



Oral History of Bas Ording

Interviewed by:
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Marc Weber

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Hsu: It is September 12, 2017. I am Hansen Hsu, and I'm here with Marc Weber, and we're interviewing Bas Ording. Is that correct pronunc--

Ording: Bas Ording, yeah.

Hsu: It's Bas, okay. So let's-- can you just start with a little bit of background on yourself, where you're from--

Ording: Sure, yeah, so I'm from the Netherlands. So I was born in a-- I studied Interaction Design in the Netherlands, it was a pretty new course at that time.

Hsu: In college?

Ording: Yeah, I was in college, I was part of the Art Academy, art school. And they had a special department that did more like technical things. And they also had like Music Technology, and Animation and that kind of stuff. So and Interaction Design was part of that department as well. So.

Hsu: Was it a new field? Or a new program?

Ording: Yeah, it was new. So when I started, it was just the second year that it was running, basically, so--

Hsu: Oh. What year was that?

Ording: That was in '92.

Hsu: '92. Hm.

Ording: And I was looking for what I wanted to study. And I knew I wanted to do something creative and like a little bit graphic design, or even industrial design. And then I heard about this thing, and I was like really excited. Even though I didn't quite know what it was, but I understood it had to do with technology, but also the creative part like design and so I thought, hey this could be interesting, because I was already interested in computers, as well, and I liked drawing and that kind of stuff. So it seemed like a perfect combination. So.

Hsu: What was your first exposure to computers?

Ording: Just when I was like in school, I guess, in my first year in high school, we had a Commodore 64 <laughter>, that's how I learned a little bit of programming in BASIC and that kind of stuff, which was fun, so.

Weber: And how about your interest in art or graphics?

Ording: Well, I guess, my dad is a graphic designer, and he had his own company, and they were working on packaging design, like branding and logos and all that kind of stuff. So well, I grew up with that sort of just seeing, or being interested in visuals or graphics and all that kind of stuff. So-- and like I said, combined with also interest for computers, too. I was like happy to see this course called Interaction Design. Like, "Oh, this could be something good." So.

Hsu: So it was always called that? It was not called like User Interface Design or Experience Design, or--

Ording: No, I think they may have changed it in the meantime now in the past years, but when I started, it was called Interaction Design, yeah.

Hsu: Yeah, hm. And so what was your first job out of school?

Ording: Well, I started already working freelance on smaller projects during school time, so like one of my professors, he had his own company, and I would start to help out like on small projects there, and on the side. So that was good. So this could make a little bit of money, and also you got to experience what it is to work on an actual real thing. So that was pretty valuable, so.

Hsu: So how did you end up at Apple?

Ording: Well, so I was working freelance in the Netherlands for another year, I guess, after I graduated, my Master's. And I was always interested in Apple, and because we'd been one time with school we had a work week in Silicon Valley, and I went along with that, too. And my professor he knew people in this area, and after that week at that company, he wanted to drive by some of the other places, other companies where he knew people, and he asked if someone wanted to join him. Like, "Sure, I'll go along with you." So then we went to Apple, and like Silicon Graphics and a bunch of other places, and so that was the first time I saw like the Apple campus, and I was all like, "Ooo, wow, this is like amazing! <laughter> This is super cool!" And I don't know, I think I felt that energy, or I felt something special there, and I'm like this, "I don't know, some time in the future I want to go back there if possible." And anyway, so I was working freelance in the Netherlands and I decided that maybe I can see if I can do a project for Apple or something. And so my professor, he knew the person in the HI Group back then, Pauline Strilond [ph?] and she was heading up that group. And she's also Dutch.

Hsu: Pauline?

Ording: Pauline Strilond.

Hsu: Strilond.

Ording: Yeah, I can give you the spelling later. And so my professor, he made big-- he made this contact where he helped me to create a contact at Apple. And anyway, I ended up buying an airplane ticket, and booked a hotel, and I just spent two weeks in Silicon Valley, and I went by a couple of companies. One was Apple and one was MetaCreations. I don't know if you still know about that one.

Hsu: Huh? I think I remember something.

Ording: And Kai Krause, they did like a bunch of pretty cool software for like Photoshop extensions like with cool filter effects and they were known for doing very cool-looking UI, it was very new, different kind of stuff that went like outside the box. And so I talked with them as well, and that was super exciting. They have a cool studio. Well, they don't exist anymore, but then they had this cool studio in Santa Barbara like was basically right by the beach and a cool group of people there working on pretty awesome UI stuff. So after I talked with Apple, which went pretty well, but they said that they couldn't hire anyone, because at that point Apple was not doing so well. <laughs>

Hsu: Oh, right, this was 1997?

Ording: This is '90--

Hsu: Six?

Ording: This is in '97 then. Actually, no, that was in '98. And--

Hsu: '98.

Ording: That was in '98. And then, sorry, what was I-- all right, so Apple had this hiring freeze, so they weren't allowed to hire people, so that's what they told me. So, "Yeah, sorry. But we do have a list of some other companies or people that you maybe can go by as well, if you like." So I went by Adobe and some other companies as well. And then I ended up at MetaCreations talking there. And which was super exciting to me, because of all the cool UI stuff that they were doing. So I was all like, "Oh, yeah, this is great!" And they were like, "Well, we can talk about getting you a job here." And like, "Wow! This is awesome!" So I was excited. But then I got this email from Apple, and if I wanted to come back again, because I was still in the area, to talk to more people from the HI team there. So I was hesitating, because I thought, "Well, I want to do this MetaCreation thing. I think that's pretty cool." But I was in the area, so I'm like, "I might as well go back." So I did, and I spent a day there talking to-- having a lot of

one-to-ones with people from the Human Interface Group. And at the end of the day, the manager picks me up from the last person that I was talking to, and he says, "Well, there's one more person who wants to see your work, and it's Steve Jobs wants to see yours," so I'm like, "Oh, wow!" Like I really had not expected that. So <laughs> I was like, "Ooo, okay." So I walked with him to the Building One at the Infinite Loop there, and we went to the Fourth Floor to the Boardroom, and that's where the first iMac was sitting there in the corner. And I basically had to like show my work. I had my CD-ROM with me, and had to show it on that iMac, which no one had seen for real before at that point. It was announced.

