

UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE PATENT TRIAL AND APPEAL BOARD

-----  
APPLE INC., )  
Petitioner, ) Case IPR2018-01250  
v. )  
QUALCOMM INCORPORATED, ) U.S. Patent No.  
Patent Owner.) 8,447,132  
-----

-----  
ORAL DEPOSITION

OF

ALAN C. BOVIK, Ph.D., P.E.  
-----

August 28, 2019

ORAL DEPOSITION OF ALAN C. BOVIK, Ph.D., P.E.,  
produced as a witness at the instance of the Patent  
Owner, and duly sworn, was taken in the above-styled  
and numbered cause from 10:30 a.m. to 3:43 p.m. on  
August 28, 2019, before Karen Tyler, CSR in and for  
the State of Texas reported by machine shorthand  
method, at the offices of Fish & Richardson, P.C.,  
111 Congress Avenue, Suite 810, City of Austin, County  
of Travis, State of Texas, pursuant to the Texas Rules  
of Civil Procedure and the provisions stated on the  
record or attached here

1 UNITED STATES PATENT AND TRADEMARK OFFICE  
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD

3 -----  
4 APPLE INC., )  
5 Petitioner, ) Case IPR2018-01250  
6 v. )  
7 QUALCOMM INCORPORATED, ) U.S. Patent No.  
8 Patent Owner.) 8,447,132  
9 -----

10 -----  
11 ORAL DEPOSITION

12 OF

13 ALAN C. BOVIK, Ph.D., P.E.  
14 -----

15 August 28, 2019

16 ORAL DEPOSITION OF ALAN C. BOVIK, Ph.D., P.E.,  
17 produced as a witness at the instance of the Patent  
18 Owner, and duly sworn, was taken in the above-styled  
19 and numbered cause from 10:30 a.m. to 3:43 p.m. on  
20 August 28, 2019, before Karen Tyler, CSR in and for  
21 the State of Texas reported by machine shorthand  
22 method, at the offices of Fish & Richardson, P.C.,  
23 111 Congress Avenue, Suite 810, City of Austin, County  
24 of Travis, State of Texas, pursuant to the Texas Rules  
25 of Civil Procedure and the provisions stated on the  
record or attached hereto.

## A P P E A R A N C E S

## FOR THE PLAINTIFF :

Mr. Timothy W. Riffe  
FISH & RICHARDSON, P.C.  
1000 Maine Avenue SW  
Washington, D.C. 20024  
202.783.5070  
riffe@fr.com

Ms. Kim Leung  
FISH & RICHARDSON, P.C.  
12390 El Camino Real  
San Diego, California 92130  
858.678.5070  
leung@fr.com

## FOR THE PATENT OWNER:

Mr. Erik Janitens  
NORTON ROSE FULBRIGHT US LLP  
1301 McKinney, Suite 5100  
Houston, Texas 77010  
713.651.5151  
713.651.5246 - Facsimile  
erik.janitens@nortonrosefulbright.com

///

///

///

///

///

///

///

///

///

INDEX

	Page
Appearances.....	2
ALAN C. BOVIK, Ph.D., P.E.	
Examination by Mr. Janitsen.....	4
Reporter's Certificate.....	113

EXHIBITS REFERENCED

	Exhibit	Page
9	Exhibit 1001	10
10	Exhibit 1003	8
11	Exhibit 1004	75
12	Exhibit 1005	75
13	Exhibit 1006	111
14	Exhibit 1007	106
15	Exhibit 1008	45
16	Exhibit 1009	10
17	Exhibit 1010	29
18	Exhibit 1012	26
19	Exhibit 1017	9
20	Exhibit 1022	9
21	Exhibit 1023	10

///

///

///

1                   ALAN C. BOVIK, PH.D., P.E.

2   having been called as a witness in the above matter,  
3   and after having been first duly sworn, was examined  
4   and testified as follows beginning at 10:30 a.m.:

5   EXAMINATION

6   BY MR. JANITENS:

7           Q.   Morning, Dr. Bovik.

8           A.   Good morning, Counselor.

9           Q.   Thanks for taking the time to be here today.  
10   Before we get into anything substantive, I'd like to  
11   go over some ground rules, if you don't mind.

12          A.   Sure.

13          Q.   Do you understand that you're under oath?

14          A.   Yes.

15          Q.   Do you understand that you have to tell the  
16   truth, the whole truth, and nothing but the truth?

17          A.   Yes.

18          Q.   And you'll do that; right?

19          A.   I will.

20          Q.   And if you don't understand a question that I  
21   ask, please let me know.   Okay?

22          A.   I will.

23          Q.   And if you ever want to change an answer,  
24   please let me know.

25          A.   Okay.   Sure.

1 Q. And we'll take a break about every hour, but  
2 if you want a break sooner than that, let me know.  
3 Okay?

4 A. (Nods head, yes.) Got it.

5 Q. And all that I ask is that you answer the  
6 question before we take a break. Okay?

7 A. Okay.

8 Q. And is there any reason, medical or  
9 otherwise, why you cannot give truthful, complete, and  
10 accurate testimony today?

11 A. Not at all, but I do want to tell you, I had  
12 an ear infection last week, and that's over with, but  
13 I still have a little bit of closure in my ear canal.  
14 So usually I hear really keenly, and I -- but if I do,  
15 like, go, can you say that again, it's probably  
16 because of this. But it's not a problem in any way.  
17 I just may be asking you to repeat your question, if  
18 you happen to speak softly.

19 And that includes you. Okay.

20 Q. Yeah. That's fine. Yeah, just at any time,  
21 ask me to speak up.

22 A. And aside from that, yeah, I'm not sick or  
23 anything.

24 Q. Sounds great. We have a court reporter here  
25 today who will be preparing a written transcript, so

1 please remember to make verbal responses to all my  
2 questions. Okay?

3 A. Yes.

4 Q. And we want to make sure the transcript is  
5 clear as possible, so it's important that we take  
6 turns speaking. So please let me finish before  
7 answering, and I'll let you finish your answers before  
8 asking additional questions. Okay?

9 A. Okay.

10 Q. Roughly, how many times have you been  
11 deposed?

12 A. Well, I happened to check that. This is my  
13 42nd deposition.

14 Q. And you were previously deposed on  
15 March 28th, 2019, for the proceedings that we're  
16 discussing today; right?

17 A. That is correct.

18 Q. And just for the record, the proceedings are  
19 IPR2018-01250 and IPR2018-01251; right?

20 A. Yes.

21 Q. All right. And if I refer to them as 1250 or  
22 1251, you'll understand?

23 A. I will.

24 Q. All right. I'd like to discuss what you did  
25 to prepare for this deposition. Without revealing the

1 substance of any privileged communication you had with  
2 your attorney, did you meet with anyone to prepare for  
3 today's deposition?

4 A. I did. I met with counsel. That's one part  
5 of my preparation. That's not all my preparation, but  
6 I'm answering the specific question.

7 Q. And how many times did you meet?

8 A. Well, if you mean physically, I met just  
9 once, but I've met with Counsel multiple times -- I  
10 didn't count them -- over telephone and over email as  
11 well, and that's certainly valid communication.

12 Q. All right. And at each of these meetings,  
13 who was present?

14 A. Oh, Kim is -- this is Counsel over here, is  
15 generally -- has always been present. And I'm only  
16 talking about for the recent proceeding, not all the  
17 previous stuff, the previous deposition and so on.

18 Q. Right. And did you review any documents to  
19 prepare for this depo?

20 A. Yes. I reviewed quite a lot of documents.

21 Q. And what documents did you review?

22 A. Oh, well, I reviewed, you know, my  
23 supplementary declaration and Villasenor's declaration  
24 and then deposition testimony and the patent owner  
25 responses, and, you know, the patents themselves, the



1 prior art patents, et cetera. I'm not going to try to  
2 remember everything off --

3 Q. Sure, yeah.

4 A. -- off the top of my head.

5 Q. That's fine. All right. Before we dive into  
6 it, I'll just go ahead and hand you all your  
7 declarations. I see that you have them in front of  
8 you.

9 A. Both of them?

10 Q. Well, yeah. We'll go through -- let's get  
11 this all out of the way. So the first thing I hand  
12 you is what's labeled as Exhibit 1003.

13 A. Is this my original declaration?

14 Q. Correct.

15 A. Well, Counselor, with all -- with all  
16 respect, I've already been deposed on this document --

17 Q. Right.

18 A. -- for seven hours, and so I'm -- you know, I  
19 prepared a new declaration. It's my supplementary,  
20 and that's what this deposition is about.

21 So I'm not going to answer questions about my  
22 previous declaration. I'll be asking you -- just as a  
23 preview, I'll be asking you to show me where in my  
24 supplementary declaration I recently signed -- more  
25 recently signed, is this question coming from.

1 Q. Sure. Just so you -- for -- if we need it  
2 for reference or anything, just in case --

3 A. Well, leave it there, but this --

4 Q. -- we'll be addressing the supplemental; so.

5 A. Okay.

6 Q. And just for the record, so Exhibit 1003,  
7 that's your first declaration for the 1250; correct?

8 A. Well, let's see now. I don't see the 1250 on  
9 there, but -- I have to take a look at -- yeah. This  
10 would be the 1250.

11 Q. All right. Next I'll hand you what's labeled  
12 as Exhibit 1017.

13 A. Uh-huh.

14 Q. And that is your first declaration for the  
15 1251.

16 A. Yeah. And, here again, I don't mind these  
17 being entered into the record or as evidence, but I've  
18 already answered seven hours of questions on these.

19 Q. All right. Next we have Exhibit 1022, which  
20 is your supplemental declaration, the subject of this  
21 deposition --

22 A. Yeah.

23 Q. -- for the 1250; correct?

24 A. Thank you. You'd think they'd put the 1250  
25 on there, but, yeah.

1 Q. I think the bottom right-hand corner.

2 A. Oh, down there. Yeah. Okay. Sure.

3 Q. All right. And next, it's labeled as  
4 Exhibit 1023, and this is your supplemental  
5 declaration for 1251; correct?

6 A. Yes. That's correct.

7 Q. All right. I'm going to hand you one more  
8 document. This is labeled as Exhibit 1009.

9 And do you recognize that document?

10 A. This is the Konoplev '410. You're going to  
11 hand me some more documents too; right?

12 Q. Not yet.

13 A. Because I'm going to ask for them, because if  
14 we're talking about a certain patent here, and I -- I  
15 like to give the best and most accurate answers.

16 Q. While we're at it, I will also hand you  
17 Exhibit 1001. And do you recognize that?

18 A. Yeah.

19 Q. And, for the record, that's U.S. Patent  
20 8447132; correct?

21 A. Yes. Uh-huh.

22 Q. And if we -- if I reference that as the '132  
23 patent, you'd understand; correct?

24 A. Sure. And, you know, I'm not going to insist  
25 at this moment, but at some point it's very likely

1 I'll be asking for several other prior art patent  
2 references and so on.

3 Q. Right. Well, we'll get to those for sure.  
4 All right. So let's turn to Konoplev, 1009. And if  
5 you'd like to turn in your 1251 supplemental  
6 declaration, we'll be looking at page 5 for now with  
7 respect to Konoplev.

8 A. Uh-huh.

9 Q. Sorry. Actually, if you could turn to  
10 page 4, paragraph 8.

11 A. Okay.

12 Q. So can you tell me, in your opinion, what you  
13 think the novel aspect of Konoplev's invention is?

14 MR. RIFFE: Objection. Form.

15 A. Well, you know, I talk about this in my  
16 report, and as I state in paragraph 9, since applying  
17 a method to reduce wrinkles on images wouldn't be an  
18 invention, I -- you know, this is an idea which  
19 existed before Konoplev.

20 Then going back to paragraph 8 of my 1251  
21 declaration, supplemental, you know, Konoplev  
22 describes the novel aspect of his invention himself in  
23 the inset part of paragraph 8 where he states, "It's  
24 apparent that improved automated techniques for  
25 improving the portrait images are desired."

1           So, in addition, in the prosecution of the  
2       patent, the Examiner -- I'm back to my paragraph 9  
3       again, inset portion, the Examiner even, you know,  
4       pointed out another reference that does things like  
5       removing or reducing wrinkles.

6           So it's his, you know, his automation of this  
7       process. I see -- you know, when you think of -- in  
8       my field, the Examiner says removing these, but in  
9       practice, that removing means, you know, reducing as  
10      much as possible.

11          Q. (By Mr. Janitens) So removing is the same as  
12      reducing?

13          A. In this context. You know, because there's  
14      no magical algorithm that, you know, knows what the  
15      face would look like without a blemish. Okay?  
16      Because the face actually has wrinkles. So it tries  
17      to, you know, make it look as though there's no  
18      wrinkles, but, you know, in truth, in an algorithm, if  
19      it's a smoothing algorithm of some type, it's -- you  
20      know, that removing is really reducing. You know,  
21      it's an attempt to remove, you know, but it's a  
22      reducing. And I -- so I would put those two words  
23      together in this context.

24          Q. Okay. And during the prosecution of  
25      Konoplev, a number of references were listed here,

1 including Simon -- Simon, et al., 2004/10170337. Did  
2 you review that reference?

3 A. Yes.

4 Q. And is it your opinion that it discloses  
5 wrinkle-reducing parameters?

6 MR. RIFFE: Objection. Form.

7 A. So, if you look on the same -- it's a long  
8 paragraph, paragraph 9, of my 1251 supplemental. On  
9 the next page, page 6 -- you know, Konoplev and the  
10 Examiner recognized this through his amendment -- does  
11 discuss using an initial filtering radius and a final  
12 filtering radius. These radii may be, you know,  
13 regarded as, you know, wrinkle-reducing parameters,  
14 but, again, this was -- you know, this was part of the  
15 process of, you know, automating the correction  
16 process as it also states on line 7 of page 6 of my  
17 declaration that I'm currently talking about.

18 So as I go on, even though it discloses some  
19 parameters, line 1, 2, 3, 4 -- like 8, "Thus,  
20 'processing the converted images in wrinkle-reducing  
21 parameters' -- and that part is in quotes -- "was not  
22 the novel aspect of Konoplev's invention, and a POSITA  
23 would clearly possess the knowledge to implement  
24 'processing the converted images and wrinkle-reducing  
25 parameters,' given," you know, these references like

1 Simon and so on.

2 Q. So it's your opinion that Simon does disclose  
3 wrinkle-reducing parameters?

4 MR. RIFFE: Objection. Form. Asked and  
5 answered.

6 A. I state in my paragraph 10 -- I'm sorry. Did  
7 you say Simon?

8 Q. (By Mr. Janitens) Simon, yes.

9 A. Oh, I'm sorry. I was -- I may have misheard  
10 your question, because I was addressing Konoplev.

11 Q. Right.

12 A. Yeah.

13 Q. Yeah. So with respect to going back to  
14 paragraph 9 --

15 A. So --

16 Q. -- that first reference that was cited by the  
17 Examiner during prosecution of Konoplev?

18 A. So you're asking me about a reference that's  
19 cited, and I always hesitate to, you know, answer a  
20 specific question about a document without having the  
21 document. So if you want to supply me with Simon,  
22 that way I can point and so on.

23 Q. Okay. Let's -- actually, let's move back to  
24 paragraph 8. So it's your opinion that the novel  
25 aspect of the invention is the automated

1 recognition --

2 MR. RIFFE: Object --

3 Q. (By Mr. Janitens) -- and correction of  
4 undesirable feature of the portrait images; right?

5 MR. RIFFE: Objection. Form.

6 A. Are you reading from somewhere?

7 Q. (By Mr. Janitens) Yeah. Paragraph 8. Also  
8 we can look at Konoplev itself.

9 A. Uh-huh.

10 Q. Column 1, lines 52 to 56. Konoplev.

11 A. So I'm in column 1. Yeah.

12 Q. Yeah. Column 1, line 52 to 56, start with,  
13 "It is apparent."

14 A. Yeah. That's what I cite to here in my  
15 report; so.

16 Q. So because it says, "It is apparent that  
17 improved automated techniques for improving the  
18 portrait images are desired," that language implies to  
19 you that it's a novel feature?

20 MR. RIFFE: Objection. Form.

21 A. Well, the whole -- the whole '410 document  
22 teaches me -- tells me that. Okay? I mean, this  
23 is -- this is Konoplev merely, you know, describing  
24 his invention, you know, as part of the background so  
25 we understand where he's headed. But this is, in



1 fact, what he discloses throughout.

2 Q. (By Mr. Janitens) All right. Let's turn to  
3 Figure 1 in Konoplev.

4 A. So before we go there, is there a reference  
5 in my report to Figure 1 that we're going to be  
6 talking about?

7 Q. If you turn to page 12 of your supplemental  
8 report, it has Figure 1 in there.

9 MR. JANITENS: If we could go off the record  
10 for one second.

11 (Off-the-record discussion.)

12 Q. (By Mr. Janitens) So, Dr. Bovik, if you  
13 could look at Figure 1, what would you say is the  
14 automated recognition and correction of the  
15 undesirable features of the portrait images?

16 MR. RIFFE: Objection. Form.

17 Q. (By Mr. Janitens) In Figure 1, could you  
18 point to the automated feature of Konoplev?

19 MR. RIFFE: Objection. Form.

20 A. I think that Konoplev is simply automated.  
21 There's not a box that, you know, is like here's the  
22 automation. It's an automated system.

23 Q. (By Mr. Janitens) Okay. And if we look at  
24 Claim 1 of Konoplev.

25 A. And is there some place in my report where I

1 discuss Claim 1 of Konoplev you want to point me to?

2 Q. Page 6 of your supplemental declaration for  
3 1251, you state that, "step 1 -- 1(e), wherein an  
4 initial filtering radius and a final filtering  
5 radius" --

6 A. I'm sorry. Page 6 of my report? And where  
7 am I?

8 Q. Line 4.

9 A. Uh-huh.

10 Q. So starting with "wherein"?

11 A. Yes.

12 Q. So that's in Claim 1; correct?

13 A. Yes. But, I mean, we're actually referring  
14 to -- I'm happy to talk about that part of Claim 1.

15 Q. Sure. Yeah. So that's column 10. All  
16 right. So column 10, line 29, step (e); right?

17 A. Well, I mean, I see Claim 1, and I see this  
18 part of my report. Is there a question?

19 Q. So is it your opinion that Claim 1, step (e),  
20 the "wherein" clause, is it your opinion that that is  
21 the novel aspect of Konoplev?

22 MR. RIFFE: Objection. Form.

23 A. What I would say is that it -- you know, as I  
24 state in my report, it reflects that -- you know, this  
25 is on page 6 of my report, lines like 3, 6, 7 -- 6 and

1 7, I think -- this reflects the novel aspect of  
2 automating the recognition and the correction process.

3 You know, I look at, you know, Konoplev, and  
4 I see a system that is, you know, an automated system,  
5 but this is the novel aspect of automating the  
6 recognition and correction process. And I don't want  
7 to just say nothing else in Konoplev is automatic.

8 Q. (By Mr. Janitens) So in step 1(e), the  
9 repeating steps (c) through (e), that's indicative of  
10 an automated process? That iterative processing of  
11 those steps?

12 MR. RIFFE: Objection. Form.

13 A. I mean, this is part of the, you know,  
14 amended claim language; right? So this is part of,  
15 you know, the novel aspect of automating the  
16 recognition and correction process, yeah. I mean,  
17 I've stated this already, and I agree with what I  
18 stated.

19 Q. (By Mr. Janitens) So since the Examiner made  
20 this -- Examiner amendment adding the language with  
21 the -- including the quotations on line 4, page 6, the  
22 starting with "wherein," since they made that  
23 amendment, that is indicative of the novel aspect?

24 MR. RIFFE: Objection. Form.

25 A. You know, I wasn't in the Examiner's shoes at

1 the time when he was conducting his job. It's his  
2 job. But -- and I don't think that, you know, our  
3 purpose here is to, you know, really study the  
4 validity of -- you know, Konoplev as much as to just  
5 understand the process that occurred.

6 But, you know, the Examiner felt that the  
7 claims needed some amendment, and this was the  
8 amendment that was included, and, you know, as I've  
9 stated, this -- I am not stating that automation is  
10 exclusively in this part of the claim language of  
11 Claim 1. I'm merely stating that the Examiner found  
12 that -- and that's what really matters, but I don't  
13 disagree with him -- that this reflects the novel  
14 aspect of automating the recognition and correction  
15 process.

16 Q. (By Mr. Janitens) And did the Examiner  
17 state that it was a novel aspect by making that  
18 amendment?

19 MR. RIFFE: Objection. Form.

20 A. Well, you know, I can't -- I don't remember  
21 the whole -- I mean, I've certainly looked at the  
22 prosecution history. I don't have it memorized. But,  
23 you know, by allowing the claim, because of this  
24 amendment, I think the Examiner has shown that he  
25 believes that this is, you know, novel. You know, you

1 allow a claim because it's novel. And other things  
2 too, of course. But that's an aspect of it.

3 And, further, it's because I also know that,  
4 you know, things like, you know, simply processing --  
5 as I state actually here, yeah -- 1, 2, 3, 4 -- it's  
6 around line 8 of page 6 -- "Processing the converted  
7 images using wrinkle-reducing parameters was not the  
8 novel aspect of Konoplev's invention." That, I  
9 certainly agree with, because there were many methods  
10 already in existence that, you know, could process the  
11 images using wrinkle-reducing parameters.

12 Q. (By Mr. Janitens) So you're stating that on  
13 line 8, that was -- the statement was made by the  
14 Examiner or is this your opinion?

15 A. Oh, no, this is my opinion.

16 Q. Okay. And you're saying you agree with that?

17 A. I realize I've stated more than -- I already  
18 answered the part about the Examiner and, you know,  
19 I'm pointing out the Examiner granted the claim based  
20 on this change, and he there blessed the claim as  
21 novel with this change.

22 And I just went on to point out what I've  
23 already written, that, you know, I and a person of  
24 ordinary skill in the art would understand that, you  
25 know, well, just processing to, you know, wrinkle

1     reduce wouldn't be enough.

2           Q.   All right.  If we look at Figure 1 in  
3     conjunction with Claim 1.  If we look at step 1(c),  
4     which is processing the converted image through a  
5     skin-recognition filter.

6           A.   What page was -- 12; right?  Remember, you  
7     know, the figures in the spec are not necessarily a  
8     direct mapping of the claim.  Okay?  So, I mean, this  
9     is a teaching of the general method so that to help  
10    the person of ordinary skill in the art understand and  
11    interpret and implement the claims.  You know, it's --  
12    you know, the spec and the figures don't have to  
13    exactly match, you know, the claim language; so.

14          Q.   Okay.

15          A.   And I'm stating that because you want to do a  
16    one-to-one, you know, matching, and I hesitate to do  
17    that, you know, any time, you know, just picking a  
18    figure.

19          Q.   Right.  And I'm not trying to be tricky or  
20    anything.  Just with that in mind, as an example,  
21    Figure 1 being an exemplary embodiment, not saying  
22    that it's a direct mapping of 1(c), would you agree  
23    that block 130 is an example of step 1(c)?

24               MR. RIFFE:  Objection.  Form.

25          A.   I'm going to disagree with that because I

1 don't think of -- again, this is a teaching, you know,  
2 so that a -- a person of ordinary skill in the art  
3 gets the gist of what the patent is doing.

4 The claim explains itself well enough. Okay?  
5 In how to proceed, you know. And the spec, you know,  
6 gives an idea. So I, you know, there's, you know --  
7 there's 13 claims here, and I'm not going to try to  
8 say, oh, this figure belongs with this claim, and this  
9 block or this Figure 130 belongs with this limitation  
10 of this claim.

11 You know, the language is different in the  
12 two, and so, you know, I think that a person of  
13 ordinary skill in the art will interpret, you know,  
14 their attempt to implement the claim and, you know,  
15 look at the specification, including the figure, to  
16 try to learn the general gist of how to go about it.

17 Q. (By Mr. Janitens) All right. And Figure --  
18 I'm sorry. Claim 1, step (e), includes repeating  
19 steps (c) through (e). So if any of the steps (c) or  
20 (d) or (e), if they were removed, would it still be a  
21 novel claim?

22 MR. RIFFE: Objection. Incomplete  
23 hypothetical.

24 A. Well, I would just point out that's for, you  
25 know, the Examiner to decide at the outset. I have

1 not, you know, performed a validity exercise in the  
2 '410 by casting it against further prior art. I have  
3 no reason to believe that, you know, as it is, it's  
4 invalid.

5 If you start removing limitations then that  
6 always, you know, I mean, then I start wondering,  
7 okay, does the claim have even meaning if you start --  
8 and I'm speaking generally at a high level -- does the  
9 claim even have meaning if you're removing  
10 limitations. Can it even be function. Okay?

11 So I -- you know, it's a hypothetical  
12 question that I don't really know how to answer.

13 Q. And at the time of the invention, Konoplev,  
14 what would a POSITA, a person of ordinary skill in the  
15 art, understand wrinkle-reducing parameters in step  
16 1(e) to be?

17 MR. RIFFE: Objection. Form.

18 A. Well, you know, that -- I'm assuming that  
19 you're talking a person of ordinary skill in the art  
20 who's reading Konoplev.

21 Q. (By Mr. Janitens) Sure.

22 A. Okay. And reading this one claim, and  
23 reading 1(e), which I cite to, you know, here, he  
24 would, you know, read the specification, and he would  
25 think about the ideas in there, but he may have his



1 own way of, you know, going about it.

2 But, you know, I -- it's hard for me to put  
3 myself in the POSITA position because I don't know  
4 what application he's, you know, using this for, what  
5 his resources are. You know, it's -- it's a bit too  
6 open-ended and vague of a question.

7 Q. So looking at Figure 1, block 160, would that  
8 inform a POSITA of what wrinkle-reducing parameters  
9 would be?

10 MR. RIFFE: Objection. Form.

11 A. Well, I think -- and, again, this is at a  
12 high level -- I think a person of ordinary skill in  
13 the art would pick a -- would decide to apply a  
14 smoothing filter. Okay? And then would, you know,  
15 try to optimize it for his application by selecting  
16 parameters of that smoothing filter.

17 Q. (By Mr. Janitens) And would the --

18 A. You know, I mean, even the claim talks about  
19 an initial filtering radius and a final filtering  
20 radius.

21 Q. And a smoothing filter, that would use  
22 wrinkle-reducing parameters?

23 A. I don't have a list of the exhibits by  
24 number. I forget what 1017 is.

25 Q. That's your -- the first declaration --

1           A.    I see.

2           Q.    -- for 1251.

3           A.    Uh-huh.  All right.  Could I hear that  
4 question again?  Sorry.

5                   (Requested portion read.)

6           A.    So, I mean, the, you know, claim language  
7 itself states that there are parameters that are set:  
8 this initial filtering radius and final filtering  
9 radius, which are parameters for correcting the image.  
10 Sure.

11          Q.    (By Mr. Janitens)  So changing the filtering  
12 radius and final filtering radius, those are  
13 wrinkle-reducing parameters?

14                   MR. RIFFE:  Objection.  Form.

15          A.    You know, the initial radius and the final  
16 radius, I'm fine with calling those wrinkle-reducing  
17 parameters, but, you know, these are -- having a --  
18 having these radii, or these wrinkle-reducing  
19 parameters, this is, you know, not the innovation.  
20 The innovation is the automation.

21          Q.    (By Mr. Janitens)  And the automation  
22 includes repeating steps (c), (d), and (e)?

23          A.    Not just repeating, but you know, as the  
24 claim states -- well, increasing this radius until you  
25 meet this final radius.

1 Q. All right. I'm handing you Exhibit 1012, and  
2 that is the Konoplev provisional; is that correct?

3 A. Yeah. Looks like it, at least from the face  
4 pages. Looks like Konoplev.

5 Q. Let's turn to paragraph 27 of the Konoplev  
6 provision.

7 A. And is this part of it referenced in my  
8 report?

9 Q. If you look at Exhibit -- yeah, 1023 at  
10 paragraph --

11 A. I'm sorry. It's my --

12 Q. So the -- your supplemental declaration for  
13 1251 at paragraph 10.

14 A. Paragraph 10.

15 Q. So is it your opinion that paragraph 27 --

16 A. Let me get there first. Okay. I'm at  
17 paragraph 10. Okay.

18 Q. Is it your opinion that paragraph 27 of the  
19 Konoplev provisional teaches processing the converted  
20 image using wrinkle-reducing parameters?

21 MR. RIFFE: Object to the form.

22 A. I state that, but I go on to state that by  
23 disclosing processing an image through a smoothing  
24 filter using a different set of filtering parameters  
25 for wrinkle removal.

1 Q. (By Mr. Janitens) And are the  
2 wrinkle-reducing parameters defined in the Konoplev  
3 provisional?

4 MR. RIFFE: Objection. Form.

5 A. You know, I don't know what you mean by, you  
6 know, defined. I mean, if you read 27 in Konoplev,  
7 paragraph 27, he states parts of the image containing  
8 human faces are processed through the smoothing filter  
9 using a different set of filtering parameters for  
10 wrinkle removal.

11 So he's, you know, disclosing that there are,  
12 you know, filtering parameters.

13 Q. (By Mr. Janitens) So paragraph 7 states that  
14 parts of the image containing human faces are  
15 processed through the smoothing filter using a  
16 different set of filtering parameters for wrinkle  
17 removal; correct?

18 A. I mean, this is just a quote from Konoplev.

19 Q. So are the filtering parameters -- are any  
20 examples of the filtering parameters disclosed?

21 MR. RIFFE: Objection. Form.

22 A. I think a person of ordinary skill of the art  
23 would understand that, you know, the smoothing filter  
24 has filtering parameters that need to be chosen. That  
25 person of ordinary skill in the art may understand

1 that in his application, his own personal application  
2 he's doing for whatever company he's working for might  
3 need, you know, a -- he may find that he needs a  
4 certain set of filtering parameters.

5 Another POSITA working for another company  
6 might find a different set of filtering parameters are  
7 needed, such as a different -- you know, for example,  
8 a different inner and outer radii, which, you know, is  
9 from the '132, but I'm just giving you an example.

10 Q. (By Mr. Janitens) Can you provide any other  
11 examples of potential wrinkle-reducing parameters or  
12 filtering parameters?

13 MR. RIFFE: Objection. Form.

14 A. Well, I think it's Dr. Villasenor's job to  
15 provide the examples and for me to rebut. Because I  
16 didn't try to list them in my declaration. I mean, I  
17 do point to the reference in Gonzalez. It's a --  
18 probably the most widely cited and used image  
19 processing book in the world. Been around, you know,  
20 many editions through many years.

21 And, you know, as I state in my paragraph 10  
22 in the report, "Gonzalez" -- at the bottom, "Gonzalez  
23 'provides an introduction to basic concepts and  
24 methodologies,'" et cetera, et cetera. Second line,  
25 "Gonzalez includes a discussion on smoothing filters,

1 which are 'used for blurring... such as removal of  
2 small details from an image... and bridging of small  
3 gaps.'"

4 And I go on to state -- I'm going to  
5 paraphrase now -- and provides examples of equations  
6 and parameters for implementing these smoothing  
7 filters. You know, this -- and examples a result.

8 So this is, you know, one place a POSITA  
9 would immediately think of going to to learn about  
10 parameters more intimately.

11 Q. Would a POSITA have had the knowledge of the  
12 contents of the book, or would just know that it was a  
13 reference that could be used for digital image  
14 processing?

15 MR. RIFFE: Objection. Form.

16 A. I think a person of ordinary skill in the art  
17 would have a general knowledge of the contents, and,  
18 you know, I mean, I am an expert with 35 years, and I  
19 still refer to my books despite having a profound  
20 knowledge.

21 Q. (By Mr. Janitens) I'm handing you what is  
22 labeled as Exhibit 1010. And that's the Gonzalez  
23 reference; correct?

24 A. Yeah. It's the 3rd edition of Gonzalez, just  
25 for accuracy.

1 Q. Sure. All right. And on page 7, in  
2 paragraph 10 of your supplemental declaration --

3 A. Of my page 7, paragraph 10. Yeah. Uh-huh.

4 Q. -- you mention that Gonzalez provides  
5 examples of equations and parameters for implementing  
6 smoothing filters. So does Gonzalez disclose  
7 wrinkle-reducing parameters?

