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Transcript of Gregory Welch, Ph.D.

Date: December 19, 2024

Case: Valve Corporation -v- Immersion Corporation (PTAB)

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Valve Exhibit 1036 Valve v. Immersion IPR2024-00582

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VALVE CORPORATION,
Petitioner

V.

IMMERSION CORPORATION,
Patent Owner.

Case IPR2024-00582
Patent 11,175,738

Virtual Deposition of GREGORY WELCH, Ph.D.
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1 Virtual deposition of GREGORY WELCH, Ph.D.,
2 pursuant to notice, before Tiffany M. Pietrzyk, a
3 Certified Shorthand Reporter in the States of
4 Illinois, Texas, and California, Registered
5 Professional Reporter, Certified Realtime Reporter,
6 and a Notary Public in and for the State of
7 Illinois.

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C O N T E N T S

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By Ms. Fellowes	5

E X H I B I T S

(Attached to transcript.)

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1 P R O C E E D I N G S

2 (Witness sworn.)

3 WHEREUPON:

4 GREGORY WELCH, Ph.D.,
5 called as a witness herein, having been first duly
6 sworn, was examined and testified as follows:

7 EXAMINATION

8 BY MS. FELLOWES:

9 Q. Good morning, Dr. Welch. My name is
10 Alexandra Fellowes, and I'm one of the counsel that
11 represents Immersion. Nice to meet you.

12 A. Nice to meet you also, Alexandra.

13 Q. So I'm going to dive in with some
14 instructions, although I appreciate that you been
15 deposed before, but I just want to make sure we all
16 have the same page. And, again, thank you for
17 starting late. I really appreciate that.

18 So first of all, we will do our best, I'm
19 sure you and I, to not talk over each other. If
20 there's anything I say, particularly if my accent
21 kicks in, where you don't understand anything or I
22 mumble, please, of course, tell me, I'll repeat it.

1 If you need to take a break, that's not a
2 problem. The only thing I ask is that, if you need
3 a break and there's a question pending, you stay to
4 answer the question and then you take a break.

5 Now, I suppose this is more mechanics than
6 anything else, but do you have access to the
7 download folder where I have put some exhibits?

8 A. I believe I do. Oh, it now has exhibits.
9 It was empty before. I see eight files, I guess.

10 Q. Yes, I think that's correct. Yes. And no
11 need to open them all at once. I've just numbered
12 them as I think we'll go through them, but we might
13 not touch on all of them.

14 A. Okay.

15 Q. All right. So to begin, and I suppose we
16 can introduce as Exhibit 2 your CV. If you can open
17 that up, please?

18 A. Let me see. I think I will download it.

19 (Exhibit 2 was marked for identification
20 and is attached to the transcript.)

21 A. Okay.

22 Q. You have that open?

1 A. Yes.

2 Q. Excellent. So can you tell me about your
3 current position at the University of Central
4 Florida?

5 A. Sure. I am an endowed professor, a Pegasus
6 professor, an endowed -- I hold an endowed chair in
7 healthcare simulation. My primary appointment and
8 tenure is in the college of nursing, but I'm not a
9 nurse. By training, I'm a computer scientist and
10 engineer, so I also have appointments in computer
11 science and an academic unit called the Institute
12 for Simulation and Training. And I've been at UCF
13 since 2011 or so.

14 Q. What is your experience in haptics?

15 A. I have used haptics in research prototypes
16 and done some published research involving haptics
17 since, boy, probably since the mid to late '90s over
18 the years, various things over the years. Some
19 published, some not published.

20 Q. And any publications relating to haptics,
21 would they be on your CV?

22 A. Publications would be, yes.

1 Q. Right. Is there any substantial unpublished
2 research that you're aware of that would not be
3 reflected on your CV?

4 A. There was a lot of work I did, for example,
5 with Wiimotes at some point in time with a couple of
6 students that never got published. And we were
7 doing a variety of things with both tracking them
8 and creating some haptic effects based on different
9 things you did. Nothing fancy, pretty
10 straightforward. But other than that, I don't
11 recall offhand.

12 Q. Kind of going back to basics a little bit,
13 what is a haptic effect?

14 A. It would depend on the context, where that
15 question is being asked and, you know, by whom,
16 under what circumstances. But generally, haptics
17 would refer to the sensations you might feel in the
18 nerves on the, say, surface of your skin, on your
19 fingers, or on your body as distinct from something
20 involving forces that would resist your attempt to
21 push on something.

22 Q. When you say forces that would attempt to

1 resist your push on something, I just want to better
2 understand that. What do you mean by that?

3 A. I mean, like, something -- it's a gross --
4 like a gross or muscular movement, so if I was
5 moving a robotic arm. So I did some work in the
6 '90s at UNC Chapel Hill. For example, there was a
7 big robotic arm that came from ARKANLABS that was
8 used to interact with a variety of virtual things
9 for research, like molecules, and so they could
10 design that to be such that when you were trying
11 to dock molecules, as you approached a configuration
12 of molecules that was compatible and you started to
13 push the molecules into place, the arm would itself
14 resist you pushing any further, would actually
15 provide forces against you.

16 Whereas most things, that if you have some
17 tactile or haptic feedback because they might be on
18 your fingertips, for example, it doesn't matter
19 whether my finger is immediately in front of me or
20 right in front of me or where my finger is, there's
21 nothing that's going to necessarily stop my hand
22 from moving. There may be other things that will

1 stop my hand from moving, like a screen or something
2 like that, but typically the haptic effects
3 themselves are superficial. So sometimes they're
4 done in gloves, for example. You might have a pair
5 of haptic gloves that have little actuators in the
6 fingers or around the hand.

7 Q. I see. Thank you.

8 So actually, next, can I ask you to open
9 your declaration, which is Exhibit 1 in that folder?

10 (Exhibit 1 was marked for identification
11 and is attached to the transcript.)

