are there any uses of "intensity dynamic range" that you can point me to as being inconsistent with other uses of "intensity dynamic range" within this patent application.

A. I don't think there's the word "inconsistent." I can't think of any, nor am I finding any right now where the term is used inconsistently relative to another. I've already said I think the dynamic range is the range of values it can take -- or it does take. I should say does take. I'm not sure what more you're looking for. I did point out the dynamic range might change for an image.

Q. Paragraph 22 of Needham refers to weights that may be assigned to different image features to specify the relative importance, refers to correction operations.

A. Yes.

Q. And it refers to correction parameters.

How do those three terms differ in the way that Needham uses that?

A. I'm sorry, so paragraph 22, weights and what else?

Q. Weight, correction operation, and correction parameter. How would a POSITA understand those three terms?

A. (Reviewing document.) Let's set aside the correction operation first. Okay? A correction operation is an algorithm which corrects an image according to some specified criteria. All right.

The correction parameters, as I explain in paragraph 52 of my report. The correction unit 270 can apply different amounts of a correction to different image features. Weights can be assigned to different image features, such as a face, such as a building, such as a, whatever, a car, to specify their relative importance and to use to control the amount of the correction parameter when applying the correction operation to the image feature. This is explained in paragraphs 22, 27, 35 of Needham.

So, really, the weights control how much of the correction occurs, meaning control correction parameter.

Q. How does the correction parameter influence the correction operation?

A. Well, for example, on a human face, it may correct in one way. In a background, it may correct in another.

Q. How does that relate to the correction parameter?

A. You would modify the correction parameter, for example, to be different values or to operate differently in different parts of the image, according to the weights. It says here, "Weights may be assigned to different image features to specify their relative importance." This is from paragraph 22. "Such weights may be used to control the correction parameters during the correction." Okay?

It explains very clearly here. "For instance, the correction operation of maximizing the intensity dynamic range is applied to both human faces and buildings and a human face feature has a higher weight than a building feature, the intensity dynamic range used for correcting human faces in an image may be larger." Okay?

So it may be that a correction parameter relates to how large the intensity dynamic range is in some region of the picture, or it might be something

that controls contrast.

Q. If the correction parameter relates to how large the intensity dynamic range is, what would the correction operation be?

A. Well, I mean, in paragraph 22, it says the correction operation of maximizing intensity dynamic range. Naturally, that would be, you know, within a context of, you know, where in the image, how much that -- what that maximum intensity dynamic range is allowed to be might be different in different places, according to the correction parameter.

So for a face, you might be allowed a larger dynamic range to maximize intensity. In a different part of the image, you might have a smaller allowable intensity dynamic range that you can maximize the image to meet.

Q. So paragraph 22 also says, "Weights may be assigned to different image features to specify the relative importance." Isn't it the weight rather than the correction parameter that is imparting or causing that difference between different areas of the image?

A. They're both part of it.

Q. So what would the correction parameter be then in this example?

A. It doesn't say exactly, but it could be, for

example, you know, the allowable dynamic range that you can maximize the image in that region to fill.

Q. But Needham doesn't say that?

A. That's what occurs to me. He does say -- he does say it. He says, "The intensity dynamic range used for correcting human faces in an image may be larger than that used for correcting buildings in the image." So he says exactly that, really.

Q. Where does he say that is the correction parameter?

A. Well, I mean in the immediately preceding sentence, he says, "For instance, if the correction operation of maximizing intensity dynamic range is applied to both faces and buildings, and human face feature has a high weight" -- actually the same sentence; there's a comma separator -- "has a higher weight than the building feature, the intensity dynamic range used for correcting," and everything else I read.

Clearly, it's the correction operation could be and likely is modifying the allowable dynamic range, according to the region as expressed by the weight given on that region. That's my reading.

Q. But what's the correction parameter and how does it relate to that correction operation and weights?

MR. GRAUBART: Object to form.

THE WITNESS: The correction parameter would be the size of the intensity dynamic range for a region, in the way I've been explaining.

MR. ROBINSON: Q. Where does Needham say that?

A. Doesn't have to say those exact words. It's obvious here. The correction operation of maximizing the intensity dynamic range, if it wasn't controlling the size of that allowable dynamic range, then this invention wouldn't be doing anything different, but it is doing something different.

It is modifying that intensity dynamic range locally based on the weights. And that modification of the intensity dynamic range is, you know, the correction parameter.

Q. Different than what?

A. I don't understand your question.

Q. You testified that, "If it wasn't controlling the size of that allowable range, then this invention wouldn't be doing anything different, but it is doing something different."

Different than what?

A. Oh, than just maximizing the dynamic range everywhere equally, the same maximum dynamic range. Clearly, the dynamic range is changing on a local basis.

The weights tell the algorithm to change it. The correction parameter is how large that dynamic range is. That's the best reading of this.

Q. What else could that correction parameter be?

A. Well, it would be -- I don't see any other immediate interpretation from this one example here of correction.

Q. In this example, at paragraph 22, Needham is applying the correction operation of maximizing intensity dynamic range to the face and the building. It's your understanding or your opinion that a POSITA's understanding is that the correction parameter changes based on whether it's being applied to a face or whether it's being applied to a building?

A. Well, it says "for instance," okay. Could be that, you know, the correction parameter has one value on the face and has another value on the building. There's other things in the picture. Right?

For instance, and, you know, keep in mind that in paragraph 21 preceding this, it's talking about one or more correction operations. And I bring that up because it's talking about correcting it according to size of the face. So you might have a different criteria for adjusting the dynamic range of a face of a certain size. It goes to the correction parameter's the

same that are changing the target intensity dynamic range that you want to maximize to.

Q. Does that mean the correction parameters correspond to different correction operations?

A. Well, I don't think you necessarily apply -- you know, let's look at paragraph 20 right above. It really answers that question. "Further, when one or more correction operations are applied to individual image features" -- image features are things like faces and buildings in Needham. Okay? Features are objects in Needham -- "different types of correction operations may be applied to different image features." Okay? So there is different correction operations, part of your question.

"For example, maximizing the intensity dynamic range" -- in effect, he says enhancing the contrast, well, it may have that effect -- "may be performed on a human face image feature" -- that would imply some sort of correction parameter we've already been talking about -- "and a different correction operation that increases the brightness may be applied to the image feature that represents the sky." Sky being another object. So you have perhaps a different correction parameter there.

So if you're asking can different correction

operations have different correction parameters -- I think your question was along those lines -- then yes.

Q. Paragraph 20 gives an example of different corrections being applied to different features; correct?

A. Yes, sure.

Q. Paragraph 21 says that different correction operations can be performed on different occurrences of the same type of feature. Correct?

A. I mean, what it says is, "The one or more correction operations performed on different occurrences of the same image feature types, e.g., different human faces, may also differ and may be controlled by one or more operational parameters."

Q. So those different correction operations in paragraph 21 would together change the dynamic range of different instances of a human face?

A. No, they don't have to. Just says, for example. Could be some other kind of correction operation. Brightness changing.

Q. In the example of paragraph 21, different correction operations applied to the different human faces in an image could result in a larger dynamic range of the larger face.

A. I think -- is there a question there?

Q. Would a POSITA understand paragraph 21 to say that different correction operations applied to different human faces in an image could result in a larger dynamic range of a larger face?

A. I think the example is just one of the correction operations. Okay? It says one or more, and then when it says "for example," that's just one of the correction operations. Another correction operation could be just doing something else. Maybe affecting color of skin. It may be affecting, you know, the degree of blur of a background. It may be doing any number of other things of the other correction operations if there are other correction operations.

Q. Is the last sentence of paragraph 21 referring to the intensity dynamic range, or is it speaking more broadly than that in its mention of dynamic range?

A. Well, I mean, there's two sentences there, for example, the intensity dynamic range used for correcting a particular face may be determined, blah, blah, blah. And then I think in the second sentence, it's carrying on from that.

So the large of the face, same example, the large of the dynamic range that may be used. Okay? Meaning this is referring to the correction parameter. I'm talking about if you have a bigger face, it may

allow a bigger dynamic range for that bigger face. But this is all just, you know, one example, "for example," this one example.

Q. In your previous testimony, you stated that POSITA could understand dynamic range to refer to a variety of characteristics of an image.

Would a POSITA understand the last sentence of paragraph 21 and its reference of dynamic range to be talking about intensity dynamic range or dynamic range more generally?

A. In the last sentence, I think it's connected to the one previous. I think just in this one example, this one instructive example that is not all encompassing, I think he means intensity dynamic range. Comes right after the previous sentence talking about the same thing. Doesn't mean that's the only thing that Needham is teaching.

Q. Is it your opinion that a POSITA would understand the last sentence to exclude other types of dynamic range?

MR. GRAUBART: Object to form.

THE WITNESS: I don't think it excludes other forms of dynamic range from the general teachings of Needham. I just think we have two sentences in a row. He talked about intensity dynamic range once.

I think for that particular example, I think he's -- he intended -- he didn't say it, but I think he intended that dynamic range in this single context is intensity dynamic range in the second sentence as well as in the first sentence.

MR. ROBINSON: Q. On the first sentence refers to different -- refers to one or more correction operations and also refers to being controlled by one or more operational parameters. Is the relationship between the size of face and the size of dynamic range controlled here by the correction parameters?

A. So you mischaracterized what I said. When I mentioned first sentence, I meant the sentence beginning, "For example," comma.

Q. I wasn't characterizing your testimony at all. I was referring to the first sentence of paragraph 21.

A. Okay. In any case, just so there's no confusion, when I said "first sentence," I meant, "for example, comma," and the rest of that. Everything I said relative was in reference to that first sentence and second sentence.

So now, I better get the question again about the first sentence of the whole paragraph.

Q. The first sentence of the paragraph 21 refers to one or more correction operations, and also refers to

the correction operations being controlled by one or more operational parameters.

Is the relationship described in paragraph 21 between head size -- sorry -- face size and intensity dynamic range controlled by one of the correction parameters?

A. Well, I think it gives an example. The first sentence is more general. It devolves to an example, "For example." I think that the, you know, the size of the dynamic range, I think it's teaching that one of the operational parameters, meaning correction parameters, would be the size of the dynamic range in that example. Doesn't say anything about the other correction parameters operations.

Q. So just to summarize, paragraph 21 lists an example of different types of features being corrected with different types of correction operations?

A. I don't think it says that. I mean, it talks about one or more correction operations on a same image feature even. Okay? So I think -- I think Needham was talking about applying multiple different operations possibly to multiple different features or objects.

Q. All right. Let me quote paragraph 20. "Further, when one or more corrections operations are applied to individual image features, different types of

correction operations may be applied to different image features."

A. You're reading paragraph 21?

Q. No. Paragraph 20.

A. Oh, 20. I'm sorry, I thought we were on 21 still. We've been there so long. Okay. Paragraph 20.

(Reviewing document.) I mean, I think what you read is what is written.

Q. Then it's followed by, "For example, maximizing intensity dynamic range, i.e. enhance the contrast, may be performed on a human face image feature and a different correction operation that increases the brightness may be applied to the image feature that represents the sky."

Is it a fair characterization in paragraph 20 that it provides an example of different correction operations being applied to different types of features?

A. Sure. Where one feature is a human face object and another is a sky object.

Q. And then paragraph 21 provides an example of different dynamic ranges being applied to a correction operation of two different instances of the same type of feature.

A. Is that a question? Am I supposed to agree?

Q. Yes.

A. Well, let's just be really clear. You know, we may say that the human face is the feature, human face object is the feature, but, you know, that face may have different sizes. So it's not the same instance of a face, object, or feature. So if you have a bigger face and a smaller face, then the dynamic range applied to those same class of -- objects from the same class of features, we may have -- the dynamic ranges may be different.

Q. Paragraph 22 gives an example of a single correction, i.e., maximizing intensity dynamic range being applied to different types of features just with different weights.

A. Well, I think it's applying -- we're talking about the 132. I think it's applying different amounts of correction, to use the claim language from claim 1 of the '132 patent. So for one -- for the face, if you have one dynamic range that you maximize, change the pixel, the intensities in that face to meet -- to maximize that one range, you have a building with a different range that you maximize to. You're applying different amounts of correction to those two regions to use the claim language.