8 MR. RIFFE: Objection. Form.

9 A. Well, since, you know, smoothing filters are  
10 a type of correction, and you can correct different  
11 types of situations, smooth different situations. So  
12 he presents -- you know, smoothing filters can  
13 certainly be used for wrinkle reduction.

14 So when he, you know, describes filters which  
15 have parameters like in equation 3.5-1, this is a  
16 weighted averaging filter, this is one smoothing  
17 filter, has parameters, you know. If you apply it to  
18 the wrinkle-reducing problem, then these are  
19 wrinkle-reducing parameters. Just for an example.  
20 It's not exclusive in any way.

21 If you -- let's see. Oh, here in  
22 section 3.5.2, order-statistic filters. These are  
23 also smoothing filters. They have parameters. These  
24 are, you know -- I know a lot about these because I  
25 invented them way back when. I was in graduate

1 school. If you apply --

2 Q. (By Mr. Janitens) So you're talking about --  
3 sorry.

4 A. If you apply order-statistic filters to the  
5 wrinkle-reduction problem, then I think the parameters  
6 of that filter may be viewed in that context as  
7 wrinkle-reducing parameters.

8 Q. Can you explain a little bit how  
9 order-statistic filters work?

10 A. Sure.

11 MR. RIFFE: Objection. Form.

12 A. They're actually pretty simple.  
13 Order-statistic filters are, you know, one of many  
14 smoothing filters in that type of correction. In this  
15 type of filter, you know, before you weighted --  
16 perform a weighted average of the values of the  
17 picture within a small region, you put them in an  
18 algebraic order from smallest to largest. Then you  
19 weight them. So it adds an additional step to, you  
20 know, the smoothing linear filters of section 3.5.1.

21 Q. (By Mr. Janitens) Okay. And the filters in  
22 3.5.1, the smoothing filters --

23 A. Those are linear.

24 Q. Linear filters.

25 A. Yeah.



1 Q. On page 174, the third -- third paragraph  
2 down.

3 (Ms. Leung exits the room.)

4 A. Page 174 of Gonzalez.

5 Q. (By Mr. Janitens) Yeah.

6 A. Third paragraph, it starts, "As mentioned  
7 earlier."

8 Q. Yeah.

9 A. Uh-huh.

10 Q. Mentions that density of smaller objects  
11 blends with the background, and larger objects become  
12 blob-like and easy to detect.

13 A. Why am I not seeing that? How far down?

14 Q. Oh, that's the third sentence, third line.

15 A. Okay. Oh, comma, "such that."

16 Q. And so this is referring to Figure 3.33?

17 A. You know, Counselor, I'm giving you some  
18 latitude by delving into Gonzalez here. I don't think  
19 we talked about this in my report. I'll just point  
20 out that, you know, a smoothing filter -- spatial  
21 averaging can be used for a variety of applications  
22 other than wrinkle reducing, and I don't think this  
23 has anything to do really with wrinkle reducing  
24 necessarily other than, you know, the spatial  
25 averaging filters used.

1           So, you know, I'll agree that, you know,  
2   these -- this whole section here on smoothing filters  
3   talks about the type of correction that does  
4   smoothing. But, you know, I don't want to dissect  
5   everything in Gonzalez here since we haven't talked  
6   about it before, in my report or elsewhere.

7           Q. Okay. And so when you -- so the pages that  
8   you do cite in your report, 172 through 177?

9           A. Yeah. I point out that these -- I mean, my  
10   purpose is to point out these are smoothing filters,  
11   but you know, I -- I'll tell you what. Ask your  
12   question.

13          Q. So in these pages 172 to 177, the term  
14   "wrinkle-reduction parameters used."

15          MR. RIFFE: Objection to the form.

16          A. No. But certainly smoothing filters can be  
17   used for wrinkle reduction. And if those filters have  
18   parameters, then in that application, those are  
19   wrinkle-reducing parameters.

20          Q. (By Mr. Janitens) All right. Let's put  
21   Gonzalez aside for a second.

22                 (Ms. Leung enters the room.)

23          Q. (By Mr. Janitens) Okay. If we turn back to  
24   the Konoplev provisional, to the 1012.

25          A. I'm there. And where now?

1 Q. Yeah. Let's look at paragraph 49.

2 A. And just for efficacy, where am I talking  
3 about this in my report?

4 Q. Paragraph 11.

5 A. Okay.

6 Q. Okay. So we look at paragraph 49, does this  
7 paragraph teach processing converted image using  
8 wrinkle-reducing parameters?

9 MR. RIFFE: Objection. Form.

10 A. I mean, paragraph 49 states that, you know,  
11 there's an imperfection reduction mode and, in  
12 parentheses, related to that, it mentions wrinkle  
13 reductions.

14 Q. (By Mr. Janitens) So an imperfection  
15 reduction mode, that includes wrinkle reductions?

16 A. It does. It says wrinkle reductions in the  
17 parenthetical.

18 Q. And filtering parameters are initial radius,  
19 final radius, and imperfection reduction mode;  
20 correct?

21 A. Well, I think that the parameters are the  
22 initial and final radius that are in the -- in  
23 paragraph 49 -- the way I read that is that the  
24 filtering parameters are an initial radius and a final  
25 radius. I don't think that it's intended to say that,

1 you know -- let me pause that.

2 Yeah. I think the mode also could be viewed  
3 as a filtering parameter. So, I think, yeah, those  
4 are the filtering parameters that are stated here.

5 Q. Imperfection reduction mode, is there any  
6 further discussion or detail about the imperfection  
7 reduction mode in the Konoplev provisional?

8 MR. RIFFE: Objection. Form.

9 A. Well, at the end of 49, it's mentioned again.  
10 In 50, it's mentioned. I mean, probably have to do a  
11 word search, you know. But I cited to 49 in my  
12 report.

13 Q. (By Mr. Janitens) All right. Let's turn  
14 back to Konoplev.

15 A. The '410?

16 Q. Yeah. The '410. And if we could turn to  
17 Figure 1. So block 130, "Enhance body skin by  
18 applying skin-recognizing filter to whole image."  
19 Would you agree that the skin-recognizing filter is  
20 applied to the whole image as it's stated?

21 MR. RIFFE: Objection. Form.

22 A. I mean, block 130 says that there's a  
23 skin-recognizing filter, you know, applied to the  
24 whole image. I won't dispute that, I mean, if that's  
25 the question. I mean, 130 -- let me just say this:

1 130 says applying skin-recognizing filter to the whole  
2 image.

3 Q. (By Mr. Janitens) Fair enough. So let's  
4 look at step 160 then.

5 A. Which is distinct from 130. Yeah.

6 Q. Now, does it use the same skin-recognizing  
7 filter as 130?

8 MR. RIFFE: Objection. Form.

9 A. So, again, I'm going to draw you to my report  
10 and ask where in my report you're drawing this  
11 question from.

12 Q. (By Mr. Janitens) If you'll look at  
13 paragraph 15 of your report.

14 (Document(s) reviewed by the witness.)

15 A. So, you know, in my report as I cite to, you  
16 know, in paragraph -- I'm sorry -- column 6 of the  
17 Konoplev '410, starting at line 20, it states, "A  
18 skin-recognition filter is used on the whole image for  
19 enhancing body skin appearance on the image in  
20 step 130." You asked me about that already.

21 "The filter uses skin-imperfection reducing  
22 parameters. Face coordinates are acquired from the  
23 face-detection module (or from the user) in step 140.  
24 If, in step 150, faces are found in the image, the  
25 facial skin is enhanced by the skin-recognition

1 filter."

2           So given that in the spec, you know, the same  
3 language is used, one could say this is the same  
4 filter. It doesn't mean that the same parameters, you  
5 know, are necessarily used. It says at the end of  
6 the -- that paragraph, line 27, "The filter uses  
7 wrinkle-reducing parameters." It's -- that's all it  
8 says there.

9           Q. Okay. So in step 130, you have the  
10 skin-recognizing filter which is applied to the whole  
11 image, could that also include the face?

12           A. So as part of my answer, you know, if you  
13 read down in column 6 of Konoplev '410 around 40,  
14 remember that, you know, the -- it's talking about the  
15 skin-recognition filter here in line 37.

16           It says, "The filtering parameters are: an  
17 initial radius, a final radius, an imperfection  
18 reduction mode," which includes, you know,  
19 body-imperfection reductions, wrinkle reductions, and  
20 so on. Okay? So you notice that in block 130 it  
21 says, "enhance body skin," and in 160 it says,  
22 "enhance facial skin."

23           So, you know, the filter has already had  
24 different parameters supplied to it. So back to your  
25 question at 130 -- well, let's have the question at

1 130 again so I can answer it most accurately.

2 (Requested portion read.)

3 A. So here I'm, you know, referring to the  
4 skin-recognizing filter in the block. I think if  
5 there's a face in the image, the face would be  
6 processed. But if you read the -- if you read the  
7 spec, you know, it's applying skin-recognizing filter  
8 to the whole image. Okay? It doesn't really -- it's  
9 not really clear on what it does to a face in 130.  
10 I'd have to speculate a little bit. But what is clear  
11 is that it then, you know, specifically looks for  
12 faces and applies the skin-recognizing filter in the  
13 wrinkle-reduction mode with that parameter to faces.

14 Q. (By Mr. Janitens) So block 160 we have  
15 wrinkle reduction, and in block 170 we have blemish  
16 reduction. Would the parameters be the same for both  
17 wrinkles and blemishes?

18 MR. RIFFE: Objection. Form.

19 A. I don't see why they would have to be the  
20 same.

21 MR. JANITENS: Looks like we've been going  
22 about an hour. Do you want to take a break?

23 THE WITNESS: Sure.

24 MR. JANITENS: All right. Let's do that.

25 (Recess taken from 11:39 a.m. to 11:46 a.m.)

1 Q. (By Mr. Janitens) All right, Dr. Bovik.

2 Let's turn to the '132 patent, Exhibit 1001 --

3 A. Uh-huh. Okay.

4 Q. -- and corresponding pages in the  
5 supplemental declaration.

6 A. 1251?

7 Q. 1251, paragraph 18, for starters. So let's  
8 look at Figures 8A, 8B, 8C in the '132 patent.

9 A. Okay.

10 Q. Okay. So Figure 8A, that's an example of no  
11 dynamic range correction being applied; correct?

12 A. You said 800A?

13 Q. 8A. Sorry. Figure 8A.

14 A. Oh, 8A.

15 Q. Yeah.

16 A. Yeah, which is also 800A here.

17 Q. Oh, yeah. Okay. So --

18 A. Yeah. There hasn't been any dynamic range  
19 correction applied here.

20 Q. Okay. And then turning the page, Figure 8B,  
21 looking at image 800B, that's an example of dynamic  
22 range correction applied without knowledge of content  
23 of the image; correct?

24 A. Yeah. It states that as pretty much exactly  
25 in the specifications.



1 Q. Okay. And so dynamic range correction would  
2 be applied uniformly?

3 A. I would say, yes, it was, you know, applied  
4 uniformly there.

5 Q. And then at 8C, Figure 8C, and the image  
6 800C, that's an example of the image with dynamic  
7 range correction selectively applied based on the  
8 presence and location of the face area, 801C; correct?

9 A. Yes.

10 Q. And so can you explain to me the difference  
11 between 8B and 8C, the luminance histogram there?

12 MR. RIFFE: Objection. Form.

13 A. Well, before I answer, I just want to point  
14 something out. That a luminance histogram of an image  
15 is a significant reduction of information about that  
16 image. An image is two-dimensional, and that  
17 information, in creating a one-dimensional image, a  
18 lot of information is lost. For example, you don't  
19 know which luminances come from where. You can't.

20 Q. (By Mr. Janitens) Okay.

21 A. You just know how many of each luminance. So  
22 the general thing I'll say is if you compare 8B and 8C  
23 is you'll see that, you know, the histogram has  
24 changed. I will just say broadly that, you know,  
25 there's more weight, you know, has moved towards --

1 weight of the graph that has moved a little bit  
2 towards the right. You can't -- it's impossible to  
3 point in here and say, oh, here's the face in the  
4 histogram.

5 Histograms, by their nature, are just  
6 one-dimensional, meaning you can see the face in the  
7 image but you don't know which of these, you know,  
8 peaks in 8B or in 8C at the bottom in the histogram  
9 plots corresponds to the face.

10 Q. But it's fair to say that it's a graph of  
11 luminance of the face region itself, though; right?

12 MR. RIFFE: Object to the form.

13 A. Oh, yeah. I'm sorry. Yeah, this is face  
14 region. Which, I should amend what I said to which  
15 part of the face is brightened rather than the face.  
16 Because this is all for the face region. Yeah.

17 Q. (By Mr. Janitens) Okay. So, generally, we  
18 can say -- we agree that it's the face region but we  
19 need a different 2-D representation of it to determine  
20 individual pixels?

21 A. Yeah. So, I mean, just to, you know,  
22 slightly correct what I said before, I said the image;  
23 but when I said the image, you know, that little 801B  
24 is not all face, for example. It's part of it in  
25 corners that aren't face, and you know, we don't --

1     you can't point at this and say, what part is the --  
2     you can't look at the histogram and say, okay, this,  
3     you know, peak here is from the nose, and this is from  
4     the eye, or anything like that.

5           Q.   All right.  And does the '132 patent disclose  
6     what is happening to regions other than the face  
7     region in Figure 8C of image 800C?

8           MR. RIFFE:  Objection.  Form.

9           A.   So, you know, the histogram is limited to  
10    just area around the face.  So the graph in the bottom  
11    doesn't really reveal anything.  But if you -- if you  
12    compare 8B with 8C, you can see that the image has  
13    been lightened even outside the face, just not as  
14    much.

15          Q.   (By Mr. Janitens)  Does the specification  
16    state what is happening outside of the face region?

17          MR. RIFFE:  Objection.  Form.

18          A.   Well, if you, you know, read in column 10, it  
19    says, "Fig. 8C shows an example of the same image  
20    after dynamic range correction is selectively applied  
21    based on knowledge of the content of the image."  I  
22    mean, in here, again, the specification is, you know,  
23    trying to inform the person of ordinary skill in the  
24    art how to apply the claims.

25               And it doesn't say in 8C that dynamic range

1 correction is only applied to the face. Okay? It's  
2 applied based on knowledge of the overall content of  
3 the image, including the presence and location of the  
4 facial area, meaning also knowledge of where the face  
5 isn't, by logical deduction. Okay?

6 Q. (By Mr. Janitens) Does the specification --

7 A. Well, I wasn't finished.

8 Q. Sorry.

9 A. So when it says "selectively applied," that,  
10 in my mind, means it's applied in different regions or  
11 portions of the image, based on that knowledge. Okay?  
12 That's what "selectively applied" means. It doesn't  
13 say only applied to face or something. It says  
14 selectively applied. And when I look at the figure,  
15 that's what I see.

16 Q. So you agree that the specification doesn't  
17 specifically say what type of processing applies  
18 outside of the face?

19 MR. RIFFE: Objection. Form.

20 A. Well, first, I'll say that my prior answer in  
21 no way was in agreement with what you just said. My  
22 prior answer was my prior answer.

23 So your question you just asked me is a  
24 separate question. You know, I -- it says -- I mean,  
25 it says dynamic range correction is selectively

1 applied. So I -- I think it states that dynamic range  
2 correction is applied to the image in a selective way.

3 Q. (By Mr. Janitens) And on line 16 -- well,  
4 let's see. 15, lines 15 to 18, so, "8C shows an  
5 example of the same image after dynamic range  
6 correction is selectively applied based on knowledge  
7 of the content of the image, i.e., based on the  
8 presence and location of the face area"; correct?

9 A. Yes. It says just that.

10 Q. Okay. Let's turn back to Konoplev '410.

11 A. Uh-huh.

12 Q. I'd like to ask you about Figure 1, block  
13 120, "Convert image to CIELAB color model."

14 A. Sure.

15 Q. First, what would a POSITA understand CIELAB  
16 to be?

17 A. I'm actually happy to answer this, but maybe  
18 you could point to me in where in my declaration I  
19 talked about 120. So just so I can -- I like to be  
20 able to point at things to be more accurate.

21 Q. All right. Let's look at -- starting at  
22 paragraph 21.

23 A. Paragraph 21? Sure.

24 Q. Yeah.

25 A. Of my 1251?

1 Q. 1251 supplemental, yeah.

2 A. Uh-huh.

3 Q. And the question of whether Konoplev is  
4 directed to both image capturer in post processing?

5 A. Since, you know, the context here includes  
6 Zhang, you might as well hand me Zhang, if you don't  
7 mind.

8 Q. All right. I'm handing you Exhibit 1008,  
9 Zhang.

10 A. Uh-huh. Okay. But I'm generally there. Was  
11 there a question outstanding?

12 (Requested portion read.)

13 A. So, I mean, I address -- so -- I mean, let me  
14 just state two things. You know, I talk about this  
15 aspect of the motivation to combine these two  
16 references on the following pages. You know, in  
17 paragraph 23, I -- of my report, for 1251, I say -- I  
18 state, "Like Zhang, Konoplev expressly teaches that  
19 its techniques are applications doing both image  
20 capture in post-processing." You know, if you look at  
21 the facing page of the '410, Figure 1, I mean, the  
22 first block 110, is "Receive image from a user or  
23 digital capturing device." Okay? I mean, you can  
24 imagine a digital camera that has a lens and a CCD  
25 array capturing it and then sending it internal to the

1 camera where it does these other kind of processing.  
 2 Same thing with a cell phone. You take a picture with  
 3 a cell phone, you know, it is -- there's capture  
 4 inside the cell phone. That -- that capturing process  
 5 is implemented by the processor in part.

6 You know, I see these two references, Zhang  
 7 and Konoplev, as -- you know, as both Dr. Villasenor  
 8 and I state and agree, we're dealing with digital  
 9 images which can be captured with solid state. And  
 10 Zhang also discloses image capture, and I thought  
 11 reading through it all in my paragraph 22, I state,  
 12 you know, "Zhang describes devices for capture." Now,  
 13 I won't read all the following.

14 And back to 23, in the inset, my paragraph 23  
 15 of my declaration, Konoplev expressly teaches -- as in  
 16 the inset -- not the exemplary -- at the bottom, it  
 17 could implemented on a processor of a digital camera  
 18 or a cell phone. These -- Zhang and Konoplev are  
 19 operating in, you know, the same space of application  
 20 here.

21 Q. (By Mr. Janitens) So in Konoplev 110, so  
 22 receiving an image from the user or digital capturing  
 23 device, is that received as RGB signal?

24 A. Where?

25 Q. In Konoplev Figure 110.

1           A. So, again, with regards to the foment of  
2 that, received signal, where have I opined upon that  
3 in my report?

4           Q. You were just talking about it in paragraph  
5 23 of your report.

6           A. Well, I don't --

7           Q. At the bottom of page 20. You quote  
8 column 6, lines 13 through 14.

9           A. Yeah. I mean, all that Konoplev says there,  
10 "An image is received from a user or from an  
11 image-capturing device in step 110."

12          Q. Just in general, I mean, when you receive --

13          A. Which could be in the digital -- let me  
14 finish. Could be, you know, as part of a digital --  
15 the whole thing, the whole, you know, Konoplev concept  
16 inside a digital camera inside a cell phone. And he  
17 doesn't say anything about whether it's RGB or not.  
18 Could be RGB but doesn't say.

19          Q. So in Figure 1 at block 185, it says,  
20 "Convert image back to RGB."

21                 MR. RIFFE: Objection. Form.

22          Q. (By Mr. Janitens) And not to be tricky  
23 or anything, it's just column 3.

24          A. Yeah. I see. Oh, column 3.

25          Q. Yeah.



1 A. Column 3 of the '410?

2 Q. Yeah. It says, "An image is converted from  
3 RGB to another color model"?

4 A. Which line?

5 Q. Line 4. Sorry.

6 A. Yeah. I just don't see the connection to  
7 Figure 1 there. I mean, yeah, I agree that's what it  
8 says. Uh-huh.

9 Q. And so why would the image need to be  
10 converted from RGB to another color model such as  
11 CIELAB?

12 A. I don't think it would need to be. It's just  
13 a design choice.

14 Q. So what is the difference between RGB and  
15 CIELAB?

16 A. They're just different color spaces.

17 Q. So why would one of ordinary skill in the art  
18 want to convert RGB to CIELAB?

19 MR. RIFFE: Objection. Form.

20 Q. (By Mr. Janitens) What are the benefits?

21 MR. RIFFE: Objection. Form. And outside  
22 the scope.

23 A. So, again, if you look at -- let me answer it  
24 this way. I already answered, you know, why would  
25 they do it? Well, they would be making a design

1 choice. It could be RGB. It could be some of the  
2 other color spaces. They list some in column 6, lines  
3 11 through 19. All of that is still image data. It  
4 still -- it remains image data.

5 And you could certainly, you know, apply  
6 algorithms for, you know, skin recognizing in  
7 different modes on RGB as well.

8 Q. (By Mr. Janitens) And would a POSITA  
9 understand by the invention that there could be any  
10 advantages to using CIELAB versus any of the other  
11 potential device-independent color models?

12 MR. RIFFE: Objection. Form.

13 A. Well, advantages and disadvantages. I mean,  
14 CIELAB, that's -- you know, it's a -- we use it a lot.  
15 I mean, it's in my work. It's what's -- a perceptual  
16 color space. And what that means is it's designed so  
17 that the distances between two colors in that space,  
18 while they may -- so that the distance between them is  
19 perceptually maintained as well as numerically. Okay?  
20 In some other color spaces, a -- you know, a numerical  
21 distance may not correspond to a perceptual distance.  
22 I could talk about that all day, but I don't think it  
23 would make for good use of our time.

24 So, you know, somebody, you know, again, in  
25 their design choice, could decide whether they want to

1 do that and use the extra computation to make that  
 2 conversion or leave it as RGB with reduced computation  
 3 without that conversion and just execute it on RGB. I  
 4 think that in the context of the '132 -- let me look  
 5 at Claim 1, it's image data, and that image data can  
 6 represent, you know, objects in the image, whether --  
 7 regardless of the color space. And you could apply  
 8 correction operations on it in that color space too.

9 Q. (By Mr. Janitens) Okay. So with Konoplev,  
 10 all the enhancement, skin enhancement and blemish  
 11 reduction, whatnot, it doesn't matter if it was RGB or  
 12 CIELAB, you could still perform the same processing?

13 MR. RIFFE: Objection. Form.

14 A. I didn't say it doesn't matter. Okay? I  
 15 mean, obviously, when you make a conversion to another  
 16 color space, I mean, you have, you know, the same  
 17 information but in a different form, and, you know,  
 18 the person of ordinary skill in the art would  
 19 recognize that, and they would, you know, realize that  
 20 if they're going to apply some kind of filters, then  
 21 they may need to modify the parameters and the type of  
 22 correction they're using. You still apply the same  
 23 type of correction. You might have to modify the  
 24 parameters.

25 And, again, you know, if you look at

1 paragraph 6 of Konoplev, it's just talking about  
2 Figure 1, and here I'm not talking about our  
3 Patent '132, but I can still state that the  
4 specification is, you know, teaching the '410.

5 And in the figure, the image is converted to  
6 CIELAB, but I don't think that Konoplev teaches away,  
7 necessarily, from using RGB. It's just giving design  
8 choices.

9 Q. (By Mr. Janitens) Would a CIELAB color model  
10 be able to be displayed on a rendering device, or does  
11 it need to be RGB or --

12 A. Well, this I'll -- even though we're getting  
13 a little bit further -- I'm just going to give you a  
14 gentle warning, we're getting a little far afield from  
15 my declaration, but this is a gimme for you. CIELAB  
16 is in a color space that can't be displayed. You need  
17 to reconvert back to RGB for display, because  
18 displays -- display RGB, because that's what we humans  
19 sense. We can't sense in CIELAB.

20 It may interest you, however, that once the  
21 visual signal strikes the retina in the post-retinal  
22 ganglion cells, your own eyes convert that information  
23 into something kind of like CIELAB, but it's for other  
24 reasons than skin detection. It's because you can  
25 achieve certain efficiencies in representation. In

1 other words, a better code.

2 Q. A perception and whatnot?

3 A. Yeah. It's irrelevant here, but it's just a  
4 little nugget of information for the Court.

5 Q. All right. Appreciate it. All right. Let's  
6 look at Zhang again.

7 Along the lines of what we've been talking  
8 about comparing Zhang and Konoplev, is it your opinion  
9 that Zhang also discloses an automated process like  
10 Konoplev?

11 A. And do you want -- perhaps you want to show  
12 me where I opined upon this in my current  
13 supplementary declaration.

14 Q. So back in the beginning, near the beginning,  
15 on paragraph 8 where you discuss the automated  
16 technique that Konoplev discloses, would a person of  
17 ordinary skill in the art at the time believe that  
18 Zhang is similar to that?

19 MR. RIFFE: Objection. Form.

20 A. With respect, Counselor, my question is,  
21 where do I opine on what Zhang, automation or not, is  
22 opined upon in my declaration?

23 Q. (By Mr. Janitens) So you do not opine about  
24 Zhang being directed to an automated process?

25 MR. RIFFE: Objection. Form.

1       A. I didn't formulate an opinion and lay it on  
2       paper here, so that's -- you know, that's something --  
3       I'd have to look at Zhang in depth and, you know,  
4       formulate an opinion by, you know, what -- what I'd  
5       want to say about automation with respect to Zhang.  
6       Let's just say it that way.

7       Q. (By Mr. Janitens) So in your declaration on  
8       page 22, at the bottom, "Zhang and Konoplev are not so  
9       materially different in their complexity that a POSITA  
10      would have found them to not be readily combinable"?

11      A. I agree with that statement, yes.

12      Q. I was wondering if you could expand on why  
13      it's your opinion that Zhang is -- Zhang and Konoplev  
14      are -- are not so materially different in their  
15      complexity.

16      A. Well, complexity is, you know, how much  
17      computation is involved. That's what I mean by  
18      "complexity." It's a standard way of referring to how  
19      much computation.

20             And, you know, if you look at -- just looking  
21      at the facing page of, you know, Zhang, and you'll see  
22      operations that are in the various blocks, the facing  
23      pages corresponds to Figure 2, I think, just for  
24      clarity of Zhang. Without getting into, you know,  
25      specifics of any of those, since I'm not really

1 opining on those in my declaration, I believe that,  
2 you know, on blocks -- the blocks contained within 22,  
3 for example, involve computations that are of similar  
4 complexity as what are discussed in Konoplev.

5 Also, in block 20, you know, you'll see  
6 similar language even, you know, face detection, skin  
7 detection; so these are the same space and they're  
8 doing a lot of the same stuff, and so it's natural  
9 that, you know, they're using techniques which are  
10 equatable complexity, which makes them, you know,  
11 pretty easy to combine. There's no imbalance between  
12 them.

13 Q. All right. Next I'd like to talk about  
14 maintaining local contrast, which is claim 8 of the  
15 '132 patent.

16 A. Yes.

17 Q. And your supplemental declaration is at  
18 paragraph 26. And my question is, how would a POSITA  
19 have defined local contrast?

20 MR. RIFFE: Objection. Form.

21 A. I'll be right with you. Okay. 26. Where  
22 are we looking at here in 26?

23 Q. (By Mr. Janitens) So claim 8 claim,  
24 "determining the amount of gain to apply to the first  
25 portion of the digital image data so as to maintain

1 local contrast of the first portion of the digital  
2 image data."

3 So I'm wondering what a POSITA -- how a  
4 POSITA would have defined "maintain local contrast"?

5 MR. RIFFE: Objection. Form.

6 A. Well, contrast, including local contrast,  
7 which is -- well, contrast, generally, is a  
8 well-defined term in the art. So are local contrast.  
9 But the thing is, there are multiple versions of  
10 contrast, local or otherwise. So a POSITA would, you  
11 know, have it in his or her -- in his or her tool kit,  
12 you know, a number of ways, such as what's called  
13 Michaelson contrast, and another method called RMS  
14 contrast. Okay? So if they wanted to make it  
15 quantitative like that.

16 But they could also, you know, visually  
17 inspect based on experimentation and observe whether  
18 local contrast being maintained in their judgment.  
19 So, in their application, I don't think that, you  
20 know, Konoplev insists on any specific definition of  
21 local contrast.

22 Q. (By Mr. Janitens) So in Konoplev, does it  
23 provide any examples of preserving fine details?

24 A. Well, I mean, Konoplev refers to, you know,  
25 the preservation of image details in a couple of



1 places. I cite to them on page 25 in my report near  
2 the bottom, referring to column 6 at the bottom of  
3 Konoplev and also abstract Konoplev.

4 So he refers to, you know, details and fine  
5 details in a couple of places.

6 Q. Okay. So is it your opinion that the  
7 preservation of fine details is akin to maintaining  
8 local contrast?

9 A. I don't know what akin means, but, you know,  
10 this discussion here where I talked about image  
11 details in my report, you know, here I'm being  
12 responsive to Dr. Villaseñor, who talks about, you  
13 know, contrast between two pixels. And you can't get  
14 more local than just two pixels that are together. I  
15 mean, you can talk about one pixel, but a single pixel  
16 doesn't have a contrast. You have to have at least  
17 two pixels to start talking about a contrast.

18 Q. Right.

19 A. So we agree -- as I state, we agree that's an  
20 extremely local thing. That's a very, very local  
21 contrast if you define it there, and, you know, if you  
22 are preserving, you know, contrast at that very, very  
23 small scale, just a couple of pixels then, you know, I  
24 would say that that is related. I don't know what  
25 akin means, but, you know, that -- and we don't have

1 any images in front of us, and we aren't talking  
2 about, you know, any specific -- the filter isn't in  
3 front of us, and we aren't running the algorithm, but  
4 I would say generally that if you're preserving that  
5 kind of local contrast, you know, it would indeed  
6 likely mean that you're preserving fine details.

7 Q. And so in Konoplev, would a blemish have  
8 local contrast?

9 A. Well, a blemish is not as local as what  
10 Dr. Villasenor is talking about here, generally.  
11 Usually it involves multiple pixels, might be dozens  
12 of pixels. Okay? Dozens of pixels in a picture is  
13 still tiny, you know, in the broad scheme of, you  
14 know, billions of pixels.

15 So, you know, yeah, local, but it would be  
16 less local, but still local. Local can include, you  
17 know, hundreds of pixels in the language of my field.

18 Q. Back to preserving fine details. Other than  
19 what you've cited in paragraph 26, are there any  
20 examples in Konoplev what preserving fine details may  
21 be?

22 A. Well, I think, you know, Konoplev is making  
23 it clear that fine details are things that are very  
24 local and smaller than, you know, blemishes and that  
25 sort of thing, so that when the blemishes are removed

1 by the smoothing process, it's not -- you know, as I  
2 state in, you know, my part of paragraph 26, that  
3 processing does reduce contrast among the adjacent  
4 pixels, meaning very, very local. It doesn't reduce,  
5 you know, local contrast at larger scales. Okay? So  
6 by that, I mean in other places and over larger  
7 localities, shall we say.

8 So everything here is very consistent.  
9 Konoplev has a smoothing process that can reduce, you  
10 know, these imperfections, yet preserve details, which  
11 are, you know, in the sense of contrast as your  
12 expert, Dr. Villasenor, is talking about.

13 So just to be clear, Konoplev is teaching  
14 details are preserved and then the locality of those,  
15 you know, the local contrast is maintained. Because  
16 the details are maintained.

17 So with regards to Qualcomm's argument about,  
18 you know, reducing local contrast, it doesn't reduce  
19 the local contrast to the details. So I'm referring  
20 to the inset part of 26.

21 Q. And would blurring decrease local contrast?

22 A. Which blurring? Where?

23 Q. Just blurring in general.

24 MR. RIFFE: Objection. Form.

25 A. Well, I, again -- with apologies, I need

1 to -- blurring is specific -- you know, specifically  
2 discussed in my declaration and have a context and  
3 that sort of thing.