12 A. Okay. I have it open.

13 Q. So, Dr. Welch, I'll just represent to you
14 that this is the declaration that we received, and
15 if you want to sort of have a skim through to see
16 that it is accurate, feel free. But what I want to
17 ask is, does your declaration contain all the
18 opinions you're intending to offer with respect to
19 the IPR of the '738 patent?

20 A. It contains all the opinions up to this
21 point in time. If I was asked to offer further
22 opinions, I would do so.

1 Q. Understood. And in paragraph 19, you say
2 that "For ease of reference, the full list of
3 documents that I have considered is included in
4 Appendix A."

5 To your knowledge, is Appendix A up-to-date?
6 Does that include the full list of documents you
7 considered?

8 A. To my knowledge, it is up-to-date, yes.

9 Q. Excellent. Thank you.

10 So the first thing I'd like to touch on is
11 the '738 patent itself. And I believe that that is
12 Exhibit Number 3. Can you please open that for me?

13 (Exhibit 3 was marked for identification
14 and is attached to the transcript.)

15 A. Okay. I have it open.

16 Q. Thank you. Give me one second. I have my
17 19 different documents open.

18 A. I understand.

19 Q. Yes. So many PDFs in my life now in a way
20 that I had not appreciated before.

21 So what is your understanding of the
22 invention of the '738 patent?

1 A. I wouldn't want to sort of shoot from the
2 hip and describe anything casually, but I do have a
3 description of it in my declaration starting at
4 paragraph 55 where I talk about basically what
5 the -- what the patent does. I give a summary of
6 what the patent does, certain features of the
7 patent, what the claimed, you know, inventive
8 concepts or what the apparently claimed inventive
9 concepts are.

10 Q. And in taking a look at that section of your
11 declaration, we'll start at paragraph 55, but you
12 describe that in the '738 patent, there is -- in
13 paragraph 58, there is a description of pushing a
14 virtual button.

15 Do you see that?

16 A. Yes.

17 Q. What is your understanding of what it means
18 to push a virtual button in the context of the '738
19 patent? And if you need to refer back to the
20 patent, feel free.

21 A. It's not described in great detail, but I
22 think a person with ordinary skill, reading what the

1 '738 patent says in reference to pushing a button or
2 pushing buttons, what they would understand that to
3 mean is a virtual meaning, not -- there would be a
4 virtual button typically. That would be the only
5 reason to simulate the haptic effect would be, for
6 example, something rendered on a screen. So the
7 mute button or something on the screen of your
8 mobile phone, for example.

9 And so the simulating or the pushing of the
10 button would be to try and give you an approximation
11 of the haptic sensation you would feel if the button
12 was actually mechanical. So typically, not always,
13 but typically, when pushing mechanical buttons, you
14 have some sort of tactile or haptic feedback that
15 your press actually affected whatever it was that
16 was supposed to happen. So it actually -- you
17 succeeded in the press. So you might feel like a
18 click or something like that that would generally
19 tell you I can let go now, that my press has been
20 registered.

21 So virtual buttons, for example, don't have
22 that. Obviously, they're just pictures. So the

1 goal, historically, has been to figure out ways to
2 provide some sort of tactile feedback to the device
3 at the moment in synchrony with you pressing,
4 putting your finger on the virtual button and
5 perhaps applying pressure so that you feel what, to
6 you, is something akin to a click. At least it's a
7 tactile effect or haptic effect that is in synchrony
8 with your touching or pressing so that you perceive
9 it as sort of atomic action with what is like a
10 pseudo mechanical button.

11 Q. You used the word "haptic sensation." And
12 I'm -- just want to understand better, is there a
13 distinction between a haptic effect and a haptic
14 sensation?

15 A. In general, in the field, there are no --
16 haptic effect would have no universal-accepted
17 meaning. It would depend on the context. Sensation
18 would be more universal. It would -- I can't
19 imagine it applying to anything other than human
20 perception, sensing of something.

21 So in the case of the patent in particular,
22 I believe it's fair to say that they're -- the

1 patent talks about the term "haptic effect" in a
2 variety of ways, but generally, it's mostly about
3 the -- I believe about the sensation to be -- that
4 they are trying to make the user perceive or sense.
5 So it's -- might be, for example, a semantic
6 description, like a bubble press or a button press
7 or something. So it's describing in English words
8 the effect on the person, so the sensation that they
9 would feel. That's most -- I believe that's mostly
10 how it's used.

11 Q. Is it possible to describe as a single
12 sensation something that is, in fact, a series of
13 haptic effects?

14 A. I would say, in general, yes, absolutely.
15 In fact, probably almost anything we sense is going
16 to be, at some level, a series of haptic events. We
17 can't -- if you just applied a DC pressure to my
18 hand somehow, you know, move an actuator and then
19 stop it, it never moves again, I wouldn't have any
20 sensation. It has to be dynamic. It has to be
21 moving. So every one of those movements in some
22 sense at the finest grain is an effect. If it's

1 oscillating, it's pushing against my finger
2 repeatedly over and over again.

3 So each one of those pushes put together is
4 perceived as maybe a vibration, and then pieces of
5 vibrations can be put together to simulate something
6 that a user would perceive as a single atomic
7 occurrence or action or effect, even though a system
8 might achieve that with a sequence of other effects.

9 Q. Is it your understanding that, in the '738
10 patent, the haptic effect needs to be based, at
11 least in part, on the touch signal and the proximity
12 signal? And by that, I mean the claimed invention,
13 I don't mean just the specification.

14 A. I'm sorry. What -- I didn't understand the
15 question. What's the question?

16 Q. Sure. Is it your understanding that, in the
17 claimed invention, the haptic effect must be based,
18 in part, on the touch signal and, in part, on the
19 proximity signal?

20 A. That is certainly the case where that is
21 stated in the claims. So each claimed invention
22 corresponding to claims that state that, absolutely.