Q. So Needham contemplates several different types of correction operations; correct?

A. Well, I'll point you to it talks about increasing brightness, for example.

Q. In paragraph 22, Needham doesn't say that it's applying an intensity dynamic range correction to the face and the building because there's a face in the image; does it?

A. I don't think that Needham is saying that the example that begins with "for instance" in paragraph 22 requires that the input image have faces in it. They may or may not.

Q. And in paragraph 22, Needham doesn't say that it's applying an intensity dynamic range correction to the face and the building because there's a building in the image; does it?

A. I think the algorithm would be applied whether or not there's a building in the image. You know, and keep in mind, it's just a "for instance" here.

Q. Would that algorithm also be applied whether or not there's a face in the image?

A. I already said that. Yeah. There's nothing that says here that you wouldn't -- couldn't apply to algorithm. I mean, I don't think the example is limiting. It just says "for instance," "faces," "buildings." There might be three or four other features that are treated differently and have different

dynamic ranges applied to them according to a correction parameter. The algorithm would still be functional.

Or it might be that some images don't need correction because -- maybe the intention is that it doesn't have faces or buildings. And in that instance, the designer of the algorithm doesn't care whether there's a more visible face or not.

I mean, keep in mind the last sentence here, you know, we're talking about a hypothetical example -- not hypothetical, but an exemplary example. "In this way, the human faces may be corrected so they become more visible than buildings."

Q. So the weighting in this example of paragraph 22 is what's used to sort of distinguish the application of a single correction parameter to two different types of features?

A. I think it only gives -- I think it's really teaching to make faces more visible. It gives an example of buildings as something that would be made less invisible relative to the face. I don't think the intention is there would only be pictures of faces and buildings. Again, this is a teaching. This is teaching to help the POSITA understand.

Q. Would you please refer to Exhibit 1017, which is your declaration from the 1251 proceeding.

A. Yes, sure.
Q. Specifically page 52, element (e)?
A. Let me get there. 52 (e), yeah.
Q. Which recites, "Processing the converted image using wrinkle-reducing parameters."
A. M-hm.
Q. In the right-hand column, you quote four excerpts from Konoplev provisional, which is Exhibit 1012. I'll hand you a copy of that as well.
(Exhibit No. 1012 was marked for identification.)
MR. ROBINSON: Q. You, in the first one on paragraph 25 of Exhibit 1012, it states, "In one aspect of the invention there is provided a method for automated enhancement of digital images containing portraits or images of human faces by correcting imperfections such as wrinkles, skin blemishes, freckles, pimples, et cetera."
Does that sentence that I just read explain to a POSITA how to process a converted image using wrinkle-reducing parameters?
A. All of these four paragraphs on the right-hand column and even in the following are, you know, related to processing it with wrinkle-reducing parameters. I mean, this line here is the bottom of the box on the

page. Because the, you know, the next part of the limitation begins with wherein, the four paragraphs following that also relate.

Q. We'll get to those paragraphs as well. I'm just starting with that first, just one sentence that you quoted from paragraph 25 of the Konoplev provision.

Is that sentence enough to inform a POSITA how to process a converted image using wrinkle-reducing parameters?

A. Well, no. It's not intended to. In one aspect of the invention, there's a method for automated enhancement of images or portraits, by correcting imperfections such as wrinkles, skin blemishes, freckles, pimples. This is not an algorithm.

Q. So let's go on to the second sentence quoted there in paragraph 52 of the right-hand column.

"Human faces are processed through the smoothing filter using a different set of smoothing for wrinkle removal."

Does that sentence explain to a POSITA how to process a converted image using wrinkle-reducing parameters?

A. Well, yeah. I mean, if you have a smoothing filter where smoothing is being used for wrinkle removal, then you can modify that smoothing filter. You

can always modify the filter, change its size, its weights if it has weights, change the degree of effect that it has -- the effect it has on the image or, on particular, on the wrinkles.

So it is, you know, again, it's not a detailed algorithm. But it's explaining you can change the filter parameters, but to effect wrinkle removal and reduction.

Q. Does that sentence explain what the filter parameters should be for wrinkle removal?

A. Well, I mean, like I said, you know, you don't expect just one phrase to explain everything. In fact, that's only one sentence. I go on and say that, you know, if you look at page 53, "Filtering parameters are received. The filtering parameters are: an initial radius, a final radius, a imperfection reduction mode," et cetera.

Filter parameters can also be weights of linear filter, if it's linear filter, the size of a linear filter. This would be understood by a POSITA for sure. Okay? A smoothing filter has parameters like this.

If it's a nonlinear filter like a median filter, it might be the geometry of a median filter or the size of it. This would be understood by a POSITA as

well. It substantially informs.

Q. Would a POSITA immediately understand how to select initial and final filtering radii in this context?

A. Oftentimes, when you apply a filter for a purpose like wrinkle-reduction removal, you may have to experiment a little bit. Okay. They may have an initial sense, you know, because they may look at the wrinkles in an image or a class of images or in a database of images, and notice that those wrinkles are typically, you know, occupy a region that is some size.

So they may, accordingly, choose a filter that has certain parameters such as the size, radius, weights, geometry of the filter. A POSITA will understand that, you know.

Q. How much experimentation would it take for a POSITA to sort that out?

A. Probably not much. I mean, it all depends on what they're doing it for. Let's just suppose they're on the Apple iTeam for cameras. So, you know, they determine what's the typical size of the face on the picture taken by a typical iPhone user. They have a lot of data. Or Facebook or somebody like that.

They would come up with some practical estimate, the size of the -- the sizes or regions that,

you know, wrinkles might cover. Once they decided that, they wouldn't have too much trouble experimenting briefly with, you know, different kinds of filters because they hire people of ordinary skill in the art, and they might try, they might say, "Well, let's try a median filter that's got a 5x5 square geometry." If it works, they may have little more experimentation. Or none.

Q. Did the Apple iTeam have that experience for cameras for a typical iPhone user back in 2009?

MR. GRAUBART: Object to form.

THE WITNESS: The iPhone came out before then, they certainly had a camera team. I think there was a camera in the iPhone; wasn't there? I can't remember for sure. I think so.

I can tell you the Apple camera team were of ordinary skill of the art with respect to that, most likely. Keep in mind, they're very secret there, so I didn't know who was working on what.

MR. ROBINSON: Q. Did Facebook include, provide wrinkle-reducing filters back in 2009?

A. I don't know. They're secret, too. I would have to go ask somebody at Facebook what they were doing in 2009. I was just giving you examples of what could be. What could be. Okay.

Call it company x who acquires pictures, and they want to reduce wrinkles. I didn't mean to say anybody was doing anything.

MR. ROBINSON: Q. How long ago -- excuse me.

In 2009, how long would it have taken a POSITA to figure out the wrinkle-reducing parameters?

A. I don't know the application, so how long is really a relative thing. If there's an absolute, would it take them a day or a week? If this is a product being deployed and sold to thousands or millions of people, then spending, you know, a month on it might be just fine. It might be worth it, does a better job if you spend a month. But it might not take them anywhere near that long. Might be take him a few days. I don't know.

There were tools back then for finding eyes and things, for analyzing faces. They could bring those to bear. So I don't know where the wrinkles are that you're talking about.

Q. Staying with your opinions related to the Konoplev provisional, (f), spanning pages 53 and 54 of Exhibit 1017.

A. M-hm.

Q. First sentence, "In one aspect of the invention, there is provided a method for automated

enhancement of digital images containing portraits or images of human faces by correcting imperfections such as wrinkles, skin, blemishes, freckles, pimples, et cetera."

That's paragraph 25 of the Konoplev provisional.

Does that sentence explain to a POSITA how to reduce blemishes in a converted image?

A. It's not meant to be explanatory about it. It's just supposed to say -- it's just saying in this invention, there is provided a method for enhancing images by correcting imperfections of such types as listed there.

Q. The next sentence spanning pages 53 and 54, "Subsequently, the parts of image containing human faces are processed through the same smoothing filter using yet another set of parameters for removing brown spots from the faces, i.e., pimples or other blemishes."

Does that sentence explain how to reduce blemishes in the converted image?

A. No. What's being described here is function. You know, function is being described here. It's not an algorithm. It's not -- it's not trying to give an algorithm or specific circuit or structure, anything like that. It's just explaining that there's a

filtering process that has parameters which can be modified to remove these.

Q. That sentence doesn't explain what those parameters are or how to determine them?

A. I think a person of ordinary skill here as well as in the section (e) part that we just talked would understand that there's a design choice.

Q. The next sentence, "According to the exemplary embodiment, facial spots, such as pimples, are processed by analyzing a second derivative of the edge pixel value. The level of pixel coloring over is set based on the second derivative of the edge pixel value."

Does that sentence explain to a POSITA how to remove blemishes from a converted image?

A. (Reviewing document.) It's instructing the reader of the patent how they might proceed to accomplish this. Again, it's not a specific algorithm. It's teaching you can use second derivatives, which are a measure of change to help you identify these blemishes.

Q. Does this explain how to analyze a second derivative of the edge pixel value?

A. It doesn't, you know, give an algorithm specifically, but it certainly -- a person of ordinary skill in the art would understand there's a way of using

this information to do this. Doesn't go into granular detail.

Q. On the following sentence, "Then the facial skin is enhanced by the skin-recognition filter applied to the detected facial areas using spots/blemishes reducing parameters."

That's from paragraph 48 of the Konoplev provisional.

A. Yes.

Q. Does that sentence explain to a POSITA how the skin-recognition filter is applied or how to determine the spot/blemish reducing parameters?

A. So, I mean, it's not in isolation. It's along with everything else, you know. I mean, two paragraphs above on page 54, it says through the same smoothing filter using different parameters. So, you know, then there's giving a general teaching here, which a POSITA could put into practice, design his own way possibly using this guidance.

Q. How long would it take for a POSITA to figure out how to analyze the second derivative of the edge pixel value?

A. Not very long. I mean, that's -- that's something a POSITA would know how to do.

Q. Give me a quantitative minimum, I guess.

A. Of time?

Q. M-hm.

A. Probably just a -- probably wouldn't need much time at all to understand how to approximate a digital second derivative, which is what it's talking about here. If he's a person of ordinary skill in the art dealing with images, he pretty much would know how to do that if he chose to use that method for this.

Q. What's "much time at all" in this context? A day? A week?

A. Counselor, I mean, for example, students who have experience with image processing or have had an image-processing class, they would have had exposure to that already. They wouldn't have to go and find it.

So to actually implement it, depending on how good a programmer they are. How long it took them to, you know, find a library that maybe does it already. Any kind of quantitative answer I'd just be speculating on a particular situation.

Q. How long would it take for a POSITA to decide how to set the level of pixel covering over based on the second derivative of the edge pixel value?

A. Take a little experimentation. Depend on the situation, the images they're using. I can't give you anything specific.

Q. How much experimentation?

A. I don't know the situation. I don't know how, for example, it gives a range of blemishes. I don't know if these blemishes are obvious, like big dark moles. I don't know if they're subtle. I don't know if these blemishes are intended to be discovered on people of different ethnicities or not. Sometimes a mole is easy to find, and the same mole might be hard to find in a different person. I don't know how answer that. It's too --

Q. So it depends on the size or characteristics of the pimples or blemishes?

A. It could depend on that, in part. It could depend on other things. I mean, pimples, people get all kinds of pimples. Some people have horrible, you know, acne. Other ones have isolated little tiny ones. I don't know what the target here is.

Q. When you say it could depend on that, in part, or depend on other things, what do you mean by "depend"?

A. It would guide the design choice.

Q. Larger blemishes might take longer to figure out the appropriate relationship between pixel covering over and second derivative of edge pixel value?

A. I don't have specific reason to think that. I don't know what kind of blemish it is.

Q. Are there types of blemishes that make it harder to sort out that relationship between the level of pixel covering over and the second derivative of the edge pixel value?

A. I think it's fair to say that some blemishes may be more subtle than others. Some types of blemishes may be more subtle than others. The way you approach the problem might be modified because of that. You might make different design choices. The guidance here would still broadly apply.