4 Q. (By Mr. Janitens) I'll rephrase that. So  
5 Konoplev's facial smoothing, would that reduce local  
6 contrast?

7 MR. RIFFE: Objection. Form.

8 A. In the context of the fine details which are  
9 preserved, okay, the local contrast is maintained. So  
10 if the object detail remains visible and the detail  
11 remains, then the local contrast has not been reduced  
12 by Konoplev. And Konoplev teaches that image details  
13 are preserved so the local contrast is not reduced.

14 Q. (By Mr. Janitens) Let's look at paragraph 29  
15 of your declaration. It's on the next page, actually,  
16 still in paragraph 29, but the two images, castle  
17 images, you've got there. Can you explain the  
18 difference between those?

19 MR. RIFFE: Objection to form.

20 A. The difference between these two images?

21 Q. (By Mr. Janitens) Yeah.

22 A. Well, I mean, it's explained. So the top one  
23 is an original image of Castle Neuschwanstein. Okay?  
24 In southern Germany. In the bottom one, you can see  
25 that a blurring process has been applied to selected

1 portions, so the castle itself is largely not blurred  
2 by that blurring process. The rest of the image, you  
3 know, as you proceed outward from the castle becomes  
4 blurred. And, in addition, the whole image, the whole  
5 bottom image had a contrast enhancement applied. And  
6 you can see it's -- has a heightened contrast.

7 Q. And the source of these images is movavi.com?

8 A. Yeah. There's a link there. You can also  
9 find the original image here on Wikipedia.

10 Q. What is MOVAVI?

11 A. It's just a Web site. It's one of many Web  
12 sites devoted to picture processing.

13 Q. Was that available to POSITA in 2009?

14 A. Well, I'm using this example here not as an  
15 example of what a POSITA would refer to necessarily,  
16 but just merely to explain what I'm trying to explain  
17 with regards to combining contrast enhancement with  
18 blurring.

19 Q. So is it your opinion that in 2009, at the  
20 time of the invention, would a POSITA have understood  
21 that blurring and contrast enhancement be combined?

22 A. Oh, sure.

23 Q. Used together? And so why would a POSITA be  
24 motivated to apply both blurring and contrast  
25 emphasis?

1       A. Well, I mean, I state in paragraph 29 that,  
2       you know, if you apply, you know, blurring to an image  
3       in a digital way, okay, then as I state, "Indeed,  
4       because blurring reduces contrast between the adjacent  
5       pixels, a POSITA would have found it desirable to  
6       apply contrast enhancement to the blurred portions to  
7       restore contrast to the blurred portions."

8       Q. And so you said blurred in a digital way as  
9       opposed to an analog?

10      A. Well, with a lens. I mean, this picture  
11      below here was blurred with using -- in a digital way.  
12      I mean, even if it was blurred in an analog way, you  
13      could contemplate this. But, you know, here I  
14      referred to blurring in a specific way in  
15      paragraph 28.

16      Q. And so is it your opinion that the blurring  
17      does not decrease visibility background?

18      A. Where are you referring to what I've opined?

19      Q. Paragraph 27.

20      A. By the way, you should probably give me  
21      Nonaka at this point.

22      Q. Yeah. We'll get to that. Sure.

23      A. There's not a question, is there? I thought  
24      you were looking at me expecting something.

25      Q. Yeah. So just -- so is it your opinion that

1 the blurring does not decrease visibility in the  
2 background?

3 A. Okay. So all that silent space was waiting  
4 for me?

5 Q. I thought you were reading.

6 A. My apologies.

7 Q. No problem.

8 A. I honestly thought we'd moved on. You said  
9 something like, you know, not just now or something.  
10 So what's the question?

11 Q. So is it your opinion that the blurring does  
12 not decrease visibility of the background?

13 MR. RIFFE: Objection. Form.

14 A. So, I mean, you didn't -- see, I asked you to  
15 direct me to it. And that's -- I remember what  
16 happened. I asked you to direct me to someplace, and  
17 you didn't.

18 So in the context of blurring the background,  
19 I mean, you're talking about what Zhang is teaching.  
20 Is this the context we're looking at?

21 Q. (By Mr. Janitens) Yeah.

22 A. Okay. So, you know, as I state in  
23 paragraph 30, Zhang teaches enhancing focus of the  
24 foreground by blurring background. And as I state,  
25 that blurring is not intended to decrease visibility

1 but just decreases the amount of focus. You can still  
2 see the background. It's still just as there as it  
3 was before; it's just been blurred.

4 Q. So is visibility affected at all?

5 A. Well, I mean, the background is still  
6 visible. Okay? It's still there. It's just been  
7 modified to give this, you know, depth-of-field  
8 effect. So I would disagree with the statement that  
9 the goal is to decrease visibility of the background  
10 by that.

11 Q. Can blurring of the background increase  
12 visibility of the background?

13 MR. RIFFE: Objection. Form.

14 A. So, you know, again, I think what I've tried  
15 to explain is what the inventor of Zhang is attempting  
16 to do, is seeking to do. So he applies this blurring  
17 with the intention of decreasing focus which gives a  
18 certain effect. His goal is neither to increase nor  
19 decrease visibility of the background.

20 And I would say that when you apply his  
21 method, that's what you're doing; you're blurring the  
22 background. You're not -- he's not trying to decrease  
23 visibility.

24 Now, so if you're asking me a specific  
25 question that's really broad and open-ended, I don't



1 know how to answer that.

2 MR. JANITENS: All right. Looks like it's  
3 been about an hour. So we can break for lunch?

4 THE WITNESS: Sure. Sure. Sure.

5 MR. JANITENS: All right. Sounds good.

6 (Recess taken from 12:56 p.m. to 1:34 p.m.)

7 Q. (By Mr. Janitens) All right, Dr. Bovik.  
8 Let's turn to -- let's look at your supplemental  
9 declaration for 1251.

10 A. Okay. Back to 1251.

11 Q. Paragraph 28.

12 A. 28.

13 Q. Just to kind of continue our discussion about  
14 contrast emphasis versus blurring.

15 A. Uh-huh.

16 Q. You cite Gonzalez there at pages 126 to 127.

17 A. Uh-huh.

18 Q. If you would go ahead and turn to that real  
19 quick. So on page --

20 A. On Gonzalez? Okay.

21 Q. Yeah. So the bottom of 127, 3.2 Some Basic  
22 Intensity Transformation Functions.

23 A. Yeah.

24 Q. I was wondering if you could tell me about  
25 some of the basic transformation functions that would

1 have been available to a POSITA at the time of the  
2 invention of the '132 patent.

3 MR. RIFFE: Objection. Form.

4 A. I realize I'm citing these pages, but do I,  
5 you know, cite to specifically 3.2 in these intensity  
6 transformations that you want to point me to?

7 Q. (By Mr. Janitens) So just in general, as you  
8 mentioned, "Contrast emphasis, which operates on  
9 individual pixels (called "point processing"),  
10 increases the difference between the highest and  
11 lowest intensity levels in an image and adjusts pixel  
12 values accordingly, resulting in the higher intensity  
13 levels becoming brighter or the lower intensity levels  
14 becoming darker."

15 A. So to answer -- I mean, I'm sorry. I didn't  
16 mean to interrupt.

17 Q. Oh, no problem. So I just wondered what kind  
18 of transformations would be used for contrast  
19 emphasis?

20 A. Again, I mean, I don't see the word -- I  
21 mean, you're reading from 29 here, and I don't see  
22 anything about transformations. You know, if you look  
23 at Gonzalez here, he talks about a number of  
24 transformations for enhancement. If you look at  
25 page 128 of Gonzalez at the top, he's talking about,

1 you know, logarithmic operations. I mean, this is  
 2 where you apply a logarithm to every pixel value.  
 3 Okay? What does that do? It's a way of, you know,  
 4 changing the histogram of an image. Okay? But it may  
 5 not -- it may be directed to something different than,  
 6 you know, contrast, you know, processing.

7           Although, you know, anything you do to an  
 8 image may affect contrast, you know, a little bit,  
 9 okay, even if it's, you know, negligible. Just  
 10 because you're changing pixels; right? Every time you  
 11 process an image, you're changing pixels; right? Just  
 12 like Dr. Villasenor said somewhere in his testimony,  
 13 you're changing pixels; so.

14           So these power log, logarithmic kind of  
 15 things, they're not really -- you know, I wouldn't  
 16 generally associate them with, you know, contrast  
 17 enhancement.

18           Let me give you a good example of when you'd  
 19 use a logarithmic transfer. Okay? Astronomers do  
 20 this a lot. So if you take a photograph of the night  
 21 sky with a telescope, okay, and if you don't do any  
 22 processing to it, you'll -- all you'll see is black,  
 23 except for a few bright dots which are stars. All  
 24 right? There might be a lot of structure in that  
 25 picture.

1           So then if you take a logarithm, okay, of  
2   every pixel, suddenly fainter structures may emerge  
3   like nebulae and galaxies and so on, which actually  
4   might be big in the picture but, you know, hard to  
5   see. Okay? This -- that's why they use it.

6           Now, is that a kind of contrast processing?  
7   It's not the goal, I think. I think the goal is to  
8   change the histogram so that these -- these faint  
9   structures which are sort of hidden by these very  
10   bright, dominant stars. Okay? So I would call that  
11   something different than the goal of contrast  
12   enhancement.

13          Q. Okay. So like looking at 3.3, just  
14   generally, input intensity versus output intensity,  
15   are you just trying to change --

16          A. Yeah. I mean, these are -- these are  
17   different -- this is a subset of the possible  
18   transformations, you know. And when I teach these in  
19   my class, I call them point operations. Okay? He's  
20   calling them intensity transformations. I think those  
21   could be used interchangeably. They operate on a  
22   single pixel at a time. Okay? So it's not a filter  
23   like we've been talking about.

24          Q. Uh-huh.

25          A. Is it -- could you call it a type of

1 correction? Sure. But maybe not using the term  
2 correction as we're using it in the context of, you  
3 know, the '132, which has specific goals for  
4 correction. You know, I don't think you'd use any of  
5 these things to reduce wrinkles, for example.

6 Q. Then, I guess --

7 A. And I don't mean to limit people's  
8 creativity. Somebody could say, well, if I did this  
9 fancy thing with this log, maybe I could jump through  
10 a hoop and reduce wrinkles. But I can't think of it  
11 on the spot.

12 Q. And so the rest of it is just other  
13 transformations that would generally be available?

14 A. What page are we on again here?

15 Q. Just leafing through page 130, power log  
16 gamma transformations.

17 A. Well, you see 126 also talks about spatial  
18 filtering, you see.

19 Q. Okay.

20 A. So, remember, this is drawn from, you know,  
21 page 78, 126, 127. In fact, you know, further down I  
22 include 124 through 127; right? So, there's no  
23 failure of Gonzalez to talk about things like  
24 blurring -- right? -- in this part, and talk about  
25 spatial filtering and so on. It's just that the --

1     you know, this one little part of that longer set of  
2     pages I gave isn't really directed towards that. I'm  
3     not saying they couldn't affect contrast. It's just  
4     that's not what you'd first think of to use.

5             Q. Can you tell me what contrast stretching is?

6             A. Yeah.

7             MR. RIFFE: Objection. Form.

8             A. You know, contrast stretching is actually  
9     related to something we're talking about in this case,  
10    which is, you know, dynamic range correction. All  
11    right?

12            So -- and, you know, I want to point out that  
13    it touches upon arguments that are being made and  
14    opinions given by myself and Dr. Villasenor. So I  
15    would broadly say that, you know, contrast stretching  
16    is a -- you know, it's -- it's in the type of  
17    correction on his dynamic range correction.

18            Q. (By Mr. Janitens) Okay.

19            A. Okay? I would say that.

20            Q. All right. Let's turn to your supplemental  
21    declaration for 1250, the 1022 exhibit.

22            A. Okay.

23            Q. Okay. So in paragraphs 7 through 10, you  
24    discuss claim construction for terms gain and gain  
25    map.

1           A.    Yes.

2           Q.    Turn to that.

3           A.    Uh-huh.

4           Q.    Okay.  And you state that, in your opinion,  
5    "Qualcomm's construction is not 'the broadest  
6    reasonable interpretation'" for gain and gain map;  
7    correct?

8           A.    I would say that, and I would go beyond, you  
9    know.  And, I mean, as I state, I don't think that a  
10   POSITA would understand the '132 Patent's use of gain  
11   to be only limited to brightening or darkening a  
12   region of an image.  I have no reason to believe that.

13          Q.    And why is that?

14          A.    Well, the '132 doesn't teach that.  It's  
15   limited in that way.  It doesn't -- it teaches  
16   otherwise, I think.  And, also, in ordinary meaning,  
17   you know, gain doesn't -- an image processing field  
18   doesn't just mean brightening or darkening.  It can  
19   be, you know, applied to amplification or attenuation.

20                I kind of see gain as amplification or  
21   attenuation of something.  Okay?  Think of turning a  
22   knob.  All right?  So, and that could affect, you  
23   know, global contrast.  It could be on the local  
24   contrast.  It could be on -- dynamic range is  
25   controlled by one or more parameters.  It could be --

1 it could be something that affects sensitivity of an  
2 algorithm to an object, like a face or to a texture.

3 So, in all those -- in all those instances,  
4 gain could certainly be used without any -- you know,  
5 in a very natural way.

6 Q. Okay. When you cite the '132 patent at  
7 column 3, lines 59 to 64, that's in paragraph 8.

8 A. Yeah. I see that. I'm sorry. Column --  
9 I've lost mine.

10 Q. Column 3, lines 59 and 64. It's actually on  
11 the next page, the citation.

12 A. Oh, there we go. Yeah. Is there a question?

13 Q. Yeah. So in -- in that portion, so it starts  
14 off with, "Note that the content-based technique  
15 introduced here is not necessarily limited to  
16 determining a gain adjustment or to DRC. For example,  
17 other types of corrections or adjustments can be made  
18 based on image content as described herein, such as  
19 contrast enhancement, color manipulation, sharpness,  
20 adjustment, noise reduction, and skin smoothing."

21 So isn't the '132 patent treating those as  
22 other types, separate from gain?

23 MR. RIFFE: Objection. Form.

24 A. I think it's not limiting it. I think  
25 it's -- you know, it could be other kinds of



1 corrections, but those could definitely involve gain.  
 2 Okay? You know, it could involve other adjustments  
 3 that don't include gain. I think it's very broad,  
 4 but, you know, if gain is included, you certainly can  
 5 have a gain on contrast, unquestionably. You can have  
 6 a gain on, you know, color in various dimensions and  
 7 directions. You can, you know, put a gain on degree  
 8 of sharpness. Absolutely.

9           You can -- it's -- the word "gain" is not a  
 10 term of the art that is limited to any particular type  
 11 of correction as a POSITA would understand it, as an  
 12 expert like myself would understand it and, in my  
 13 opinion, as the '132 patent teaches it.

14           So looking, for example, at line 49,  
 15 column 3, "Multiplying each color component of the  
 16 input image by one or more pixel dependent gain or  
 17 attenuation factors, using a nonlinear mapping  
 18 function, that may either lighten shadow regions or  
 19 darken" ones. Okay? So it can do that. I'm not  
 20 denying. It could be used to lighten or darken  
 21 things. "Or change the chromaticity of pixels."  
 22 Changing chromaticity has nothing to do with  
 23 brightening or darkening. Nothing.

24           Q. (By Mr. Janitens) And in that portion it  
 25 says, "may either lighten shadow regions or darken

1 highlights or change chromaticity of pixels."

2 A. Yes. This is different kinds of -- you know,  
3 it says using pixel-dependent gain, it can do this,  
4 this, or this, for example. And just as examples. So  
5 it's clearly using gain to change chromaticity, which  
6 that is not brightening or darkening.

7 So a person of ordinary skill in the art  
8 would understand gain isn't limited in any way to  
9 just -- I want to make sure that I'm looking at  
10 addressing -- yeah.

11 So, you know, Qualcomm wants to limit it to  
12 brightening or darkening a region of an image, but it  
13 is not limited in that way either to a person of  
14 ordinary skill in the art reading this, or a person of  
15 ordinary skill in the art just working in the field,  
16 or myself, as an expert reading this or working in the  
17 field. And specifically the '132 teaches away from  
18 this being limited in that way.

19 If you look at column 4, line 19 through 25,  
20 "Although the following discussion is given terms of a  
21 single gain factor for each pixel, more generally this  
22 can be one or more pixel-dependent gain or attenuation  
23 factors or other factors, such as changing the  
24 chromaticity of pixels in either shadow regions or  
25 highlights that can enhance the perception of image

1 details."

2 So, again, when you're changing chromaticity,  
3 whether or not it's in a shadow region or not, or in a  
4 highlight region or not, changing the chromaticity is  
5 not brightening or darkening.

6 Q. So if you look at column 3, line 54, 54 to 58  
7 states, "Altering input image pixel chromaticity  
8 (color balance) can be done separately, or in  
9 combination with, overall pixel gain adjustments." So  
10 isn't that treating chromaticity and gain separately?

11 MR. RIFFE: Objection. Form.

12 A. Well, you'll notice that the word "gain" here  
13 is modified by the word "pixel." So I think that, you  
14 know, I do not believe that pixel gain is limiting.  
15 Okay? It's just that the author here in this one  
16 sentence is trying to explain that you could modify  
17 chromaticity as well as, you know, maybe brightness or  
18 contrast. Okay? To enhance the image. So, no, I  
19 don't think it's excluding it. I think it's just  
20 trying to say that there could be a, you know,  
21 chromaticity modification, just as altering  
22 chromaticity. Okay? So it might be that it's altered  
23 in a way that it doesn't involve the gain on the  
24 chromaticity.

25 No, I don't agree. I think that it doesn't

1     cause such a distinction.

2             There's not a question; right?   Okay.

3             Q.   (By Mr. Janitens)   Okay.   Next question.

4             A.   Okay.

5             Q.   Let's turn to the '132 patent, Figure 7.

6             A.   Figure 7 of the '132.

7             Q.   Yeah.

8             A.   And if we're going to talk about it, you  
9     might want to show me where I talk about it in my  
10    declaration.

11            Q.   So we're looking at paragraph 12.   While  
12    we're at it, I'll hand you Exhibit 1004, which is  
13    Needham.   Also, since we'll be getting to this soon  
14    enough, 1005, Nonaka.

15            So with the '132 patent, Figure 7, can you  
16    describe generally what's happening in this figure?

17            MR. RIFFE:   Objection.   Form.

18            A.   So, you know, again, this is a figure from  
19    the '132.   It's part of the specification.   It's not  
20    part of the claim language.   Okay?

21            Q.   (By Mr. Janitens)   Sure.

22            A.   So, again, it's, you know, a teaching  
23    concept, so that somebody might practice what's  
24    actually in the claims.   So in Figure 7 --

25            Q.   The corresponding column is 5.

1       A. 5? I just zipped past it. There we go.  
2       Thank you. So Figure 7 is intended to show, you know,  
3       a way of encompassing dynamic range correction. It's  
4       a visualization. In this particular answer, you'll  
5       notice that at brighter image intensities, the curve  
6       is, you know, straight line, what we call linear. And  
7       that really means it's kind of a do-nothing happening  
8       here.

9       Q. Line 701?

10      A. Yeah. It coincides with 701, whereas some  
11      darker intensities, they get amplified. They get  
12      brighter. So this is --

13      Q. Is that with respect to 702? The curve?

14      A. Yeah. This is line 702. Yeah. So this is  
15      just an example of an idea of how a POSITA might go  
16      about, you know, dynamic range correction.

17             And, you know, the end of that paragraph  
18      says, of course, other shaped curves could  
19      alternatively be used, and, you know, I would go  
20      beyond that and say, well, not every dynamic range  
21      correction algorithm will be describable by a curve  
22      like this.

23      Q. So -- okay. So not -- we could have other  
24      shaped curves or other, like other transformations  
25      like we were talking about with the contrast

1 stretching or --

2 MR. RIFFE: Objection. Form.

3 A. I didn't use the term "other  
4 transformations." I would just say, you know, you  
5 could process an image in a way where in that dynamic  
6 range correction process, you know, you -- the way a  
7 pixel's brightness was mapped might depend on some  
8 neighboring pixels and stuff, and you couldn't map  
9 that; so.

10 Q. (By Mr. Janitens) Could you explain what you  
11 meant with the --

12 A. Oh, sure. I'll just do it this way. So you  
13 couldn't use this curve to describe how a dynamic  
14 range correction was used on 800C. Figure 8C. Okay?  
15 Because on the face, there was more brightening  
16 applied because, you know, the processing of the  
17 surrounding pixels, you would determine if there was a  
18 face there.

19 And in the other regions of the picture, call  
20 it second portion, as opposed to the first portion,  
21 the face, using the claim language, you would have,  
22 you know, less brightening. Okay? So you couldn't  
23 use a single curve here to describe the dynamic range  
24 correction of -- in 800C, or Figure 8, however it's --  
25 yeah. Figure 8C, top picture.

1           Again, you know, I mean, the inventor is just  
2   trying to explain concept. And it's not a mapping to  
3   the claim language, to or from.

4           Q. And from the spec, column 5, line 56, the  
5   "Curved line 702 represents an example of the effect  
6   of selectively modifying the gain  $G(s)$  to increase the  
7   intensity of darker portions of an image, such as face  
8   of person standing in the shadow."

9           A. Yes. It says that.

10          Q. And so if there was -- if the curve was  
11   shaped differently, the intensity of the face could be  
12   changed accordingly?

13          MR. RIFFE: Objection. Form.

14          Q. (By Mr. Janitens) In accordance with that  
15   curve.

16          A. If you're following this particular line of  
17   teaching using a single curve for a standard way of  
18   dynamic range correction, you know, it may not -- you  
19   may not probably match the claims where you're doing,  
20   you know -- it's determining process on physical  
21   objects of a predetermined type and all that kind of  
22   stuff.

23                 So setting outside the claim language and  
24   just looking at this, yeah. I mean, if you modify the  
25   gain, you will -- you will change how much any pixel,

1 potentially, is modified.

2 Q. Could you explain how this Figure 7  
3 translates to a gain map or how, in conjunction, it  
4 works with a gain map?

5 A. Could you show me where I stated that  
6 Figure 7 is being used to create a gain map?

7 Q. Or just like following the portion that we  
8 just read regarding Figure 7, talks about contact --  
9 content map, 119, after that.

10 MR. RIFFE: Objection. Form.

11 A. Well, pretty easy. If you look, you know,  
12 around -- well, 60 through 67 explains that pretty  
13 well. And I'm not sure how well the spec explains it  
14 here, but they say, for example, "one embodiment,  
15 shown in Figure 2A," all right? Figure 2A. There it  
16 is. Where they have a lookup table that is embodied  
17 by the graph or vice versa, I should say. "The gain  
18 lookup table 207 contains one or more gain values,  
19 G(s) for use with pixels that are part of a detected  
20 object," such as a face. In my mind, that reads for  
21 one gain curve.

22 So it's a part of the table or a gain lookup  
23 table for face. Okay? And then it says, "and one or  
24 more other gain values for use with pixels that are  
25 not part of a detected object." So I would view that



1 as, you know, either a different table or a different  
2 part of the same table and will correspond to a  
3 different -- potentially a different curve like the  
4 one in Figure 7. So, you know, you'd have at least  
5 two different curves here.

6 And if you had other objects of a  
7 predetermined type of interest, you might have three  
8 curves or five or seven, you know. So you can see  
9 that you can't have one curve here that describes  
10 dynamic range correction when you're practicing the  
11 patent in this way.

12 Q. (By Mr. Janitens) All right. Let's turn to  
13 Needham.

14 A. Yes.

15 Q. And in your declaration, we start at  
16 paragraph 11.

17 A. Okay.

18 Q. So does Needham define the term "match" or  
19 "matched"?

20 A. Well, so, you know, to start with, the term  
21 "match," which appears in the claim language of the  
22 '132, does not appear in the specification. And so we  
23 don't have the '132 inventor defined. I know your  
24 question was about Needham. Okay? So I just wanted  
25 to start with that, that the '132 spec doesn't define

1 match.

2 But I think, you know, a correction -- a type  
3 of correction being, you know, matched to an object or  
4 image feature, you know, Needham uses feature like,  
5 you know, like objects. Okay? And I think that's  
6 something that I made clear previously when being  
7 deposed in the previous deposition. And I don't think  
8 there's really any argument with that by anybody.

9 So as I state in my paragraph 17, I point to  
10 many places where Needham, in my opinion, is  
11 disclosing the matching of a type of correction to an  
12 image feature. Okay?

13 So, in particular, paragraph 32 in Needham --  
14 well, I'll just -- let's go back to my report. I'm  
15 still in paragraph 17. As I state on page 13, near  
16 the middle, "Needham clearly discloses a type of  
17 correction being defined for, i.e., 'matched' to an  
18 image feature," and my own parenthetical here is,  
19 again, that corresponds to a predetermined object,  
20 "e.g., a human face image feature." That part being  
21 back to reading.

22 "Needham's example describes different types  
23 of corrections being applied to different types of  
24 image features." Again, parenthetical, you know,  
25 objects of interest or pre-determined types, end of

1     parenthetical. "The operation of maximizing dynamic  
2     range is applied to human faces, and the operation of  
3     increasing brightness is applied to the sky which  
4     indicates that different corrections are matched to  
5     the different image features." So I'm just reading  
6     straight up from my report, and I'll just refer to the  
7     rest of it and just paraphrase a little bit.

8             In 32, which -- let me just find that point.  
9     That's paragraph 32 in Needham, just for clarity.

10            Around -- we don't have line numbers, so  
11     three quarters into paragraph 32 -- well, let me first  
12     read the first sentence.

13            "For each defined correction, operation, one  
14     or more operational parameters may be specified." So  
15     Needham is very clear that, you know, you have a type  
16     of correction, meaning a defined correction, and for  
17     each type you may have parameters that can be varied  
18     which will change the way that correction acts upon an  
19     image.

20            So back down to three quarters down in 32.

21     "The operational parameters may also specify that  
22     different occurrences of a same feature type" -- I  
23     won't give the parenthetical this time,  
24     "(e.g., different human faces) in an image receive a  
25     differing correction operation."

1           Now, let me explain that. By "differing  
2   correction operation," it does not mean a different  
3   type of correction. It means clearly in this context  
4   throughout this, he means a differing amount of  
5   correction. Okay?

6           Even given a type of correction, such as  
7   smoothing or dynamic range correction, or noise  
8   removal, you know, when you adjust the parameters, you  
9   adjust the outcome. You're going to -- you know,  
10   differing result. A differing correction. But it's  
11   not a different type of correction that's being  
12   referred to. And I realize I'm rebutting another  
13   point from Dr. Villasenor in pointing this out.

14           So I think Needham makes clear matching  
15   examples, and I think I gave a long answer to a  
16   question that was pretty simple, didn't I.

17           Q. Okay. So in 32, the second-to-last sentence,  
18   "For example, the intensity of dynamic range used for  
19   correcting a human face may be determined according to  
20   the size of the face detected." So the intensity  
21   dynamic range used depends on the characteristic of  
22   the face? In this case, the size of the face?

23           A. Well, it could. Okay? So the intensity  
24   dynamic range, I would call that an operational  
25   parameter of a -- of a dynamic range correction. And

1 I think -- let me see. So, in fact, in the middle  
2 of 32, Needham refers to -- it's 1, 2, 3, 4, 5, 6, 7,  
3 8, 9 -- line 10 of paragraph 32 of Needham, it says an  
4 intensity dynamic range 760 -- let me say that  
5 clearly. I fumbled my words.

6 "An intensity dynamic range 760 may be  
7 specified as an operational parameter." Okay? So  
8 back down to five lines from the bottom of 32, in  
9 response to your question, "the intensity dynamic  
10 range," which is an operational parameter of dynamic  
11 range correction, which is the type of correction used  
12 for correcting a particular human face, "may be  
13 determined according to the size of the face  
14 detected."

15 So it's the same type of correction. It's  
16 dynamic range correction. It's just that we're  
17 varying this parameter according to the size of the  
18 face. And, you know, that certainly is not a  
19 different type of correction applied. It's a  
20 different amount of correction applied, according to  
21 the size of the face.

22 Now, I'm being very specific in my answer,  
23 and citing to the entire paragraph 32, and on this  
24 topic, Dr. Villasenor cited only, you know, a passage  
25 or so out of context.

1           Q.   So in 32, does paragraph 32 disclose that  
2   intensity dynamic range is applied to the face because  
3   it's a face?

4           A.   It doesn't say that, no.  It just -- it's  
5   stating that you have this parameter, and when you're  
6   applying it to the face, which you've detected  
7   ostensibly, then you can modify this operational  
8   parameter, which is the intensity dynamic range, in  
9   this instance, according to the size of the face.

10           It doesn't -- it doesn't say that you  
11   don't -- you can't -- you know, that you don't apply  
12   dynamic range correction to, you know, other portion  
13   of the image.

14           You know, go back to Figure 8C and image  
15   800C.  There you have different amounts of dynamic  
16   range correction applied to different portions of the  
17   image.  Not just the face.

18           Q.   And so the intensity dynamic range, how would  
19   one adjust that?

20           A.   Where?

21           Q.   Just, in general, when we're talking about  
22   intensity of dynamic range, whether it be in 32 or 22.

23           MR. RIFFE:  Objection.  Form.

24           A.   Well, I'll field it that way.  I would say  
25   that there isn't a single way.  You know, dynamic

1 range correction involves a number of parameters. You  
2 know, there's -- I'm going to take a second --

3 Q. (By Mr. Janitens) Sure.

4 A. -- to find something where I can answer your  
5 question best.

6 Changing the parameter of the dynamic range  
7 correction, it's still dynamic range correction. Same  
8 type of correction. Okay? I'll say that first.

9 So I'll take advantage, in my page 19, which  
10 is also my paragraph 19, of what Dr. Villasenor talked  
11 about. Now, these were all same type of correction.  
12 You know, we're just varying some parameters.

13 So somebody asked him a question that was  
14 just like the one you asked me pretty much.

15 "Are there different ways to adjust  
16 dynamic range of an image or a part of an image, like  
17 a face."

18 He said, "Yes, there are."

19 "Can you give me some examples?"

20 "So one example would be to" -- he says, in  
21 his answer, "to perform an adjustment such that after  
22 the adjustment, the region of interest used the full  
23 range of possible values from using the convention  
24 agreed on before from zero to 255."

25 And I agree. That is one way. And I'll just

1 point out two parameters there. Zero and 255, which  
2 are the maximum allowed, you know, brightness and the  
3 minimum allotted brightness, may be for an entire  
4 image.

5 But for a region in an image, you may have a  
6 different maximum allowed and minimum allowed,  
7 according to your method of doing dynamic range  
8 correction. Or I should say, when I say "method,"  
9 your selection of parameter for dynamic range  
10 correction. Okay?

11 So he goes on to say that you could leave the  
12 darkest value in the image. And I would just modify  
13 that and say maybe the darkest value in the face, and  
14 not change that, or maybe the darkest value in the  
15 building. Okay? And not change that. And then only  
16 increasing, you know, the other values that are  
17 brighter than that. Okay?

18 So that's, you know, changing the lower-bound  
19 parameter; right? And then you could also change --  
20 like he says, you could reverse the process and keep  
21 brighter values unchanged and then darken darker  
22 pixels. So that's sort of keeping another parameter  
23 fixed and varying another one. Okay.

24 So he's describing ways, and you could keep  
25 them both fixed but neither one zero or 255. And, you



1 know, I could go on and on.

2 So there's a lot of ways, and I agree with  
3 Dr. Villasenor that these are different ways of  
4 varying parameters of the type of correction called  
5 dynamic range correction.

6 Q. And so you're saying dynamic range could be  
7 maximized on a global level, as well as region --  
8 regions within the image?

9 A. Well, that wasn't the point of what I was  
10 saying.

11 Q. Right. Right. Just --

12 A. Everything I said just now could apply at a  
13 global level or at a regional level. For example, it  
14 could be applied on a -- you know, a predetermined  
15 object --

16 Q. So if we look at --

17 A. Just to finish my answer, I'd just like to be  
18 precise.

19 Q. Sure.

20 A. -- could be applied to a physical object of a  
21 predetermined type, or several such, or to other  
22 portions that aren't those.