1 Q. And if there is a haptic effect that is
2 generated based solely on touch, we can agree that
3 that would not be a haptic effect based, in part, on
4 proximity and, in part, on touch; is that correct?

5 A. Indeed, if there is a haptic effect that --
6 such that the effect depends only on the touch and
7 is unaffected by anything, any proximal or proximity
8 measurements, for example, prior to that, that,
9 indeed, I think, for the claims that require both,
10 that would not satisfy the claim.

11 Q. Similarly, if there's a haptic effect that's
12 generated based on hovering your finger over a
13 virtual button but not pressing it, that would be a
14 haptic effect based on the proximity signal but not
15 the touch signal; correct?

16 A. I think you said hovering over but not
17 touching.

18 Q. Yes.

19 A. Generally, I mean, of course, a human is
20 only going to perceive a sensation, receive an
21 effect if they touch. They can't perceive an effect
22 generally from haptic devices if you're not coming

1 into contact somewhere on your body, a hand, a
2 finger, or something. So just hovering over
3 something that is moving would not produce any
4 sensation other than, of course, you know, there
5 might be sound accompanying that or some other
6 effect. None of that's described in the patent.
7 But otherwise, just generally, from the mechanical
8 movement, you wouldn't have a sensation if you were
9 just hovering.

10 Q. That's interesting. So you're saying that
11 there would be a haptic effect but there would be no
12 haptic sensation?

13 A. No. No. I'm saying, as I said earlier, I
14 think it's fair to say the haptic effect is the
15 sensation. So whatever -- it depends on the
16 context, who is talking about it, where it's being
17 talked about. Somebody could issue commands to
18 attempt to cause a haptic effect. So they might
19 send signals to vibrate in the intent to create an
20 effect that would be perceived if the person touched
21 the device. But if the person never touches the
22 device, those actions won't ever succeed in causing

1 the sensation, the perceived effect.

2 Q. I see. So let's say we have a phone that's
3 just sitting on the table. And I bring my finger
4 above the virtual button and I just sit there and I
5 hold it. If the phone then vibrates -- I want to
6 better understand this. If the phone then vibrates,
7 is that a haptic effect?

8 A. In the context of this patent, of the '738,
9 I would say it would -- I mean, I'd have to -- this
10 is a hypothetical so I'd really, you know, need to
11 dig into this a little deeper. But given my
12 understanding of that hypothetical, I think I would
13 say it would not create a haptic effect. Of course,
14 what I mean by that is I'm assuming, for example,
15 the person cannot see the phone vibrating, cannot
16 hear the phone vibrating, they're not touching the
17 table. So they themselves don't have any awareness
18 of something that's happening inside the device if
19 they don't have a mechanical connection to that
20 device in some way or audio or other.

21 But assuming no audio, assuming I can't hear
22 it, assuming I don't have any mechanical contact

1 with the device, potentially through a table or
2 something else, then there would not be -- that
3 would not achieve a haptic effect on the person.
4 They would never perceive anything.

5 Q. I see. So there has to be a perception, a
6 sensation for there to be a successful haptic
7 effect?

8 A. As I said earlier, I think the patent refers
9 to -- it uses the term "haptic effect" in sort of
10 some odd ways that sometimes it talks about it like
11 you're going to, for example, output a haptic
12 effect, which sounds like the action. But, I mean,
13 a person of ordinary skill would understand what
14 that is is outputting something to achieve that
15 haptic -- that desired haptic effect.

16 So I think the answer to your question is
17 yes. What was your question again? Sorry.

18 Q. That's okay. I'll ask it in a different
19 way. I just -- I guess it's a little bit of a sort
20 of the tree falls in the forest and no one is there
21 to hear it, does it make a sound. I'm just trying
22 to understand -- if I'm correct, that what you're

1 saying is, if there is no mechanical connection such
2 that the user perceives the haptic effect or has a
3 sensation associated with it, there is no actual
4 haptic effect. That there must be an effect on the
5 human being for it to be a haptic effect.

6 Perhaps I'm trying to put words in your
7 mouth and I don't want to do that. So I just want
8 to better understand, if it's not perceived in any
9 way, then it is not a haptic effect. If there's, as
10 you say, no mechanical connection, I can't see it, I
11 can't hear it, I can't touch it.

12 A. So, again, I don't -- the term "haptic
13 effect" in the patent is used in different ways
14 throughout.

15 Q. Okay.

16 A. And it's -- I think it's not used in my
17 opinion, and I think a person of ordinary skill
18 wouldn't say it has a single sort of identifiable
19 definition, I don't think. But generally, I would
20 say it refers to the sensation that the person would
21 be feeling.

22 So, again, the system could and somebody

1 might describe it as creating haptic effect, and
2 what they might -- what that would mean in the
3 context of this patent, I think, is predominantly
4 they would do some action that is intended to create
5 that perception. But the perception will actually
6 only happen, so the effect will only be successful,
7 if you will, or complete -- I guess I'm trying to
8 come up with a good way to describe it here -- but
9 the effect won't be effective or the action won't be
10 effective at creating the effect unless there is
11 some sort of a mechanical connection to the person.
12 If we're talking -- again, if we're talking about
13 haptics, not audio, not visual changes.

14 Q. Relatedly, is it a haptic effect if the only
15 connection is audio? Does it need to be tactile to
16 be a haptic effect?

17 A. A person of ordinary skill and I would say
18 that it would need to be tactile. Of course, you
19 know, with the caveat that there are, as audio
20 signals become lower and lower in frequency and,
21 with sufficient power, become or can create haptic
22 effects.

1 So there are devices, for example, one we
2 use in our lab for research over the years called a
3 butt kicker, which is a device made for, like,
4 gamers. And you would, like, bolt it to your chair
5 or to the floor where your chair is on top of and
6 you drive it with audio. And so you plug the
7 computer speaker into it. And so it filters out the
8 higher frequencies and takes the lower frequencies
9 and converts those into haptic effects.