Q. The variations in blemishes and pimples make it impossible for you to tell me how long it would take for a POSITA to determine the relationship between a level of pixel covering over and the second derivative of the edge pixel value?

A. I think if you ask me any image-processing task, I can't tell you how long it would take a POSITA to figure out how to do that image-processing task, just because a POSITA isn't a robot. They're not replicated like robots. They're human beings who take different amount of time to do things. Some are faster on some tasks than other tasks, you know.

Q. Some take a significant amount of time?

A. I don't even know what at that means. "Significant" is relative. If you have a deadline for a

product, a short of amount of time suddenly becomes a significant amount of time. You know, there's just way too open-ended questions. And...

Q. So elements (g) and (h) of claim 1, scanning pages 54 and 55 --

A. M-hm.

Q. -- quote a number of sentences in the right-hand column for those two claim elements.

A. M-hm.

Q. Do any of those sentences explain to a POSITA how to analyze the chromaticity distribution and modify the facial areas based on the distribution analysis --

THE REPORTER: How to analyze what?

MR. ROBINSON: Q. Would any of these sentences explain to a POSITA how to analyze the chromaticity distribution and modify the facial areas of the converted image based on the distribution analysis?

A. You know, I have to take all the paragraphs together. That's what, you know, I'm mapping onto (g) and (h) here.

You know, I think any POSITA would understand what's being taught here, which is a way of doing this, would be to, you know, calculate a histogram of color parameters, and what those parameters might be would depend on a specific task of modifying. And a POSITA

would understand, by reading this, generally how they might proceed.

And you know, I think an ordinary POSITA wouldn't take very long to figure out how to do this just like it wouldn't take very long how to figure out (e) and (f).

Q. Do any of those quoted sentences in the right-hand column for elements (g) and (h) explain to a POSITA how to analyze the chromaticity distribution or how to modify the facial areas of the converted image based on that distribution analysis?

A. I think like with (e) and (f), it broadly guides the reader of the patent towards a way of doing this. You know, it's not an algorithm. It's not a specific structure. It's just, you know, broadly guides, as a specification is supposed to, informs how a person of ordinary skill in the art might proceed in practicing the claim.

Q. What is the way of analyzing the chromaticity distribution toward which this collection of sentences guides a POSITA?

A. Well, what's being guided is that these are images of -- on facial areas. It's face area parts of the image. You know, the goal is to achieve the most natural colors. A person of ordinary skill in the art

would realize that human skin, including on the face, is very characteristic. Human skin, if properly photographed, occupies a very small part of color space. It's well-known.

A POSITA would understand that they would modify the color distribution so that the colors in the face area, color distribution of the face area, would agree with what naturalistic faces appear, meaning those colors would, you know, the goal would be to have those colors agree with the known portions of color space.

Q. Is that description you just offered true of all ethnicities and races of humans?

A. Yes. It is a fact.

Q. Where does the claim language for element (g) or (h) reference the most natural colors?

A. I'm sorry, where does what?

Q. The claim language for element (g) or (h) for paragraph 54, where do those reference the most natural colors?

A. Well, I mean they don't. But the specification does. It's teaching how to practice this.

Q. So the sentence that you just quoted from paragraph 30 of the Konoplev provisional application doesn't just talk about the most natural colors of the face area; does it? It also mentions the most natural

colors for the whole image.

A. It says for the face area or for the whole image. It doesn't say "and." That's an important difference. It certainly admits the possibility of only doing it for the face.

Q. How would the POSITA determine the most natural colors for the whole image if it includes a face or doesn't include a face at all?

A. I would have to know the application of what, you know, images are being contemplated, you know. It might be that what if the people in it are -- it's basketball videos. It's always about basketball games. And we have a known set of jersey colors. Okay? Faces in the background, and the wood of the court -- I'm just throwing this out there -- it may be there's a priori knowledge that can be used with regards to the natural colors in the image.

Q. M-hm. Is any of that described in Konoplev's provisional?

A. What I just said is not in there, but I think a person of ordinary skill in the art would have in mind, that, you know, depending on their application as they try to practice the patent, that they would have the option of, you know, doing that for the whole image.

I think the point of this, though, is for the

face area of the image.

Q. Despite the fact that several of the sentences that you quote here also refer to the whole image or the entire image?

A. Keep in mind that element (g) here is calculating at least one chromaticity distribution in a facial area of the converted image. This is how I'm mapping this. But I can't imagine how that can even apply there. It might be that you seek to make the facial area, you know, have naturalistic colors. You might make the rest of the image black.

That would certainly affect the -- that would be affecting the natural colors. And is black a natural color? I think so in the absence of light. That's kind of an extreme case. Certainly fits it. It certainly is an exemplar example I wouldn't find disagreeable.

Q. So natural colors, I mean, could include the full spectrum of colors?

A. Yes. It could be the absence of color.

Q. Paragraph 92 on page 50 of Exhibit 1017, you say that, "The following claim chart shows the disclosure of Konoplev's provisional application provides support for at least the independent claims in Konoplev.

What do you mean by "support" in that

sentence?

A. I mean, basically it teaches the same thing as those independent claims.

Q. Did you intend for "support" in that sentence to mean any kind of a legal standard?

A. Well, you know, I'm not a legal expert. I'm a technical expert. So what I mean is they technically support -- they disclose what's disclosed in the independent claims. I'm not a lawyer, so I'm not trying to give a -- anything beyond a technical opinion of support.

Q. What's the -- what does "technical support" mean?

MR. GRAUBART: Object to form.

THE WITNESS: Well, what I'm saying is that the technical content of the Konoplev provisional, I find to -- let me turn that around.

I believe that the technical content in the Konoplev patent can be found in the Konoplev provisional, the same technical approaches as in those independent claims.

MR. ROBINSON: Q. What do you mean by "technical approaches"?

A. Well, in the same way that I'm a technical expert. I, you know, I think I'm here for my opinions

related to my expertise on image processing and image analysis and computer vision and related concepts and techniques and methods. That stuff is what I'm calling "technical."

MR. ROBINSON: Should we go ahead and break for lunch?

MR. GRAUBART: Sounds good.

(Whereupon, the lunch recess was taken at 1:17 p.m.)

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AFTERNOON SESSION

(Time Noted: 2:03 p.m.)

MR. ROBINSON: Q. Dr. Bovik, did you discuss at all during our lunch break the substance of your testimony today?

A. I did not.

Q. Did you discuss any other aspects of your testimony today?

A. No.

MR. ROBINSON: I'm going to hand you the Nonaka reference that's been marked as Exhibit 1005.

(Exhibit No. 1005 was marked for identification.)

MR. ROBINSON: Q. I'll ask you to refer to paragraph 56 of Exhibit 1003, which is your declaration

in the 1250 proceeding.

A. Paragraph 56, yes.

Q. So paragraph 56, you say that, "If no face is detected in the image, the optimization processing section 5b does not perform any corrections."

You cite paragraph 58 of Nonaka.

Is that statement always true?

A. So, you know, paragraph 58 is part of a description of a possible embodiment. What's being taught is that in that embodiment if there's no face detected in the image, then the optimization doesn't perform any corrections. Doesn't mean always in any other sense.

Q. So in paragraph 42, doesn't Nonaka also describe that when a face is in a dark part of the screen --

A. Paragraph 42 of Nonaka?

Q. Of Nonaka.

When a face is in a dark part of the screen, the face-detecting section might not be able to detect the face. In that instance, "the optimization processing section 5b and the exposure control section 12a perform processing and control so as to brighten the dark part."

A. (Reviewing document.) So that's just an

example of what I was talking about in my previous answer.

Q. How so?

A. Well, you asked if a face was always detected. I said, well, that paragraph 58 is part of an embodiment. In that embodiment, I said it was teaching that if no face is detected, then it doesn't perform any corrections.

But, you know, I said this is -- I don't remember exactly what I said. But this is, you know -- I said something along the lines, wasn't explaining what always happens, in any case. Here's another case where you have a face in a dark region.

Q. So are paragraphs 42 and 58 of Nonaka describing different embodiments or two different aspects of the same embodiment?

A. These are both in the section first embodiment, but, you know, in paragraph 58, it doesn't say anything about "always." So there could be a situation as explained in the same embodiment, very dark.

Q. Are paragraphs 42 and 58 talking about the same image?

A. I mean, in paragraph 58, it's talking about different scenarios. I mean, paragraph 58 talks about

Figure 6, which has only a landscape without a person. It also talks about Figure 3 where there is a person. A person is detected at the backlight part.

And paragraph 42 isn't referring to any particular image that I see here.

Q. Does Nonaka rely upon a reference image or an image for monitoring to speed or simplify processing of an image to be captured?

A. I'm not sure what you're referring to. Maybe you can point me to that. I don't have it memorized.

Q. Start with the abstract of Nonaka.

A. And you want to ask your question again?

Q. Does Nonaka rely upon a reference image or an image for monitoring to speed or simplify processing of an image to be captured?

A. I don't see that mentioned in the abstract.

Q. What's your understanding of Nonaka's discussion in its abstract of an image to be captured and an image for monitoring?

I'm sorry, an image signal for use as a photographed image versus an image signal for use as an image for monitoring.

A. So, I mean, Nonaka is describing a wave of, you know, doing image correction which uses an ancillary image.

Q. How does it use ancillary image?

A. (Reviewing document.) So if you look at paragraph 8 of Nonaka, "When an acquired image signal is corrected or modified so as to raise luminance of the signal or brightness of the image represented by the signal, in accordance with the luminance of each region, a correction amount of the image signal for use as a photographed image is smaller than that of an image signal for use as a monitor image."

It's a way of putting a bound on the correction level.

Q. How does Nonaka achieve that smaller correction amount?

A. (Reviewing document.) So this is not in something I've opined upon. I was spending time, you know, I read it before, saw there were various approaches taken to this optimization processing. So perhaps you want to point to me in my report where I've discussed this issue of using auxiliary or ancillary image.

Q. Paragraph 63 is one example of Exhibit 1003 where you reference the image for monitoring, "to improve the visibility of the subject during the display of the image for monitoring while the user is shooting the image."

A. So (Reviewing document.)

So in paragraph 27 of Nonaka, as pointed to in paragraph 63 of my report -- first of all, in paragraph 63, as I state, "Nonaka describes processing image data at a high speed so that the image signal from an image pickup device is substantially displayed in real time and processing image data to improve the visibility of the subject during the display of the image for monitoring while the user is shooting the image."

And it is paragraph 27, page 2, "When an image for monitoring is displayed" -- then it describes, I won't read it all, how it's fit in there. It goes down and says, "In consequence, a user can shoot the image while seeing this displayed." Okay? So this monitor images is for a human to observe while the processing is occurring. So a human can make a judgment of it.

Q. Is it your opinion that the image for monitoring is the same as the image that is being photographed?

A. In the sections I'm referencing, these are from the first embodiment, keep in mind that when you're attempting to capture a photograph with an image, you've got to monitor. What's displayed on the monitor is rarely, if ever, the exact same as the image that is -- would be captured because it goes through a series of

processing steps prior to display.

So, generally, what's shown in the monitor is a representation of what you might be capturing, okay, on any camera. That's a way of guiding the photographer as they're capturing a picture. What's on that monitor won't be exactly the same as what will be captured generally ever in most cameras.

Q. So is what's on the monitor separated by what you actually capture by a period of time between when the image for monitoring is captured versus a later point of time at which the image for photographing is captured?

A. Well, there's human latency involved. So you know, when you see on the monitor that the picture is the way you want it, without correction, and that representation, then your response will follow that. But, you know, the intention is that it be substantially the same, substantially the same. Not a picture of something else, for example.

Q. Nonaka actually suggests continuous elimination of a scene so that the image for monitoring can be static for a period of time. Does it not?

A. Well, even in a -- even if a camera is on a tripod, then the camera is pretty static. But there's still vibrations. Furthermore, out there in the world

there are events occurring.