23 Q. All right. In paragraph 22, Needham --

24 A. And, by the way, you could mix them up in the  
25 same algorithm, the same application. You could

1 maximize brightness over here, minimize it over there,  
2 you know, different portions, but it's all same type  
3 of correction being applied, just changing the  
4 parameters according to content.

5 Sorry. I'm done now.

6 Q. Okay. So on 22, looking about halfway down,  
7 it says, "For instance, the correction operation of  
8 maximizing intensity dynamic range is applied to both  
9 human faces and buildings and the human face feature  
10 has a higher weight than a building feature, the  
11 intensity dynamic range used for that correcting" --

12 A. I'm just not seeing where you're reading  
13 from. I'm sorry. Page 22?

14 Q. Paragraph. Sorry. Of Needham.

15 A. I saw 22, and that's where I stopped. Okay.  
16 Sure. So for the -- okay. Sure. Where I'm talking  
17 about paragraph 22 is about Nonaka.

18 Q. No. Sorry. In Needham.

19 A. Oh, in Needham. Sure.

20 Q. Just generally it talks about maximizing  
21 intensity and dynamic range for a human face and  
22 maximizing intensity and dynamic range for a building.  
23 Just wondering if full range of intensity levels are  
24 used for both?

25 A. Let me find it first. Okay. No, there's no

1 reason why they would have the same parameters. In  
2 fact, I think the '13 -- I mean, I think Needham is  
3 teaching, like the '132, that you can vary parameters  
4 of your different types of corrections.

5 So, there was no reason, no limitation given  
6 here where you couldn't, you know, change the upper  
7 bound to which you could maximize intensities or  
8 change the lower bound.

9 And, in fact, if you read 22 carefully, at  
10 the very bottom, you know, it says, the last sentence,  
11 "For instance, if the correction operation of  
12 maximizing intensity dynamic range is applied to both  
13 human faces and buildings, and human face feature has  
14 a higher weight than the building feature" -- well,  
15 that weight does something; right? -- "the intensity  
16 dynamic range used for correcting faces in an image  
17 may be larger."

18 So already we can see that the -- to change  
19 the intensity of the dynamic range to a larger one  
20 that's allowable, you need to modify the parameters of  
21 your dynamic range correction algorithm to make a  
22 bigger range of possible intensities that could be  
23 mapped to by the correction. And it says correspond  
24 to a higher contrast, which could be the case.

25 "And with good reason," it goes on to say

1 that you know, "In this way, the human faces may be  
2 corrected so they become more visible than buildings."

3 How would this maximizing the intensity  
4 dynamic range impact the gain?

5 MR. RIFFE: Objection to form. Leading.

6 A. Well, the word "gain" isn't used here. I  
7 could gain in various ways here. So I think that, you  
8 know, the gain on dynamic range would increase on  
9 faces. The gain on dynamic range would be an  
10 attenuation, perhaps, on buildings. Expanding or  
11 contracting the allowable dynamic range, well, that's  
12 a gain, of course. But that's not the actual  
13 processing of the pixels.

14 So then when you apply, well, the amount of  
15 change applied to the pixels, well, a given pixel may  
16 go up or down according to your dynamic-range  
17 correction algorithm.

18 It's not -- I wouldn't always call -- you  
19 know, an algorithm makes a pixel go up or down. I  
20 would call it a change. I wouldn't say that it's, you  
21 know, has to be a gain, but it could be. Certainly,  
22 it could be. But in this instance, I wouldn't be  
23 unhappy with saying, well, if it did that, then the  
24 gain would be increasing the brightness and -- or  
25 decreasing the brightness. You know what I mean?

1           If you go back to what I was reading here  
2   from Dr. Villasenor, on my page 23 of my 1250  
3   declaration, his whole Q&A passage there from 22 over  
4   to 23, he's talking about, you know, saying, you know,  
5   the darkest pixels would stay unchanged and brightest  
6   pixels would get adjusted the most. Okay.

7           Well, I think in that instance, you know, you  
8   would be adjusting, you know -- or let's look at it  
9   over here. I think above is a better example. So  
10   this is line 3 of page 23 of my 1250 report.

11           "You could adjust it by -- by, for example,  
12   leaving the darkest value in the image, not changing  
13   that, but only making -- you know, doing -- doing an  
14   increase in brightness in proportion to how much  
15   brighter a pixel was relative to the darker pixel."

16           I think that that is a gain there in the  
17   context of dynamic range correction. In fact, I think  
18   that's a gain under even Qualcomm's proposed  
19   construction of gain.

20           And I don't agree with Qualcomm's proposed  
21   construction, but, you know, Needham could certainly  
22   practice this. Okay? And so Needham could, you know,  
23   be applying a gain in this kind of dynamic range  
24   correction that would -- that would satisfy Qualcomm's  
25   construction of gain. So under my understanding -- I

1 mean, they have a specific construction of gain. I  
2 don't agree with that. But in either case, Needham  
3 satisfies.

4 Q. (By Mr. Janitens) In light of Needham, how  
5 would you construe the term "gain"?

6 MR. RIFFE: Objection. Form.

7 A. Very broadly. Very broadly. And, in fact,  
8 earlier I gave a long discourse on how gain -- you  
9 know, I talked about a person of ordinary skill in the  
10 art both reading the patent, not reading it, myself as  
11 an expert, both reading the patent, not reading it,  
12 well, now I'm being a POSITA, hypothetical POSITA,  
13 reading Needham or not reading it, I think I would --  
14 you could just cut and paste that and put it right  
15 here to keep my answer, you know, short here.

16 Just look at 20, paragraph 20, of Needham.  
17 He says, "One or more types of correction operations  
18 may be applied," you know.

19 As I said before, all of these can have  
20 gains. I don't know. I'm done.

21 Q. (By Mr. Janitens) All right. Let's check out  
22 paragraph 30.

23 A. Uh-huh. Paragraph 30 of my declaration?

24 Q. Of Needham.

25 A. Of Needham.

1 Q. Needham. Yes.

2 A. Sure. Also point to me where I discuss this  
3 paragraph.

4 Q. On page 15 of the declaration.

5 A. Page 15?

6 Q. Yeah.

7 A. Sure. You seem to be able to find these a  
8 lot faster than I can.

9 Q. So what would you say -- or how would you  
10 define feature descriptions?

11 MR. RIFFE: Objection. Form.

12 A. Well, again, this is Needham, okay, and so  
13 the term "feature," you know, you look at Figure 2  
14 above, it's detecting features and correcting.  
15 Feature, in my mind, means object. Okay? It's just  
16 the way he's using the term "feature." So a face is a  
17 feature, for example. And, you know, he states, you  
18 know, a feature description. That was your question;  
19 right? Feature description?

20 Q. (By Mr. Janitens) Yeah.

21 A. 260. Which you can see in the middle of  
22 Figure 2 above includes a feature type. Okay? So  
23 that might be face; right? It could be building or  
24 something. A location descriptor. Well, that tells  
25 you something about where it is since it's been

1 detected. A shape descriptor. Well, that's, you  
2 know, some -- could be a lot of different things  
3 describing shape. Round face, elongated -- whatever.  
4 And statistical properties. That could be an awful  
5 lot of things. Average brightness, local histogram,  
6 standard deviation of brightness, color features,  
7 whatever. Okay?

8 So, I mean -- and I'm not limiting it in any  
9 way. I'm just giving examples. So that's what he  
10 means by feature description, what he says.

11 Q. And then at the end of paragraph 30, it says,  
12 "Such descriptions may be used to determine where and  
13 how to apply one or more specified correction  
14 operations"; right?

15 A. Yes. Indeed.

16 Q. So does Needham describe that a specific  
17 correction operation is performed based on a specific  
18 feature type?

19 A. So, I think I understand your question. Does  
20 Needham teach -- better ask it again, just so I'm  
21 clear.

22 (Requested portion read.)

23 A. Okay. So, back to paragraph 20, and I'll  
24 just read from my report, page 17, paragraph 17 also,  
25 middle of the page, "Paragraph 20" of Needham



1 "discloses, 'one or more types of correction  
2 operations may also be defined for each image  
3 feature.'" And, "'different types of correction  
4 operations may be applied to different image  
5 features.'"

6 So he's directly teaching that you can match  
7 the type of correction to the -- and, again, feature  
8 is the object, like face, as I state above and have  
9 stated many times.

10 So Needham is teaching just that.

11 Q. (By Mr. Janitens) Your declaration, at the  
12 bottom of page 16 --

13 A. Uh-huh.

14 Q. -- you state that "feature type, e.g., human  
15 faces, is matched to a specific correction type" --  
16 "correction operation"?

17 A. I see that, yeah.

18 Q. So the specified correction operation is not  
19 matched to the feature type?

20 MR. RIFFE: Objection. Form.

21 A. In the context of what's being taught in  
22 Needham and in '132, for that matter, I see no  
23 difference between those, because you're given an  
24 image. You know, if the faces are there, they're  
25 faces. Okay? So you don't do something to the faces

1 to somehow match them to a correction operation.  
2 Instead, you, you know, you match -- you know, in  
3 retrospect, I would -- should probably reverse that  
4 order just for clarity, but I think it's just the same  
5 thing. You match the correction, really, to the  
6 object.

7 And, you know, in 20, again, it says, you  
8 know, 20 from Needham, paragraph 20, it says, "One or  
9 more type of correction options may also be defined  
10 for each image feature." Again, image feature is an  
11 object.

12 That is very strongly pointing out matching.  
13 Okay? So, for example, both contrast and brightness  
14 may be corrected for a specific image feature, such as  
15 a human face.

16 This is associating contrast correction --  
17 this is matching contrast correction and brightness  
18 correction to faces. That type of, you know,  
19 predetermined object.

20 MR. JANITENS: All right. Let's take a quick  
21 break and then get back to it.

22 THE WITNESS: Okay.

23 (Recess taken from 2:44 p.m. to 2:56 p.m.)

24 Q. (By Mr. Janitens) All right, Dr. Bovik,  
25 let's go ahead and look at Nonaka now.

1 A. Sure.

2 Q. That's Exhibit 1005.

3 A. Great.

4 Q. And your declaration, let's look at, starting  
5 at paragraph 23.

6 A. I'll arrange a little bit here. Okay.  
7 Nonaka, paragraph 23 of my declaration.

8 Q. Okay. So we're looking at a Figure 8 there;  
9 right?

10 A. Yes.

11 Q. What types of processing do we have in  
12 Figure 8?

13 A. A lot of things.

14 Q. Let me rephrase that. What kind of  
15 correction processing do we have in Figure 8?

16 A. So, you know, as I state, there's three types  
17 of optimization processing. Okay? And amongst those  
18 there is S15 -- I think you said correction?  
19 Correction? Yeah.

20 Q. Right.

21 A. So amongst those, you know, S15 is identified  
22 as, you know, doing correction/emphasis processing.  
23 And just -- just for clarity, I mean, I said there's  
24 an optimization processing here. There's a correction  
25 emphasis process, S15, whereas the optimization

1 processing was, you know, S17.

2 So I'm not quite done. But all of this is  
3 done in Figure 1 in 5B, the optimization processing  
4 section. So, yeah, I just want to be clear about  
5 optimization processing being this little block S15.  
6 Okay? Versus, you know, the optimization processing  
7 section, which is, you know, doing all this stuff.

8 Q. So S17, Optimization Processing, S20,  
9 Optimization Processing (Intense), are those the same  
10 kind of processing?

11 A. Okay. I've lost my place here. Okay. S20;  
12 S17. This is a longer -- so in paragraph 64, it  
13 describes the optimization processing section, 5b,  
14 subjects the face part and the person to the  
15 optimization processing -- this is referring to S17 --  
16 of correcting the brightness of the part emphasizing  
17 the contrast.

18 So a step past 17. Notice that's also being  
19 done by the optimization processing, 5b. And I know  
20 you asked about the intense one. I'm getting there.  
21 You notice in paragraph 68, here it's referring to  
22 S15. I'm just addressing all three of these, you  
23 know, different aspects. S15, which is the correction  
24 you asked me.

25 About a minute ago, in paragraph 68, it says,

1 "the optimization processing section 5b performs  
2 emphasizing correction processing," like it says in  
3 the block of S15 in Figure 8, and it says, "amplifying  
4 correction, contrast emphasis, or the like." So it's  
5 not limiting, but it's giving some examples for this  
6 face-detection process. So that's S15. And I am  
7 still hunting down, with my apologies, S20. Okay.  
8 Here we go.

9 At the end of 65, "Moreover, the optimization  
10 processing section 5b performs processing to further  
11 increase the correction amount of the dark part or  
12 further emphasize the contrast value," S20. "This is  
13 also referred to as the intense optimization  
14 processing."

15 Okay. So that covers the three. And they,  
16 obviously, are not limiting. They're allowing for  
17 different kinds of processing.

18 Q. Okay. So would you agree that all of S15,  
19 S17, and S20 may emphasize contrast?

20 A. I would say instead that, you know, contrast  
21 is something that S15 could emphasize, you know,  
22 because it says it in paragraph 68. Okay?

23 And at the end of 65, it does say that the  
24 optimization processing could include emphasizing  
25 contrast. But that may be the same, you know, type of

1 correction, yes. But it may be a different amount of  
2 correction. I think it's teaching a different amount  
3 of correction. No reason they should be the same. I  
4 think it's teaching away from that.

5 And at the top of 64, with reference to S17,  
6 it, again, states, emphasizing the contrast. So could  
7 be same type of correction. It does say the same  
8 type. It is the same type, but, you know, different  
9 amounts of that.

10 Q. And so contrast emphasis, might it be  
11 performed regardless of whether or not a face is  
12 detected?

13 A. Well, I mean, as you can see in Figure 8, you  
14 follow this path. So in one instance, you know, you  
15 do this face detection at S10. S11 is a decision. If  
16 the answer is no, then you do S14 and -15, and then  
17 you do correction emphasis. That correction emphasis,  
18 for the purpose of enhancing another try at face  
19 detection, does, you know, contrast emphasis as a -- I  
20 mean, it says, you know, "amplifying correction  
21 contrast emphasis or the like." Okay? Which, you  
22 know, all these sound to me like -- you know, like  
23 they could be dynamic, you know, range correction.

24 You know, it can do it, and then, you know,  
25 it may still determine the face is not detectible,

1 even if it's there. Sometimes a face is there but not  
2 detectible. Okay? So if the face isn't detected,  
3 then it doesn't apply any further processing. You see  
4 the no, it exits the whole figure. All right? So, I  
5 mean, there was -- you know, or the face -- there may  
6 not be the face and exit the figure yet.

7 So there was some kind of correction, but it  
8 was for the purpose of augmenting face detection. It  
9 wasn't for the purpose of people looking at it in that  
10 instance; right?

11 And this is all supported by, you know, my  
12 language and the excerpts I'm taking from, you know,  
13 paragraphs 42 and 63 of the Nonaka reference and --  
14 but as I point out in step 26, I state, "The emphasis  
15 processing of step S15 is a different correction."

16 What I mean by that in the context of what I  
17 just said is, it generally is different, because in  
18 none of these three paragraphs I read from -- 64, 65,  
19 and 68 -- is the correction specified to be one thing.  
20 Okay? So one of them, you know, could be correcting  
21 brightness. Correcting brightness may not be done by  
22 the other parts. Okay?

23 Q. So in paragraph 67 it --

24 A. And just to finish, it could be that they  
25 both apply the same type of correction, and this is --

1 refers to other places where the language is -- you  
2 know, has to be understood. I don't say a different  
3 type of correction here. It could be different  
4 amounts, which makes a different correction but not a  
5 different type of correction.

6 So even if contrast emphasis is done in all  
7 of S -- you know, -15 and S17, say. Okay? It's -- it  
8 could be the same type, although it's not necessarily.  
9 Generally, it's not required to be, but even if it is  
10 both the same type, it's not the same correction,  
11 because there would be generally different amounts.

12 Otherwise, why have this decision process.

13 Q. And so what happens if a face is not detected  
14 in the process tree here?

15 MR. RIFFE: Objection to form.

16 A. Well, as it states at the end of 42 -- pardon  
17 me. Just let me check what I -- okay. So I want to  
18 hear the question again, because it's a fine point.

19 (Requested portion read.)

20 A. I'm not sure what's meant by "process tree."  
21 But going back here, you can see the face detected,  
22 S11. So when you say no, then we follow the path that  
23 leads to S14. As I, you know, read further on in my  
24 report, I explain all this on page 32, which is the  
25 latter parts of paragraph 27.



1           You apply increased exposure amount, that --  
2   when you increase exposure, that brightens things. So  
3   as I state on page 32 in the middle, "So it's  
4   perfectly acceptable to have a variation where you  
5   detect something that is so dark you can't decide  
6   whether it is a face, then you brighten it, then you  
7   try face detection again." I don't see any  
8   contradiction at all.

9           But, you know, in-between there there's, you  
10   know, correction emphasis. So, I mean, this is  
11   performed by the optimization processing section to  
12   try to make a face more visible. And that could  
13   include, you know, as I state in the second paragraph  
14   of my answer on page 32, and certainly, you know, it  
15   goes on to say that, quote, "The optimization  
16   processing section and the exposure control section  
17   perform processing control so as to brighten the dark  
18   part that is described later in detail." And that's  
19   actually just, you know -- let's see. 12A. That's  
20   the end of paragraph 42 of Nonaka.

21           Then -- so I spent some time on pages 32 and  
22   33 in reciting the Q&A. Your question was really, you  
23   know, is there this kind of processing that occurs if  
24   a face isn't detected. And it's important to  
25   understand that, you know, there are different

1 scenarios that occur where faces aren't detected. One  
 2 of which is, you know, paragraph 42, which I just  
 3 addressed, where, as I state on page 32 in my answer,  
 4 with regards to paragraph 42, it may be determined,  
 5 you know -- I'll just read it.

6 And I'm referring -- for instance, when I say  
 7 different reasons, I'm referring to paragraphs 42 and  
 8 58 being different reasons.

9 "The conditions of the image are different.  
 10 So just because they can't detect the face doesn't  
 11 mean that the camera can't, you know, determine that,  
 12 'Well, it's really dark there. Maybe that's why I  
 13 didn't detect a face.'" Okay?

14 Whereas in paragraph 58, there's just -- and  
 15 there may or may not be a face in that dark part.  
 16 Okay? And it may or may not be detected at all.  
 17 Whereas in 58, it describes a scenario where there  
 18 isn't a person at all. Okay?

19 And so in this instance -- well, first of  
 20 all, that is a different instance, because it may not  
 21 even be dark there. And so there wouldn't be any  
 22 reason to brighten something that isn't possibly too  
 23 dark to find the face. So you can't really mix these  
 24 paragraphs, as I state. Done.

25 Q. All right. I'm going to hand you

1 Exhibit 1007, Dvir, however you pronounce that.

2 A. Sure.

3 Q. And in your declaration, we're looking at  
4 paragraph 34.

5 A. 34.

6 Q. So you state that the '132 patent and Dvir  
7 are substantially the same with respect to local  
8 contrast; right?

9 A. I'm sorry. State that again?

10 Q. You state that the '132 specification, as  
11 well as Dvir, are substantially the same with respect  
12 to local contrast?

13 MR. RIFFE: Objection. Form.

14 A. Well, now, my statement that I made in my  
15 declaration was with regards to particular sections of  
16 the '132 and Dvir. So as I state in paragraph 34 of  
17 my declaration, 1250, as I pointed out in my original  
18 declaration and words reemphasizing here, the  
19 '132 patent at column 3, lines 29 through 32, and  
20 column 9, 29 through 53, are substantially the same as  
21 Dvir in paragraphs 12 and paragraphs 33 through 36,  
22 respectively. So that would be more accurate.

23 There's more. There's, you know, a figure --  
24 I've forgotten the figures as part of the  
25 specification, and I point out it's a high similarity

1 between the figures bordering on identicalness.

2 Q. (By Mr. Janitens) And that's on page 44?

3 A. By the way, exactly identical. Yeah. So you  
4 look on page 44, you see Figure 2B coming from '132,  
5 and Figure 2 of Dvir. And these are identical except  
6 for the upper portion.

7 Q. And each of those figures, they're just  
8 example embodiments from each specification; right?

9 A. Well, I mean, as I state in 35, with regards  
10 to both the figures and the supporting part of  
11 the language of the specification, these portions of  
12 the '132 in Dvir describe general embodiments of  
13 Figures 3 and 4. Okay? Which is an embodiment of  
14 block 205 shown in, and then I refer to these two  
15 figures on page 44.

16 Q. If we could look at the '132 patent.

17 A. Okay.

18 Q. Lines -- sorry. Column 9.

19 A. I'm there.

20 Q. Sorry. Let's go to column 3.

21 A. Column 3?

22 Q. Yeah.

23 A. Okay.

24 Q. Lines 28 -- yeah. 28 to 32. So a cascade of  
25 nonlinear edge-preserving filters are used?

1           A.    Sure.

2           Q.    And Dvir, at paragraph 12, discloses the  
3 cascade of nonlinear edge-preserving filters?

4           A.    I'm trying to look at the process here.  
5 Okay.

6           Q.    So, then, in column 9, though, on '132, line  
7 36, "In addition, to detecting predetermined types of  
8 objects, various spatial measurements" --

9           A.    So I'm in column 9 of '132 also. Is that  
10 what you said?

11          Q.    Line 36.

12          A.    Okay.

13          Q.    So that paragraph, in addition to cascade of  
14 nonlinear edge-preserving filters, there's also the  
15 use of predetermined object types; right?

16          A.    Well, I mean, we're talking -- we're talking  
17 about different parts of the spec. You know, I'm in  
18 column 3, and now I'm told to jump to column 9. You  
19 know, column 3 says, well, embodiments described below  
20 employ these, but when I come here, unless you show  
21 me, I'm not sure if right here we're talking about, at  
22 36, we're using cascades of filters. I'd have to...

23          Q.    It's right above that, actually, in -- it's  
24 starting on line 33.

25          A.    There we go. Okay. Uh-huh. Actually above

1     that.  Yeah.

2           Q.  32.  Thank you.

3           A.  Yeah.  Well, I see that, you know.  I see  
4     here, you know, the local contrast may be controlled  
5     by selectively using various sections in cascade.  You  
6     know, when I read the '132, I try to find, you know,  
7     what does the specifications say about maintaining  
8     local contrast, and this is all I can find really.

9           Somewhere else it says to create a -- I  
10    forget the exact language -- something like to make it  
11    pleasurable to view or whatever.  But here it says,  
12    you know, the local contrast may be controlled.  And I  
13    think that's the only place that, you know, acting on  
14    the local contrast is mentioned in the '132.  There  
15    could be -- you know, it explains what maintaining the  
16    local contrast is.

17          Q.  If you look at column 9, line 38 --

18          A.  Yes.

19          Q.  -- to 42.

20          A.  Uh-huh.  So there.  That's the user  
21    preference.  Yeah.

22           MR. RIFFE:  Is there a question pending?

23           THE WITNESS:  Yeah.

24          Q.  (By Mr. Janitens)  Yeah.  So locations of  
25    predetermined type of object and are the spatial

1 measurements which can be taken together, the user  
2 preference for the amount of local contrast needed can  
3 be used to adapt or determine which and how many  
4 sections will be used.

5 So in Dvir, are any predetermined types of  
6 objects utilized for local contrast?

7 MR. RIFFE: Objection. Form.

8 A. Well, you know, I mean, Dvir, in Figure 2,  
9 shows a gain lookup table exactly like the one in the  
10 '132, Figure 2B, and talked about. You know, that  
11 gain lookup table is associated with, you know,  
12 predetermined objects.

13 And so as I stated on page 44 of my report,  
14 "Dvir discloses determining a gain amount 'to maintain  
15 local contrast to the first portion of the digital  
16 image data.'" The same manner as the '132 patent.  
17 And here I'm referring to my understanding of, you  
18 know, the maintaining of local contrast in the '132.

19 And so I'd say, at the very least, Dvir is --  
20 would mesh seamlessly, entirely seamlessly, with --  
21 I've just kind of lost my place, that's why I'm  
22 hesitating -- with the other, you know, references to,  
23 you know, to disclose in an obvious way maintaining of  
24 local contrast to the extent that, you know, it isn't  
25 otherwise revealed.

1 Q. (By Mr. Janitens) All right. I'll go ahead  
2 and hand you Exhibit 1006, Gallagher. Page 46 of your  
3 declaration.

4 A. That's where I am.

5 Q. All right. So Gallagher is directed to a  
6 method for sharpening a digital image without  
7 amplifying noise; correct?

8 A. What was the last part?

9 Q. Oh, just the title of Gallagher. Method For  
10 Sharpening the Digital Image Without Amplifying Noise?

11 A. Yes, that's correct.

12 Q. All right. And Gallagher teaches using gain  
13 maps?

14 A. Yes.

15 Q. All right. Does Gallagher discuss using gain  
16 maps for anything other than sharpening?

17 MR. RIFFE: Objection. Form.

18 A. Well, you know, I -- I don't recall  
19 whether -- you know, I don't want to exclude that it's  
20 in there, but I don't remember anything. I do know  
21 that he's not directing it to control brightening or  
22 darkening, and certainly, you know, his main emphasis  
23 is for sharpening, which you can view as correcting an  
24 image, of course.

25 Sharpening is a type of correction which



1 might very well, you know, fall under the auspices of  
2 the '132 patent, and it's a correction. You might  
3 want to sharpen faces, for example.

4 Q. (By Mr. Janitens) All right. Just one more  
5 thing I have to ask. During any of the breaks, did  
6 you discuss any of the deposition with your counsel?

7 A. No. IRP rules. Nothing at all.

8 MR. JANITENS: All right. And I'll pass the  
9 witness.

10 MR. RIFFE: Take a little break.

11 (Recess taken from 3:38 p.m. to 3:43 p.m.)

12 MR. RIFFE: No further questions.

13 (Whereupon, the witness was excused and the  
14 deposition concluded at 3:43 p.m.)

15 ///

16 ///

17 ///

18 ///

19 ///

20 ///

21 ///

22 ///

23 ///

24 ///

25 ///

1 UNITED STATES PATENT AND TRADEMARK OFFICE  
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD

3 -----  
4 APPLE INC., )  
5 Petitioner, ) Case IPR2018-01250  
6 v. )  
7 QUALCOMM INCORPORATED, ) U.S. Patent No.  
8 Patent Owner.) 8,447,132  
9 -----

10  
11  
12  
13 REPORTER'S CERTIFICATION  
14 ORAL DEPOSITION OF  
15 ALAN C. BOVIK, Ph.D., P.E.  
August 28, 2019

16 I, Karen Tyler, Certified Shorthand Reporter in  
17 and for the State of Texas, hereby certify to the  
18 following:

19 That the witness, ALAN C. BOVIK, Ph.D., P.E., was  
20 duly sworn by the officer and that the transcript of  
21 the oral deposition is a true record of the testimony  
22 given by the witness;

23 That the amount of time used by each party at the  
24 deposition is as follows:

25 Mr. Janitens - 4 hours, 6 minutes

1           That pursuant to information given to the  
2 deposition officer at the time said testimony was  
3 taken, the following includes counsel for all parties  
4 of record:

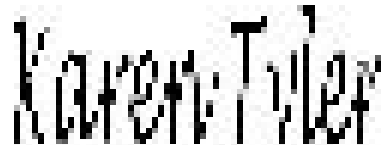
5           Mr. Timothy W. Riffe - Attorney for Plaintiff

6           Ms. Kim Leung - Attorney for Plaintiff

7           Mr. Erik Janitens - Attorney for Patent Owner

8           I further certify that I am neither counsel for,  
9 related to, nor employed by any of the parties or  
10 attorneys in the action in which this proceedings was  
11 taken, and further that I am not financially or  
12 otherwise interested in the outcome of this action.