10 But audio alone, if the only sensation or
11 perception is through, you know, the nerves in our
12 inner ear, then a person of ordinary skill would not
13 consider that to be a haptic effect.

14 Q. So then, I think, going back to the -- where
15 we started in the hypothetical, if you have that
16 phone and it's sitting there on the table and you
17 don't have a visual connection and you don't have
18 any vibratory connection via the table, if I hover
19 my finger over a virtual button but I don't touch,
20 then I don't have a haptic effect; correct?

21 A. I think it's correct. I would say you don't
22 have a haptic effect. So there is no haptic effect

1 achieved. Again, the system may issue commands
2 hoping to provide a haptic effect in the event you
3 did have a mechanical connection or created a
4 mechanical connection, but if that connection was
5 absent, then you would not perceive that haptic
6 effect.

7 Q. Let's change the hypothetical just a tiny
8 bit, which is that now I'm holding the phone, so I
9 have that mechanical connection. If I then hover my
10 finger over a virtual button and a haptic effect is
11 generated, is that based on proximity?

12 A. I would say yes, that is -- if I understand
13 your hypothetical, and, again, it is hypothetical so
14 I'm going with your hypothetical. So if, for
15 example, I hold my mobile phone, my mobile in my
16 left hand, and I take my right hand index finger and
17 place it a few centimeters above the phone, if the
18 phone has -- it tends to create a haptic effect
19 based on that proximity, noncontact, and I feel that
20 in my left hand that is holding the phone, then yes,
21 I would consider that a -- and I think a person of
22 ordinary skill in the art would consider that a

1 haptic effect based on proximity, a successful
2 haptic effect based on proximity.

3 Q. Give me just one second.

4 A. Uh-huh.

5 Q. Next, can I ask you to please open
6 Exhibit 6, which is the U.S. patent application
7 2012/0249474 A1 to Pratt. Can you tell me when you
8 have that open?

9 (Exhibit 6 was marked for identification
10 and is attached to the transcript.)

11 A. Okay. I have it open.

12 Q. And if I refer to this throughout our
13 deposition as the Pratt reference, you'll understand
14 that I'm referring to this patent application?

15 A. Yes.

16 Q. Now, give me just one second.

17 Can you take a look at figure 5, please?

18 A. Okay. I am there.

19 Q. So it shows here that there is haptic
20 effect 1, then haptic effect 2, and haptic effect 3.

21 What's your understanding of what haptic
22 effect 1 is based on, in the context of this figure?

1 A. So as I said earlier, just to be clear, to
2 begin with, the term "haptic effect" has no
3 universal-accepted proper meaning. It will depend
4 on who is using that term, in what context, and a
5 person of ordinary skill would, if they understood,
6 they would be fine with probably, you know, most
7 reasonable definitions.

8 So in the context of Pratt, the haptic
9 effect here would be some actuation -- one moment,
10 please.

11 Q. Sure.

12 A. So Pratt, I believe, in referring to
13 figure 5 and other places, uses the phrase "haptic
14 effect generation." So in figure 5, where it says
15 "haptic effect 1," that would be based presumably
16 on -- I'd have to go back to look to confirm -- the
17 finger crossing threshold 1 as shown where
18 threshold 1 is a height, for example, above the
19 surface. So it would be a haptic effect generated,
20 in the context of Pratt and the way Pratt uses that,
21 when the finger is proximal but yet, not yet
22 touching, not yet in contact with the device.

1 Q. Let's take a step back for a second, then.

2 How does Pratt use the term "haptic effect"?

3 A. I don't think -- I don't know that I could
4 universally tell you that because I don't think
5 that's something I would have had to really
6 understand. As I said, the words in, like, another
7 piece of art aren't really that consequential to a
8 person of ordinary skill. They would look at seeing
9 what it does and see if it matches the words of,
10 like, in this case, the '738 patent. So I haven't
11 done that exercise and I don't -- would be reluctant
12 to sit here and, you know, on the fly try to tell
13 you that.

14 Q. Then let's come at this a different way.

15 Does Pratt use the term "haptic effect" in a
16 different way than the '738 patent?

17 A. So, again, I'm not sure. I would have to go
18 through and look at it carefully, but I think that
19 even in figure 5, where you pointed me to, where it
20 says "haptic effect 1," the -- it refers to haptic
21 effect generation. So that, what we see is what
22 happens to be sort of oscillatory or pulsed signal

1 in that haptic effect 1 interval, in that vertical
2 interval. That, if someone was touching a Pratt
3 embodiment, for example, with a left hand or through
4 the table or something else, so it would be
5 generating, as I said, with the '738 patent, the
6 action or the mechanical movement that would be
7 perceived in the '738 patent's use of the term
8 "haptic effect" would be used as -- I'm sorry --
9 would be carried out in order to achieve that
10 sensation.

11 Does the Pratt -- does Pratt use it in
12 exactly the same way? I couldn't tell you. I just
13 searched, you know, quickly, and I'd have to really
14 think carefully and go back and look at the context
15 and how that term is used. I'm not sure it would
16 make any difference to me because, again, a person
17 of ordinary skill would look at what Pratt is
18 disclosing in terms of what you would actually do or
19 what it's teaching. And a person of ordinary skill
20 wouldn't look at a term like "haptic effect" and
21 make an immediate judgment about it being a
22 particular thing. They would reserve that judgment

1 until reading everything and then trying to
2 understand what was meant by that. But, again, I
3 don't think it would change anything in my opinions.

4 Q. I see. Okay. So to the extent that there
5 is a difference -- and I'm not forcing you to agree
6 that there is one, but to the extent that there is a
7 difference, it doesn't change your analysis?