Even if you have a person sitting for a portrait, we're humans. We move. We're mobile. So there may be an intention, but then there's the reality, too. But the intention, of course, is that the -- what you capture will be -- what you're monitoring and what you capture will be substantially similar.

Q. What do you mean by "substantially similar"?

A. I mean, this is commonsensical. You don't even need a POSITA to understand that if somebody is trying to take a picture, what you see in the display screen, you're centering, you're maybe performing -- there's operations that might be correcting, and what you capture -- your intention in using the monitor is what you capture will have the good characteristics of what you're seeing in the monitor, monitored image.

Q. Would you take a look at the last three sentences of paragraph 56 in Nonaka. And let me know if those sentences change any of your answers to the last two or three questions.

A. (Reviewing document.) So it doesn't change my opinion. I mean, it's true that Nonaka deals with, you know, the possibility of introducing a flash apparatus as part of the photographic composition. That's really neither here nor there with regards to the method of

correction. That is what I'm pointing out in Nonaka.

Q. Isn't it true that Nonaka reduces the amount of correction in the photographed image by analyzing the image for monitoring to streamline the process for individually photographed images?

A. It teaches that can be done. But nevertheless, it teaches a method of correction.

Q. Doesn't that method of correction depend on processing the image for monitoring?

A. I don't think the method of correction depends upon that. I mean --

Q. You're saying the method of correction can be divorced from the way that Nonaka implements it as dependent on an image for monitoring?

A. The method of correction is not the same as the correction amount. Okay. So you know looking at, for example, claim 1 of Nonaka, so it talks about a correction amount of the luminance would be smaller than that of an image for monitoring.

That's not the same as the method of correction. So, in other words, the method of correction doesn't depend upon that, but the amount may be -- it may.

Q. So in paragraph 42 when it says that when the face is in a dark or blackened part of a scene, the face

detecting section cannot detect the face. And so the optimization processing section 5B goes ahead and brightens the dark part.

Is that talking about the image for monitoring or the image to be photographed?

A. Well, the image for monitoring is always derived from an image that could have been photographed. So, you know, it may have been processed. It may be that the moment has passed for it to be captured.

These are all, because of photons going through the same lens and striking the same sensor and being recorded by that same sensor. It's not two cameras. So, substantially, the monitored image and the photographed image are always the same in some sense, meaning, well, once you photograph it, it's not going to get monitored maybe. They come from the same, you know, sensor. That's what I mean.

Q. Nonaka makes crystal clear the photographed image is always later in time than the image for monitoring; is it not?

A. Well, as I explained earlier, there is a time delay. So when you photograph and capture the image, as is currently incident, and that image never gets monitored. In that sense, so sure.

Q. So paragraph 42, when it says that the face

can't be detected, then the optimization processing section 5b and the exposure control section 12a perform processing and control so as to brighten the dark part, that's referring to the image for monitoring; correct?

A. So in paragraph 42, it says, "The face detection section extracts the characteristic point from information during focusing and the image for monitoring described above" -- so that's information -- "based on the image data" -- meaning the image for monitoring -- "output from the image processing section 5 to detect the face."

So just to back up a little bit, in terms of what is meant by an image, you asked me that a while ago. Okay? Beginning of our proceeding. If you look at, you know, books and documents, textbooks and so on with regards to images and videos, you'll discover that an image -- a video is an image. It's a moving image. Okay?

And an image, like a video frame is also video. Okay? So in trying to distinguish what is displayed on the monitor and what is the captures of the photograph, these are deriving from the same image signal, which is function of space and of time. So my point is that if we're doing face detection on this monitored image, which is a video in any camera of use,

so you see as you're centering and so on, and the face is detected on it, and then in a fraction of a second later or a second later when you capture the photograph, it's capturing the same face in the same image signal.

Q. Where does Nonaka talk about a video?

A. Well, they monitored -- he may not use the term "video" that I recollect, but you know, in any camera, a monitor that shows what you're going to take is useless unless it's video. It would not be incorporated or designed.

Q. In paragraph 56, Nonaka specifically says, "When flash emission is used, the image for monitoring becomes intermittent images." What sense does that make if it's always a video?

A. He doesn't carefully explain this. He doesn't suggest in any way that there is -- the monitor stops capturing, even though it says becomes intermittent images. But when you have a scene and then a flash, that, you know, suddenly illuminates it, there's this dramatic change in the scene, and then it reverts to what it was before, I think that's what he means by "intermittent images."

In other words, even though you have this continuous stream of images, which is a video -- that's the definition really of video if it's of the same

scene -- you know, the images -- I notice he says images -- become brightened during the period of the flash for an intermittent period. I think that's what he's saying. That's what makes the most clarity to me. Okay?

That's why he goes on to say, "Therefore, continuously emittable illumination," we don't have this sudden flash that then disappears and exists only for a few frames of the monitored image or a video. That's what this means.

Q. In the abstract, he says, "A correction amount of an image signal for use as a photographed image is smaller than a correction amount of an image signal for use as an image for monitoring."

If that's not two different image signals, what sense does that sentence make?

A. Well, again, they come from the same sensor. They pass -- the photons pass through the same lens. It's the same scene. The same electrical signal is generated. It goes through some processing normally to be displayed as a monitor signal. It's a compression, that sort of thing.

When you capture it, you're not capturing what's displayed on the monitor. You're capturing what does come off that, you know, sensor. It's -- it's

substantially the same -- I mean, it's the same scene. It's substantially the same picture, even though the monitor picture has been processed, and it's slightly displaced in time. They come from the same image signal.

It's true the monitor signal is a processed version of that image signal, but it's the same image signal.

Q. Is it not an image signal that's static as of the moment in time that image for monitoring was captured?

A. Is it not what?

Q. The image for monitoring?

A. Okay, I didn't quite understand your question. Is not the image for monitoring what?

Q. Is it your opinion that the image for monitoring is continuously changing as in a video signal?

A. I mean, regardless of whether there's a flash or not, it's a continuous stream of images being captured from the lens of the sensor. I can't tell you exactly what is happening in front of the camera.

Q. I'm talking specifically about the image for monitoring. Is it being continuously updated from the sensor, or is it statically processed and then stayed

the same until there is a largely different disagreement between it and the photographed image?

A. Maybe you could, since I'm not really understanding, maybe point to what you're referring to in the spec and whether it's part of that embodiment or a different embodiment.

Q. Paragraph 78, "A reason why the conditions of the image emphasis processing are changed during the photographing and the monitor display is that a characteristic of the actually photographed image is largely different from the image for monitoring."

The image for monitoring were being continuously updated as in a video signal?

A. Hold on, I'm catching up. I'm not listening very well. I want to see -- I didn't get there yet. So paragraph 78. And what -- where is it?

Q. First sentence.

A. Okay. (Reviewing document.) I read that. I see no contradiction. It's the same image signal. Some of it is taken and displayed for monitoring. That same image signal, which is a function of space and time, is processed according to the invention to, for example, improve the visibility of the face.

Q. How could the photographed image ever largely differ from the image for monitoring if the image for

monitoring is being continuously updated as in a video signal?

A. Well, it explains that. "The photographed image is largely different from the image for monitoring" -- because it's been processed -- "in which the contrast of the only face part as mainly emphasized or the face part is brightened to simply improve the visibility of the face."

So I guess that's the same image signal, but it's been processed to do this enhancement of the face.

Q. It's that processing that makes them different, and because the processing is different, that's a reason to change the conditions of the image processing?

MR. GRAUBART: Object to form.

THE WITNESS: Your question again is?

MR. ROBINSON: Q. You suggested that the difference between the image for monitoring and the photographed image may be due to the image processing.

If that were the case, then it would seem this paragraph is saying that the difference due to processing is the reason to change the processing.

Is that what you're telling me that means?

A. Well, no. There's a bigger picture in the surrounding paragraphs. There's processing that occurs

for the monitor. You know, just to read from, for example, paragraph 77. "In a remarkably dark scene, shown Figure 10a, the optimization processing section 5b increases the correction amount of luminance/contrast or the like so that the face of the subject can clearly be recognized in the monitor display." Okay?

So this is a processing of the displayed -- the image signal as is being displayed. Okay. One image signal is processed for display in the monitor in darkened conditions. And that same image signal, looking at the same previous paragraph, the optimization says the correction amount to be smaller than that during the monitor display.

And the rationale for that are given, you know, in the next paragraph beyond the part that you directed my attention to, paragraph 78. For example, "That is during the monitor display," paragraph 78, "the sunlight may be reflected depending on a direction in which the camera is held, and the visibility thus deteriorates."

So naturally, if you want to take a good picture, you want to be able to have the monitor be visible.

So, "To improve this visibility, intense correction is necessary." This -- I'm adding this, this

is the monitor. The image signal that's being directed to the monitor. "However, during the photographing, such improvement is not necessary. The background needs to be rather balanced, and natural gradation shading the face needs to be represented."

The point is -- as it goes on -- it's a different amount of correction for the image to be photographed. It's the same image signal. So their appearances will be different on the monitor and the photograph. It's the same image signal.

Q. Would your opinion change at all if I tell you this patent is categorized international patent classification system still picture camera?

A. Most -- doesn't change at all. Still picture cameras have, you know, in that time period, still picture cameras would have a continuous video display to help you and assist you in taking the picture.

Q. If my camera captured an image right now, and five seconds from now I captured another image, both are still images, they're captured from the same sensor five seconds apart, do you consider those to be the same image signal?

A. They came from the same image signal. They're part of the same image signal. Just because I chose to capture that image signal at two different points in

time does not change that.

Q. But they're two images once they're captured; correct?

A. They are two still images that derive from the same space-time continuous image signal.

Q. If you reduce the number of pixels in one of those images, would it be fair to say it reduces the quality of the image in which the number of pixels is reduced?

A. Are we going to make comparisons? Are you just talking about what if I have an image and I reduce the pixels? Is your question directed toward comparison between those two images? I'm really lost in this question. Could you clarify?

Q. The number of pixels is reduced in the first of those two images. Does it reduce the quality of that image?

A. It could. People have a common misunderstanding that resolution and quality are the same thing. They're not. I can have a 50-megapixel camera and take a horrible quality picture with it. And I can have a 5-megapixel camera and take a very high quality picture. It may or may not.

Q. Nonaka's paragraph 42, just to close the loop, is it discussing processing of the image to be monitored

or the photographed image?

A. (Reviewing document.) I'm reading the paragraph now. My apologies. Well, this signal in paragraph 42 is being discussed. It refers to the image for monitoring. Okay? "The image data," parentheses, "the image for monitoring, output from the image processing section 5." Okay?

The image for monitoring comes from the same image signal as the image that will be photographed, so they come from the same image signal. It is describing, you know, that that image signal is sent for monitoring as well as for photographing. It's describing processing on the version of it that was sent for monitoring.

Q. Paragraph 58, when it says that the optimization processing section 5b does not perform the optimization processing in a backlight landscape without any person, is it talking about the image for monitoring or the photographed image?

A. Again, there are different -- they're the same image signal sent to different places.

Q. At which place is this happening?

A. If you carry on paragraph 42 describing and detecting the face on the image for monitoring, which is the same image signal that is just sent for monitoring,

that image signal sent for monitoring undergoes different kinds of processes to make it suitable for monitoring. Face detection can be conducted on that monitoring signal, which is the same image signal.

So if you're detecting a face in the image for monitoring, or not, then you're also detecting a face, or not, in the image to be photographed. It's the same image signal sent on two different paths.

Q. Object as nonresponsive.

At which path is paragraph 58's processing happening?

A. So that section of the specification is not specific, but you know, it could be on the path for the, you know, the path for monitoring. Or it could be before it's sent off on the path for monitoring. It doesn't really say there. Doesn't really matter. I didn't render an opinion on it in here.

Q. Let's take it step-by-step.

We've established paragraph 42 and 58 are both talking about the first embodiment of Nonaka; correct?

A. This, I agree with.

Q. Paragraph 42 says if a face is not found in the dark area, then the optimization processing section 5b performs the optimization processing section on the dark area; correct?