13           Subscribed and sworn to on this the 29th day of  
14 August, 2019.

15           

16           \_\_\_\_\_  
17 Karen Tyler, CSR(TX), CCR(LA), TCRR, CRR, CRC  
18 Registered Diplomate Reporter  
19 Texas CSR 5182  
20 Expiration 12/31/19  
21  
22  
23  
24  
25

/	83:19;84:13,17,20;85:9; 87:7;89:4;91:16	31:19	23:2
/// (11) 112:15,16,17,18,19,20,21, 22,23,24,25	accordingly (2) 65:12;78:12	adjacent (2) 58:3;61:4	ago (1) 99:25
A	accuracy (1) 29:25	adjust (5) 83:8,9;85:19;86:15;92:11	agree (19) 18:17;20:9,16;21:22; 33:1;35:19;41:18;43:16; 46:8;48:7;53:11;56:19,19; 74:25;86:25;88:2;92:20; 93:2;100:18
able (3) 44:20;51:10;94:7	accurate (4) 5:10;10:15;44:20;106:22	adjusted (1) 92:6	agreed (1) 86:24
about (82) 5:1;7:16;8:20,21;10:14; 11:15;13:17;14:18,20;16:6; 17:14;20:18;22:16;23:25; 24:1,18;29:9;30:24;31:2; 32:19;33:3,6;34:3;35:6; 36:20;37:14;38:22;40:15; 44:12,19;45:14;47:4,17; 49:22;51:1,2;52:8,23;53:5; 54:13;56:10,12,15,17;57:2, 10;58:12,17;62:19;64:3,13, 24;65:22,23,25;67:23; 68:17,23,24;69:9;75:8,9; 76:16,25;79:8;80:24;85:21; 86:11;89:6,17,17,20;92:4; 93:9;94:25;99:4,20,25; 108:17,21;109:7;110:10	achieve (1) 38:1	agreement (1) 43:21	
	achieved (1) 51:25	adjustment (4) 71:16,20;86:21,22	ahead (4) 8:6;64:18;97:25;111:1
	acquired (1) 36:22	adjustments (3) 71:17;72:2;74:9	akin (3) 56:7,9,25
	acting (1) 109:13	adjusts (1) 65:11	al (1) 13:1
	acts (1) 82:18	advantage (1) 86:9	ALAN (1) 4:1
	actual (1) 91:12	advantages (2) 49:10,13	algebraic (1) 31:18
	Actually (15) 11:9;12:16;14:23;17:13; 20:5;31:12;44:17;59:15; 67:3;69:8;71:10;75:24; 104:19;108:23,25	affect (3) 66:8;69:3;70:22	algorithm (10) 12:14,18,19;57:3;71:2; 76:21;88:25;90:21;91:17, 19
	adapt (1) 110:3	affected (1) 63:4	algorithms (1) 49:6
above (7) 4:2;92:9;94:14,22;96:8; 108:23,25	adding (1) 18:20	affects (1) 71:1	allotted (1) 87:3
Absolutely (1) 72:8	addition (4) 12:1;60:4;108:7,13	afield (1) 51:14	allow (1) 20:1
abstract (1) 56:3	additional (2) 6:8;31:19	after (5) 4:3;42:20;44:5;79:9; 86:21	allowable (2) 90:20;91:11
acceptable (1) 104:4	address (1) 45:13	again (35) 5:15;9:16;12:3;13:14; 22:1;24:11;25:4;35:9;36:9; 38:1;42:22;47:1;48:23; 49:24;50:25;52:6;58:25; 63:14;65:20;68:14;74:2; 75:18,22;78:1;81:19,24; 94:12;95:20;96:7;97:7,10; 101:6;103:18;104:7;106:9	allowed (3) 87:2,6,6
accordance (1) 78:14	addressed (1) 105:3	against (1)	allowing (2) 19:23;100:16
according (8)	addressing (4) 9:4;14:10;73:10;99:22		Along (1)
	adds (1)		

52:7	85:15;101:9;103:4,11	<b>appearance (1)</b>	<b>around (6)</b>
<b>already (10)</b>	<b>amplification (2)</b>	36:19	20:6;28:19;37:13;42:10;
8:16;9:18;18:17;20:10,	70:19,20	<b>appears (1)</b>	79:12;82:10
17,23;36:20;37:23;48:24;	<b>amplified (1)</b>	80:21	<b>arrange (1)</b>
90:18	76:11	<b>application (8)</b>	98:6
<b>also (29)</b>	<b>amplifying (4)</b>	24:4,15;28:1,1;33:18;	<b>array (1)</b>
10:16;13:16;15:7;20:3;	100:3;101:20;111:7,10	46:19;55:19;88:25	45:25
30:23;35:2;37:11;39:16;	<b>analog (2)</b>	<b>applications (2)</b>	<b>art (23)</b>
43:4;46:10;52:9;54:5;	61:9,12	32:21;45:19	8:1;11:1;20:24;21:10;
55:16;56:3;60:8;68:17;	<b>another (11)</b>	<b>applied (38)</b>	22:2,13;23:2,15,19;24:13;
70:16;75:13;82:21;86:10;	12:4;28:5,5;48:3,10;	35:20,23;37:10;39:11,19,	27:22,25;29:16;42:24;
87:19;94:2;95:24;96:2;	50:15;55:13;83:12;87:22,	22:40;2,3,7;42:20;43:1,2,9,	48:17;50:18;52:17;55:8;
97:9;99:18;100:13;108:9,	23;101:18	10,12,13,14;44:1,2,6;59:25;	72:10;73:7,14,15;93:10
14	<b>answer (25)</b>	60:5;70:19;77:16;81:23;	<b>aside (2)</b>
<b>altered (1)</b>	4:23;5:5;8:21;14:19;	82:2,3;84:19,20;85:2,16;	5:22;33:21
74:22	23:12;37:12;38:1;40:13;	88:14,20;89:3,8;90:12;	<b>Asked (9)</b>
<b>Altering (2)</b>	43:20,22,22;44:17;48:23;	91:15;96:4	14:4;36:20;43:23;62:14,
74:7,21	64:1;65:15;76:4;83:15;	<b>applied' (1)</b>	16;86:13,14;99:20,24
<b>alternatively (1)</b>	84:22;86:4,21;88:17;93:15;	93:18	<b>asking (7)</b>
76:19	101:16;104:14;105:3	<b>applies (3)</b>	5:17;6:8;8:22,23;11:1;
<b>Although (3)</b>	<b>answered (4)</b>	38:12;43:17;63:16	14:18;63:24
66:7;73:20;103:8	9:18;14:5;20:18;48:24	<b>apply (22)</b>	<b>aspect (14)</b>
<b>always (4)</b>	<b>answering (2)</b>	24:13;30:17;31:1,4;	11:13,22;13:22;14:25;
7:15;14:19;23:6;91:18	6:7;7:6	42:24;49:5;50:7,20,22;	17:21;18:1,5,15,23;19:14,
<b>amend (1)</b>	<b>answers (2)</b>	54:24;60:24;61:2,6;63:20;	17:20;2,8;45:15
41:14	6:7;10:15	66:2;85:11;88:12;91:14;	<b>aspects (1)</b>
<b>amended (1)</b>	<b>anybody (1)</b>	95:13;102:3,25;104:1	99:23
18:14	81:8	<b>applying (6)</b>	<b>associate (1)</b>
<b>amendment (7)</b>	<b>anyone (1)</b>	11:16;35:18;36:1;38:7;	66:16
13:10;18:20,23;19:7,8,18,	7:2	85:6;92:23	<b>associated (1)</b>
24	<b>anything (13)</b>	<b>Appreciate (1)</b>	110:11
<b>among (1)</b>	4:10;5:23;9:2;21:20;	52:5	<b>associating (1)</b>
58:3	32:23;42:4,11;47:17,23;	<b>area (4)</b>	97:16
<b>amongst (2)</b>	65:22;66:7;111:16,20	40:8;42:10;43:4;44:8	<b>assuming (1)</b>
98:17,21	<b>apologies (3)</b>	<b>aren't (5)</b>	23:18
<b>amount (11)</b>	58:25;62:6;100:7	41:25;57:1,3;88:22;105:1	<b>Astronomers (1)</b>
54:24;63:1;83:4;84:20;	<b>apparent (3)</b>	<b>argument (2)</b>	66:19
91:14;100:11;101:1,2;	11:24;15:13,16	58:17;81:8	<b>attempt (2)</b>
104:1;110:2,14	<b>appear (1)</b>	<b>arguments (1)</b>	12:21;22:14
<b>amounts (4)</b>	80:22	69:13	<b>attempting (1)</b>

63:15	52:14;57:18;64:10;81:14,	<b>being (22)</b>	<b>blemishes (3)</b>
<b>attenuation (5)</b>	21;82:20;84:8;85:14;92:1;	9:17;21:21;39:11;52:24;	38:17;57:24,25
70:19,21;72:17;73:22;	95:23;97:21;103:21	55:18;56:11;69:13;73:18;	<b>blends (1)</b>
91:10	<b>background (14)</b>	79:6;81:3,6,17,20,23;83:11;	32:11
<b>attorney (1)</b>	15:24;32:11;61:17;62:2,	84:22;89:3;93:12;96:21;	<b>blessed (1)</b>
7:2	12,18,24;63:2,5,9,11,12,19,	99:5,18;105:8	20:20
<b>augmenting (1)</b>	22	<b>believe (5)</b>	<b>blob-like (1)</b>
102:8	<b>balance (1)</b>	23:3;52:17;54:1;70:12;	32:12
<b>auspices (1)</b>	74:8	74:14	<b>block (16)</b>
112:1	<b>based (10)</b>	<b>believes (1)</b>	21:23;22:9;24:7;35:17,
<b>author (1)</b>	20:19;40:7;42:21;43:2,	19:25	22;37:20;38:4,14,15;44:12;
74:15	11;44:6,7;55:17;71:18;	<b>belongs (2)</b>	45:22;47:19;54:5;99:5;
<b>automated (12)</b>	95:17	22:8,9	100:3;107:14
11:24;14:25;15:17;16:14,	<b>basic (3)</b>	<b>below (2)</b>	<b>blocks (3)</b>
18,20,22;18:4,10;52:9,15,	28:23;64:21,25	61:11;108:19	53:22;54:2,2
24	<b>because (33)</b>	<b>benefits (1)</b>	<b>blurred (8)</b>
<b>automatic (1)</b>	5:16;10:13,13;12:13,16;	48:20	60:1,4;61:6,7,8,11,12;
18:7	14:10;15:16;19:23;20:1,3,	<b>best (2)</b>	63:3
<b>automating (5)</b>	9;21:15,25;24:3;28:15;	10:15;86:5	<b>blurring (24)</b>
13:15;18:2,5,15;19:14	30:24;41:16;51:17,18,24;	<b>better (3)</b>	29:1;58:21,22,23;59:1,
<b>automation (7)</b>	58:15;61:4;66:10;77:15,16;	52:1;92:9;95:20	25;60:2,18,21,24;61:2,4,14,
12:6;16:22;19:9;25:20,	85:2;96:23;100:22;102:17;	<b>between (12)</b>	16;62:1,11,18,24,25;63:11,
21;52:21;53:5	103:11,18;105:10,20	40:11;48:14;49:17,18;	16,21;64:14;68:24
<b>available (3)</b>	<b>become (2)</b>	54:11;56:13;59:18,20;61:4;	<b>body (3)</b>
60:13;65:1;68:13	32:11;91:2	65:10;96:23;107:1	35:17;36:19;37:21
<b>average (2)</b>	<b>becomes (1)</b>	<b>beyond (2)</b>	<b>body-imperfection (1)</b>
31:16;95:5	60:3	70:8;76:20	37:19
<b>averaging (3)</b>	<b>becoming (2)</b>	<b>big (1)</b>	<b>book (2)</b>
30:16;32:21,25	65:13,14	67:4	28:19;29:12
<b>away (3)</b>	<b>been (18)</b>	<b>bigger (1)</b>	<b>books (1)</b>
51:6;73:17;101:4	4:2,3;6:10;7:15;8:16;	90:22	29:19
<b>awful (1)</b>	28:19;38:21;39:18;42:13;	<b>billions (1)</b>	<b>bordering (1)</b>
95:4	52:7;59:11,25;63:3,6,64:3;	57:14	107:1
<b>B</b>	65:1;67:23;94:25	<b>bit (9)</b>	<b>Both (16)</b>
	<b>Before (14)</b>	5:13;24:5;31:8;38:10;	8:9;38:16;45:4,19;46:7;
<b>back (24)</b>	4:10;5:6;6:6,7;8:5;11:19;	41:1;51:13;66:8;82:7;98:6	60:24;87:25;89:8,24;90:12;
	16:4;31:15;33:6;40:13;	<b>black (1)</b>	93:10,11;97:13;102:25;
	41:22;63:3;86:24;93:19	66:22	103:10;107:10
11:20;12:2;14:13,23;	<b>beginning (3)</b>	<b>blemish (5)</b>	<b>bottom (15)</b>
30:25;33:23;35:14;37:24;	4:4;52:14,14	12:15;38:15;50:10;57:7,9	10:1;28:22;41:8;42:10;
44:10;46:14;47:20;51:17;			

46:16;47:7;53:8;56:2,2; 59:24;60:5;64:21;84:8; 90:10;96:12	70:5 <b>broadly (4)</b> 40:24;69:15;93:7,7	19:20;40:19;41:2;42:1,2; 51:16,19;56:13;68:10;80:9; 85:11;104:5;105:10,11,23	8:1;28:24,24 <b>change (18)</b> 4:23;20:20,21;67:8,15; 72:21;73:1,5;78:25;82:18; 87:14,15,19;90:6,8,18; 91:15,20
<b>bound (2)</b> 90:7,8	<b>building (5)</b> 87:15;89:10,22;90:14; 94:23	<b>capture (4)</b> 45:20;46:3,10,12	<b>changed (2)</b> 40:24;78:12
<b>BOVIK (6)</b> 4:1,7;16:12;39:1;64:7; 97:24	<b>buildings (4)</b> 89:9;90:13;91:2,10	<b>captured (1)</b> 46:9	<b>changing (13)</b> 25:11;66:4,10,11,13; 72:22;73:23;74:2,4;86:6; 87:18;89:3;92:12
<b>box (1)</b> 16:21	<b>C</b>	<b>capturer (1)</b> 45:4	<b>characteristic (1)</b> 83:21
<b>break (7)</b> 5:1,2,6;38:22;64:3;97:21; 112:10	<b>call (8)</b> 67:10,19,25;76:6;77:19; 83:24;91:18,20	<b>capturing (4)</b> 45:23,25;46:4,22	<b>check (3)</b> 6:12;93:21;103:17
<b>breaks (1)</b> 112:5	<b>called (5)</b> 4:2;55:12,13;65:9;88:4	<b>carefully (1)</b> 90:9	<b>choice (3)</b> 48:13;49:1,25
<b>bridging (1)</b> 29:2	<b>calling (2)</b> 25:16;67:20	<b>cascade (4)</b> 107:24;108:3,13;109:5	<b>choices (1)</b> 51:8
<b>bright (2)</b> 66:23;67:10	<b>camera (5)</b> 45:24;46:1,17;47:16; 105:11	<b>cascades (1)</b> 108:22	<b>chosen (1)</b> 27:24
<b>brighten (3)</b> 104:6,17;105:22	<b>can (63)</b> 5:15;11:12;14:22;15:8; 23:10;28:10;30:10,12;31:8; 32:21;33:16;38:1;40:10; 41:6,18;42:12;44:19;45:23; 46:9;50:5;51:3,24;56:15; 57:16;58:9;59:17,24;60:6; 8:63;1,11;64:3;69:5;70:18; 71:17;72:4,5,7,9,19;73:3; 22,25;74:8;75:15;80:8; 82:17;85:7;86:4,19;90:3; 18;93:19;94:8,21;96:6; 101:13,24;103:21;109:8; 110:1,2;111:23	<b>case (5)</b> 9:2;69:9;83:22;90:24; 93:2	<b>chromaticity (13)</b> 72:21,22;73:1,5,24;74:2, 4,7,10,17,21,22,24
<b>brightened (1)</b> 41:15		<b>casting (1)</b> 23:2	<b>CIELAB (13)</b> 44:13,15;48:11,15,18; 49:10,14;50:12;51:6,9,15, 19,23
<b>brightening (9)</b> 70:11,18;72:23;73:6,12; 74:5;77:15,22;111:21		<b>castle (4)</b> 59:16,23;60:1,3	<b>citation (1)</b> 71:11
<b>brightens (1)</b> 104:2		<b>cause (1)</b> 75:1	<b>cite (8)</b> 15:14;23:23;33:8;36:15; 56:1;64:16;65:5;71:6
<b>brighter (6)</b> 65:13;76:5,12;87:17,21; 92:15		<b>CCD (1)</b> 45:24	<b>cited (6)</b> 14:16,19;28:18;35:11; 57:19;84:24
<b>brightest (1)</b> 92:5		<b>cell (5)</b> 46:2,3,4,18;47:16	<b>citing (2)</b> 65:4;84:23
<b>brightness (16)</b> 74:17;77:7;82:3;87:2,3; 89:1;91:24,25;92:14;95:5, 6;97:13,17;99:16;102:21,21	<b>canal (1)</b> 5:13	<b>cells (1)</b> 51:22	<b>Claim (38)</b>
<b>broad (3)</b> 57:13;63:25;72:3	<b>cannot (1)</b> 5:9	<b>certain (4)</b> 10:14;28:4;51:25;63:18	
<b>broadest (1)</b>	<b>can't (15)</b>	<b>certainly (13)</b> 7:11;19:21;20:9;30:13; 33:16;49:5;71:4;72:4; 84:18;91:21;92:21;104:14; 111:22	
		<b>cetera (3)</b>	

16:24;17:1,12,14,17,19; 18:14;19:10,11,23;20:1,19, 20;21:3,8,13;22:4,8,10,14, 18,21;23:7,9,22;24:18;25:6, 24;50:5;54:14,23,23;69:24; 75:20;77:21;78:3,23;80:21	21;108:6,9,18,18,19;109:17 <b>combinable (1)</b> 53:10 <b>combination (1)</b> 74:9 <b>combine (2)</b> 45:15;54:11 <b>combined (1)</b> 60:21 <b>combining (1)</b> 60:17 <b>come (2)</b> 40:19;108:20 <b>coming (2)</b> 8:25;107:4 <b>comma (1)</b> 32:15 <b>communication (2)</b> 7:1,11 <b>company (2)</b> 28:2,5 <b>compare (2)</b> 40:22;42:12 <b>comparing (1)</b> 52:8 <b>complete (1)</b> 5:9 <b>complexity (6)</b> 53:9,15,16,18;54:4,10 <b>component (1)</b> 72:15 <b>computation (4)</b> 50:1,2;53:17,19 <b>computations (1)</b> 54:3 <b>concept (3)</b> 47:15;75:23;78:2 <b>concepts (1)</b> 28:23 <b>concluded (1)</b>	112:14 <b>conditions (1)</b> 105:9 <b>conducting (1)</b> 19:1 <b>conjunction (2)</b> 21:3;79:3 <b>connection (1)</b> 48:6 <b>consistent (1)</b> 58:8 <b>construction (6)</b> 69:24;70:5;92:19,21,25; 93:1 <b>construe (1)</b> 93:5 <b>contact (1)</b> 79:8 <b>contained (1)</b> 54:2 <b>containing (2)</b> 27:7,14 <b>contains (1)</b> 79:18 <b>contemplate (1)</b> 61:13 <b>content (7)</b> 39:22;42:21;43:2;44:7; 71:18;79:9;89:4 <b>content-based (1)</b> 71:14 <b>contents (2)</b> 29:12,17 <b>context (15)</b> 12:13,23;31:6;45:5;50:4; 59:2,8;62:18,20;68:2;83:3; 84:25;92:17;96:21;102:16 <b>continue (1)</b> 64:13 <b>contracting (1)</b>	91:11 <b>contradiction (1)</b> 104:8 <b>contrast (85)</b> 54:14,19;55:1,4,6,6,7,8, 10,13,14,18,21;56:8,13,16, 17,21,22;57:5,8;58:3,5,11, 15,18,19,21;59:6,9,11,13; 60:5,6,17,21,24;61:4,6,7; 64:14;65:8,18;66:6,8,16; 67:6,11;69:3,5,8,15;70:23, 24;71:19;72:5;74:18;76:25; 90:24;97:13,16,17;99:17; 100:4,12,19,20,25;101:6,10, 19,21;103:6;106:8,12; 109:4,8,12,14,16;110:2,6, 15,18,24 <b>control (3)</b> 104:16,17;111:21 <b>controlled (3)</b> 70:25;109:4,12 <b>convention (1)</b> 86:23 <b>conversion (3)</b> 50:2,3,15 <b>Convert (4)</b> 44:13;47:20;48:18;51:22 <b>converted (9)</b> 13:20,24;20:6;21:4; 26:19;34:7;48:2,10;51:5 <b>coordinates (1)</b> 36:22 <b>corner (1)</b> 10:1 <b>corners (1)</b> 41:25 <b>correct (22)</b> 6:17;8:14;9:7,23;10:5,6, 20,23;17:12;26:2;27:17; 29:23;30:10;34:20;39:11,
---	---	--	--



23;40:8;41:22;44:8;70:7; 111:7,11 <b>corrected (2)</b> 91:2;97:14 <b>correcting (10)</b> 25:9;83:19;84:12;89:11; 90:16;94:14;99:16;102:20, 21;111:23 <b>correction (122)</b> 13:15;15:3;16:14;18:2,6, 16;19:14;30:10;31:14;33:3; 39:11,19,22;40:1,7;42:20; 43:1,25;44:2,6;50:8,22,23; 68:1,2,4;69:10,17,17;72:11; 76:3,16,21;77:6,14,24; 78:18;80:10;81:2,3,11,17; 82:13,16,16,18,25;83:2,3,5, 6,7,10,11,25;84:11,11,15, 16,19,20;85:12,16;86:1,7,7, 8,11;87:8,10;88:4,5;89:3,7; 90:11,21,23;91:17;92:17, 24;93:17;95:13,17;96:1,3,7, 15,16,18;97:1,5,9,16,17,18; 98:15,18,19,24;99:23; 100:2,4,11;101:1,2,3,7,17, 17,20,23;102:7,15,19,25; 103:3,4,5,10;104:10; 111:25;112:2 <b>correction/emphasis (1)</b> 98:22 <b>corrections (5)</b> 71:17;72:1;81:23;82:4; 90:4 <b>correspond (3)</b> 49:21;80:2;90:23 <b>corresponding (2)</b> 39:4;75:25 <b>corresponds (3)</b> 41:9;53:23;81:19 <b>could (87)</b>	11:9;16:9,13,17;20:10; 25:3;29:13;35:2,16;37:3, 11;44:18;46:17;47:13,14, 18;49:1,1,5,9,22,25;50:7, 12;53:12;55:16;61:13; 64:24;67:21,25;68:8,9; 70:22,23,24,25;71:1,4,25; 72:1,2,20;74:16,20;76:18, 23;77:5,10;78:11;79:2,5; 83:23;87:11,19,20,24;88:1, 6,12,14,20,24,25;90:7,22, 24;91:7,21,22;92:11,21,22; 93:14;94:23;95:2,4;100:21, 24;101:6,23;102:20,24; 103:3,8;104:12;107:16; 109:15 <b>couldn't (5)</b> 69:3;77:8,13,22;90:6 <b>counsel (4)</b> 7:4,9,14;112:6 <b>Counselor (4)</b> 4:8;8:15;32:17;52:20 <b>count (1)</b> 7:10 <b>couple (3)</b> 55:25;56:5,23 <b>course (4)</b> 20:2;76:18;91:12;111:24 <b>court (2)</b> 5:24;52:4 <b>covers (1)</b> 100:15 <b>create (2)</b> 79:6;109:9 <b>creating (1)</b> 40:17 <b>creativity (1)</b> 68:8 <b>current (1)</b> 52:12	<b>currently (1)</b> 13:17 <b>curve (11)</b> 76:5,13,21;77:13,23; 78:10,15,17;79:21;80:3,9 <b>Curved (1)</b> 78:5 <b>curves (4)</b> 76:18,24;80:5,8 <b>cut (1)</b> 93:14 <b>D</b> <b>dark (7)</b> 100:11;104:5,17;105:12, 15,21,23 <b>darken (4)</b> 72:19,20,25;87:21 <b>darkening (7)</b> 70:11,18;72:23;73:6,12; 74:5;111:22 <b>darker (5)</b> 65:14;76:11;78:7;87:21; 92:15 <b>darkest (5)</b> 87:12,13,14;92:5,12 <b>data (6)</b> 49:3,4;50:5,5;54:25;55:2 <b>data' (1)</b> 110:16 <b>day (1)</b> 49:22 <b>dealing (1)</b> 46:8 <b>decide (4)</b> 22:25;24:13;49:25;104:5 <b>decision (2)</b> 101:15;103:12 <b>declaration (44)</b>	7:23,23;8:13,19,22,24; 9:7,14,20;10:5;11:6,21; 13:17;17:2;24:25;26:12; 28:16;30:2;39:5;44:18; 46:15;51:15;52:13,22;53:7; 54:1,17;59:2,15;64:9; 69:21;75:10;80:15;92:3; 93:23;94:4;96:11;98:4,7; 106:3,15,17,18;111:3 <b>declarations (1)</b> 8:7 <b>decrease (8)</b> 58:21;61:17;62:1,12,25; 63:9,19,22 <b>decreases (1)</b> 63:1 <b>decreasing (2)</b> 63:17;91:25 <b>deduction (1)</b> 43:5 <b>define (4)</b> 56:21;80:18,25;94:10 <b>defined (10)</b> 27:2,6;54:19;55:4;80:23; 81:17;82:13,16;96:2;97:9 <b>definitely (1)</b> 72:1 <b>definition (1)</b> 55:20 <b>degree (1)</b> 72:7 <b>delving (1)</b> 32:18 <b>density (1)</b> 32:10 <b>denying (1)</b> 72:20 <b>depend (1)</b> 77:7 <b>dependent (1)</b>
---	---	---	--

72:16	<b>despite (1)</b>	7:10;28:16;50:14;53:1;	111:5
<b>depends (1)</b>	29:19	62:14,17;65:15;77:3;83:16;	<b>directing (1)</b>
83:21	<b>detail (4)</b>	105:13	111:21
<b>depo (1)</b>	35:6;59:10,10;104:18	<b>difference (6)</b>	<b>directions (1)</b>
7:19	<b>details (18)</b>	40:10;48:14;59:18,20;	72:7
<b>deposed (4)</b>	29:2;55:23,25;56:4,5,7,	65:10;96:23	<b>directly (1)</b>
6:11,14;8:16;81:7	11;57:6,18,20,23;58:10,14,	<b>different (63)</b>	96:6
<b>deposition (10)</b>	16,19;59:8,12;74:1	22:11;26:24;27:9,16;	<b>disadvantages (1)</b>
6:13,25;7:3,17,24;8:20;	<b>detect (4)</b>	28:6,7,8;30:10,11;37:24;	49:13
9:21;81:7;112:6,14	32:12;104:5;105:10,13	41:19;43:10;48:16;49:7;	<b>disagree (3)</b>
<b>depth (1)</b>	<b>detected (13)</b>	50:17;53:9,14;66:5;67:11,	19:13;21:25;63:8
53:3	79:19,25;83:20;84:14;	17;73:2;80:1,1,3,3,5;81:22,	<b>disclose (5)</b>
<b>depth-of-field (1)</b>	85:6;95:1;101:12;102:2;	23;82:4,5,22,24;83:2,11;	14:2;30:6;42:5;85:1;
63:7	103:13,21;104:24;105:1,16	84:19,20;85:15,16;86:15;	110:23
<b>describable (1)</b>	<b>detectible (2)</b>	87:6;88:3;89:2;90:4;95:2;	<b>disclosed (1)</b>
76:21	101:25;102:2	96:4;99:23;100:17;101:1,2,	27:20
<b>describe (5)</b>	<b>detecting (2)</b>	8;102:15,17;103:2,3,4,5,11;	<b>discloses (10)</b>
75:16;77:13,23;95:16;	94:14;108:7	104:25;105:7,8,9,20;108:17	13:4,18;16:1;46:10;52:9,
107:12	<b>detection (7)</b>	,	16;81:16;96:1;108:2;
<b>described (3)</b>	51:24;54:6,7;101:15,19;		110:14
71:18;104:18;108:19	102:8;104:7	<b>'different (1)</b>	<b>disclosing (3)</b>
<b>describes (7)</b>	<b>determine (6)</b>	96:3	26:23;27:11;81:11
11:22;30:14;46:12;80:9;	41:19;77:17;95:12;	<b>D</b>	<b>discourse (1)</b>
81:22;99:13;105:17	101:25;105:11;110:3		93:8
<b>describing (3)</b>	<b>determined (3)</b>		<b>discuss (8)</b>
15:23;87:24;95:3	83:19;84:13;105:4	<b>differently (1)</b>	6:24;13:11;17:1;52:15;
<b>description (3)</b>	<b>determining (4)</b>	78:11	69:24;94:2;111:15;112:6
94:18,19;95:10	54:24;71:16;78:20;	<b>differing (5)</b>	<b>discussed (2)</b>
<b>descriptions (2)</b>	110:14	82:25;83:1,4,10,10	54:4;59:2
94:10;95:12	<b>deviation (1)</b>	<b>digital (17)</b>	<b>discussing (1)</b>
<b>descriptor (2)</b>	95:6	29:13;45:23,24;46:8,17,	6:16
94:24;95:1	<b>device (4)</b>	22;47:13,14,16;54:25;55:1;	<b>discussion (6)</b>
<b>design (4)</b>	45:23;46:23;47:11;51:10	61:3,8,11;110:15;111:6,10	16:11;28:25;35:6;56:10;
48:13,25;49:25;51:7	<b>device-independent (1)</b>	<b>dimensions (1)</b>	64:13;73:20
<b>designed (1)</b>	49:11	72:6	<b>display (2)</b>
49:16	<b>devices (1)</b>	<b>direct (4)</b>	51:17,18
<b>desirable (1)</b>	46:12	21:8,22;62:15,16	<b>displayed (2)</b>
61:5	<b>devoted (1)</b>	<b>directed (5)</b>	51:10,16
<b>desired (2)</b>	60:12	45:4;52:24;66:5;69:2;	<b>displays (1)</b>
11:25;15:18	<b>didn't (10)</b>		51:18

<b>dispute (1)</b> 35:24	33:4;34:25;38:19;40:18; 41:7;25;45:6;47:6;48:6,12; 49:22;51:6;55:19;56:9,24, 25;63:25;65:20,21;66:21; 68:4,7;70:9;72:3;74:19,25; 80:23;81:7;82:10;85:11,11; 92:20;93:2,20;96:25;103:2; 104:7;111:18,19,20	70:24;76:3,16,20;77:5,13, 23;78:18;80:10;82:1;83:7, 18,21,24,25;84:4,6,9,10,16; 85:2,8,12,15,18,22,25;86:6, 7,16;87:7,9;88:5,6;89:8,11, 21,22;90:12,16,19,21;91:4, 8,9,11;92:17,23;101:23	95:3
<b>dissect (1)</b> 33:4			<b>else (2)</b> 18:7;109:9
<b>distance (3)</b> 49:18,21,21			<b>elsewhere (1)</b> 33:6
<b>distances (1)</b> 49:17		<b>dynamic-range (1)</b> 91:16	<b>email (1)</b> 7:10
<b>distinct (1)</b> 36:5	<b>dots (1)</b> 66:23		<b>embodied (1)</b> 79:16
<b>distinction (1)</b> 75:1	<b>down (12)</b> 10:2;32:2,13;37:13; 68:21;82:20,20;84:8;89:6; 91:16,19;100:7	<b>E</b>	<b>embodiment (3)</b> 21:21;79:14;107:13
<b>dive (1)</b> 8:5		<b>each (10)</b> 7:12;40:21;72:15;73:21; 82:13,17;96:2;97:10;107:7, 8	<b>embodiments (3)</b> 107:8,12;108:19
<b>document (6)</b> 8:16;10:8,9;14:20,21; 15:21	<b>dozens (2)</b> 57:11,12	<b>ear (2)</b> 5:12,13	<b>emerge (1)</b> 67:2
<b>documents (5)</b> 7:18,20,21;10:11;36:14	<b>Dr (17)</b> 4:7;16:12;28:14;39:1; 46:7;56:12;57:10;58:12; 64:7;66:12;69:14;83:13; 84:24;86:10;88:3;92:2; 97:24	<b>earlier (2)</b> 32:7;93:8	<b>emphasis (15)</b> 60:25;64:14;65:8,19; 98:25;100:4;101:10,17,17, 19,21;102:14;103:6; 104:10;111:22
<b>doesn't (25)</b> 37:4;38:8;42:11,25; 43:12,16;47:17,18;50:11, 14;56:16;58:4,18;70:14,15, 17,18;74:23,25;80:25;85:4, 10,10;102:3;105:10	<b>draw (1)</b> 36:9	<b>easy (3)</b> 32:12;54:11;79:11	<b>emphasize (3)</b> 100:12,19,21
<b>doing (11)</b> 22:3;28:2;45:19;54:8; 63:21;78:19;87:7;92:13,13; 98:22;99:7	<b>drawing (1)</b> 36:10	<b>edge-preserving (3)</b> 107:25;108:3,14	<b>emphasizing (4)</b> 99:16;100:2,24;101:6
<b>dominant (1)</b> 67:10	<b>drawn (1)</b> 68:20	<b>edition (1)</b> 29:24	<b>employ (1)</b> 108:20
<b>done (9)</b> 74:8;89:5;93:20;99:2,3, 19;102:21;103:6;105:24	<b>DRC (1)</b> 71:16	<b>editions (1)</b> 28:20	<b>encompassing (1)</b> 76:3
<b>do-nothing (1)</b> 76:7	<b>duly (1)</b> 4:3	<b>effect (3)</b> 63:8,18;78:5	<b>end (9)</b> 35:9;37:5;76:17;81:25; 95:11;100:9,23;103:16; 104:20
<b>don't (57)</b> 4:11,20;9:8,16;18:6;19:2, 12,20,22;21:12;22:1;23:12; 24:3,23;27:5;32:18,22;	<b>during (3)</b> 12:24;14:17;112:5	<b>efficacy (1)</b> 34:2	<b>Enhance (5)</b> 35:17;37:21,22;73:25; 74:18
	<b>Dvir (12)</b> 106:1,6,11,16,21;107:5, 12;108:2;110:5,8,14,19	<b>efficiencies (1)</b> 51:25	<b>enhanced (1)</b> 36:25
	<b>dynamic (61)</b> 39:11,18,21;40:1,6;42:20, 25;43:25;44:1,5;69:10,17;	<b>eg (3)</b> 81:20;82:24;96:14	<b>enhancement (10)</b> 50:10,10;60:5,17,21; 61:6;65:24;66:17;67:12;
		<b>either (6)</b> 72:18,25;73:13,24;80:1; 93:2	
		<b>elongated (1)</b>	