8 A. Sitting here right now, I can't see how it
9 would change my analysis.

10 Q. Okay. Now, going back to haptic effect 1 in
11 figure 5, we're agreed that that's a haptic effect
12 that's based on the proximity signal; correct?

13 A. I believe that is the case. I don't know
14 that -- I can't see looking here right now that
15 Pratt says that expressly, but that's what I
16 would -- I think a person of ordinary skill would
17 understand from the diagram, from the figure.

18 Q. And haptic effect 2, what is that based on?

19 A. I believe -- and there is apparent -- I just
20 found more discussion of this in, for example,
21 paragraphs 42, 43, 44, 45 of Pratt. So in
22 paragraph 44 of Pratt, for example, it says "At time

1 T2, the device may detect the finger touching the
2 touch surface with threshold 2." And so then it's
3 talking about it may drive the haptic actuator so
4 generate a second haptic effect. So I would say
5 that it seems clear that in figure 5, that the
6 second interval haptic effect 2 is -- corresponds to
7 or is in response to the finger passing threshold 2,
8 which Pratt is saying, in effect, you would declare
9 as contact.

10 Q. When you say "in response to," is there any
11 difference between saying it's a haptic effect
12 generated in response to touch and it's a haptic
13 effect generated based on touch?

14 A. I don't know. It would depend on where
15 those -- I'd have to see how those two different
16 phrases were used in context. Based on --

17 Q. Sorry. Go ahead.

18 A. "Response to" to me, just in the general
19 English language sense, seems more general that
20 something happens in response to that. "Based on"
21 sounds a little more specific, like it could be a
22 function of something related to the touch. But I'm

1 just speculating without, you know -- again, we'd
2 have to look at how those terms were used and look
3 at the context.

4 Q. Okay. Well, I just want to make sure
5 because you used the term "in response to." So I
6 just didn't know if those were words that you chose
7 just as part of your answer or if they were coming
8 from somewhere in the patent.

9 A. I don't know whether they're in the patent,
10 but I was not reading from the patent. That was
11 just me saying that, that haptic effect 2 will not
12 happen until you cross threshold 2 in figure 5, so
13 until it senses there's a touch. So it is cause and
14 effect, when you cross threshold 2 with your finger
15 as shown in figure 5, haptic effect 2 begins. It
16 doesn't begin before that, only begins when you
17 cross the threshold. So I guess you could describe
18 that in a variety of ways.

19 Q. I see. And, finally, haptic effect 3, what
20 is that based on?

21 A. So as described in paragraph 45 of Pratt,
22 referring to figure 5, that -- it says "At time T3,

1 the device may detect the force of the finger
2 contact crossing a predetermined level with
3 threshold 3. The device, consequently, may be
4 generating X, Y, Z coordinates based on the force
5 sensor results." And then it goes on to say "At
6 this time T3, the device may drive the haptic
7 actuator to generate a third haptic effect."

8 So in figure 5, that third -- that third
9 sort of vertical region where it's labeled "haptic
10 effect 3" would be an action that takes place once
11 the system in this Pratt example determines that
12 there appears to be a certain amount of pressure
13 crossing some threshold applied to the surface.

14 Q. Okay. Now I'd like to talk about Pratt's
15 bubble effect. Can you tell me what's referred to
16 in Pratt by "bubble effect"? If you'd like, I can
17 point you to paragraph 49.

18 A. That's fine. I also wanted to just check
19 something else.

20 So at the highest level, I mean, we can read
21 what Pratt actually says in paragraph 49, where it
22 says "The device, for example, may generate a,

1 quote, bubble, closed quote, effect, which may
2 correspond to simulating a clicking function using
3 haptic effects." And then it goes on to refer to
4 some figures, which have the wrong figure numbers as
5 I noted in my declaration. It's a typographical
6 error.

7 So a bubble effect is something that a
8 person of ordinary skill would recognize that Pratt
9 has it in quotes. It's kind of a well-known
10 mechanical type of button. Relatively common.

11 Q. When you say a well-known mechanical type of
12 button, can you describe the sensation that you're
13 supposed to have with the bubble effect?

14 A. So I don't think I can characterize the
15 sensation you are supposed to have. I think that's
16 what you asked. That would depend on what the
17 device did to try and simulate the bubble effect.
18 But the effect you would perceive in the actual
19 bubble switch, so the thing that people tend to try
20 and replicate is an effect -- if you look in my
21 declaration at paragraph 137, you'll see here, I've
22 got some figures from some other prior art,

1 middleman, and it has a nice diagram showing how the
2 buttons are mechanically constructed.

3 So there is, like, a hemispherical or part
4 of a sphere, like a dome, that has a conductive
5 inner surface and some conductive contacts below the
6 dome. And when you press the dome, typically what
7 you would feel is some resistance until you apply
8 enough force that the dome collapses and the
9 outermost portion of that dome falls inward and
10 touches and stops because it touches the electrical
11 contact. So you feel sort of a kind of a maybe a
12 little bit of a pop, but a distinct drop when you're
13 pressing on the button.

14 Q. I see. So it would -- if I'm understanding
15 you correctly, there would be some resistance, then
16 a drop in resistance as your finger hours, and then
17 resistance again as it meets the surface that it
18 can't then go any lower than?

19 A. Something like that. Again, I'm describing
20 the sensation for the actual bubble or dome button.
21 What someone might do to try and simulate that or
22 provide what they would deem a comparable effect

1 might not be exactly that.

2 Q. Does Pratt describe the bubble effect
3 specifically or does it just refer to the clicking
4 functionality?

5 A. I don't recall that Pratt has more
6 description other than the word, which is a very --
7 you know, you can see in Pratt it's in quotes. It's
8 a -- not iconic but a very recognizable term. It
9 would be to a person of ordinary skill. And then,
10 of course, Pratt has the figures, 7(a) through 7(d),
11 which Pratt uses as part of the description of that
12 specific effect.