A. It says that, yeah.
Q. And paragraph 58 says if a face is not found in the dark area, that optimization processing is not performed on the dark area; correct?
A. I don't see anything about optimizing or not optimizing in the dark area. I don't see the dark area is being equated in any way between those two paragraphs.
Q. Paragraph 58 says, "In a scene of only backlight landscape without any person, the optimization processing section 5b does not perform the optimization processing." Correct?
A. Of course. That's what it says, yeah.
Q. In fact, at your paragraph 56 in Exhibit 1003, you say that citing paragraph 58 of Nonaka.
A. I'm sorry, what?
Q. Paragraph 56 of Exhibit 1003, you say, "If no face is detected in the image, the optimization processing section 5b does not perform any corrections."
A. Paragraph 56?
Q. Yes.
A. Yeah, I'm just quoting basically.
Q. To be clear, it's not quoting; correct?
A. It's not quoting, but I'm citing to it immediately.

Q. That's what your opinion of what paragraph 58 says?

A. Paraphrasing.

Q. So in Nonaka, paragraph 48 and -- sorry -- paragraph 42 and paragraph 58 can't both be true if they're on the same path; can they?

A. Paragraph 58 is talking about a situation where there isn't any person, meaning no face, because there isn't a person. Paragraph 42 is talking about there is a face potentially, but it's dark, so it can't detect the face. It's a different scenario than whether, you know, the other one there's just no person; here, it's saying it's dark. Okay?

And certainly, you know, it goes on to say that, "The optimization processing section and the exposure control section perform processing control so as to brighten the dark part as described later in detail."

So it's perfectly acceptable to have a variation where you detect that something is so dark that you can't decide whether there's a face, then you brighten it, then you try face detection again. I don't see any contradiction at all.

Q. Do you agree both paragraphs 42 and 58 are addressing the possibility in which the face detection

unit can't initially determine whether there is a face in the dark part of the image?

A. They can't determine, but for different reasons. The conditions of the image are different. So just because they can't detect the face doesn't mean that the camera can't, you know, determine that, "Well, it's really dark there. Maybe that's why I didn't detect a face."

So it doesn't mean the processing has to be the same or that those two scenarios are the same, and that's why there's different paragraphs.

Q. So given the scenario 42, when the dark section is so dark it can't detect a face, if you apply paragraph 58 to that same scenario, wouldn't 42 and 58 reach different conclusions: one of which would brighten the dark area and one of which would not brighten the dark area?

A. (Reviewing document.) I don't think that paragraph 58 and 42 are generally -- you know, you can't really comingle them, because paragraph 58 doesn't talk in any way about there being a dark part. Okay? It's not even a same scenario.

I mean, not such a dark part you couldn't find the face. Let's be careful. It does say "produced that the dark part is emphasized." Okay?

So I don't think that those two paragraphs are meant to be commingled or combined or one superimposed on the other one artificially in any such way. I think they're describing different scenarios where the processing happens differently for good reasons.

Q. Might those different scenarios be that paragraph 42 is applied to the image for monitoring whereas paragraph 58 is applied to the photographed image?

A. I don't think it has to be. Might be. But remember, they're the same image signal.

Q. In fact, at paragraph 52 does Nonaka pivot to describing the second processing that is used during flash photographing?

A. Well, paragraph 52 starts out by talking about the situation where flash occurs, of course.

Q. And that's the photographed image; correct?

A. Yes, but it doesn't change my opinion. I mean, they're the same image signal, and sure, it talks a lot about processing. But...

Q. We've established there are two paths for processing; correct?

A. Okay. Keep in mind that, you know, the inventor is teaching here. Okay? He's talking about, you know, a monitor image. He's talking about an image

that is photographed, is derived from the same image signal. He doesn't talk about two paths.

It could be that some processing occurs before there's any, you know -- before the signal is sent to either, along either of paths. It has just been acquired. And I don't think that the inventor teaches away from that.

I mean, if you look in paragraph 56, in talking about part of this processing, second processing, "It is to be noted that this processing may be applied to not only the photographing, but also the display of the image for monitoring." So he's commingling these. It's not like there's some sharp separation. So I can't agree.

Q. Doesn't that sentence "it is to be noted" in paragraph 56 suggest that would be a variation on what's described before it?

A. This is a specification. It's full of variations, like specifications often are. That's why they're multiple embodiments. You're teaching principles here. It's talking about various possibilities. You could have -- it could be that paragraph 58 is just on the photographed part, or it could be before either photographing are sent off to monitoring or, you know, so...

Pointedly, the inventor doesn't say.

Q. I'll object to that answer as nonresponsive.

In paragraph 58, the sentence starting, "It is to be noted," doesn't the phrasing of that suggest that it is a variation of what is described above it?

A. In paragraph 58 where?

Q. The sentence starting, "It is to be noted." Sorry, paragraph 56.

A. That's why I just can't find it. Okay.

So your question is what? I mean, I think what he's saying is this process, he's simply saying this processing may be applied to either the part of the image signal that is captured as a photograph or the part of the -- or the same image signal that is displayed for monitoring.

Q. To be clear, paragraph 56 is referring to the process, the second processing as described above.

A. Doesn't change my opinion. Says right here, "May be applied to photographing and also the displayed image for monitoring." That's my opinion. That's what it says.

Q. This processing refers to the second processing as described above.

A. Well, all it says is, "As described above, in the second processing, the visibilities of both of the

outdoor landscape and the person in the room are improved." That's all it says about the second processing.

Q. That only happens when optimization processing section 5b performs its optimization process; correct?

A. It says a number of things, firstly, in paragraph 52, the main thing about second processing is, you know, during flash -- the flash photography is happening. Then the second sentence is, "The second process is processing mainly for the image data during the photographing."

My mind immediately says, well, that's for the image data that from the image signal will be captured from the photograph, but also for the monitor. Maybe more of the processing is done in the creation of the photograph. Doesn't say how much. Maybe 51/49 percent. I don't know. Doesn't say. But it certainly does not exclude in any way processing of the image signal as it's sent for monitoring.

Q. The sentence that you specifically pointed to a moment ago, "The visibilities of both of the outdoor landscape and the person in the room improve."

A. Where is that again?

Q. Paragraph 56, it's the optimization performed by the optimization processing section 5b that gives

rise to that result; correct?

A. (Reviewing document.) You know, I don't think he says at any point in 52, 53, all the way up to 58, anything about the optimization processing section 5b being, you know, limited to processing image for -- that comes from the image signal that is then used for photographing versus for monitoring.

It says the second processing is mainly for the image data during photographing. I can't come to your conclusion.

Q. Object to that answer as nonresponsive. Please listen carefully, Dr. Bovik.

The optimization processing section 5b is the only thing described in Nonaka for achieving that result in paragraph 56; correct? Specifically, the first sentence of paragraph 56.

A. Well, my answer doesn't change.

The optimization processing section 5b is used in the first processing and the second processing. It has access to the image signal. The image signal is sent for monitoring. That same image signal is sent for photographing. Okay.

I don't see how it's being limited in the way you're asking for paragraph 56. If you look at paragraph 51, optimization is being used in first

processing.

Q. Object as nonresponsive.

The optimization processing section 5b is the only thing that is described in Nonaka for achieving the improvement of the visibilities both of the outdoor landscape and the person in the room as recited in the first sentence of paragraph 56; correct?

A. Sure. In paragraph 53, you know, 5b is implicated in correction of landscape as well as outdoor parts.

Q. Referring back to paragraph 42 and paragraph 58 --

A. So, Counselor, I mean --

Q. I haven't asked a question yet, Dr. Bovik.

A. Okay. Sure. Go ahead.

Q. Paragraphs 42 and 58, paragraph 42 says, "If a face can't be detected in the dark part, the dark part is lightened."

Paragraph 58 says, "If a face can't be detected in the dark part, the dark part is not lightened."

Both of those two things can't be true in the same image; can they?

MR. GRAUBART: Object to form.

THE WITNESS: Who says it's the same image?

Was it paragraph 58 and 42 again?

MR. ROBINSON: Q. Yes.

A. Okay. I don't think this spec is teaching that this is in the same exact situation or the same image. Might not be in the same day, the same town.

Q. Can those two things be true on the same image?

A. You're asking me to speculate. I haven't talked about anything about this in my report. And you've gone so far afield from my report at this point, I really have to point that out. I need to --

Q. Your report cites paragraphs 42 and 58; does it not?

A. It does.

Q. Surely you don't mean to suggest your understanding of these two paragraphs and their interrelationship is irrelevant to these proceedings?

A. I think I'm explaining, you know, how the correction unit operates in the reference. We're talking about scenarios of, you know -- anyway, I just thought I would point that out.

So the answer to your question is, you know, I don't think that the inventor here is trying to create a situation where there isn't a person and there is a person. I think that's illogical.

Q. Please listen carefully to my question.

If paragraph 42 is processing and paragraph 58 is processing were both applied to the same image with a person in the dark part, but in which the dark part was too dark for the person to be detected without lightening the dark part, could both paragraph 42 and paragraph 58 be applied to that same image?

A. Again, those are different scenarios. Paragraph 42 has a person with a face. Paragraph 58, as it says, a scene of only backlight landscape without any person, hence no face.

Now, furthermore, paragraph 58 -- has a dark part, but it doesn't say so dark it might be hiding a face. Whereas, paragraph 42 is talking about specifically -- it even says the image is blackened. It's really emphasizing how dark it is. You know, you just -- the face that is present can't be detected.

I don't think you can compare or combine these two scenarios or try to map one or the other or vice versa or anything else like that.

Q. Is it your opinion that Nonaka automatically detects the presence of a face in an image?

A. You know, there's billions of digital cameras that have face detection apparatus in them. You have a little square. The screen is detecting a face on the

monitored image, which is then captured. You know, and they attempt to detect. All this is about trying to detect a face. And if you do detect the face, then perform a correction.

Q. So Nonaka might not detect faces, despite its best intentions?

A. That's true of every face detection algorithm ever devised.

MR. GRAUBART: Do you mind if we take a quick break after this question?

MR. ROBINSON: Sure.

Q. If Nonaka works as intended, it automatically detects the presence of a face. Is it true then it also automatically detects the absence of a face?

A. You know, I, keep in mind that in Nonaka, you've got a face detection. It's basically describing a function. Okay? You know, if you look at -- if you look at Figure 8, there's face detection circuitry -- not circuitry, a face detection block. Okay?

But there isn't a structure revealed here. There isn't an algorithm. I don't know how it's detecting a face, just like I don't know how it's being detected in the '132 objects. You look at the '132, '118, it's just a block. It's just a function. No structure. No structure here in Nonaka.

So I don't -- it doesn't say how the face is necessarily detected. But it doesn't say anything about specifically seeking non-detection. In fact, in paragraph 42, when the face detection algorithm, however it doesn't work, doesn't detect a face, it makes clear that, well, golly, if there's a part of the image that's so dark that it could be that a face was there but obscured, it does additional processing to brighten it up and potentially detect a face, if indeed it's in the dark part.

Q. Are you saying that happens in paragraph 48's processing as well?

A. Do you mean 58?

Q. 58, yes.

A. I would say that those algorithm steps are unfavorable. But I mean, every algorithm is full of subroutines. You don't enter a subroutine unless there's an "if" condition, say. The "if" here could be, well, is there a part that's blackened or so dark there could be a face there? You know.

Well, paragraph 58 doesn't deal with that situation. Instead, it's dealing with a situation where there isn't a person. It doesn't make a point of a blackened part of the image.

MR. GRAUBART: Could we go ahead and break for

a second?

MR. ROBINSON: I have one follow-up, and I'll shut up and take a break.

Q. How in the world would paragraph 58 determine that there's not a face if it doesn't run the face detection algorithm?

A. It doesn't say it doesn't run the face detection algorithm. It may not run the part of the face detection algorithm that includes deciding there's a blackened region, but it may run the face detection algorithm.

You know, I mean, somehow it's determined that not to do optimization processing. Algorithm isn't prescient. You would have to run face detection. It's implied even if it doesn't say it.

MR. ROBINSON: How much time do you want?

MR. GRAUBART: Just a few minutes.

MR. ROBINSON: All right.

(Recess taken: 3:33 p.m. - 3:42 p.m.)