71:19	<b>examined (1)</b>	23:1	110:24
<b>enhancing (3)</b>	4:3	<b>Exhibit (17)</b>	<b>extra (1)</b>
36:19;62:23;101:18	<b>Examiner (15)</b>	8:12;9:6,12,19;10:4,8,17;	50:1
<b>enough (4)</b>	12:2,3,8;13:10;14:17;	26:1,9;29:22;39:2;45:8;	<b>extremely (1)</b>
21:1;22:4;36:3;75:14	18:19,20;19:6,11,16,24;	69:21;75:12;98:2;106:1;	56:20
<b>entered (1)</b>	20:14,18,19;22:25	111:2	<b>eye (1)</b>
9:17	<b>Examiner's (1)</b>	<b>exhibits (1)</b>	42:4
<b>enters (1)</b>	18:25	24:23	<b>eyes (1)</b>
33:22	<b>example (33)</b>	<b>existed (1)</b>	51:22
<b>entire (2)</b>	21:20,23;28:7,9;30:19;	11:19	<b>F</b>
84:23;87:3	39:10,21;40:6,18;41:24;	<b>existence (1)</b>	
<b>entirely (1)</b>	42:19;44:5;54:3;60:14,15;	20:10	<b>face (81)</b> 12:15,16;26:3;36:22; 37:11;38:5,5,9;40:8;41:3,6, 9,11,13,15,15,16,18,24,25; 42:6,10,13,16;43:1,4,13,18; 44:8;54:6;71:2;77:15,18, 21;78:7,11;79:20,23;81:20; 83:19,20,22,22;84:12,13,18, 21;85:2,3,6,9,17;86:17; 87:13;89:9,21;90:13;94:16, 23;95:3;96:8;97:15;99:14; 101:11,15,18,25;102:1,2,5, 6,8;103:13,21;104:6,7,12, 24;105:10,15,23
110:20	66:18;68:5;71:16;72:14;	<b>exit (1)</b>	
<b>equatable (1)</b>	73:4;76:15;78:5;79:14;	102:6	
54:10	81:22;83:18;86:20;88:13;	<b>exits (2)</b>	
<b>equation (1)</b>	92:9,11;94:17;97:13;107:8;	32:3;102:4	
30:15	112:3	<b>expand (1)</b>	
<b>equations (2)</b>	<b>examples (13)</b>	53:12	
29:5;30:5	27:20;28:11,15;29:5,7;	<b>Expanding (1)</b>	
<b>et (4)</b>	30:5;55:23;57:20;73:4;	91:10	
8:1;13:1;28:24,24	83:15;86:19;95:9;100:5	<b>expecting (1)</b>	
<b>even (17)</b>	<b>except (2)</b>	61:24	
12:3;13:18;23:7,9,10;	66:23;107:5	<b>experimentation (1)</b>	
24:18;42:13;51:12;54:6;	<b>excerpts (1)</b>	55:17	
61:12;66:9;83:6;92:18;	102:12	<b>expert (5)</b>	
102:1;103:6,9;105:21	<b>exclude (1)</b>	29:18;58:12;72:12;73:16;	
<b>ever (1)</b>	111:19	93:11	<b>face' (1)</b>
4:23	<b>excluding (1)</b>	<b>explain (12)</b>	105:13
<b>every (5)</b>	74:19	31:8;40:10;59:17;60:16,	<b>face-detection (2)</b>
5:1;66:2,10;67:2;76:20	<b>exclusive (1)</b>	16;63:15;74:16;77:10;78:2;	36:23;100:6
<b>everything (4)</b>	30:20	79:2;83:1;103:24	<b>faces (19)</b>
8:2;33:5;58:8;88:12	<b>exclusively (1)</b>	<b>explained (1)</b>	27:8,14;36:24;38:12,13;
<b>evidence (1)</b>	19:10	59:22	82:2,24;89:9;90:13,16;91:1,
9:17	<b>excused (1)</b>	<b>explains (4)</b>	9;96:15,24,25,25;97:18;
<b>exact (1)</b>	112:13	22:4;79:12,13;109:15	105:1;112:3
109:10	<b>execute (1)</b>	<b>exposure (3)</b>	<b>facial (4)</b>
<b>exactly (4)</b>	50:3	104:1,2,16	36:25;37:22;43:4;59:5
21:13;39:24;107:3;110:9	<b>exemplary (2)</b>	<b>expressly (2)</b>	<b>facing (3)</b>
<b>EXAMINATION (1)</b>	21:21;46:16	45:18;46:15	45:21;53:21,22
4:5	<b>exercise (1)</b>	<b>extent (1)</b>	<b>fact (7)</b>

16:1;68:21;84:1;90:2,9; 92:17;93:7	12:8;57:17;70:17;73:15; 17:85:24	28:3,6;60:9;82:8;86:4; 89:25;94:7;105:23;109:6,8	19:19;21:24;23:17;24:10; 25:14;26:21;27:4,21;28:13; 29:15;30:8;31:11;33:15; 34:9;35:8,21;36:8;38:18; 40:12;41:12;42:8,17;43:19; 47:21;48:19,21;49:12; 50:13,17;52:19,25;54:20; 55:5;58:24;59:7,19;62:13; 63:13;65:3;69:7;71:23; 74:11;75:17;77:2;78:13; 79:10;85:23;91:5;93:6; 94:11;96:20;103:15; 106:13;110:7;111:17
<b>factor (1)</b>	<b>Fig (1)</b>	<b>fine (12)</b>	
73:21	42:19	5:20;8:5;25:16;55:23; 56:4,7;57:6,18,20,23;59:8; 103:18	
<b>factors (3)</b>	<b>Figure (61)</b>		
72:17;73:23,23	16:3,5,8,13,17;21:2,18, 21;22:8,9,15,17;24:7;32:16; 35:17;39:10,13,20;40:5; 42:7;43:14;44:12;45:21; 46:25;47:19;48:7;51:2,5; 53:23;75:5,6,15,16,18,24; 76:2;77:14,24,25;79:2,6,8, 15,15;80:4;85:14;94:13,22; 98:8,12,15;99:3;100:3; 101:13;102:4,6;106:23; 107:4,5;110:8,10	<b>finish (5)</b> 6:6,7;47:14;88:17;102:24	
<b>failure (1)</b>		<b>finished (1)</b>	
68:23		43:7	
<b>faint (1)</b>			
67:8		<b>first (20)</b>	
<b>fainter (1)</b>		4:3;8:11;9:7,14;14:16; 24:25;26:16;43:20;44:15; 45:22;54:24;55:1;69:4; 77:20;82:11,12;86:8;89:25; 105:19;110:15	
67:2			
<b>Fair (2)</b>			<b>formulate (2)</b>
36:3;41:10			53:1,4
<b>fall (1)</b>			<b>found (4)</b>
112:1			19:11;36:24;53:10;61:5
<b>fancy (1)</b>	<b>figures (9)</b>	<b>five (2)</b>	
68:9	21:7,12;39:8;106:24; 107:1,7,10,13,15	80:8;84:8	<b>from (50)</b>
<b>far (2)</b>		<b>fixed (2)</b>	5:22;8:25;15:6;26:3; 27:18;28:9;29:2;31:18; 36:5,11,22,23;38:25;40:19; 42:3,3;45:22;46:22;47:10; 10:48;2,10;51:7,14;60:3; 64:6;65:21;68:20;71:22; 73:17;75:18;78:3,4;82:6; 83:13;84:8;86:23,24;89:13; 92:2,3;95:24;97:8,23; 101:4;102:12,18;107:4,8; 112:11
32:13;51:14	<b>filter (31)</b>	87:23,25	
<b>faster (1)</b>	21:5;24:14,16,21;26:24; 27:8,15,23;30:16,17;31:6, 15;32:20;35:18,19,23;36:1, 7,18,21;37:1,4,6,10,15,23; 38:4,7,12;57:2;67:22	<b>focus (3)</b> 62:23;63:1,17	
94:8		<b>follow (2)</b>	
<b>feature (29)</b>	<b>filtering (27)</b>	101:14;103:22	
15:4,19;16:18;81:4,4,12, 18,20;82:22;89:9,10;90:13, 14;94:10,13,15,16,17,18,19, 22;95:10,18;96:7,14,19; 97:10,10,14	13:11,12;17:4,4;24:19, 19;25:8,8,11,12;26:24;27:9, 12,16,19,20,24;28:4,6,12; 34:18,24;35:3,4;37:16; 68:18,25	<b>following (5)</b> 45:16;46:13;73:20;78:16; 79:7	
<b>feature' (1)</b>		<b>follows (1)</b>	
96:3		4:4	
<b>features (5)</b>	<b>filters (26)</b>	<b>foment (1)</b>	
16:15;81:24;82:5;94:14; 95:6	28:25;29:7;30:6,9,12,14, 22,23;31:4,9,13,14,20,21, 22,24;32:25;33:2,10,16,17; 50:20;107:25;108:3,14,22	47:1	<b>front (3)</b>
<b>features' (1)</b>		<b>foreground (1)</b>	8:7;57:1,3
96:5		62:24	<b>full (2)</b>
<b>felt (1)</b>		<b>forget (2)</b>	86:22;89:23
19:6	<b>final (11)</b>	24:24;109:10	<b>fumbled (1)</b>
<b>few (1)</b>	13:11;17:4;24:19;25:8, 12,15,25;34:19,22,24;37:17	<b>forgotten (1)</b>	84:5
66:23		106:24	<b>function (2)</b>
<b>field (6)</b>	<b>find (10)</b>	<b>Form (65)</b>	23:10;72:18
		11:14;13:6;14:4;15:5,20; 16:16,19;17:22;18:12,24;	<b>Functions (2)</b> 64:22,25
			<b>further (10)</b>

20:3;23:2;35:6;51:13; 68:21;100:10,12;102:3; 103:23;112:12	<b>Germany (1)</b> 59:24 <b>gets (1)</b> 22:3 <b>getting (5)</b> 51:12,14;53:24;75:13; 99:20 <b>gimme (1)</b> 51:15 <b>gist (2)</b> 22:3,16 <b>give (8)</b> 5:9;10:15;51:13;61:20; 63:7;66:18;82:23;86:19 <b>given (8)</b> 13:25;37:2;69:14;73:20; 83:6;90:5;91:15;96:23 <b>gives (2)</b> 22:6;63:17 <b>giving (5)</b> 28:9;32:17;51:7;95:9; 100:5 <b>global (3)</b> 70:23;88:7,13 <b>goal (5)</b> 63:9,18;67:7,7,11 <b>goals (1)</b> 68:3 <b>goes (3)</b> 87:11;90:25;104:15 <b>going (23)</b> 8:1,21;10:7,10,13,24; 11:20;14:13;16:5;21:25; 22:7;24:1;29:4,9;36:9; 38:21;50:20;51:13;75:8; 83:9;86:2;103:21;105:25 <b>Gonzalez (17)</b> 28:17,22,22,25;29:22,24; 30:4,6;32:4,18;33:5,21; 64:16,20;65:23,25;68:23	<b>Good (5)</b> 4:8;49:23;64:5;66:18; 90:25 <b>graduate (1)</b> 30:25 <b>granted (1)</b> 20:19 <b>graph (4)</b> 41:1,10;42:10;79:17 <b>great (2)</b> 5:24;98:3 <b>ground (1)</b> 4:11 <b>Gs (2)</b> 78:6;79:19 <b>guess (1)</b> 68:6	4:2,3;14:20;25:17,18; 29:19 <b>head (2)</b> 5:4;8:4 <b>headed (1)</b> 15:25 <b>hear (3)</b> 5:14;25:3;103:18 <b>heightened (1)</b> 60:6 <b>help (1)</b> 21:9 <b>herein (1)</b> 71:18 <b>here's (2)</b> 16:21;41:3 <b>hesitate (2)</b> 14:19;21:16 <b>hesitating (1)</b> 110:22 <b>hidden (1)</b> 67:9 <b>high (3)</b> 23:8;24:12;106:25 <b>higher (4)</b> 65:12;89:10;90:14,24 <b>highest (1)</b> 65:10 <b>highlight (1)</b> 74:4 <b>highlights (2)</b> 73:1,25 <b>himself (1)</b> 11:22 <b>histogram (10)</b> 40:11,14,23;41:4,8;42:2, 9;66:4;67:8;95:5 <b>Histograms (1)</b> 41:5 <b>history (1)</b>
<b>G</b>		<b>H</b>	
<b>gain (60)</b> 54:24;69:24,24;70:6,6,10, 17,20;71:4,16,22;72:1,3,4,5, 6,7,9,16;73:3,5,8,21,22; 74:9,10,12,14,23;78:6,25; 79:3,4,6,17,18,21,22,24; 91:4,6,7,8,9,12,21,24;92:16, 18,19,23,25;93:1,5,8;110:9, 11,14;111:12,15 <b>gains (1)</b> 93:20 <b>galaxies (1)</b> 67:3 <b>Gallagher (5)</b> 111:2,5,9,12,15 <b>gamma (1)</b> 68:16 <b>ganglion (1)</b> 51:22 <b>gaps' (1)</b> 29:3 <b>gave (3)</b> 69:2;83:15;93:8 <b>general (9)</b> 21:9;22:16;29:17;40:22; 47:12;58:23;65:7;85:21; 107:12 <b>generally (16)</b> 7:15;23:8;41:17;45:10; 55:7;57:4,10;66:16;67:14; 68:13;73:21;75:16;89:20; 102:17;103:9,11 <b>gentle (1)</b> 51:14			

19:22	14;28;18;29;2,13;34;7;	<b>implementing (2)</b>	<b>indicative (2)</b>
<b>honestly (1)</b>	35:18,20,24;36:2,18,19,24;	29:6;30:5	18:9;23
62:8	37:11;38:5,8;39:21,23;40:5,	<b>implies (1)</b>	<b>individual (2)</b>
<b>hoop (1)</b>	6,14,16,16,17;41:7,22,23;	15:18	41:20;65:9
68:10	42:7,12,19,21;43:3,11;44:2,	<b>important (2)</b>	<b>infection (1)</b>
<b>hour (3)</b>	5,7,13;45:4,19,22;46:10,22;	6:5;104:24	5:12
5:1;38:22;64:3	47:10,20;48:2,9;49:3,4;	<b>impossible (1)</b>	<b>inform (2)</b>
<b>hours (2)</b>	50:5,5,6;51:5;54:25;55:2,	41:2	24:8;42:23
8:18;9:18	25;56:10;59:12,23;60:2,4,5,	<b>improved (2)</b>	<b>information (6)</b>
<b>however (3)</b>	9;61:2;65:11;66:4,8,11;	11:24;15:17	40:15,17,18;50:17;51:22;
51:20;77:24;106:1	70:12,17;71:18;72:16;	<b>improving (2)</b>	52:4
<b>human (15)</b>	73:12,25;74:7,18;76:5;	11:25;15:17	<b>initial (9)</b>
27:8,14;81:20;82:2,24;	77:5;78:7;81:4,12,18,20,24;	<b>in-between (1)</b>	13:11;17:4;24:19;25:8,
83:19;84:12;89:9,9,21;	82:5,19,24;85:13,14,17;	104:9	15;34:18,22,24;37:17
90:13,13;91:1;96:14;97:15	86:16,16;87:4,5,12;88:8;	<b>include (6)</b>	<b>inner (1)</b>
<b>humans (1)</b>	90:16;92:12;96:2,4,24;	37:11;57:16;68:22;72:3;	28:8
51:18	97:10,10,14;105:9;110:16;	100:24;104:13	<b>innovation (2)</b>
<b>hundreds (1)</b>	111:6,10,24	<b>included (2)</b>	25:19,20
57:17	<b>image-capturing (1)</b>	19:8;72:4	<b>input (3)</b>
<b>hunting (1)</b>	47:11	<b>includes (8)</b>	67:14;72:16;74:7
100:7	<b>images (15)</b>	5:19;22:18;25:22;28:25;	<b>inset (5)</b>
<b>hypothetical (3)</b>	11:17,25;13:20,24;15:4,	34:15;37:18;45:5;94:22	11:23;12:3;46:14,16;
22:23;23:11;93:12	18;16:15;20:7,11;46:9;	<b>including (5)</b>	58:20
	57:1;59:16,17,20;60:7	13:1;18:21;22:15;43:3;	<b>inside (3)</b>
<b>I</b>	<b>imagine (1)</b>	55:6	46:4;47:16,16
	45:24	<b>Incomplete (1)</b>	<b>insist (1)</b>
<b>idea (3)</b>	<b>imbalance (1)</b>	22:22	10:24
11:18;22:6;76:15	54:11	<b>increase (7)</b>	<b>insists (1)</b>
<b>ideas (1)</b>	<b>immediately (1)</b>	63:11,18;78:6;91:8;	55:20
23:25	29:9	92:14;100:11;104:2	<b>inspect (1)</b>
<b>identical (2)</b>	<b>impact (1)</b>	<b>increased (1)</b>	55:17
107:3,5	91:4	104:1	<b>instance (10)</b>
<b>identicalness (1)</b>	<b>imperfection (6)</b>	<b>increases (1)</b>	85:9;89:7;90:11;91:22;
107:1	34:11,14,19;35:5,6;37:17	65:10	92:7;101:14;102:10;105:6,
<b>identified (1)</b>	<b>imperfections (1)</b>	<b>increasing (4)</b>	19,20
98:21	58:10	25:24;82:3;87:16;91:24	<b>instances (1)</b>
<b>ie (2)</b>	<b>implement (3)</b>	<b>indeed (3)</b>	71:3
44:7;81:17	13:23;21:11;22:14	57:5;61:3;95:15	<b>Instead (2)</b>
<b>image (112)</b>	<b>implemented (2)</b>	<b>indicates (1)</b>	97:2;100:20
21:4;25:9;26:20,23;27:7,	46:5,17	82:4	<b>intended (3)</b>

34:25;62:25;76:2	15:24;20:8;23:13;49:9;	80:12;86:3;93:4,21;94:20;	87:20,24;93:15
<b>Intense (3)</b>	60:20;65:2	96:11;97:20,24;107:2;	<b>keeping (1)</b>
99:9,20;100:13	<b>inventor (3)</b>	109:24;111:1;112:4,8	87:22
<b>intensities (4)</b>	63:15;78:1;80:23	<b>job (3)</b>	<b>Kim (1)</b>
76:5,11;90:7,22	<b>involve (4)</b>	19:1,2;28:14	7:14
<b>Intensity (29)</b>	54:3;72:1,2;74:23	<b>judgment (1)</b>	<b>kind (17)</b>
64:22;65:5,11,12,13;	<b>involved (1)</b>	55:18	46:1;50:20;51:23;57:5;
67:14,14,20;78:7,11;83:18,	53:17	<b>jump (2)</b>	64:13;65:17;66:14;67:6;
20,23;84:4,6,9;85:2,8,18,	<b>involves (2)</b>	68:9;108:18	70:20;76:7;78:21;92:23;
22;89:8,11,21,22,23;90:12,	57:11;86:1	<b>just (137)</b>	98:14;99:10;102:7;104:23;
15,19;91:3	<b>IPR2018-01250 (1)</b>	5:17,20;6:18;7:8;8:6,22;	110:21
<b>intention (1)</b>	6:19	9:1,2,6;18:7;19:4;20:22,25;	<b>kinds (3)</b>
63:17	<b>IPR2018-01251 (1)</b>	21:17,20;22:24;25:23;	71:25;73:2;100:17
<b>interchangeably (1)</b>	6:19	27:18;28:9;29:12,24;30:19;	<b>kit (1)</b>
67:21	<b>IRP (1)</b>	32:19;34:2;35:25;40:13,21,	55:11
<b>interest (4)</b>	112:7	24;41:5,21;42:10,13;43:21,	<b>knob (1)</b>
51:20;80:7;81:25;86:22	<b>irrelevant (1)</b>	23;44:9,19;45:14;47:4,12,	70:22
<b>internal (1)</b>	52:3	23;48:6,12,16;50:3;51:1,7,	<b>know (398)</b>
45:25	<b>iterative (1)</b>	13;52:3;53:6,20,23;56:14,	4:21,24;5:2;7:22,25;8:18;
<b>interpret (2)</b>	18:10	23;58:13,23;60:11,16;	10:24;11:15,18,21;12:3,6,7,
21:11;22:13	<b>itself (5)</b>	61:25;62:9;63:1,2,3,6;	9,13,14,17,18,20,20,21;
<b>interpretation' (1)</b>	15:8;22:4;25:7;41:11;	64:13;65:7,17;66:9,11;	13:9,12,13,14,15,25;14:19;
70:6	60:1	67:13,15;68:12,15,25;69:3;	15:23,24;16:21;17:23,24;
<b>interrupt (1)</b>	<b>J</b>	70:18;73:4,9,15;74:15,19,	18:3,3,4,13,15,25;19:2,3,4,
65:16		21;76:1,15;77:4,12;78:1,24;	6,8,20,23,25,25;20:3,4,4,10,
<b>intimately (1)</b>	<b>JANITENS (78)</b> 4:6;12:11;14:8;15:3,7; 16:2,9,12,17,23;18:8,19; 19:16;20:12;22:17;23:21; 24:17;25:11,21;27:1,13; 28:10;29:21;31:2,21;32:5; 33:20,23;34:14;35:13;36:3, 12;38:14,21,24;39:1;40:20; 41:17;42:15;43:6;44:3; 46:21;47:22;48:20;49:8; 50:9;51:9;52:23;53:7; 54:23;55:22;59:4,14,21; 62:21;64:2,5,7;65:7;69:18; 72:24;75:3,21;77:10;78:14;	79:7,8;80:24;81:14;82:5,6, 7,8,9;84:16;85:4,17,21; 86:12,14,25;87:12;88:11, 12,17,17;89:3,12,20,23; 93:14,16;94:15;95:9,20,24; 96:10;97:4,4;98:23,23;99:4, 22;102:17,24;103:17; 104:19;105:2,5,10,14; 107:7;110:21;111:9;112:4	18,23,25,25;21:7,11,12,13, 16,17,17;22:1,5,5,6,6,11,12, 13,14,25;23:1,3,6,11,12,18, 23,24;24:1,2,3,4,5,14,18; 25:6,15,17,19,23;27:5,5,6, 11,12,23;28:3,7,8,19,21; 29:7,8,12,18;30:9,12,14,17, 24,24;31:13,15,20;32:17, 20,24;33:1,1,4,11;34:10;
<b>into (7)</b>		<b>K</b>	35:1,11,23;36:15,16;37:2,5, 12,14,18,23;38:3,7,11;40:3,
4:10;8:5;9:17;32:18;			19,21,23,24,25;41:7,7,21,
51:23;53:24;82:11		<b>keenly (1)</b>	23,25;42:3,9,18,22;43:24;
<b>introduced (1)</b>		5:14	45:5,14,16,20;46:3,6,7,12,
71:15		<b>keep (3)</b>	19;47:14,15;48:24;49:5,6,
<b>introduction (1)</b>			
28:23			
<b>invalid (1)</b>			
23:4			
<b>invented (1)</b>			
30:25			
<b>invention (11)</b>			
11:13,18,22;13:22;14:25;			



14,20,24,24;50:6,16,17,19, 25;51:4;53:2,3,4,16,20,21, 24;54:2,5,6,9,10;55:11,12, 16,20,24;56:4,9,9,11,13,21, 22,23,24,25;57:2,5,13,14, 15,17,22,24;58:1,2,5,10,11, 15,18;59:1;60:3;61:2,2,13; 62:9,22;63:7,14;64:1;65:5, 22;66:1,3,6,6,7,8,9,15,16; 67:4,18;68:3,4,20,21;69:1, 8,10,12,15,16;70:9,17,19, 23;71:4,25;72:2,4,6,7;73:2, 11;74:14,17,20;75:18,22; 76:2,6,16,17,19;77:4,6,16, 22;78:1,18,20;79:11;80:1,4, 8,20,23;81:2,3,4,5,24; 82:15;83:8,9;84:18,24; 85:11,12,14,25;86:2,12; 87:2,16,18;88:1,14;89:2; 90:6,10;91:1,8,19,21,25; 92:4,4,7,8,13,21,22;93:9,15, 18,20;94:13,17,18;95:2; 96:24;97:2,2,7,8,18;98:16, 21,22;99:1,6,7,19,23; 100:20,21,25;101:8,14,19, 20,22,22,23,24,24;102:5,11, 12,20;103:2,7,23;104:9,10, 13,14,19,23,25;105:2,5,11; 106:23;108:17,19;109:3,4, 6,6,12,13,15;110:8,10,11, 18,22,23,24;111:18,19,20, 22;112:1	10,23;16:3,18,20,24;17:1, 21;18:3,7;19:4;23:13,20; 26:2,4,5,19;27:2,6,18; 33:24;35:7,14;36:17;37:13; 44:10;45:3,18;46:7,15,18, 21,25;47:9,15;50:9;51:1,6; 52:8,10,16;53:8,13;54:4; 55:20,22,24;56:3,3;57:7,20, 22;58:9,13;59:12,12	<b>leads (1)</b> 103:23 <b>leafing (1)</b> 68:15 <b>learn (2)</b> 22:16;29:9 <b>least (4)</b> 26:3;56:16;80:4;110:19 <b>leave (3)</b> 9:3;50:2;87:11 <b>leaving (1)</b> 92:12 <b>lens (2)</b> 45:24;61:10 <b>less (2)</b> 57:16;77:22 <b>Leung (2)</b> 32:3;33:22 <b>level (5)</b> 23:8;24:12;88:7,13,13 <b>levels (4)</b> 65:11,13,13;89:23 <b>light (1)</b> 93:4 <b>lighten (3)</b> 72:18,20,25 <b>lightened (1)</b> 42:13 <b>likely (2)</b> 10:25;57:6 <b>limit (2)</b> 68:7;73:11 <b>limitation (2)</b> 22:9;90:5 <b>limitations (2)</b> 23:5,10 <b>limited (8)</b> 42:9;70:11,15;71:15; 72:10;73:8,13,18 <b>limiting (5)</b>	71:24;74:14;95:8;100:5, 16 <b>line (32)</b> 13:16,19;15:12;17:8,16; 18:21;20:6,13;28:24;32:14; 36:17;37:6,15;44:3;48:4,5; 72:14;73:19;74:6;76:6,9, 14;78:4,5,16;82:10;84:3; 92:10;108:6,11,24;109:17 <b>linear (4)</b> 31:20,23,24;76:6 <b>lines (12)</b> 15:10;17:25;44:4;47:8; 49:2;52:7;71:7,10;84:8; 106:19;107:18,24 <b>link (1)</b> 60:8 <b>list (3)</b> 24:23;28:16;49:2 <b>listed (1)</b> 12:25 <b>little (14)</b> 5:13;31:8;38:10;41:1,23; 51:13,14;52:4;66:8;69:1; 82:7;98:6;99:5;112:10 <b>local (45)</b> 54:14,19;55:1,4,6,8,10, 18,21;56:8,14,20,20;57:5,8, 9,15,16,16,16,24;58:4,5,15, 18,19,21;59:5,9,11,13; 70:23;95:5;106:7,12;109:4, 8,12,14,16;110:2,6,15,18,24 <b>localities (1)</b> 58:7 <b>locality (1)</b> 58:14 <b>location (4)</b> 40:8;43:3;44:8;94:24 <b>locations (1)</b> 109:24
	<b>Konoplev's (4)</b> 11:13;13:22;20:8;59:5		
	<b>L</b>		
	<b>labeled (5)</b> 8:12;9:11;10:3,8;29:22 <b>language (19)</b> 15:18;18:14,20;19:10; 21:13;22:11;25:6;37:3; 54:6;57:17;75:20;77:21; 78:3,23;80:21;102:12; 103:1;107:11;109:10 <b>largely (1)</b> 60:1 <b>larger (5)</b> 32:11;58:5,6;90:17,19 <b>largest (1)</b> 31:18 <b>last (3)</b> 5:12;90:10;111:8 <b>later (1)</b> 104:18 <b>latitude (1)</b> 32:18 <b>latter (1)</b> 103:25 <b>lay (1)</b> 53:1 <b>Leading (1)</b> 91:5		
<b>knowledge (10)</b> 13:23;29:11,17,20;39:22; 42:21;43:2,4,11;44:6 <b>knows (1)</b> 12:14 <b>Konoplev (66)</b> 10:10;11:4,7,19,21; 12:25;13:9;14:10,17;15:8,			

<b>log (3)</b> 66:14;68:9,15	<b>lower (2)</b> 65:13;90:8	<b>manner (1)</b> 110:16	<b>maximum (2)</b> 87:2,6
<b>logarithm (2)</b> 66:2;67:1	<b>lower-bound (1)</b> 87:18	<b>many (11)</b> 6:10;7:7;20:9;28:20,20; 31:13;40:21;60:11;81:10; 96:9;110:3	<b>may (51)</b> 5:17;13:12;14:9;23:25; 27:25;28:3;31:6;49:18,21; 50:21;51:20;57:20;66:4,5, 8;67:2;72:18,25;78:18,19; 82:14,17,21;83:19;84:6,12; 87:3,5;90:17;91:1,15; 93:18;95:12;96:2,4;97:9, 14;100:19,25;101:1,25; 102:5,21;105:4,15,15,16,16, 20;109:4,12
<b>logarithmic (3)</b> 66:1,14,19	<b>lowest (1)</b> 65:11	<b>map (7)</b> 69:25;70:6;77:8;79:3,4,6, 9	<b>maybe (7)</b> 44:17;68:1,9;74:17; 87:13,14;105:12
<b>logical (1)</b> 43:5	<b>luminance (4)</b> 40:11,14,21;41:11	<b>mapped (2)</b> 77:7;90:23	<b>mean (75)</b> 7:8;15:22;17:13,17; 18:13,16;19:21;21:8;23:6; 24:18;25:6;27:5,6,18; 28:16;29:18;33:9;34:10; 35:10,22,24,25;37:4;41:21; 42:22;43:24;45:13,13,21, 23;47:9,12;48:7;49:13,15; 50:15,16;53:17;55:24; 56:15;57:6;58:6;59:22; 61:1,10,12;62:14,19;63:5; 65:15,16,20,21;66:1;67:16; 68:7;70:9,18;78:1,24;83:2; 90:2;91:25;93:1,95:8; 98:23;101:13,20;102:5,16; 104:10;105:11;107:9; 108:16;110:8
<b>long (3)</b> 13:7;83:15;93:8	<b>luminances (1)</b> 40:19	<b>mapping (4)</b> 21:8,22;72:17;78:2	
<b>longer (2)</b> 69:1;99:12	<b>lunch (1)</b> 64:3	<b>maps (2)</b> 111:13,16	
<b>look (44)</b> 9:9;12:15,17;13:7;15:8; 16:13,23;18:3;21:2,3; 22:15;26:9;34:1,6;36:4,12; 39:8;42:2;43:14;44:21; 45:20;48:23;50:4,25;52:6; 53:3,20;59:14;64:8;65:22, 24;73:19;74:6;79:11;88:16; 92:8;93:16;94:13;97:25; 98:4;107:4,16;108:4; 109:17	<b>M</b>	<b>March (1)</b> 6:15	
<b>looked (1)</b> 19:21	<b>made (7)</b> 18:19,22;20:13;69:13; 71:17;81:6;106:14	<b>match (9)</b> 21:13;78:19;80:18,21; 81:1;96:6;97:1,2,5	
<b>looking (16)</b> 11:6;24:7;39:21;53:20; 54:22;61:24;62:20;67:13; 72:14;73:9;75:11;78:24; 89:6;98:8;102:9;106:3	<b>magical (1)</b> 12:14	<b>matched (5)</b> 80:19;81:3;82:4;96:15,19	
<b>Looks (5)</b> 26:3,4;38:11,21;64:2	<b>main (1)</b> 111:22	<b>matched' (1)</b> 81:17	
<b>lookup (5)</b> 79:16,18,22;110:9,11	<b>maintain (3)</b> 54:25;55:4;110:14	<b>matching (5)</b> 21:16;81:11;83:14;97:12, 17	
<b>lost (4)</b> 40:18;71:9;99:11;110:21	<b>maintained (5)</b> 49:19;55:18;58:15,16; 59:9	<b>materially (2)</b> 53:9,14	
<b>lot (12)</b> 7:20;30:24;40:18;49:14; 54:8;66:20,24;88:2;94:8; 95:2,5;98:13	<b>maintaining (6)</b> 54:14;56:7;109:7,15; 110:18,23	<b>matter (4)</b> 4:2;50:11,14;96:22	
	<b>make (11)</b> 6:1,4;12:17;49:23;50:1, 15;55:14;73:9;90:21; 104:12;109:10	<b>matters (1)</b> 19:12	
	<b>makes (4)</b> 54:10;83:14;91:19;103:4	<b>maximize (2)</b> 89:1;90:7	
	<b>making (4)</b> 19:17;48:25;57:22;92:13	<b>maximized (1)</b> 88:7	
	<b>manipulation (1)</b> 71:19	<b>maximizing (6)</b> 82:1;89:8,20,22;90:12; 91:3	
			<b>means (11)</b> 12:9;43:10,12;49:16; 56:9,25;76:7;83:3,4;94:15; 95:10