13 Q. Well, then let's take a look at figure 7.

14 A. Okay.

15 Q. So what does figure 7(a) through 7(d) show?
16 If you could describe it to me because I appreciate
17 that it's effectively a flow of many diagrams.

18 A. Right. So 7(a) through 7(d) are intended to
19 show a sequence of states or a sequence of
20 circumstances, things that would typically happen in
21 the circumstances where one would be receiving the
22 sensation that Pratt would be trying to give to

1 simulate or mimic as much as possible the bubble
2 effect. So it shows in figure 7(a) -- so it's
3 described in -- I'm sorry -- paragraph 50 of Pratt
4 describes that sequence. But speaking very -- you
5 know, at a very high level, without just repeating
6 what's in figure -- in that paragraph -- sorry --
7 the sequence is that your hand is proximal, or not
8 touching, but near the surface and that's A.

9 And then in 7 -- I'm sorry -- 7(b), it's
10 intended to represent the point in time when your
11 finger comes into contact with the surface. But
12 you'll note there's a delta Z and a horizontal
13 dashed line, and that is, when you compare that to
14 figure 7(a), at 7(b), what Pratt describes that as
15 is the result of a recharging or a deflection
16 operation that starts when your finger is proximal
17 but not yet contacting. So when you are in sort of
18 the 7(a) configuration by some threshold
19 determination, it would begin to deflect the surface
20 to move the surface of the touchscreen up towards
21 your finger. That's the delta Z, such that, as some
22 point, these two rendezvous, they meet each other.

1 The surface is going up and your finger is going
2 down. And in 7(b), it's when you come into contact
3 with the screen at the elevated height.

4 And then figure 7(c) is -- I think is fair
5 to say is the sort of simulation of the collapsing
6 of the dome, the popping down. So you would feel,
7 in figure 7(c), the touchscreen would drop down
8 after you come into contact with it.

9 And by the way, figure 7(d) is another error
10 in Pratt. I don't know if I -- I don't think I
11 noted that in my declaration, but I've caught it
12 before. If you go back and look at the provisional
13 for this where there are actually figures 4(a),
14 4(b), 4(c), 4(d), (d) is correctly showing the
15 finger down on top of the touchscreen. If you look
16 here in Pratt, 7(c) and 7(d) are identical. So I
17 think that's clearly a copy-paste mistake when you
18 go back and look at the original diagrams.

19 But a person of ordinary skill would
20 understand that this sequence is intended to mimic
21 that contact with the dome, your finger feeling you
22 are on the dome, the dome collapses, and your finger

1 drops down to the lower touchscreen height, if you
2 will, in 7 -- in what should be the 7(d). And all
3 of that happens relatively fast.

4 Q. Let's say we were to stop at figure 7(b),
5 and by "stop at figure 7(b)," I mean that the finger
6 comes into contact with the screen but doesn't
7 continue pushing. Is the deflection of the screen
8 in figure 7(b) a haptic effect?

9 A. Boy, that's an interesting question.
10 Interesting.

11 Q. I'm not trying to stump you.

12 A. Sort of hypothetical. So if I understand
13 your hypothetical, one might think of that as a
14 haptic effect if the finger is actually coming into
15 contact. In 7(b), that's what it's showing. So if
16 you are -- if your hypothetical has the finger
17 coming into contact, then the effect that you would
18 perceive is that your finger would come into contact
19 with the surface sooner than it might otherwise.
20 That might seem like a subtle thing but that's --
21 people might actually be able to sense that.

22 So there's at least the possibility of a

1 perception of an effect when you just get to 7(b)
2 because your finger has contacted the surface
3 earlier than it might have otherwise.

4 Q. So is the -- is it fair to characterize the
5 deflection as one haptic effect and the dropping as
6 another haptic effect, or are they one haptic effect
7 with two components?

8 A. If you're asking in terms of the patent in
9 my analysis with respect to the '738 claims that --
10 where I point it this or where I refer to this, I
11 don't think you would necessarily refer to -- I
12 don't know. And I don't know that it matters. You
13 might or might not refer to the first part as a
14 haptic effect.

15 Again, if you were -- if, in the
16 conversation, you were having, like, a person of
17 ordinary skill was very clear that your bounds on
18 your question are up to the point of contact, you
19 might call that a haptic effect. But the second
20 part, which I think you're asking about, which is
21 what follows in 7(c) and (d), the dropping, will
22 always be a function of the first deflection. In

1 other words, if the deflection didn't happen, then
2 really (c) and (d) can't happen, or they would be
3 very different. So you would feel something
4 different.

5 So whatever you want to call that deflection
6 period, I'm not sure that it really matters. I
7 haven't thought about that deeply. Whatever it is,
8 its occurrence has to happen for the user to
9 perceive the desired, what Pratt calls bubble
10 effect, as they come into contact with the device.

11 Q. With respect to the bubble effect, is it
12 correct that Pratt describes the bubble effect in
13 terms of reducing latency?

14 Actually, let me take that question back
15 again. Sorry about that.

16 A. That's okay.

17 Q. The initial deflection of the screen towards
18 the finger, that's in response to the proximity
19 signal; correct?

20 A. Yes. If I understood your question, yes,
21 that initial deflection is in response to a
22 proximity within some threshold.

1 Q. The deflection happens only with proximity.
2 And if I use the word "depression," do you
3 understand what I mean there about the flattening of
4 the screen?

5 A. No.

6 Q. Or would you use a different word than
7 "depression"?

8 A. I'm fine with whatever you want to use if
9 you just explain it.

10 Q. Okay. Well, then, let's call it returning
11 to level. The screen returning to level after
12 having been deflected towards the finger, that's in
13 response to the user touching the screen; correct?