MR. ROBINSON: Q. If the processing of Nonaka's paragraph 58 were applied to the blackened image of Nonaka's paragraph 42, can we agree that Nonaka would never detect a face?

A. Well, this is only an embodiment. But I think the way I would read it is the method of 58 would never

be applied to the image in 42. If the image in 42 were received, then the methods of image 42 would instead be applied, so...

It would be another embodiment --

Q. Where does Nonaka describe that?

A. Describe what, Counselor?

Q. What you just described in your answer.

A. Well, in 42, it says, "If this happens, then this is what is done," without reading it all and taking up time. Then 58, it says, "Well, if this is what happens, this is what is done." It doesn't say in 42, "Well, if this is what happens, then let's jump to the method in 58 and do what it says there."

Q. Doesn't 42 suggest that it can't know that there's nobody in the background until it runs the processing of 42?

A. Can you refer to background in 42? I mean, point to me where the word "background" appears, because I couldn't find it.

Q. Doesn't 42 suggest that Nonaka's system can't determine whether there is a face in the darkened portion of the image unless it performs a processing of paragraph 42?

A. Well, yes, but -- but it doesn't mean that it's darkened in the same way, you know, a dark part in

paragraph 58. In fact, it's teaching away from that. Again, they're not comparable.

Q. How is it teaching away from that? Does paragraph 58 say that the landscape in 58 is lighter than that in 42?

A. No. It says in a case where the main -- in 42, it says, "In addition, in a case where the main subject is positioned in a dark part of the screen of the backlight scene or the like, the image is blackened and a fine difference between the brightness and the darkness cannot be seen. In this state, the face detecting section cannot detect the face."

There's no scenario like that described in 58.

Q. But 58 can't possibly conclude that that scenario is not present unless it goes through the process of 42; correct?

A. I disagree.

Q. How so?

A. It may determine, "Oh, it's dark over here, but not so dark that I couldn't detect a face," as I already explained.

Q. What if 58 receives an image that is so dark it can't detect a face?

MR. GRAUBART: Object to form.

THE WITNESS: You're acting as though 58 and

42 are different embodiments. So 58 receiving that, I don't know. That doesn't have any meaning. Instead, 42 receives that in the sense you're doing it. It's actually all just one algorithm.

Instead, the image is received, and the processing in 42 is described. It's not like 42 receives something and 58 receives something. It's one embodiment. It does different things in different situations.

Q. We've already established that paragraph 42 is acting on the image for monitoring; correct?

MR. GRAUBART: Object to form.

THE WITNESS: So keep in mind that the image from the monitor and the image that's photographed, it's all the same image signal. Okay?

Sure, we directed that on two paths, same image signal. When one is dark, the other is dark. It's the same image signal. It's just that the image signal is dark then, is what I mean to say.

Q. Isn't the more likely explanation that paragraph 42 is acting on the path for the image for monitoring which tells it whether there's a face, and paragraph 58 is acting on the photographed image after it also knows whether there's a face?

MR. GRAUBART: Object to form.

THE WITNESS: I don't see anything to lead me to believe that. I don't see your logic leading in that direction either.

MR. ROBINSON: Q. I'm sorry. You do see logic in that direction, or you don't?

A. I do not.

Q. Okay. Hypothetically, if the blackened image of paragraph 42 were run through the steps of paragraph 58, Nonaka wouldn't be able to detect the face; would it?

A. I mean, we started out with "hypothetically," which means I'm stepping outside the embodiment. In any such hypothetical thing, it's a different embodiment. I don't know what's going to happen. Okay. I don't know, for example, what the threshold for darkness is. Okay?

What we're going to -- if it's really dark, are you going to sidestep 42? Then you've got a different algorithm. I don't know what's going to happen. It's just a hypothetical. I don't know how to answer that.

Q. 42 says you do apply section 5b. 58 says you don't apply section 5b.

Can those both be true at the same time?

A. Well, it's not as simple as what you said, okay. I mean, optimization processing is not done

because there's no face, okay.

Q. Is there a button on top of the camera you push when there's no face, or does it automatically determine whether there's a face?

A. Well, we've already established that this invention includes face detection. That's why optimization processing 5b does not perform optimization because without a person there, no face detected.

Q. Have you had an opportunity to review the institution decision issued by the Board in the 1251 proceeding?

A. I did read those.

Q. Did you disagree with any of the conclusions reached by the Board?

A. My understanding is that the decision of the Board is that, you know, these IPRs be instituted. That's the main decision. They don't render anything with finality. So if you want to point me to something, I'll tell you whether I agree or disagree with it.

Q. As you sit here today, did you -- are there any instances of the Board's reasoning with which you disagree?

A. I haven't looked at the petitions in awhile, so I don't remember all the details. But I will say that, I mean, I think that the petition should have been

instituted. That's all.

If you want to direct me to something specific, I'm happy --

(Exhibit No. 1009 was marked for identification.)

MR. ROBINSON: Q. I'm going to hand you what's been marked as Exhibit 1009. That's the Konoplev reference. Column 2, lines 4 through 7, "Imperfections are automatically corrected by selecting a most suitable skin color using a histogram of distributions" --

A. I'm sorry. Where are you at in Konoplev?

Q. Column 2, lines 4 through 7. "Imperfections are automatically corrected by selecting" --

A. Hold it. I got to get there.

Q. Let me know when you're ready.

A. Okay. I've reached column 2, lines 4 through 7.

Q. You see where it says, "Imperfections are automatically corrected by selecting a most suitable skin color using a histogram of distributions of color values on a face"?

A. M-hm. I do.

Q. And then at Konoplev column 6, lines 1 through 4.

A. Konoplev column?

Q. 6.
A. 6, lines 1 through 4.
Q. Do you see where it says, "Facial spots, such as pimples, are processed by analyzing a second derivative of the edge pixel value. The level of pixel coloring over is set based on the second derivative of the edge pixel value"?
A. Yes.
Q. Is coloring over the same as smoothing?
A. He doesn't use that language. Could be smoothing, you know, but doesn't have to be, depending on the approach applied. The idea here is to hide the pimple.
Q. Would a POSITA consider coloring over to be smoothing?
A. I don't think a POSITA would say they are necessarily equivalent. A POSITA would consider that you could use smoothing as part of coloring over.
Q. But coloring over could also be done without smoothing?
A. You see, Counselor, the term "smoothing," it doesn't have any fixed specific definition. So, I mean, I think what it's teaching is removing these blemishes, and that could involve a smoothing filter.
Like in paragraph 54 of my P2 report, "If the

face detection module detects a face, the facial skin is enhanced by applying a smoothing filter to the detected facial areas of the image to reduce wrinkle, spots, and blemishes."

I mean, you can use a smoothing filter. I don't think there is any definition or limitation here.

Q. Would a POSITA have understood the meaning of a Gaussian fuzzy computation in the context of a blurring method?

A. Probably not. A Gaussian fuzzy computation also could be Gaussian filtering. It's a type of smoothing filter. I think the language is odd and might have been -- that, I believe, is in --

Q. Zhang.

A. Zhang.

MR. ROBINSON: In fact, I'll hand you a copy of Exhibit 1008, which is the Zhang reference.

THE WITNESS: Sure.

(Exhibit No. 1008 was marked for identification.)

MR. ROBINSON: Q. Does Gaussian filter involve coloring over?

A. Gaussian filter could be used as part of trying to color over a blemish. I don't think it describes using only that.

Q. Does Gaussian -- sorry?
A. If you look in paragraph 43.
Q. Of?
A. Zhang, I'm sorry. I think we're we should step back and realize Zhang is talking about something other than blemishes and such.
You want to start your question over again, and I'll try to adapt?
Q. Does a Gaussian filter use a histogram of colors to color over?
A. Where, Counselor? You want to point to me something in one of these? Could you use a Gaussian filter as part of the coloring over as used in the '410 Konoplev? It could be part of that, sure.
Q. Does a Gaussian filter necessarily include coloring over?
A. Gaussian filters are used for an amazing diversity of things unrelated to any of this art.
Q. So a Gaussian filter does not necessarily involve coloring over?
A. Gaussian filter is a very, you know -- generally speaking, a Gaussian filter is a very diverse tool.
Q. Would a POSITA applying a Gaussian filter to a digital image to blur a part of a digital image

understand that doing so would necessarily involve coloring over?

A. Gaussian filters applied to digital images, mathematically, they're a low-pass filter. They'll reduce the high frequency content of the image. It can have a smoothing effect. That might be intentional. It might be a part of a larger process.

But, you know, ordinarily a person of ordinary skill in the art wouldn't think of the term "coloring over" because "coloring over" is a term that's introduced primarily I think in this patent. It might occur somewhere else out there. It certainly is a usual term of the art.

So POSITA if you say "coloring over," they aren't going to think of Gaussian filter. First, they'll ask, "What do you mean by coloring over?" That's what would really happen with a POSITA.

Now, if they read this and they read it, you know, they get that you're hiding the pimple. There's no specific association between pimples and Gaussian filters.

Q. Would a POSITA applying a Gaussian filter to a digital image to blur a part of that digital image understand that doing so necessarily uses a histogram of distributions of color values on a face to select a

suitable skin color?

A. You're reading from where? I would like a context to better answer this question.

Q. We're talking about Zhang and Konoplev, and they're respective teachings. How much more context do you need? I referred you specifically to parts of the Konoplev that discuss exactly what I just asked about.

A. Well, you pointed to me to where coloring over is.

Q. Column 2, lines 4 through 7, of Konoplev discuss one example of using histogram distributions of color values on a face.

A. Yes, uh-huh. You can certainly use the histograms as Konoplev revealed. You can certainly use second derivatives. Sorry. I think I misplaced your question.

Q. Would a POSITA applying a Gaussian filter to a digital image to blur a part of that digital image understand that doing so necessarily uses a histogram of distributions of color values on a face to select a suitable skin color?

A. So, I mean, you ordinarily wouldn't use a Gaussian smoothing filter to select skin colors. Again, I think you're combining things. Where is the Gaussian filter? Where are you reading from that?

You're conflating a couple of things. I need to understand that conflation. And is this something I talked about in my report?

Q. Your declaration says to -- combined Konoplev with Zhang.

A. Yes.

Q. That combination doesn't result in a Gaussian -- in Zhang's Gaussian filter for blurring using Konoplev's histogram of distributions for color values on a face?

A. As I pointed out, paragraph 60, a person of ordinary skill in the art would have understood the skin smoothing applied in Konoplev and the background blurring applied in Zhang are different amounts of the same type of correction.

Q. What type of correction is that?

A. It's an operation to do smoothing. Konoplev and Zhang could be combined to both blur the background as well as, you know, smooth the skin.

Q. So "blurring" and "smoothing" are synonymous?

A. You can use some tools like a Gaussian filter. A Gaussian filter can be used to smooth and to blur.

Q. What's the distinction between "smoothing" and "blurring"?

A. Well, it depends upon the context. You could

use a Gaussian filter to smooth and blur here. There are other operators that might smooth but not blur. A good example is a median filter which smooths noise -- actually could smooth pimples pretty well, too, but does it without blurring.

Q. Does your declaration meanings a mention filter?

A. No, but you asked me.

Q. Are you suggesting now that the combined Konoplev and Zhang would use a Gaussian filter to both blur the background and smooth the skin?

A. I don't see why you couldn't use a Gaussian filter. You could blur a background in Zhang with a Gaussian filter, and you can smooth skin with a Gaussian filter.

Q. Where does your declaration say that you use a Gaussian filter to do both of those operations?

A. I think you asked me. So that's why I said.

Q. Does your declaration say you would use a Gaussian filter to perform both of those operations?

A. I mean, I didn't write that. You asked me, and I've stated it.

Q. So the answer is no, your declaration does not say that?

A. Well, when I said I didn't write that, that's

what I meant to say.

Q. Okay. Does the coloring over of blemishes in Konoplev reduce local contrast?

MR. GRAUBART: Object to form.

THE WITNESS: You know, I haven't really contemplated that. Maybe it could. Certainly corrects the image.

MR. ROBINSON: Q. Don't you identify blemish by identifying the local contrast?