<b>meant (2)</b> 77:11;103:20	101:10;112:1,2	29:10;40:25;44:20;56:14;	41:5
<b>measurements (2)</b> 108:8;110:1	<b>mind (7)</b> 4:11;9:16;21:20;43:10; 45:7;79:20;94:15	70:25;72:16;73:21,22; 77:15;79:18,24;82:14;91:2; 93:17;95:13;96:1;97:9; 104:12;106:22,23;112:4	<b>near (3)</b> 52:14;56:1;81:15
<b>medical (1)</b> 5:8	<b>mine (1)</b> 71:9	<b>Moreover (1)</b> 100:9	<b>nebulae (1)</b> 67:3
<b>meet (3)</b> 7:2,7;25:25	<b>minimize (1)</b> 89:1	<b>Morning (2)</b> 4:7,8	<b>necessarily (7)</b> 21:7;32:24;37:5;51:7; 60:15;71:15;103:8
<b>meetings (1)</b> 7:12	<b>minimum (2)</b> 87:3,6	<b>most (4)</b> 10:15;28:18;38:1;92:6	<b>need (11)</b> 9:1;27:24;28:3;41:19; 48:9,12;50:21;51:11,16; 58:25;90:20
<b>memorized (1)</b> 19:22	<b>minute (1)</b> 99:25	<b>motivated (1)</b> 60:24	<b>needed (3)</b> 19:7;28:7;110:2
<b>mention (1)</b> 30:4	<b>misheard (1)</b> 14:9	<b>motivation (1)</b> 45:15	<b>Needham (34)</b> 75:13;80:13,18,24;81:4, 10,13,16;82:9,15;83:14; 84:2,3;88:23;89:14,18,19; 90:2;92:21,22;93:2,4,13,16, 24,25;94:1,12;95:16,20,25; 96:10,22;97:8
<b>mentioned (5)</b> 32:6;35:9,10;65:8;109:14	<b>mix (2)</b> 88:24;105:23	<b>MOVAVI (1)</b> 60:10	<b>Needham's (1)</b> 81:22
<b>Mentions (2)</b> 32:10;34:12	<b>mode (8)</b> 34:11,15,19;35:2,5,7; 37:18;38:13	<b>movavicom (1)</b> 60:7	<b>needs (1)</b> 28:3
<b>merely (3)</b> 15:23;19:11;60:16	<b>model (4)</b> 44:13;48:3,10;51:9	<b>move (1)</b> 14:23	<b>negligible (1)</b> 66:9
<b>mesh (1)</b> 110:20	<b>models (1)</b> 49:11	<b>moved (3)</b> 40:25;41:1;62:8	<b>neighboring (1)</b> 77:8
<b>met (3)</b> 7:4,8,9	<b>modes (1)</b> 49:7	<b>much (9)</b> 12:10;19:4;39:24;42:14; 53:16,19;78:25;86:14; 92:14	<b>neither (2)</b> 63:18;87:25
<b>method (8)</b> 11:17;21:9;55:13;63:21; 87:7,8;111:6,9	<b>modification (1)</b> 74:21	<b>multiple (3)</b> 7:9;55:9;57:11	<b>Neuschwanstein (1)</b> 59:23
<b>methodologies' (1)</b> 28:24	<b>modified (3)</b> 63:7;74:13;79:1	<b>Multiplying (1)</b> 72:15	<b>new (1)</b> 8:19
<b>methods (1)</b> 20:9	<b>modify (7)</b> 50:21,23;74:16;78:24; 85:7;87:12;90:20	<b>myself (5)</b> 24:3;69:14;72:12;73:16; 93:10	<b>Next (8)</b> 9:11,19;10:3;13:9;54:13; 59:15;71:11;75:3
<b>Michaelson (1)</b> 55:13	<b>modifying (1)</b> 78:6	<b>N</b>	<b>night (1)</b> 66:20
<b>middle (5)</b> 81:16;84:1;94:21;95:25; 104:3	<b>module (1)</b> 36:23		
<b>might (17)</b> 28:2,6;45:6;50:23;57:11; 66:24;67:4;74:22;75:9,23; 76:15;77:7;80:7;94:23;	<b>moment (1)</b> 10:25	<b>natural (2)</b> 54:8;71:5	
	<b>more (25)</b> 8:24;10:7,11;20:17;	<b>nature (1)</b>	

Nods (1)	O	occurrences (1)	on (110)
5:4		82:22	6:14;7:17;8:16;9:8,18,25;
<b>noise (4)</b>		<b>occurs (1)</b>	11:2,17;13:7,8,16,18;14:1,
71:20;83:7;111:7,10	<b>oath (1)</b>	104:23	22;17:25;18:21;20:12,20,
<b>Nonaka (7)</b>	4:13	<b>off (4)</b>	22;26;22;28:25;29:4;30:1;
61:21;75:14;89:17;97:25;	<b>Object (18)</b>	8:2,4;16:9;71:14	32:1;33:2;36:18,19;37:20;
98:7;102:13;104:20	15:2;26:21;41:12;59:10;	<b>Off-the-record (1)</b>	38:9;40:7;42:21;43:2,11;
<b>none (1)</b>	71:2;79:20,25;81:3,19;	16:11	44:3,6,7;45:16;46:17;49:7;
102:18	88:15,20;94:15;96:8;97:6,	<b>Oh (20)</b>	50:3,8;51:10;52:15,21;53:1,
<b>nonlinear (4)</b>	11,19;108:15;109:25	7:14,22;10:2;14:9;20:15;	7,12;54:1,2;55:17,20;56:1;
72:17;107:25;108:3,14	<b>Objection (63)</b>	22:8;30:21;32:14,15;39:14,	59:15;60:9;62:8;64:19,20;
<b>nor (1)</b>	11:14;13:6;14:4;15:5,20;	17:41:3,13;47:24;60:22;	65:8;67:3,21;68:11,14,25;
63:18	16:16,19;17:22;18:12,24;	65:17;71:12;77:12;89:19;	69:17;70:23,24;71:10,18;
<b>nose (1)</b>	19:19;21:24;22:22;23:17;	111:9	72:5,6,7;74:23;77:7,14,15;
42:3	24:10;25:14;27:4,21;28:13;	<b>Okay (151)</b>	78:20;81:15;83:21;84:23;
<b>Note (1)</b>	29:15;30:8;31:11;33:15;	4:21,25;5:3,6,7,19;6:2,8,	86:24;87:11;88:1,1,7,14;
71:14	34:9;35:8,21;36:8;38:18;	9:9:5;10:2;11:11;12:15,24;	89:6;90:25;91:8,8,9,10;
<b>nothing (5)</b>	40:12;42:8,17;43:19;47:21;	14:23;15:22;16:23;20:16;	92:2;93:8;94:4;95:17;
4:16;18:7;72:22,23;112:7	48:19,21;49:12;50:13;	21:8,14;22:4;23:7,10,22;	103:23,24;104:3,14,15,21;
<b>notice (5)</b>	52:19,25;54:20;55:5;58:24;	24:14;26:16,17;31:21;	105:3;107:1,2,4,15;108:6,
37:20;74:12;76:5;99:18,	59:7,19;62:13;63:13;65:3;	32:15;33:7,23;34:5,6;37:9,	24;109:13;110:13
21	69:7;71:23;74:11;75:17;	20;38:8;39:3,9,10,17,20;	<b>once (2)</b>
<b>novel (17)</b>	77:2;78:13;79:10;85:23;	40:1,20;41:17;42:2;43:1,5,	7:9;51:20
11:13,22;13:22;14:24;	91:5;93:6;94:11;96:20;	11;44:10;45:10,23;49:19;	<b>one (43)</b>
15:19;17:21;18:1,5,15,23;	103:15;106:13;110:7;	50:9,14;54:21;55:14;56:6;	7:4;10:7;16:10;23:22;
19:13,17,25;20:1,8,21;	111:17	57:12;58:5;59:9,23;61:3;	29:8;30:16;31:13;37:3;
22:21	<b>objects (10)</b>	62:3,22;63:6;64:10,20;66:3,	48:17;56:15;59:22,24;
<b>nugget (1)</b>	32:10,11;50:6;78:21;	4,9,19,21;67:1,5,10,13,19,	60:11;69:1;70:25;72:16;
52:4	80:6;81:5,25;108:8;110:6,	22;68:19;69:18,19,22,23;	73:22;74:15;79:14,18,21,
<b>number (5)</b>	12	70:4,21;71:6;72:2,19;74:15,	23;80:4,9;82:13;85:19;
12:25;24:24;55:12;65:23;	<b>observe (1)</b>	18,22;75:2,3,4,20;76:23;	86:14,20,25;87:23,25;
86:1	55:17	77:14,22;79:23;80:17,24;	90:19;93:17;95:13;96:1;
<b>numbers (1)</b>	<b>obvious (1)</b>	81:5,12;83:5,17,23;84:7;	97:8;99:20;101:14;102:19,
82:10	110:23	86:8;87:10,15,17,23;89:6,	20;105:1;110:9;112:4
<b>numerical (1)</b>	<b>obviously (2)</b>	15,16,25;92:6,22;94:12,15,	<b>one-dimensional (2)</b>
49:20	50:15;100:16	22;95:7,23;96:25;97:13,22;	40:17;41:6
<b>numerically (1)</b>	<b>occur (1)</b>	98:6,8,17;99:6,11,11;100:7,	<b>ones (1)</b>
49:19	105:1	15,18,22;101:21;102:2,20,	72:19
	<b>occurred (1)</b>	22;103:7,17;105:13,16,18;	<b>one-to-one (1)</b>
	19:5	107:13,17,23;108:5,12,25	21:16

<b>only (8)</b> 7:15;43:1,13;70:11; 84:24;87:15;92:13;109:13	<b>optimize (1)</b> 24:15	<b>output (1)</b> 67:14	<b>paragraph (95)</b> 11:10,16,20,23;12:2;13:8, 8;14:6,14,24;15:7;26:5,10, 13,14,15,17,18;27:7,13; 28:21;30:2,3;32:1,6;34:1,4, 6,7,10,23;36:13,16;37:6; 39:7;44:22,23;45:17;46:11, 14;47:4;51:1;52:15;54:18; 57:19;58:2;59:14,16;61:1, 15,19;62:23;64:11;71:7; 75:11;76:17;80:16;81:9,13, 15;82:9,11;84:3,23;85:1; 86:10;88:23;89:14,17; 93:16,22,23;94:3;95:11,23, 24,25;97:8;98:5,7;99:12,21, 25;100:22;102:23;103:25; 104:13,20;105:2,4,14; 106:4,16;108:2,13
<b>open-ended (2)</b> 24:6;63:25	<b>options (1)</b> 97:9	<b>outset (1)</b> 22:25	<b>paragraphs (7)</b> 69:23;102:13,18;105:7, 24;106:21,21
<b>operate (1)</b> 67:21	<b>order (2)</b> 31:18;97:4	<b>outside (5)</b> 42:13,16;43:18;48:21; 78:23	
<b>operates (1)</b> 65:8	<b>order-statistic (4)</b> 30:22;31:4,9,13	<b>outstanding (1)</b> 45:11	<b>parameter (12)</b> 35:3;38:13;83:25;84:7, 10,17;85:5,8;86:6;87:9,19, 22
<b>operating (1)</b> 46:19	<b>ordinary (19)</b> 20:24;21:10;22:2,13; 23:14,19;24:12;27:22,25; 29:16;42:23;48:17;50:18; 52:17;70:16;73:7,14,15; 93:9	<b>outward (1)</b> 60:3	
<b>operation (11)</b> 82:1,2,13,25;83:2;89:7; 90:11;95:17;96:16,18;97:1	<b>original (4)</b> 8:13;59:23;60:9;106:17	<b>over (10)</b> 4:11;5:12;7:10,10,14; 58:6;89:1,1;92:3,9	<b>parameters (67)</b> 13:5,13,19;14:3;20:7,11; 23:15;24:8,16,22;25:7,9,13, 17,19;26:20,24;27:2,9,12, 16,19,20,24;28:4,6,11,12; 29:6,10;30:5,7,15,17,19,23; 31:5,7;33:14,18,19;34:8,18, 21,24;35:4;36:22;37:4,7,16, 24;38:16;50:21,24;70:25; 82:14,17,21;83:8;86:1,12; 87:1;88:4;89:4;90:1,3,20
<b>operational (6)</b> 82:14,21;83:24;84:7,10; 85:7	<b>ostensibly (1)</b> 85:7	<b>overall (2)</b> 43:2;74:9	
<b>operations (8)</b> 50:8;53:22;66:1;67:19; 93:17;95:14;96:2,4	<b>other (35)</b> 11:1;20:1;28:10;32:22, 24;42:6;46:1;49:2,10,20; 51:23;52:1;57:18;58:6; 68:12;71:17,22,25;72:2; 73:23;76:18,23,24,24;77:3, 19;79:24;80:6;85:12;87:16; 88:21;102:22;103:1; 110:22;111:16	<b>own (4)</b> 24:1;28:1;51:22;81:18	<b>parameters' (2)</b> 13:21,25
<b>opine (2)</b> 52:21,23	<b>otherwise (5)</b> 5:9;55:10;70:16;103:12; 110:25	<b>owner (1)</b> 7:24	
<b>opined (4)</b> 47:2;52:12,22;61:18	<b>out (18)</b> 8:11;12:4;20:19,22; 22:24;32:20;33:9,10;40:14; 69:12;83:13;84:25;87:1; 93:21;97:12;102:14; 106:17,25	<b>P</b>	<b>paraphrase (2)</b> 29:5;82:7
<b>opining (1)</b> 54:1	<b>outcome (1)</b> 83:9	<b>page (48)</b> 11:6,10;13:9,9,16;16:7; 17:2,6,25;18:21;20:6;21:6; 30:1,3;32:1,4;39:20;45:21; 47:7;53:8,21;56:1;59:15; 64:19;65:25;68:14,15,21; 71:11;81:15;86:9;89:13; 92:2,10;94:4,5;95:24,25; 96:12;103:24;104:3,14; 105:3;107:2,4,15;110:13; 111:2	
<b>opinion (22)</b> 11:12;13:4;14:2,24; 17:19,20;20:14,15;26:15, 18;52:8;53:1,4,13;56:6; 60:19;61:16,25;62:11;70:4; 72:13;81:10	<b>outer (1)</b> 28:8	<b>pages (10)</b> 26:4;33:7,13;39:4;45:16; 53:23;64:16;65:4;69:2; 104:21	
<b>opinions (1)</b> 69:14		<b>paper (1)</b> 53:2	
<b>opposed (2)</b> 61:9;77:20			
<b>optimization (17)</b> 98:17,24,25;99:3,5,6,8,9, 13,15,19;100:1,9,13,24; 104:11,15			

<b>pardon (1)</b> 103:16	70:10	99:14;105:18	56:1,5;58:6;81:10;103:1
<b>parentheses (1)</b> 34:12	<b>path (2)</b> 101:14;103:22	<b>personal (1)</b> 28:1	<b>please (4)</b> 4:21;24;6:1,6
<b>parenthetical (5)</b> 34:17;81:18,24;82:1,23	<b>pause (1)</b> 35:1	<b>PHD (1)</b> 4:1	<b>pleasurable (1)</b> 109:11
<b>part (38)</b> 7:4;11:23;13:14,21; 15:24;17:14,18;18:13,14; 19:10;20:18;26:7;37:12; 41:15,24;42:1;46:5;47:14; 58:2,20;68:24;69:1;75:19, 20;79:19,22,25;80:2;81:20; 86:16;99:14,16;100:11; 104:18;105:15;106:24; 107:10;111:8	<b>PE (1)</b> 4:1	<b>phone (5)</b> 46:2,3,4,18;47:16	<b>plots (1)</b> 41:9
<b>particular (6)</b> 72:10;76:4;78:16;81:13; 84:12;106:15	<b>peak (1)</b> 42:3	<b>photograph (1)</b> 66:20	<b>pm (7)</b> 64:6,6;97:23,23;112:11, 11,14
<b>parts (5)</b> 27:7,14;102:22;103:25; 108:17	<b>peaks (1)</b> 41:8	<b>physical (2)</b> 78:20;88:20	<b>point (29)</b> 10:25;14:22;16:18;17:1; 20:22;22:24;28:17;32:19; 33:9,10;40:13;41:3;42:1; 44:18,20;61:21;65:6,9; 67:19;69:12;81:9;82:8; 83:13;87:1;88:9;94:2; 102:14;103:18;106:25
<b>pass (1)</b> 112:8	<b>pending (1)</b> 109:22	<b>physically (1)</b> 7:8	<b>pointed (2)</b> 12:4;106:17
<b>passage (2)</b> 84:24;92:3	<b>people (1)</b> 102:9	<b>pick (1)</b> 24:13	<b>pointing (3)</b> 20:19;83:13;97:12
<b>past (2)</b> 76:1;99:18	<b>people's (1)</b> 68:7	<b>picking (1)</b> 21:17	<b>portion (16)</b> 12:3;25:5;38:2;45:12; 54:25;55:1;71:13;72:24; 77:20,20;79:7;85:12;95:22; 103:19;107:6;110:15
<b>paste (1)</b> 93:14	<b>perception (2)</b> 52:2;73:25	<b>picture (9)</b> 31:17;46:2;57:12;60:12; 61:10;66:25;67:4;77:19,25	<b>portions (9)</b> 43:11;60:1;61:6,7;78:7; 85:16;88:22;89:2;107:11
<b>patent (26)</b> 7:24;10:14,19,23;11:1; 12:2;22:3;39:2,8;42:5;51:3; 54:15;65:2;71:6,21;72:13; 75:5,15;80:11;93:10,11; 106:6,19;107:16;110:16; 112:2	<b>perceptual (2)</b> 49:15,21	<b>pixel (17)</b> 56:15,15;65:11;66:2; 67:2,22;72:16;73:21;74:7,9, 13,14;78:25;91:15,19; 92:15,15	<b>portrait (4)</b> 11:25;15:4,18;16:15
<b>patents (2)</b> 7:25;8:1	<b>perceptually (1)</b> 49:19	<b>pixel-dependent (2)</b> 73:3,22	<b>POSITA (25)</b> 13:22;23:14;24:3,8;28:5; 29:8,11;44:15;49:8;53:9; 54:18;55:3,4,10;60:13,15, 20,23;61:5;65:1;70:10; 72:11;76:15;93:12,12
<b>Patent's (1)</b>	<b>perform (4)</b> 31:16;50:12;86:21; 104:17	<b>pixels (28)</b> 41:20;56:13,14,17,23; 57:11,12,12,14,17;58:4; 61:5;65:9;66:10,11,13; 72:21;73:1,24;77:8,17; 79:19,24;87:22;91:13,15; 92:5,6	<b>position (1)</b> 24:3
	<b>performed (4)</b> 23:1;95:17;101:11; 104:11	<b>pixel's (1)</b> 77:7	
	<b>performs (2)</b> 100:1,10	<b>place (5)</b> 16:25;29:8;99:11;109:13; 110:21	
	<b>perhaps (2)</b> 52:11;91:10	<b>places (5)</b>	
	<b>person (20)</b> 20:23;21:10;22:2,12; 23:14,19;24:12;27:22,25; 29:16;42:23;50:18;52:16; 73:7,13,14;78:8;93:9;		

<b>possess (1)</b> 13:23	5:25	6:15,18	26:6
<b>possible (5)</b> 6:5;12:10;67:17;86:23; 90:22	<b>presence (3)</b> 40:8;43:3;44:8	<b>process (28)</b> 12:7;13:15,16;18:2,6,10, 16;19:5,15;20:10;46:4; 52:9,24;58:1,9;59:25;60:2; 66:11;77:5,6;78:20;87:20; 98:25;100:6;103:12,14,20; 108:4	<b>provisional (5)</b> 26:2,19;27:3;33:24;35:7
<b>possibly (1)</b> 105:22	<b>present (2)</b> 7:13,15		<b>purpose (5)</b> 19:3;33:10;101:18;102:8, 9
<b>post (1)</b> 45:4	<b>presents (1)</b> 30:12		<b>put (7)</b> 9:24;12:22;24:2;31:17; 33:20;72:7;93:14
<b>post-processing (1)</b> 45:20	<b>preservation (2)</b> 55:25;56:7	<b>processed (3)</b> 27:8,15;38:6	<b>Q</b>
<b>post-retinal (1)</b> 51:21	<b>preserve (1)</b> 58:10	<b>processing (53)</b> 13:20,24;18:10;20:4,6, 25;21:4;26:19,23;28:19; 29:14;34:7;43:17;45:4; 46:1;50:12;58:3;60:12; 65:9;66:6,22;67:6;70:17; 77:16;91:13;98:11,15,17, 22,24;99:1,3,5,6,8,9,10,13, 15,19;100:1,2,10,10,14,17, 24;102:3,15;104:11,16,17, 23	
<b>potential (2)</b> 28:11;49:11	<b>preserved (3)</b> 58:14;59:9,13		<b>Q&amp;A (2)</b> 92:3;104:22
<b>potentially (2)</b> 79:1;80:3	<b>preserving (6)</b> 55:23;56:22;57:4,6,18,20		<b>Qualcomm (1)</b> 73:11
<b>power (2)</b> 66:14;68:15	<b>pretty (7)</b> 31:12;39:24;54:11;79:11, 12;83:16;86:14		<b>Qualcomm's (5)</b> 58:17;70:5;92:18,20,24
<b>practice (3)</b> 12:9;75:23;92:22	<b>preview (1)</b> 8:23		<b>quantitative (1)</b> 55:15
<b>practicing (1)</b> 80:10	<b>previous (4)</b> 7:17,17;8:22;81:7	<b>processor (2)</b> 46:5,17	<b>quarters (2)</b> 82:11,20
<b>precise (1)</b> 88:18	<b>previously (2)</b> 6:14;81:6	<b>profound (1)</b> 29:19	<b>question (38)</b> 4:20;5:6,17;7:6;8:25; 14:10,20;17:18;23:12;24:6; 25:4;33:12;35:25;36:11; 37:25,25;43:23,24;45:3,11; 52:20;54:18;61:23;62:10; 63:25;71:12;75:2,3;80:24; 83:16;84:9;86:5,13;94:18; 95:19;103:18;104:22; 109:22
<b>predetermined (11)</b> 78:21;80:7;81:19;88:14, 21;97:19;108:7,15;109:25; 110:5,12	<b>prior (6)</b> 8:1;11:1;23:2;43:20,22, 22	<b>pronounce (1)</b> 106:1	<b>questions (5)</b> 6:2,8;8:21;9:18;112:12
<b>pre-determined (1)</b> 81:25	<b>privileged (1)</b> 7:1	<b>properties (1)</b> 95:4	<b>quick (2)</b> 64:19;97:20
<b>preference (2)</b> 109:21;110:2	<b>probably (6)</b> 5:15;28:18;35:10;61:20; 78:19;97:3	<b>proportion (1)</b> 92:14	<b>quite (2)</b> 7:20;99:2
<b>preparation (2)</b> 7:5,5	<b>problem (5)</b> 5:16;30:18;31:5;62:7; 65:17	<b>proposed (2)</b> 92:18,20	<b>quotations (1)</b> 18:21
<b>prepare (3)</b> 6:25;7:2,19	<b>proceed (2)</b> 22:5;60:3	<b>prosecution (4)</b> 12:1,24;14:17;19:22	
<b>prepared (1)</b> 8:19	<b>proceeding (1)</b> 7:16	<b>provide (3)</b> 28:10,15;55:23	
<b>preparing (1)</b>	<b>proceedings (2)</b>	<b>provides (3)</b> 28:23;29:5;30:4	
		<b>provision (1)</b>	

<b>quote (3)</b> 27:18;47:7;104:15	<b>reads (1)</b> 79:20	15:1;16:14;18:2,6,16; 19:14	11:2;12:25;13:25;45:16; 46:6;110:22
<b>quotes (1)</b> 13:21	<b>real (1)</b> 64:18	<b>recognize (3)</b> 10:9,17;50:19	<b>referred (3)</b> 61:14;83:12;100:13
<b>R</b>	<b>realize (4)</b> 20:17;50:19;65:4;83:12	<b>recognized (1)</b> 13:10	<b>referring (12)</b> 17:13;32:16;38:3;53:18; 56:2;58:19;61:18;99:15,21; 105:6,7;110:17
	<b>really (20)</b> 5:14;12:20;19:3,12; 23:12;32:23;38:8,9;42:11; 53:25;63:25;66:15;69:2; 76:7;81:8;97:5;104:22; 105:12,23;109:8	<b>recognizing (1)</b> 49:6	<b>refers (4)</b> 55:24;56:4;84:2;103:1
<b>radii (3)</b> 13:12;25:18;28:8	<b>reason (8)</b> 5:8;23:3;70:12;90:1,5,25; 101:3;105:22	<b>reconvert (1)</b> 51:17	<b>reflects (3)</b> 17:24;18:1;19:13
<b>radius (21)</b> 13:11,12;17:4,5;24:19, 20:25;8,9,12,12,15,16,24, 25;34:18,19,22,24,25; 37:17,17	<b>reasonable (1)</b> 70:6	<b>record (5)</b> 6:18;9:6,17;10:19;16:9	<b>regarded (1)</b> 13:13
<b>range (64)</b> 39:11,18,22;40:1,7;42:20, 25;43:25;44:1,5;69:10,17; 70:24;76:3,16,20;77:6,14, 23;78:18;80:10;82:2;83:7, 18,21,24,25;84:4,6,10,11, 16;85:2,8,12,16,18,22;86:1, 6,7,16,23;87:7,9;88:5,6; 89:8,11,21,22,23;90:12,16, 19,21,22;91:4,8,9,11;92:17, 23;101:23	<b>reasons (3)</b> 51:24;105:7,8	<b>reduce (9)</b> 11:17;21:1;58:3,4,9,18; 59:5;68:5,10	<b>regarding (1)</b> 79:8
<b>rather (1)</b> 41:15	<b>rebut (1)</b> 28:15	<b>reduced (3)</b> 50:2;59:11,13	<b>regardless (2)</b> 50:7;101:11
<b>read (21)</b> 23:24;25:5;27:6;34:23; 37:13;38:2,6,6;42:18; 45:12;46:13;79:8;82:12; 90:9;95:22,24;102:18; 103:19,23;105:5;109:6	<b>rebutting (1)</b> 83:12	<b>reduces (1)</b> 61:4	<b>regards (6)</b> 47:1;58:17;60:17;105:4; 106:15;107:9
<b>readily (1)</b> 53:10	<b>recall (1)</b> 111:18	<b>reducing (9)</b> 12:5,9,12,20,22;32:22,23; 36:21;58:18	<b>region (14)</b> 31:17;41:11,14,16,18; 42:7,16;70:12;73:12;74:3, 4;86:22;87:5;88:7
<b>reading (19)</b> 15:6;23:20,22,23;46:11; 62:5;65:21;73:14,16;81:21; 82:5;89:12;92:1;93:10,10, 11,11,13,13	<b>Receive (3)</b> 45:22;47:12;82:24	<b>reduction (13)</b> 30:13;33:17;34:11,15,19; 35:5,7;37:18;38:15,16; 40:15;50:11;71:20	<b>regional (1)</b> 88:13
	<b>received (3)</b> 46:23;47:2,10	<b>reductions (5)</b> 34:13,15,16;37:19,19	<b>regions (7)</b> 42:6;43:10;72:18,25; 73:24;77:19;88:8
	<b>receiving (1)</b> 46:22	<b>reemphasizing (1)</b> 106:18	<b>related (3)</b> 34:12;56:24;69:9
	<b>recent (1)</b> 7:16	<b>refer (5)</b> 6:21;29:19;60:15;82:6; 107:14	<b>relative (1)</b> 92:15
	<b>recently (2)</b> 8:24,25	<b>reference (12)</b> 9:2;10:22;12:4;13:2; 14:16,18;16:4;28:17;29:13, 23;101:5;102:13	<b>remains (3)</b> 49:4;59:10,11
	<b>Recess (4)</b> 38:25;64:6;97:23;112:11	<b>referenced (1)</b> 26:7	<b>remember (8)</b> 6:1;8:2;19:20;21:6; 37:14;62:15;68:20;111:20
	<b>reciting (1)</b> 104:22	<b>references (6)</b>	<b>removal (5)</b>
	<b>recognition (6)</b>		



26:25;27:10,17;29:1;83:8	<b>respectively (1)</b>	23:17;24:10;25:14;26:21;	<b>rules (2)</b>
<b>remove (1)</b>	106:22	27:4,21;28:13;29:15;30:8;	4:11;112:7
12:21	<b>response (1)</b>	31:11;33:15;34:9;35:8,21;	<b>running (1)</b>
<b>removed (2)</b>	84:9	36:8;38:18;40:12;41:12;	57:3
22:20;57:25	<b>responses (2)</b>	42:8,17;43:19;47:21;48:19,	<b>S</b>
<b>removing (7)</b>	6:1;7:25	21;49:12;50:13;52:19,25;	
12:5,8,9,11,20;23:5,9	<b>responsive (1)</b>	54:20;55:5;58:24;59:7,19;	<b>S10 (1)</b>
<b>rendering (1)</b>	56:12	62:13;63:13;65:3;69:7;	
51:10	<b>rest (3)</b>	71:23;74:11;75:17;77:2;	101:15
<b>repeat (1)</b>	60:2;68:12;82:7	78:13;79:10;85:23;91:5;	<b>S11 (2)</b>
5:17	<b>restore (1)</b>	93:6;94:11;96:20;103:15;	101:15;103:22
<b>repeating (4)</b>	61:7	106:13;109:22;110:7;	<b>S14 (2)</b>
18:9;22:18;25:22,23	<b>result (2)</b>	111:17;112:10,12	101:16;103:23
<b>rephrase (2)</b>	29:7;83:10	<b>right (85)</b>	<b>S15 (11)</b>
59:4;98:14	<b>resulting (1)</b>	4:18;6:16,19,21,24;7:12,	98:18,21,25;99:5,22,23;
<b>report (31)</b>	65:12	18;8:5,17;9:11,19;10:3,7,	100:3,6,18,21;102:15
11:16;15:15;16:5,8,25;	<b>retina (1)</b>	11;11:3,4;14:11;15:4;16:2;	<b>S17 (7)</b>
17:6,18,24,25;26:8;28:22;	51:21	17:16,16;18:14;21:2,6,19;	99:1,8,12,15;100:19;
32:19;33:6,8;34:3;35:12;	<b>retrospect (1)</b>	22:17;25:3;26:1;30:1;	101:5;103:7
36:9,10,13,15;45:17;47:3,5;	97:3	33:20;35:13;38:24;39:1;	<b>S20 (5)</b>
56:1,11;81:14;82:6;92:10;	<b>reveal (1)</b>	41:2,11;42:5;44:21;45:8;	99:8,11;100:7,12,19
95:24;103:24;110:13	42:11	52:5,5;54:13,21;56:18;64:2,	<b>same (41)</b>
<b>reporter (1)</b>	<b>revealed (1)</b>	5,7;66:10,11,24;68:22,24;	12:11;13:7;36:6;37:2,3,4;
5:24	110:25	69:11,20;70:22;75:2;79:15;	38:16,20;42:19;44:5;46:2,
<b>represent (1)</b>	<b>revealing (1)</b>	80:12;87:19;88:11,11,23;	19:50:12,16,22;54:7,8;80:2;
50:6	6:25	90:15;93:14,21;94:19,23;	82:22;84:15;86:7,11;88:25,
<b>representation (2)</b>	<b>reverse (2)</b>	95:14;97:20,24;98:9,20;	25;89:2;90:1;97:4;99:9;
41:19;51:25	87:20;97:3	102:4,10;105:25;106:8;	100:25;101:3,7,7,8;102:25;
<b>represents (1)</b>	<b>review (3)</b>	107:8;108:15,21,23;111:1,	103:8,10,10;106:7,11,20;
78:5	7:18,21;13:2	5,12,15;112:4,8	110:16
<b>Requested (5)</b>	<b>reviewed (3)</b>	<b>right-hand (1)</b>	<b>satisfies (1)</b>
25:5;38:2;45:12;95:22;	7:20,22;36:14	10:1	93:3
103:19	<b>RGB (17)</b>	<b>RMS (1)</b>	<b>satisfy (1)</b>
<b>required (1)</b>	46:23;47:17,18,20;48:3,	55:13	92:24
103:9	10,14,18;49:1,7;50:2,3,11;	<b>room (2)</b>	<b>saw (1)</b>
<b>resources (1)</b>	51:7,11,17,18	32:3;33:22	89:15
24:5	<b>RIFFE (69)</b>	<b>Roughly (1)</b>	<b>saying (7)</b>
<b>respect (8)</b>	11:14;13:6;14:4;15:2,5,	6:10	20:16;21:21;69:3;88:6,
8:16;11:7;14:13;52:20;	20;16:16,19;17:22;18:12,	<b>Round (1)</b>	10;91:23;92:4
53:5;76:13;106:7,11	24;19:19;21:24;22:22;	95:3	<b>scale (1)</b>