14 A. If I understand your question, I believe
15 that is correct. It only would -- it's set up in
16 response to the proximity, and then the click, if
17 you will, that starts at that setup deflection point
18 only occurs when there's been contact. So both of
19 those things have to have happened in order for that
20 to play out and, you know, give someone the
21 sensation of a dome or bubble button approximately.

22 Q. Taking a look at paragraph 41 of Pratt, I

1 believe you refer to this as the rate-of-approach
2 embodiment; is that correct?

3 A. I think that's fair. It certainly starts at
4 41, but I think it's predominantly 41. So I think
5 the answer is yes.

6 Q. In the rate-of-approach embodiment, there's
7 a haptic effect if the rate of approach is fast and
8 a different haptic effect if the rate of approach is
9 slow; correct?

10 A. Yes, if I understand what you said. I mean,
11 paragraph 41 says -- expressly it says "A first
12 haptic effect may be selected in response to a
13 relatively, quote, fast, unquote, velocity and a
14 second haptic effect may be selected in response to
15 a relatively, quote, slow, closed quote, velocity."
16 I believe that's what you said.

17 Q. Yes.

18 Do you still get the haptic effect even if
19 you never touch the screen?

20 A. Well, as I've said before, it's an
21 impossibility of physics for you to perceive any
22 haptic effect if there is no mechanical connection

1 between you and the device that is attempting to
2 create the effect. So it would depend on whether
3 you have a mechanical connection. So, for example,
4 if your -- back to your earlier example, if you're
5 holding your mobile in your left hand and your right
6 hand is coming into contact, you might perceive
7 something before you come into contact with the
8 screen with your index finger of your right hand,
9 for example.

10 Q. Then let's go with that example. Let's say
11 I'm holding it with my left hand. My finger of my
12 right hand approaches the virtual button but does
13 not touch it. Will there be a haptic effect based
14 on the rate of my approach?

15 A. So just to make sure I understand, is this a
16 hypothetical or are you asking specifically about
17 something in Pratt or what?

18 Q. Well, I'm asking specifically, with respect
19 to the rate-of-approach embodiment in Pratt, whether
20 there is a haptic effect generated based on the rate
21 of approach that does not depend on whether or not
22 you touch the screen.

1 A. If I understand your question, if the -- if
2 there was no other mechanical connection, so back to
3 your earlier hypothetical, if the phone was sitting
4 on the table and I wasn't touching the table in any
5 way --

6 Q. Oh, I'm gonna pause you right there because
7 actually I was going for the other version. Let's
8 say -- I realize we're not videotaping this so we're
9 not going to have the benefit of me waving my hands
10 around.

11 But you're holding it in your left hand,
12 your right hand, you approach the virtual button but
13 you don't touch it. And I am asking, per the
14 description in paragraph 41 of Pratt, will a haptic
15 effect be generated based on the rate of approach
16 irrespective of whether or not the finger ultimately
17 touches?

18 A. I don't know. I think in the -- I'm not
19 sure. I'd have to go back and look at this more
20 carefully. But I think, in the context of Pratt and
21 the way this is used and what comes before, it
22 really is about the sensation that you receive at

1 that location when you contact, you know, the big
2 button, for example. So it would really -- this
3 would really -- the intent of this would really be
4 not some accidental, you know, sensation through
5 some other pathway, but the direct sensation through
6 the finger, which would only happen when you come
7 into contact with the screen. You wouldn't feel it,
8 certainly on that finger, before that. And feeling
9 in the finger would be, again, the intended use
10 because that is the haptic motor synchrony effect
11 that we would normally feel in pressing a button.
12 You would feel it on that finger tip when you're
13 touching or depressing a button.

14 Q. I see. So you're saying that in the
15 embodiment described as the rate-of-approach
16 embodiment, the haptic effect is not generated until
17 the finger touches the virtual button; is that
18 correct?

19 A. I don't -- again, going back to what I was
20 saying, haptic effect, I don't think I'm saying a
21 haptic -- quote -- I think you said haptic effect is
22 not generated. I wouldn't refer to haptic effects

1 being generated. I would refer to it as being
2 achieved because, again, it has to do with the
3 sensation.

4 So there won't be -- regardless of whether
5 something starts, you know, prior to the user coming
6 into contact in the way that term is used in the
7 '738 patent, there has to be a perception. So in
8 this case, it wouldn't matter if the something had
9 started before. The effect, the haptic effect is
10 not going to occur until the finger comes into
11 contact with that device, with the screen or the
12 button.

13 Q. I think I see what you're saying, but I'm
14 trying to find the right words to ask this question.
15 So based on the rate-of-approach embodiment, is
16 there any action by the actuator before the finger
17 touches the virtual button?

18 A. Given the context and what comes before --
19 and I talk about this in paragraph 149, for example,
20 of my declaration -- it -- a very reasonable
21 interpretation of what Pratt is referring to there
22 would be -- most likely would be that there is, for

1 example, some sort of pre-charging because that is
2 what was discussed prior to that. And that
3 certainly is one of the things that would happen,
4 that you would be pre-charging differently depending
5 on the rate -- the rate of approach.

6 In fact, Pratt somewhere around there --
7 actually, it's paragraph 40 -- talks about adapting
8 the threshold at which point you start the
9 pre-charging so that you're sort of trying to target
10 some effect when your finger does come into contact,
11 eventually, with that. So in the examples in Pratt
12 here, Pratt is talking about doing the pre-charging
13 or the deflection, for example, of the device prior
14 to contact, but the -- that sensation, whatever it
15 is, would only be perceived at the fingertip when it
16 comes into contact.

17 MS. FELLOWES: Dr. Welch, would now be a
18 good time to take just a quick five-minute break?

19 THE WITNESS: Certainly, that's fine. Thank
20 you.

21 MS. FELLOWES: Okay. Great. I'll be back
22 in five.

1 THE WITNESS: Okay.

2 (A short break was had.)