MR. GRAUBART: Object to form.

THE WITNESS: Well, I mean, what Konoplev teaches is using a second derivative, which is not synonymous with contrast.

MR. ROBINSON: Q. Are blemishes in a digital image identified by finding corresponding local contrast?

MR. GRAUBART: Object to form.

THE WITNESS: I mean, if you can show me this kind of language in Konoplev, I'm happy to opine upon it.

MR. ROBINSON: Q. How would a POSITA reading Konoplev go about trying to identify a blemish on a face?

A. (Reviewing document.) So, I mean, the simplest answer and most direct is he describes a number

of different kinds of blemishes, and a different method might be used for each kind of blemish: spots, wrinkles, pimples, you know, so on.

Q. Would all those blemishes in a digital image be marked by a local contrast?

A. Could you point to me where this kind of language appears in Konoplev?

Q. Would a POSITA understand those types of blemishes to be marked by local contrast?

MR. GRAUBART: Object to form.

THE WITNESS: Every part of every image is marked by local contrast. I mean, if I take -- I don't know what you mean by "marked."

MR. ROBINSON: Q. Delineated.

A. Every part of every image has a local contrast. I don't know what you mean by "marked" or anything. Maybe you can point to me what you're talking about in Konoplev.

Q. I'm just asking whether a POSITA, with all of his years of experience and education, would understand to be the boundaries in the way of finding blemishes in a digital image?

MR. GRAUBART: Object to form.

THE WITNESS: Could you use local contrast as a way of finding blemishes? Generally speaking, I think

you could. But I don't think, you know, the '410 patent is limited in any such way.

MR. ROBINSON: Q. Eliminating or hiding a blemish would necessarily result in reducing that local contrast; would it not?

MR. GRAUBART: Object to form.

THE WITNESS: It could. That wasn't my first -- my last answered question was not meant to imply that. I said you might use some characteristic, some characteristic of local contrast. It might be local contrast of a color component.

And in the processing the pixel coloring over, it might in the end reduce the contrast. But the goal is not contrast reduction. The goal is blemish reduction and removal.

MR. ROBINSON: Q. Reducing the appearance of the blemish in the image is the goal; correct?

A. I think reducing it as much as possible.

Q. That's --

A. Meaning removing it. Like you try to detect a face, we call it face detection.

Q. And that's accomplished by reducing the local contrast that's indicative of such a blemish; correct?

A. I don't see that expressed anywhere in Konoplev.

Q. Would a POSITA understand that to be a true statement or not?

A. I don't think a POSITA would come to that conclusion. For example, the blemish might just be -- might just be redness, okay. By removing the redness, you may do that without modifying the contrast at all. So it doesn't follow.

Q. How about at the boundary of the redness?

A. The contrast, you know, the brightness may be the same. Call that equal luminescent. So across the red part, doesn't mean it's darker or lighter. It might be the same brightness.

Q. There might be no perceivable contrast between a red part and an un-reddened part of a person's face?

A. Again, you know, I don't have a definition, your definition of "contrast." I gave you earlier ones. If they were applied to an equal luminescent red spot, that is correct. The contrast wouldn't change across the boundary.

Q. Between the red spot and the non-red boundary?

A. If applied to, if you apply it to -- you compute the contrast on the luminance of that image in that region and that's equal luminescent, then that is correct, you would not have a change in contrast, by definition.

Q. Is luminescence the definition of contrast you've been using for our discussion today?

A. Contrast is using defined in terms of luminance.

Q. That was a very specific hypothetical you just offered, Dr. Bovik. Is that a realistic one?

A. I didn't offer the hypothetical. You did.

Q. Equal luminescent red spot versus equal luminescent non-red spot just outside the boundary of the red spot, does that happen a lot?

A. It doesn't happen a lot anywhere, whether blemishes or otherwise.

Q. So there would be some local contrast there in most circumstances, if not all?

A. And there would be local contrast everywhere else in the image as well.

Q. And by removing that red spot or covering over that red spot, you would reduce the local contrast between the red spot and the bordering non-red portion?

A. The point is the goal is not necessarily reduction of contrast. It could be there's reduction of contrast as a byproduct of the blemish removal operation. It's not the stated goal.

And Konoplev has not stated that the goal as being removing or reducing contrast. It's changing.

I'll say it's changing.

Q. Object as nonresponsive to the entire answer.

Whether it's a stated goal or not, coloring over the red spot to match the non-red boundary wouldn't necessarily reduce the local contrast at that boundary; correct?

A. It very likely could change the contrast, but almost any spatial image-processing operation I apply, whether it's low-pass, high-pass, detail, preserving, they can all modify contrast.

Q. Zhang's blurring of its background is another example of modifying contrast; correct?

A. You want to point to me where he states that?

Q. The entire --

A. First of all, you're premise I disagree with. You said it's another example of modifying contrast. You said modifying? Go ahead. I'm sorry.

Q. So you don't disagree with modifying contrast?

A. I think in most spatial image-processing operations in some way modify contrast. There's nothing special about blemish-reducing in that regard.

Q. Zhang's entire application is about blurring its background; correct? That's the point. Can we agree on that?

A. No.

Q. Okay. One of the things Zhang describes in all of its embodiments is blurring its background; correct?

A. Zhang does describe blurring background.

Q. Would that reduce the contrast of Zhang's background?

A. I would say it could definitely reduce contrast. It could also reduce brightness in places. It's not just reducing contrast. It could be byproduct. In other places, it may not reduce contrast.

I already said earlier smooth regions, it may not reduce contrast, either mathematically maybe or at least noticeably.

Q. Would Zhang's blurring of its background ever increase the contrast of its background?

A. So the measurement of contrast is a nonlinear operation. So the blurring we've been talking about, Gaussian blurring and so on, it's a linear operation. The outcomes of a linear operation you can't really predict using, you know -- there are effects on a nonlinear operation, like contrast. So I can't really say, mathematically speaking.

Q. Keeping in mind what you've previously testified to about a POSITA's understanding of blurring, would Zhang's blurring of its background be expected by

a POSITA to increase the contrast within that background?

A. Probably generally not.

Q. Okay.

A. Again, I don't think that's the goal of what Zhang is presenting. He's blurring. So to be clear, I'm not equating blurring and contrast reduction, to be especially clear.

Q. But contrast reduction, generally, is a characteristic of blurring?

A. There's a lot of things that are a characteristic of blurring.

Q. Is it inaccurate to say that contrast reduction is a characteristic of blurring?

A. No, because there are signals for which -- I already mentioned constant signals. There are other, if you had a sinusoidal image, then its contrast would not be changed by, say, a Gaussian blur.

So I mean, it's yes and no. It's not really the goal. You know, you're trying to -- my reservation is you're trying to import a measurement for which, you know -- a characteristic for which Gaussian filtering is not generally designed.

Q. Would a POSITA ever apply a Gaussian filter to a constant image signal?

A. Yes.

MR. GRAUBART: Object to form. Go ahead.

THE WITNESS: Yes, because image signals contain constant parts. Not always, but plenty often.

MR. ROBINSON: Q. Nonaka -- you can look at Figures 2A through Figure 2C of Nonaka, for example, specifically describes increasing the contrast of backlight portion 30b; correct?

A. You're getting ahead of me again.

So we're in Nonaka and looking at Figure 2?

Q. 2A through 2C.

A. And specification you're referring to it where?

Q. All right. How about paragraph 50 of Nonaka?

A. Going there. Paragraph 50. (Reviewing document.) Yep.

Q. The entire point of the operation that Nonaka performs on the part of the image 30b is to increase the contrast to improve the visibility of the details, including a person. Is that correct?

A. Well, no. It says, you know, you've got a gain 2 as a correction value larger than a gain 1 to raise luminance curve. So there's a brightening happening. So brightening and contrast emphasis are not the same thing.

Q. "Moreover, the optimization processing section 5b performs large contrast emphasis processing as compared with the landscape 30a to raise the contrast delta F0 to delta F2."

A. Well, there's, you know, modifying an image to improve visibility certainly can involve, you know, tightening the contrast within limits just like old television had a contrast knob.

Q. In fact this sentence in paragraph 50 of Nonaka specifically says that it involves emphasizing the contrast.

A. It does. It also says raising the luminance curve. Moreover, it emphasizes the contrast. So there's a lot of different aspects that can involve, you know, correction of an image.

Q. By performing those corrections, the visibility in the room sufficiently improves; therefore, an image providing visibility close to that obtained by human eyes can finally be achieved. Meaning all of that is to improve visibility of that portion of the image, 30b.

A. I have no problem with agreeing that correcting an image in various ways improves visibility. I will point out that he didn't really state what he means by "visibility."

Q. Would a POSITA have had an idea what he meant by "visibility" here?

A. Probably, yes. But there's technical aspects of this visibility that may not occur.

I think a POSITA would just think it's easier to see. So the Court isn't confused, that will work.

Q. That's the opposite of blurring?

A. I don't agree.

Q. Does blurring make it easier to see these details?

A. Sometimes.

Q. Does --

A. For example, if you have an image that's corrupted while in noise, you might want to blur it to get rid of the noise, and then you can see the rest of the image better.

Q. Does Zhang's blurring improve visibility of Zhang's background?

A. No, but it improves the visibility of the face. Human eyes are drawn to sharper regions.

Q. So Nonaka's gain 1 that applies to region 30a is predefined; correct?

A. If you look at paragraph 48, okay, in describing gain 1 there, it is stated that it's a predetermined correction model. That's part of the

first embodiment. Practicing a patent wouldn't have to be --

Q. Gain 1 is predetermined. Is there a reason to give it its own lookup table?

A. Just to save time, you want to point me where its given its own lookup table?

Q. 1017 at --

A. 1017?

Q. Exhibit 1017 at paragraph 91.

A. In a different embodiment. These embodiments are already, you know, separated. So it's the third embodiment.

Q. What's in the third embodiment?

A. Paragraph 91.

Q. No, paragraph 91 in your declaration, Exhibit 1017.

A. Sorry. Paragraph 91.

Going back to -- what was the original paragraph, so I can --

Q. Original paragraph of what?

A. We're talking about fixing the gain. 48?

Q. Yes. Gain 1 is the predetermined correction amount.

A. You have to store these values somewhere. If you have a predetermined value, processor or a computer

or whatever device you're using, could be a lot of things, you've got to be able to access it, so you store it somewhere. A lookup table is a good place.

Q. Why give us a separate table for a single value?

A. Well, it says, as I state in my report, "A POSITA would have recognized that the predictable modification of the combination of Zhang in view Konoplev and Nonaka, as suggested by the teachings of Gonzalez, would have included precalculating Nonaka's gain 1 and gain 2 values for the background and the person, respectively, storing the precalculated gain values in one or more lookup tables according to whether the gain values are for personal background and determining the gain values to apply to the facial," blah, blah, blah.

Okay. So I mean, already there's more than one gain, but there's two gain values that suggest more than one storage location, which you can represent as a table. You can have a one-entry table. There's no difficulties here.

Q. If gain 1 only had one predetermined amount as suggested in paragraph 48 of Nonaka, would it make sense to put it in a separate single entry table?

A. Well, we don't know it only has one. It might

be predetermined. Doesn't mean it has only one. It may be that you have a table of values, and you know, sometimes you use this predetermined value. Sometimes you use that predetermined value. There's a setting on the camera, you know. There's a lot of reasons.

Q. Nonaka doesn't say any of that for gain 1; does it?

A. Pardon me?

Q. Nonaka doesn't say any of that for gain 1; does it?

A. It doesn't -- (Reviewing document.) No, I don't agree.

Q. Why?

A. Well, I mean, as I state, you have a couple of gain values, and you can store those gain values in a lookup table.

Q. Where do you state that?

A. Paragraph 91 of my report.

Q. Paragraph 91 doesn't cite to anything in any of these prior art references; does it?

A. No. But it's hardly a leap for a POSITA to understand if you have a couple of gain values you're going to use, you have to store them somewhere. And storing them together in a lookup table makes a lot of sense.

Q. Nonaka never describes two different values for gain 1; does it? Which was the question I asked a moment ago before you reviewed the reference.