56:23	44:2	<b>shoes (1)</b>	<b>size (6)</b>
<b>scales (1)</b>	<b>selectively (9)</b>	18:25	83:20,22;84:13,17,21;
58:5	40:7;42:20;43:9,12,14,	<b>short (1)</b>	85:9
<b>scenario (1)</b>	25;44:6;78:6;109:5	93:15	<b>skill (18)</b>
105:17	<b>sending (1)</b>	<b>show (6)</b>	20:24;21:10;22:2,13;
<b>scenarios (1)</b>	45:25	8:23;52:11;75:9;76:2;	23:14,19;24:12;27:22,25;
105:1	<b>sense (3)</b>	79:5;108:20	29:16;42:23;48:17;50:18;
<b>scheme (1)</b>	51:19,19;58:11	<b>shown (3)</b>	52:17;73:7,14,15;93:9
57:13	<b>sensitivity (1)</b>	19:24;79:15;107:14	<b>skin (10)</b>
<b>school (1)</b>	71:1	<b>shows (3)</b>	35:17;36:19,25;37:21,22;
31:1	<b>sentence (5)</b>	42:19;44:4;110:9	49:6;50:10;51:24;54:6;
<b>scope (1)</b>	32:14;74:16;82:12;83:17;	<b>sick (1)</b>	71:20
48:22	90:10	5:22	<b>skin-imperfection (1)</b>
<b>seamlessly (2)</b>	<b>separate (2)</b>	<b>signal (3)</b>	36:21
110:20,20	43:24;71:22	46:23;47:2;51:21	<b>skin-recognition (4)</b>
<b>search (1)</b>	<b>separately (2)</b>	<b>signed (2)</b>	21:5;36:18,25;37:15
35:11	74:8,10	8:24,25	<b>skin-recognizing (9)</b>
<b>second (6)</b>	<b>set (7)</b>	<b>significant (1)</b>	35:18,19,23;36:1,6;
16:10;28:24;33:21;77:20;	25:7;26:24;27:9,16;28:4,	40:15	37:10;38:4,7,12
86:2;104:13	6:69:1	<b>silent (1)</b>	<b>sky (2)</b>
<b>second-to-last (1)</b>	<b>setting (1)</b>	62:3	66:21;82:3
83:17	78:23	<b>similar (3)</b>	<b>slightly (1)</b>
<b>section (11)</b>	<b>seven (3)</b>	52:18;54:3,6	41:22
30:22;31:20;33:2;99:4,7,	8:18;9:18;80:8	<b>similarity (1)</b>	<b>small (4)</b>
13;100:1,10;104:11,16,16	<b>several (2)</b>	106:25	29:2,2;31:17;56:23
<b>sections (3)</b>	11:1;88:21	<b>Simon (7)</b>	<b>smaller (2)</b>
106:15;109:5;110:4	<b>shadow (5)</b>	13:1,1;14:1,2,7,8,21	32:10;57:24
<b>seeing (2)</b>	72:18,25;73:24;74:3;78:8	<b>simple (2)</b>	<b>smallest (1)</b>
32:13;89:12	<b>shall (1)</b>	31:12;83:16	31:18
<b>seeking (1)</b>	58:7	<b>simply (2)</b>	<b>smooth (1)</b>
63:16	<b>shape (2)</b>	16:20;20:4	30:11
<b>seem (1)</b>	95:1,3	<b>single (6)</b>	<b>smoothing (28)</b>
94:7	<b>shaped (3)</b>	56:15;67:22;73:21;77:23;	12:19;24:14,16,21;26:23;
<b>selected (1)</b>	76:18,24;78:11	78:17;85:25	27:8,15,23;28:25;29:6;30:6,
59:25	<b>sharpen (1)</b>	<b>site (1)</b>	9,12,16,23;31:14,20,22;
<b>selecting (1)</b>	112:3	60:11	32:20;33:2,4,10,16;58:1,9;
24:15	<b>sharpening (5)</b>	<b>sites (1)</b>	59:5;71:20;83:7
<b>selection (1)</b>	111:6,10,16,23,25	60:12	<b>softly (1)</b>
87:9	<b>sharpness (2)</b>	<b>situations (2)</b>	5:18
<b>selective (1)</b>	71:19;72:8	30:11,11	<b>solid (1)</b>

46:9	16;51:16;54:7;62:3	<b>standard (3)</b>	92:5
<b>somebody (4)</b>	<b>spaces (3)</b>	53:18;78:17;95:6	<b>step (18)</b>
49:24;68:8;75:23;86:13	48:16;49:2,20	<b>standing (1)</b>	17:3,16,19;18:8;21:3,23;
<b>somehow (1)</b>	<b>spatial (6)</b>	78:8	22:18;23:15;31:19;36:4,20,
97:1	32:20,24;68:17,25;108:8;	<b>stars (2)</b>	23,24;37:9;47:11;99:18;
<b>someplace (1)</b>	109:25	66:23;67:10	102:14,15
62:16	<b>speak (2)</b>	<b>start (8)</b>	<b>steps (5)</b>
<b>something (22)</b>	5:18,21	15:12;23:5,6,7;56:17;	18:9,11;22:19,19;25:22
40:14;43:13;51:23;53:2;	<b>speaking (2)</b>	80:15,20,25	<b>still (19)</b>
61:24;62:9,9;66:5;67:11;	6:6;23:8	<b>starters (1)</b>	5:13;22:20;29:19;49:3,4;
69:9;70:21;71:1;81:6;86:4;	<b>spec (9)</b>	39:7	50:12,22;51:3;57:13,16;
90:15;94:24,25;96:25;	21:7,12;22:5;37:2;38:7;	<b>starting (6)</b>	59:16;63:1,2,5,6;81:15;
100:21;104:5;105:22;	78:4;79:13;80:25;108:17	17:10;18:22;36:17;44:21;	86:7;100:7;101:25
109:10	<b>specific (14)</b>	98:4;108:24	<b>stopped (1)</b>
<b>Sometimes (1)</b>	7:6;14:20;55:20;57:2;	<b>starts (2)</b>	89:15
102:1	59:1;61:14;63:24;68:3;	32:6;71:13	<b>straight (2)</b>
<b>somewhere (3)</b>	84:22;93:1;95:16,17;96:15;	<b>state (40)</b>	76:6;82:6
15:6;66:12;109:9	97:14	11:16;14:6;17:3,24;	<b>stretching (4)</b>
<b>soon (1)</b>	<b>specifically (5)</b>	19:17;20:5;26:22,22;28:21;	69:5,8,15;77:1
75:13	38:11;43:17;59:1;65:5;	29:4;42:16;45:14,18;46:8,9,	<b>strikes (1)</b>
<b>sooner (1)</b>	73:17	11;51:3;56:19;58:2;61:1,3;	51:21
5:2	<b>specification (13)</b>	62:22,24;70:4,9;81:9,15;	<b>strongly (1)</b>
<b>Sorry (22)</b>	22:15;23:24;42:15,22;	96:8,14;98:16;102:14;	97:12
11:9;14:6,9;17:6;22:18;	43:6,16;51:4;75:19;80:22;	104:3,13;105:3,24;106:6,9,	<b>structure (1)</b>
25:4;26:11;31:3;36:16;	106:10,25;107:8,11	10,16;107:9	66:24
39:13;41:13;43:8;48:5;	<b>specifications (2)</b>	<b>stated (9)</b>	<b>structures (2)</b>
65:15;71:8;89:5,13,14,18;	39:25;109:7	18:17,18;19:9;20:17;	67:2,9
106:9;107:18,20	<b>specifics (1)</b>	35:4,20;79:5;96:9;110:13	<b>study (1)</b>
<b>sort (4)</b>	53:25	<b>statement (4)</b>	19:3
57:25;59:3;67:9;87:22	<b>specified (5)</b>	20:13;53:11;63:8;106:14	<b>stuff (5)</b>
<b>sound (1)</b>	82:14;84:7;95:13;96:18;	<b>states (14)</b>	7:17;54:8;77:8;78:22;
101:22	102:19	11:23;13:16;25:7,24;	99:7
<b>Sounds (2)</b>	<b>specify (1)</b>	27:7,13;34:10;36:17;39:24;	<b>subject (1)</b>
5:24;64:5	82:21	44:1;74:7;94:17;101:6;	9:20
<b>source (1)</b>	<b>speculate (1)</b>	103:16	<b>subjects (1)</b>
60:7	38:10	<b>stating (5)</b>	99:14
<b>southern (1)</b>	<b>spent (1)</b>	19:9,11;20:12;21:15;85:5	<b>subset (1)</b>
59:24	104:21	<b>statistical (1)</b>	67:17
<b>space (9)</b>	<b>spot (1)</b>	95:4	<b>substance (1)</b>
46:19;49:16,17;50:7,8,	68:11	<b>stay (1)</b>	7:1

<b>substantially (3)</b> 106:7,11,20	110:9,11	<b>tells (2)</b> 15:22;94:24	109:13
<b>substantive (1)</b> 4:10	<b>taking (2)</b> 4:9;102:12	<b>term (10)</b> 33:13;55:8;68:1;72:10; 77:3;80:18,20;93:5;94:13, 16	<b>third (5)</b> 32:1,1,6,14,14
<b>suddenly (1)</b> 67:2	<b>talk (10)</b> 11:15;17:14;45:14;49:22; 54:13;56:15;68:23,24;75:8, 9	<b>terms (2)</b> 69:24;73:20	<b>those (24)</b> 11:3;12:22;18:11;25:12, 16;31:23;33:17,18;35:3; 53:25;54:1;58:14;59:18; 67:20;71:3,3,21;72:1; 88:22;96:23;98:17,21;99:9; 107:7
<b>supplemental (15)</b> 9:4,20;10:4;11:5,21;13:8; 16:7;17:2;26:12;30:2;39:5; 45:1;54:17;64:8;69:20	<b>talked (7)</b> 32:19;33:5;44:19;56:10; 86:10;93:9;110:10	<b>testified (1)</b> 4:4	<b>though (5)</b> 12:17;13:18;41:11;51:12; 108:6
<b>supplementary (4)</b> 7:23;8:19,24;52:13	<b>talking (27)</b> 7:16;10:14;13:17;16:6; 23:19;31:2;34:2;37:14; 47:4;51:1,2;52:7;56:17; 57:1,10;58:12;62:19;65:25; 67:23;69:9;76:25;85:21; 89:16;92:4;108:16,16,21	<b>testimony (3)</b> 5:10;7:24;66:12	<b>thought (4)</b> 46:10;61:23;62:5,8
<b>supplied (1)</b> 37:24	<b>talks (7)</b> 24:18;33:3;56:12;65:23; 68:17;79:8;89:20	<b>texture (1)</b> 71:2	<b>three (7)</b> 80:7;82:11,20;98:16; 99:22;100:15;102:18
<b>supply (1)</b> 14:21	<b>taught (1)</b> 96:21	<b>Thanks (1)</b> 4:9	<b>through (22)</b> 8:10;13:10;18:9;21:4; 22:19;26:23;27:8,15;28:20; 33:8;46:11;47:8;49:3;68:9, 15,22;69:23;73:19;79:12; 106:19,20,21
<b>supported (1)</b> 102:11	<b>teach (4)</b> 34:7;67:18;70:14;95:20	<b>themselves (1)</b> 7:25	<b>throughout (2)</b> 16:1;83:4
<b>supporting (1)</b> 107:10	<b>teaches (11)</b> 15:22;26:19;45:18;46:15; 51:6;59:12;62:23;70:15; 72:13;73:17;111:12	<b>thing (12)</b> 8:11;40:22;46:2;47:15; 55:9;56:20;57:25;59:3; 68:9;97:5;102:19;112:5	<b>Thus (1)</b> 13:19
<b>Sure (38)</b> 4:12,25;6:4;8:3;9:1;10:2, 24;11:3;17:15;23:21;25:10; 30:1;31:10;38:23;44:14,23; 60:22;61:22;64:4,4,4;68:1; 73:9;75:21;77:12;79:13; 86:3;88:19;89:16,16,19; 94:2,7;98:1;103:20;106:2; 108:1,21	<b>teaching (12)</b> 21:9;22:1;51:4;58:13; 62:19;75:22;78:17;90:3; 96:6,10;101:2,4	<b>things (14)</b> 12:4;20:1,4;44:20;45:14; 57:23;66:15;68:5,23;72:21; 95:2,5;98:13;104:2	<b>times (4)</b> 6:10;7:7,9;96:9
<b>surrounding (1)</b> 77:17	<b>technique (2)</b> 52:16;71:14	<b>think (70)</b> 9:24;10:1;11:13;12:7; 16:20;18:1;19:2,24;22:1, 12;23:25;24:11,12;27:22; 28:14;29:9,16;31:5;32:18, 22;34:21,25;35:2,3;38:4; 44:1;48:12;49:22;50:4; 51:6;53:23;55:19;57:22; 63:14;67:7,7,20;68:4,10; 69:4;70:9,16,21;71:24,24; 72:3;74:13,19,19,25;81:2,5, 7;83:14,15;84:1;90:2,2; 91:7;92:7,9,16,17;93:13; 95:19;97:4;98:18;101:2,4;	<b>tiny (1)</b> 57:13
<b>sworn (1)</b> 4:3	<b>techniques (4)</b> 11:24;15:17;45:19;54:9		<b>title (1)</b> 111:9
<b>system (3)</b> 16:22;18:4,4	<b>telephone (1)</b> 7:10		<b>today (4)</b> 4:9;5:10,25;6:16
<b>T</b>	<b>telescope (1)</b> 66:21		<b>today's (1)</b> 7:3
<b>table (8)</b> 79:16,18,22,23;80:1,2;			<b>together (4)</b> 12:23;56:14;60:23;110:1

<b>told (1)</b> 108:18	101:18;104:7,12;109:6	4:13;92:18,25;112:1	79:6;83:18,21;84:11;86:22; 89:11,24;90:16;91:6;95:12; 107:25;110:3,4
<b>tool (1)</b> 55:11	<b>trying (9)</b> 21:19;42:23;60:16;63:22; 67:15;74:16,20;78:2;108:4	<b>understand (20)</b> 4:13,15,20;6:22;10:23; 15:25;19:5;20:24;21:10; 23:15;27:23,25;44:15;49:9; 70:10;72:11,12;73:8;95:19; 104:25	<b>user (6)</b> 36:23;45:22;46:22;47:10; 109:20;110:1
<b>top (5)</b> 8:4;59:22;65:25;77:25; 101:5	<b>turn (17)</b> 11:4,5,9;16:2,7;26:5; 33:23;35:13,16;39:2;44:10; 64:8,18;69:20;70:2;75:5; 80:12	<b>understanding (2)</b> 92:25;110:17	<b>uses (3)</b> 36:21;37:6;81:4
<b>topic (1)</b> 84:24	<b>turning (2)</b> 39:20;70:21	<b>understood (2)</b> 60:20;103:2	<b>using (28)</b> 13:11;20:7,11;24:4; 26:20,24;27:9,15;34:7; 49:10;50:22;51:7;54:9; 60:14;61:11;68:1,2;72:17; 73:3,5;77:21;78:17;86:23; 94:16;108:22;109:5; 111:12,15
<b>touches (1)</b> 69:13	<b>turns (1)</b> 6:6	<b>undesirable (2)</b> 15:4;16:15	<b>usually (2)</b> 5:14;57:11
<b>towards (3)</b> 40:25;41:2;69:2	<b>two (14)</b> 12:22;22:12;45:14,15; 46:6;49:17;56:13,14,17; 59:16,20;80:5;87:1;107:14	<b>unhappy (1)</b> 91:23	<b>utilized (1)</b> 110:6
<b>transcript (2)</b> 5:25;6:4	<b>two-dimensional (1)</b> 40:16	<b>unless (1)</b> 108:20	<b>V</b>
<b>transfer (1)</b> 66:19	<b>type (49)</b> 12:19;30:10;31:14,15; 33:3;43:17;50:21,23;67:25; 69:16;72:10;78:21;80:7; 81:2,11,16;82:15,17,22; 83:3,6,11;84:11,15,19;86:8; 11:88:4,21;89:2;94:22; 95:18;96:7,14,15,19;97:9, 18;100:25;101:7,8,8; 102:25;103:3,5,8,10; 109:25;111:25	<b>unquestionably (1)</b> 72:5	
<b>Transformation (2)</b> 64:22,25	<b>U</b>	<b>until (1)</b> 25:24	<b>vague (1)</b> 24:6
<b>transformations (10)</b> 65:6,18,22,24;67:18,20; 68:13,16;76:24;77:4		<b>up (5)</b> 5:21;82:6;88:24;91:16,19	<b>valid (1)</b> 7:11
<b>translates (1)</b> 79:3	<b>types (15)</b> 30:11;71:17,22;81:22,23, 25;90:4;93:17;96:1,3; 98:11,16;108:7,15;110:5	<b>upon (5)</b> 47:2;52:12,22;69:13; 82:18	<b>validity (2)</b> 19:4;23:1
<b>treating (2)</b> 71:21;74:10	<b>unchanged (2)</b> 87:21;92:5	<b>upper (2)</b> 90:6;107:6	<b>value (6)</b> 66:2;87:12,13,14;92:12; 100:12
<b>tree (2)</b> 103:14,20		<b>use (16)</b> 24:21;36:6;49:14,23; 50:1;66:19;67:5;68:4;69:4; 70:10;77:3,13,23;79:19,24; 108:15	<b>values (7)</b> 31:16;65:12;79:18,24; 86:23;87:16,21
<b>tricky (2)</b> 21:19;47:22	<b>under (4)</b>	<b>used (31)</b> 28:18;29:1,13;30:13; 32:21,25;33:14,17;36:18; 37:3,5;60:23;65:18;67:21; 71:4;72:20;76:19;77:14;	<b>variation (1)</b> 104:4
<b>tried (1)</b> 63:14			<b>varied (1)</b> 82:17
<b>tries (1)</b> 12:16			<b>variety (1)</b>
<b>truth (4)</b> 4:16,16,16;12:18			
<b>truthful (1)</b> 5:9			
<b>try (9)</b> 8:1;22:7,16;24:15;28:16;			

32:21	<b>W</b>	62:10;75:16,23;96:21; 103:20	12:22;52:1;84:5;106:18
<b>various (5)</b>			<b>work (2)</b>
53:22;72:6;91:7;108:8; 109:5	<b>waiting (1)</b>	<b>whereas (4)</b>	31:9;49:15
<b>vary (1)</b>	62:3	76:10;98:25;105:14,17	<b>working (4)</b>
90:3	<b>wanted (2)</b>	<b>wherein (4)</b>	28:2,5;73:15,16
<b>varying (4)</b>	55:14;80:24	17:3,10,20;18:22	<b>works (1)</b>
84:17;86:12;87:23;88:4	<b>wants (1)</b>	<b>Whereupon (1)</b>	79:4
<b>verbal (1)</b>	73:11	112:13	<b>world (1)</b>
6:1	<b>warning (1)</b>	<b>whether (10)</b>	28:19
<b>versa (1)</b>	51:14	45:3;47:17;49:25;50:6; 55:17;74:3;85:22;101:11; 104:6;111:19	<b>wrinkle (13)</b>
79:17	<b>way (41)</b>	<b>whole (18)</b>	20:25;26:25;27:10,16; 30:13;32:22,23;33:17; 34:12,15,16;37:19;38:15
<b>versions (1)</b>	5:16;8:11;14:22;24:1; 30:20,25;34:23;43:21;44:2; 48:24;53:6,18;61:3,8,11,12, 14,20;66:3;70:15;71:5; 73:8,13,18;74:23;76:3;77:5, 6,12;78:17;80:11;82:18; 85:24,25;86:25;88:24;91:1; 94:16;95:9;107:3;110:23	4:16;15:21,21;19:21; 33:2;35:18,20,24;36:1,18; 37:10;38:8;47:15,15;60:4, 4;92:3;102:4	<b>wrinkle-reducing (23)</b>
<b>versus (4)</b>		<b>who's (1)</b>	13:5,13,20,24;14:3;20:7, 11;23:15;24:8,22;25:13,16, 18;26:20;27:2;28:11;30:7, 18,19;31:7;33:19;34:8;37:7
49:10;64:14;67:14;99:6	<b>ways (6)</b>	23:20	<b>wrinkle-reduction (3)</b>
<b>vice (1)</b>	55:12;86:15;87:24;88:2, 3;91:7	<b>widely (1)</b>	31:5;33:14;38:13
79:17	<b>Web (2)</b>	28:18	<b>wrinkles (7)</b>
<b>view (3)</b>	60:11,11	<b>Wikipedia (1)</b>	11:17;12:5,16,18;38:17; 68:5,10
79:25;109:11;111:23	<b>week (1)</b>	60:9	<b>written (2)</b>
<b>viewed (2)</b>	5:12	<b>within (3)</b>	5:25;20:23
31:6;35:2	<b>weight (6)</b>	<b>Without (9)</b>	<b>Y</b>
<b>Villasenor (11)</b>	31:19;40:25;41:1;89:10; 90:14,15	6:25;12:15;14:20;39:22; 50:3;53:24;71:4;111:6,10	
46:7;56:12;57:10;58:12; 66:12;69:14;83:13;84:24; 86:10;88:3;92:2	<b>weighted (3)</b>	<b>witness (8)</b>	<b>years (2)</b>
<b>Villasenor's (2)</b>	30:16;31:15,16	4:2;36:14;38:23;64:4; 97:22;109:23;112:9,13	28:20;29:18
7:23;28:14	<b>well-defined (1)</b>	<b>wondered (1)</b>	<b>Z</b>
<b>visibility (9)</b>	55:8	65:17	
61:17;62:1,12,25;63:4,9, 12,19,23	<b>whatever (4)</b>	<b>wondering (5)</b>	<b>zero (3)</b>
<b>visible (4)</b>	28:2;95:3,7;109:11	23:6;53:12;55:3;64:24; 89:23	86:24;87:1,25
59:10;63:6;91:2;104:12	<b>whatnot (2)</b>	<b>word (6)</b>	<b>Zhang (24)</b>
<b>visual (1)</b>	50:11;52:2	35:11;65:20;72:9;74:12, 13;91:6	45:6,6,9,18;46:6,10,12, 18;52:6,8,9,18,21,24;53:3,5, 8,13,13,21,24;62:19,23; 63:15
51:21	<b>what's (9)</b>	<b>words (4)</b>	
<b>visualization (1)</b>	8:12;9:11;49:15;55:12;		
76:4			
<b>visually (1)</b>			
55:16			

<b>zipped (1)</b> 76:1	<b>1017 (2)</b> 9:12;24:24	<b>13 (4)</b> 22:7;47:8;81:15;90:2	<b>185 (1)</b> 47:19
<b>1</b>	<b>1022 (2)</b> 9:19;69:21	<b>130 (15)</b> 21:23;22:9;35:17,22,25; 36:1,5,7,20;37:9,20,25; 38:1,9;68:15	<b>19 (4)</b> 49:3;73:19;86:9,10
<b>1 (32)</b> 13:19;15:10,11,12;16:3,5, 8,13,17,24;17:1,3,12,14,17, 19;19:11;20:5;21:2,3,21; 22:18;24:7;35:17;44:12; 45:21;47:19;48:7;50:5; 51:2;84:2;99:3	<b>1023 (2)</b> 10:4;26:9	<b>132 (40)</b> 10:22;28:9;39:2,8;42:5; 50:4;51:3;54:15;65:2;68:3; 70:10,14;71:6,21;72:13; 73:17;75:5,6,15,19;80:22, 23,25;90:3;96:22;106:6,10, 16,19;107:4,12,16;108:6,9; 109:6,14;110:10,16,18; 112:2	<b>1c (3)</b> 21:3,22,23
<b>1:34 (1)</b> 64:6	<b>11 (3)</b> 34:4;49:3;80:16	<b>14 (1)</b> 47:8	<b>1e (4)</b> 17:3;18:8;23:16,23
<b>10 (12)</b> 14:6;17:15,16;26:13,14, 17;28:21;30:2,3;42:18; 69:23;84:3	<b>11:39 (1)</b> 38:25	<b>140 (1)</b> 36:23	<b>2</b>
<b>10:30 (1)</b> 4:4	<b>11:46 (1)</b> 38:25	<b>15 (7)</b> 36:13;44:4,4;94:4,5; 101:16;103:7	<b>2 (8)</b> 13:19;20:5;53:23;84:2; 94:13,22;107:5;110:8
<b>1001 (2)</b> 10:17;39:2	<b>110 (4)</b> 45:22;46:21,25;47:11	<b>16 (2)</b> 44:3;96:12	<b>2:44 (1)</b> 97:23
<b>1003 (2)</b> 8:12;9:6	<b>119 (1)</b> 79:9	<b>160 (4)</b> 24:7;36:4;37:21;38:14	<b>2:56 (1)</b> 97:23
<b>1004 (1)</b> 75:12	<b>12 (5)</b> 16:7;21:6;75:11;106:21; 108:2	<b>17 (5)</b> 81:9,15;95:24,24;99:18	<b>20 (10)</b> 36:17;47:7;54:5;93:16, 16;95:23,25;97:7,8,8
<b>1005 (2)</b> 75:14;98:2	<b>12:56 (1)</b> 64:6	<b>170 (1)</b> 38:15	<b>2004/10170337 (1)</b> 13:1
<b>1006 (1)</b> 111:2	<b>120 (2)</b> 44:13,19	<b>172 (2)</b> 33:8,13	<b>2009 (2)</b> 60:13,19
<b>1007 (1)</b> 106:1	<b>124 (1)</b> 68:22	<b>174 (2)</b> 32:1,4	<b>2019 (1)</b> 6:15
<b>1008 (1)</b> 45:8	<b>1250 (10)</b> 6:21;9:7,8,10,23,24; 69:21;92:2,10;106:17	<b>177 (2)</b> 33:8,13	<b>205 (1)</b> 107:14
<b>1009 (2)</b> 10:8;11:4	<b>1251 (16)</b> 6:22;9:15;10:5;11:5,20; 13:8;17:3;25:2;26:13;39:6, 7;44:25;45:1,17;64:9,10	<b>18 (2)</b> 39:7;44:4	<b>207 (1)</b> 79:18
<b>1010 (1)</b> 29:22	<b>126 (3)</b> 64:16;68:17,21		<b>21 (2)</b> 44:22,23
<b>1012 (2)</b> 26:1;33:24	<b>127 (4)</b> 64:16,21;68:21,22		<b>22 (11)</b> 46:11;53:8;54:2;85:22; 88:23;89:6,13,15,17;90:9; 92:3
	<b>128 (1)</b> 65:25		<b>23 (9)</b> 45:17;46:14,14;47:5; 92:2,4,10;98:5,7
	<b>12A (1)</b> 104:19		

<b>25 (2)</b> 56:1;73:19	<b>3.5.1 (2)</b> 31:20,22	<b>410 (11)</b> 10:10;15:21;23:2;35:15, 16:36;17;37:13;44:10; 45:21;48:1;51:4	<b>6</b>
<b>255 (3)</b> 86:24;87:1,25	<b>3.5.2 (1)</b> 30:22	<b>42 (7)</b> 102:13;103:16;104:20; 105:2,4,7;109:19	<b>6 (16)</b> 13:9,16;17:2,6,25,25,25; 18:21;20:6;36:16;37:13; 47:8;49:2;51:1;56:2;84:2
<b>26 (7)</b> 54:18,21,22;57:19;58:2, 20;102:14	<b>3.5-1 (1)</b> 30:15	<b>44 (4)</b> 107:2,4,15;110:13	<b>60 (1)</b> 79:12
<b>260 (1)</b> 94:21	<b>3:38 (1)</b> 112:11	<b>46 (1)</b> 111:2	<b>63 (1)</b> 102:13
<b>27 (8)</b> 26:5,15,18;27:6,7;37:6; 61:19;103:25	<b>3:43 (2)</b> 112:11,14	<b>49 (7)</b> 34:1,6,10,23;35:9,11; 72:14	<b>64 (5)</b> 71:7,10;99:12;101:5; 102:18
<b>28 (5)</b> 61:15;64:11,12;107:24, 24	<b>30 (4)</b> 62:23;93:22,23;95:11	<b>5</b>	<b>65 (3)</b> 100:9,23;102:18
<b>28th (1)</b> 6:15	<b>32 (21)</b> 81:13;82:8,9,11,20; 83:17;84:2,3,8,23;85:1,1, 22;103:24;104:3,14,21; 105:3;106:19;107:24;109:2	<b>5 (5)</b> 11:6;75:25;76:1;78:4; 84:2	<b>67 (2)</b> 79:12;102:23
<b>29 (7)</b> 17:16;59:14,16;61:1; 65:21;106:19,20	<b>33 (3)</b> 104:22;106:21;108:24	<b>50 (1)</b> 35:10	<b>68 (4)</b> 99:21,25;100:22;102:19
<b>2A (2)</b> 79:15,15	<b>34 (3)</b> 106:4,5,16	<b>52 (2)</b> 15:10,12	<b>7</b>
<b>2B (2)</b> 107:4;110:10	<b>35 (2)</b> 29:18;107:9	<b>53 (1)</b> 106:20	<b>7 (17)</b> 13:16;17:25;18:1;27:13; 30:1,3;69:23;75:5,6,15,24; 76:2;79:2,6,8;80:4;84:2
<b>2-D (1)</b> 41:19	<b>36 (4)</b> 106:21;108:7,11,22	<b>54 (2)</b> 74:6,6	<b>701 (2)</b> 76:9,10
<b>3</b>	<b>37 (1)</b> 37:15	<b>56 (3)</b> 15:10,12;78:4	<b>702 (3)</b> 76:13,14;78:5
<b>3 (18)</b> 13:19;17:25;20:5;47:23, 24;48:1;71:7,10;72:15; 74:6;84:2;92:10;106:19; 107:13,20,21;108:18,19	<b>38 (1)</b> 109:17	<b>58 (4)</b> 74:6;105:8,14,17	<b>760 (2)</b> 84:4,6
<b>3.2 (2)</b> 64:21;65:5	<b>3rd (1)</b> 29:24	<b>59 (2)</b> 71:7,10	<b>78 (1)</b> 68:21
<b>3.3 (1)</b> 67:13	<b>4</b>	<b>5B (5)</b> 99:3,13,19;100:1,10	<b>8</b>
<b>3.33 (1)</b> 32:16	<b>4 (9)</b> 11:10;13:19;17:8;18:21; 20:5;48:5;73:19;84:2; 107:13		<b>8 (19)</b> 11:10,20,23;13:19;14:24;
	<b>40 (1)</b> 37:13		



15:7;20:6,13;52:15;54:14, 23:71:7;77:24;84:3;98:8, 12,15;100:3;101:13 <b>800A (2)</b> 39:12,16 <b>800B (1)</b> 39:21 <b>800C (5)</b> 40:6;42:7;77:14,24;85:15 <b>801B (1)</b> 41:23 <b>801C (1)</b> 40:8 <b>8447132 (1)</b> 10:20 <b>8A (5)</b> 39:8,10,13,13,14 <b>8B (6)</b> 39:8,20;40:11,22;41:8; 42:12 <b>8C (14)</b> 39:8;40:5,5,11,22;41:8; 42:7,12,19,25;44:4;77:14, 25;85:14			
<b>9</b>			
<b>9 (11)</b> 11:16;12:2;13:8;14:14; 84:3;106:20;107:18;108:6, 9,18;109:17			