3 BY MS. FELLOWES:

4 Q. So we're gonna take a break from Pratt for a
5 minute and move on to Ku, which is Exhibit 7 in your
6 folder.

7 (Exhibit 7 was marked for identification
8 and is attached to the transcript.)

9 A. All right. I managed to retrieve Ku. You
10 said number 7.

11 Q. Wonderful.

12 MS. FELLOWES: Just for the record, the
13 document that we're referring to as Ku is U.S.
14 Patent Number 8,531,319.

15 Q. Correct?

16 A. Yes.

17 Q. Can you take a look at figure 12 for me,
18 please?

19 A. Okay. I'm looking at figure 12.

20 Q. So -- sorry. Again, with my 9,000 tabs.

21 So in figure 12, we have two different
22 vibration types; correct?

1 A. Yes, figure 12 shows two different vibration
2 type and intensity, one upon touch and one upon
3 proximity, as indicated at the top of the figure.

4 Q. So the one based on proximity is indicated
5 as number 710; correct?

6 A. That is correct, yes.

7 Q. Right. And the one based on touch is 705;
8 correct?

9 A. That is correct.

10 Q. Okay. What is 715?

11 A. 715 is the combination of -- sorry. I have
12 to go back to the figure. Just give me one moment.
13 If it's okay with you, I'm going to print just the
14 figures to a separate PDF so that I can look at them
15 while we're looking.

16 Q. Oh, sure.

17 A. Which, of course, an advantage of paper.

18 Q. I know. I have to say, I don't miss the
19 days, though, of lugging an entire bankers box while
20 wearing heels up three flights of stairs. That was
21 no one's idea of fun.

22 A. I don't think it's fun in any shoes or

1 any -- okay. So let me get to -- okay. Sorry. I'm
2 back at 12.

3 So you asked about 715.

4 Q. Uh-huh.

5 A. 715 is shown on the lower right of
6 figure 12. It's discussed -- it's discussed in
7 column 16, starting at around line 22, and it's the
8 combination of the 710 signal from the -- based on
9 proximity and the 705 signal which is based on the
10 touch.

11 Q. Okay. The 710 signal, does that occur even
12 if the user never touches the screen?

13 A. I don't recall, and I'm not able to find
14 that I discussed that or that it's discussed in Ku,
15 at this moment, just sitting here right now. It
16 might or might not, under some circumstances, happen
17 prior.

18 What figure 12, (d) in particular, is
19 showing is what is perceived or the haptic effect
20 once the touch has occurred because it is -- it
21 includes both the touch signal or touch waveform 705
22 and the 710 based on proximity. So what 12(d) is

1 showing is the combination of those two, which only
2 happens after you've touched. So prior to that, I
3 seem to remember maybe it might start before, but I
4 can't -- I mean, if you know of a place definitively
5 where it talks about that, please tell me. But just
6 from memory, I'm not able to say.

7 Q. If you take a look at column 16, line 22, it
8 says "Accordingly, in the case in which, after the
9 proximity signal is maintained for a specific period
10 of time, a menu icon is touched, vibration 715 in
11 which the vibration signal 705 with respect to the
12 vibration type 3 and the vibration signal 710 with
13 respect to the proximity B have been added is
14 output, as shown in (d) of figure 12."

15 Does that clarify for you whether or not the
16 haptic effect that's generated based on the
17 proximity signal occurs before the touch?

18 A. I don't think it does clarify it because --
19 and I read along with you there, and it appears you
20 read it correctly -- I don't think there is anything
21 there that says it does not happen first. But the
22 focus of this is what the haptic effect is in the

1 language of the patent once the finger comes in
2 contact with the device. So it would depend on
3 where they were hovering for that specific period of
4 time, so, like, over which region of the screen, and
5 then where they eventually contacted. When they
6 contacted, they would get the combination of the 710
7 associated, for example, with the location where
8 they were hovering and the 705 with the --
9 corresponding to the location they touched.

10 Q. Give me just one second.

11 A. Uh-huh.

12 MS. FELLOWES: Dr. Welch, I realize that we
13 just took a break, but could we take a break for
14 really just two minutes? I just want to go off
15 camera so you don't have to stare at me as I type.

16 THE WITNESS: Of course. That's fine.

17 MS. FELLOWES: Excellent. Thank you.

18 (A short break was had.)

19 MS. FELLOWES: Dr. Welch, I have good news.
20 I don't have any more questions for you.

21 THE WITNESS: Okay.

22 (Off the record at 9:41 a.m.)

1 CERTIFICATE OF COURT REPORTER - NOTARY PUBLIC

2
3 I, TIFFANY M. PIETRZYK, Certified Shorthand
4 Reporter No. 084-004371, CSR, RPR, CRR, and a Notary
5 Public within and for the State of Illinois, do
6 hereby certify:

7 That GREGORY WELCH, Ph.D., the witness whose
8 deposition is hereinbefore set forth, was duly sworn
9 by me before the commencement of such deposition and
10 that such deposition was taken before me and is a
11 true record of the testimony given by such witness.

12 I further certify that the adverse party,
13 VALVE CORPORATION, was represented by counsel at the
14 deposition.

15 I further certify that the deposition of
16 GREGORY WELCH, Ph.D. occurred virtually, via Zoom
17 videoconference, on Thursday December 19, 2024,
18 commencing at 8:15 a.m. CST to 9:41 a.m. CST.

19 I further certify that I am not related to
20 any of the parties to this action by blood or
21 marriage, I am not employed by or an attorney to any
22 of the parties to this action, and that I am in no

1 way interested, financially or otherwise, in the
2 outcome of this matter.

3 IN WITNESS WHEREOF, I have hereunto set my
4 hand and affixed my notarial seal this 3rd day of
5 January, 2025.

6

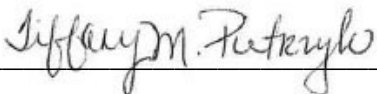
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9 My commission expires: February 28th, 2028

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