MR. GRAUBART: Object to form.

THE WITNESS: I didn't understand that to be that question. But doesn't matter. A new question is fine.

I mean, Nonaka is giving an embodiment here. And in this embodiment, he describes gain 1 as predetermined correction amount. Again, this is just a teaching. I don't think it would have to be fixed to a value, and a person of ordinary skill in the art would understand there was no reason why a gain 1 would have to be fixed to a value. He doesn't carry that into the claims, for example.

You're asking me a question. I didn't even have my report.

MR. ROBINSON: Q. Well, this goes directly to whether there are more than one gain values in a table. I would hope it's something you considered.

Nonaka doesn't ever say that a gain 1 is selected from a plurality of predetermined amounts; does it?

A. I didn't consider that. Here on the spot, I would say, you know, I think whether or not there's only

one or not, I think the combination hangs together just fine. You know, section 10 of my report had combination, which is where I was just reading from.

And you know, Nonaka as a reference is fine. And I think that, you know, a POSITA would certainly understand there could be a range of gain 1 factors.

Q. You still haven't answered my question, Dr. Bovik.

Nonaka doesn't ever say gain 1 is selected from a plurality of predetermined amounts; does it?

A. Nonaka doesn't have that language. I think a person of ordinary skill in the art would understand there could be.

Q. Words were very important earlier today, Dr. Bovik. Nonaka doesn't include those words; does it?

MR. GRAUBART: Object to form.

THE WITNESS: It does not. But Nonaka is teaching, okay. And when you're teaching a concept, sometimes you say, "Well, fix this, and then you'll understand the rest."

I think that there's no reason why gain 1 needs to be fixed to a single value. And the rest of, you know, the rest of the embodiment wouldn't require it. And I think a person of ordinary skill in the art would understand that gain 1 could be -- vary a little

bit.

MR. ROBINSON: Q. Dr. Bovik, do you know or are you personally acquainted with either of the inventors on the Nonaka references, Osamu Nonaka or Atsushi Maruyama?

A. I am not. Never met them. Never heard of them before this case.

Q. In your previous answer when you said, "When you're teaching a concept, sometimes you say, 'Well, fix this and you'll understand rest,'" you're speculating about how they might teach someone?

A. I'm a teacher. I mean, I know how good teaching is.

Q. Are any of those inventors teachers?

A. They are if they're writing a specification. They're teaching how to practice claims.

Q. If gain 1 had only one predetermined value, would it make any sense to put it in its own separate lookup table from the values of gain 2?

A. I mean, I didn't opine that. I just said that gain 1 or gain 2 could be stored in one or more lookup tables. It could be the same one. It could be two different ones. It doesn't really matter. Doesn't change my opinion about anything.

Q. In claim 5 of the '132 patent, Exhibit 1001.

A. Claim 5 of '132, yes.

Q. Last clause of that claim says, "Resulting in a first portion of a digital image that corresponds to the first portion of the digital image data being brighter than if the second amount of the parameter were applied to both the first portion and the second portion of the digital image data."

A. Okay.

Q. Did you determine whether claim 5 was met by any particular image processing technique?

MR. GRAUBART: Object to form.

THE WITNESS: I don't know what you mean. I mean, I certainly have the opinion that the prior art I presented covers this.

Nonaka is certainly, for example, since we were talking about Nonaka, modifies the brightness so that a second amount of the parameter -- I mean, so that a first portion corresponding to the first portion of the image would be brighter than the second amount than if the second amount of parameter applied to both the first and second portion of the digital image, because a much larger gain.

MR. ROBINSON: Q. Don't you need to know how bright those two portions begin before you can determine whether the relationship of claim 5 is true?

A. No, because it only says that -- I mean, if I had a face it has a certain brightness, I can apply, for example, the gain of Nonaka that's a larger gain, okay, and I will get a brightness.

Or I could apply the smaller gain of Nonaka, and I will get another brightness. Suppose I apply it to the whole image, as it says in the last part of the clause. Well, the face will be a lower brightness there absolutely for sure than if I had applied the first mentioned gain. So no.

Q. So, in fact, if you start with the input image of Nonaka, you've got 30a, which has a brightness that's the outside part, and you've got the outdoor part, the part with the backlighting. Then you've got 30b, which is the indoor part, it's darker.

A. 30a and b in Figures 2. So sorry, I was planning things. You're question?

Q. 30a has a brightness. 30b has a brightness. The input image, 30b, is less than 30a. If you apply gain 1 to 30a and gain 2 to 30b, 30b will only end brighter if the difference between gain 2 and gain 1 is larger than the difference between the brightness of those two sections in the input image; correct?

A. Well, I mean, when you apply a gain to both, they both are made brighter. They both get bigger.

Okay? And you know, we're not talking about a size of a difference here. Let's see.

We're talking about two different scenarios, one in which the first amount is applied to 30a -- which let's call that the face, okay -- versus whether the second gain is applied to both 30a and 30b. And if the first gain is larger, then 30a will be brighter than if the second gain were applied to both.

Q. Make sure we're reading the same language. So claim 5, apply the determined correction to the first portion. So we're talking about Nonaka. We're talking about gain 2 to 30b; correct?

A. Well, I don't know which part of claim 5 you're talking about. The last part of claim 5 says --

Q. I literally just quoted you some language from claim 5.

A. Okay. Read it again.

Q. "Wherein applying the determined correction to the first portion of the digital image," if you're talking about a determined correction -- remember, this is defense from claim 1 -- if you're talking about the determined correction as you've read this against Nonaka, we would be talking about gain 2 as its applied to 30b; correct?

A. Okay. I think I may have been misreading this

at the late hour. Let me read it again.
(Reviewing document.)
I mean, the way I read it, the first portion of the parameter's gain, you know, is gain 1. The second portion is gain 2.
Q. Really? Do you want to refer back to your declaration?
A. Oh, "portion of a digital image," I'm sorry. First amount and second amount.
This claim is so big and baggy, it's hard to keep straight in the mind.
(Reviewing document.) So, I mean, if the first amount is gain 1, first amount of the parameter, gain 1, to first portion where the first amount, gain 1, is different from the second amount, gain 2, applied to a second portion, different part of the image, resulting in the first portion of the image that corresponds to the first portion of the image being brighter than gain 1 being applied to the first portion than if the second amount were applied to both, gain 2, both to the first portion and the second portion.
Q. So it's your testimony here you interpret the first portion of the determined correction in Nonaka to correspond to gain 1 in Nonaka, and you interpret --
A. I said "amount." If you want to read it back,

"first amount."

Q. Okay. Read the claim language here so we're on the same page. "Applying the determined correction of the first portion of the digital image data" -- from claim 1 -- "comprises applying the first amount of a parameter to the first portion to enhance the visual characteristic."

So in Nonaka, is the first portion of the digital image data 30a or 30b as you compare this claim to Nonaka?

A. I got -- I think I may have gotten gain 1 and gain 2 confused. That's all. I didn't refer here.

Let's point out the first amount of the parameter, it's gain 2. I wasn't looking at neither Nonaka or my report. I was just looking at '132.

So the first amount of the parameter, gain 2. Second amount, gain 1, but same answer otherwise.

Q. So applying the first amount of the parameter to the first portion, so that's applying gain 2 to portion 30b in Nonaka?

A. I mean, we could apply it to 30a is what I'm thinking. Gain 2 applied to 30a.

Q. That's not how you applied it in your declaration, Dr. Bovik.

A. Okay. It doesn't really matter.

Q. No, it really does.
A. Okay. We apply gain 2 to 30b.
Q. Okay.
A. Gain 2 is larger than gain 1.
Q. All right. So gain 2 is larger than gain 1. Gain 2 is applied to 30b.
A. Okay. Sure.
Q. Okay. And resulting in a first portion of the digital image, 30b, being brighter than if the second amount, gain 1, had been applied to both the first portion and the second portion?
A. Paragraph 57 of my report just above figure -- reproduction of Figure 4A.
Counselor, since you paused, I'm going to take a five-minute break to use the rest room. Okay.
MR. ROBINSON: That's fine.
(Recess taken: 5:00 p.m. - 5:10 p.m.)
MR. ROBINSON: Q. One hopefully short question, and I'll pass the witness.
In the application of gain 1 and gain 2 to section 30b of the image in Nonaka, if the application of both of those gains saturated that portion of the image, would they have the same brightness?
A. Sure. But that wouldn't be the intention of the invention. Things like that -- bad things like that

can happen if an algorithm isn't designed properly.

MR. ROBINSON: I'll pass the witness for redirect.

EXAMINATION

BY MR. GRAUBART:

Q. Dr. Bovik, hopefully just one or two questions here. A little earlier, Counsel was asking you questions about your opinion in Exhibit 1017 declaration, in the 1251 proceeding, at paragraph 91.

A. Paragraph 91.

Q. In particular, paragraph 91 relates to the use of lookup tables for particular values. That's what I want to ask you about. Are you with me?

A. I'm there.

Q. Okay. I believe Counsel asked you something to the effect of why would one use a separate lookup table for landscape 30a if the only value to be stored there is a gain. Do you recall some questioning on that line?

A. I remember that line, yeah.

Q. With that in mind, can I ask you to please turn to Exhibit 1005, the Nonaka patent.

A. M-hm.

Q. And in particular, turn your attention to paragraph 48.

A. Yes.
Q. Paragraph 48, in addition to --
A. Where's the, "In addition to"?
Q. I'm saying -- paragraph 48 does reference a gain 1?
A. Yes.
Q. Is that correct?
A. M-hm.
Q. Okay. Are there other processing -- is there any other processing referred to in paragraph 48 besides the use of gain?
A. Yeah. There's the contrast emphasis processing.
Q. Would that contrast emphasis processing likewise generate values that can be stored in the lookup table?
A. There's no reason not. Sure.
Q. Given that then, does that does that confirm or modify your opinion as to why there would be a separate lookup table for landscape 30a?
A. Yeah. I mean, if you're calculating values for gain 1 and gain 2 in a lookup table and you're generating other values based on some processing, you may store those in, you know, a table of values associated with gain 1 and gain 2, for example. Or just

gain 1.

Q. So the lookup label for landscape 30a could have data for more than just gain 1; is that correct?

A. Yes, certainly.

MR. GRAUBART: No further questions.

FURTHER EXAMINATION

BY MR. ROBINSON:

Q. Paragraph 91 of Exhibit 1017 doesn't say anything about those other values; does it?

A. No. It doesn't include it. It makes sense you can do that.

MR. ROBINSON: Thank you.

MR. GRAUBART: Thank you. No further questions.

THE REPORTER: Did you need a certified transcript?

MR. GRAUBART: Yes, please.

(Whereupon, the deposition proceedings were adjourned at 5:15 p.m.)

---oOo---

CERTIFICATE OF WITNESS

I, the undersigned, declare under penalty of perjury that I have read the foregoing transcript, and I have made any corrections, additions or deletions that I was desirous of making; that the foregoing is a true and correct transcript of my testimony contained therein.

EXECUTED this_____day of_____, 20____at,_____,_____.

_____

ALAN BOVIK, PhD

REPORTER'S CERTIFICATE

I, KIMBERLEE SCHROEDER, TX CSR No. 10925 and CA CSR No. 11414, duly authorized to administer oaths pursuant to Section 28 (a) of the Federal Rules of Civil Procedure and 602.002 of the Texas Government Code, hereby certify that the witness in the foregoing deposition was by me duly sworn to testify the truth, the whole truth and nothing but the truth in the within-entitled cause; that said deposition was taken at the time and place therein stated; that the testimony of the said witness was reported by me and thereafter transcribed by me and that the witness was given an opportunity to read and correct said deposition and to subscribe the same.

I further certify that I am not of counsel or attorney for either or any of the parties to said cause of action, nor in any way interested in the outcome of the cause named in said cause of action.

I declare under penalty of perjury under the laws of the State of Texas that the foregoing is true and correct.

day of April, 2019

KIMBERLEE SCHROEDER, CSR, RPR, CCRR
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CASE: Apple v. Qualcomm
DATE OF DEPOSITION: Thursday, March 28, 2019

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