Hsu: It was announced, but--

Ording: There was pictures on the internet, it was announced, but no one had seen the actual thing yet for real. So I was all like, "Ooo, this is super cool! This is special!" <laughter> So I had set up my stuff, and then Steve walks in the room, and then the manager says like, Cordell Ratzlof [ph?] is his name, I think he-- I'm not sure if he stayed around. I think he left around-- anyway. So I started showing my portfolio, that's basically it's like a whole series of little interactive prototypes and very dynamic interactive stuff. And so I just went through my list of stuff to show. And I remember Steve being like quite excited about it. And there's certain things he liked, and other things he didn't like so much. He'd be like, "Well, I don't understand why-- I don't get the idea of this." And we're like, "Okay, so I'll move onto my next thing." But it went pretty well. And he was obviously very interested. And at some point he all of a sudden got up, and he's like, "Wait a minute!" And so he leaves the room, but then he comes back with the shell of an iMac, just the shell. And he starts to show me the inside of it. Like all the details and how it's-- and I don't know anything about industrial design, so I was like, "Okay." <laughter> I don't know, but I did understand that he was all about the details of things, even the inside of it, right? So that was pretty cool. And then yeah, we talked some more and I don't remember all the specifics because it's a while ago. And then afterwards, he walked down the hall with the manager, and while I was waiting in the hall there. And then he comes back to me and he says, like, "Bas, I want you to come work for Apple." And I'm like, "Oh, wow, cool," but, and I, in my mind, I'm going to MetaCreations. <laughter> So I'm like, "Well, I have to think about this." <laughs> So that's what I told him, it's like, "Yeah, I have to think about it." And he's like, "Oh, really?" And I'm like, "Yeah." And he's like, "Oh, you know what?" I'm trying to remember when-- I think he said that he wanted me to at least not get on the plane just yet, before I had like an actual contract in my hand that I could review while on my flight or something back home. <laughter> So yeah, so that happened. So I went back to the Netherlands, and I had like a couple weeks to think about stuff, because I wasn't sure what to do. It was not an easy decision, because I thought, at that point, MetaCreations was doing, at least in my field, way more interesting stuff. And Apple, at that time, was like, you know, their UI was very good, but it was like still the sort of boring gray kind of standard UI. And I mean, it worked well, but it was not super exciting compared with the MetaCreations, which was like more crazy and out there. So there was a bunch of emailing back and forth, and at some point, Steve Jobs even called me at home. <laughter> And of course, he forgot the time difference with the Netherlands, so he called way too early in the morning. And I was barely awake, and I had to like deal with Steve on the phone. I'm like, "Oh, my god!" <laughter> But anyway, but yeah, in the end, he managed to convince me to come work for Apple. And yeah, yeah.

Hsu: He's a hard man to turn down.

Ording: <laughter> I guess so, yeah. So but I'm glad I made that decision to go work for Apple. So.

Hsu: Yeah. <laughs>

Weber: And did MetaCreations know that you had the--

Ording: Yeah, I think they knew that I was talking with Apple, as well. So--

Weber: So they were both trying to--

Ording: They were both trying, yeah. And so-- and in the end like MetaCreations also congratulated me. They said, "Oh, great that you got the Apple thing. It's a cool thing. It's good." So they made me feel also good about the decision. So. So yeah, and then yeah, then the whole process started. Like I moved to the U.S., which was quite exciting, so. And yeah, it was a pretty amazing experience. So.

Hsu: What did you work on first when you got to Apple?

Ording: So yeah, when I joined the HI Group, I started to work on-- so ideas for Mac OS X. Like specifically, I guess, the dock at the bottom of the screen. Because Steve had seen one of the demos that I made where-- that had like the magnification effect that's in the Dock currently--

<overlapping conversation>

Hsu: Oh, the Genie effect?

Ording: No, it's the magnification of the icons.

Hsu: Oh, the icons, okay.

Ording: Yeah, and the demo I had made was not for icons, but it was just for little pictures, like photo images, basically in a small thin strip. And if you roll over it, it would just sort of zoom out and create sort of a fisheye effect.

Hsu: Oh, right! So that whole thing where you can ripple across. Yeah.

Ording: Right, yeah. So I started to work on that basically, but then for the Mac. And the one thing that I didn't realize at that time when I showed that demo to Steve was that at NeXT they had the Dock, but that was a fixed icon size. And you only had like, I don't know, 13 slots or something, and if it was full, it was full. That was it. You couldn't add anymore. So this, I think, that Steve thought that this would be a good solution to the problem, basically, to fit like almost an infinite amount of apps or icons in there, and you're still able to see them at full size, and you can just roll over, and it's a fun effect, as well. So yeah.

Weber: So when Apple saw your photo demo, they thought, "Aha, that could be for the dock."

Ording: I think that's probably what Steve thought. <laughs> If I'm now looking back at it. I'm like, "Oh, okay, I get it!" Because I was kind of naïve at that point, I guess, when I showed it first. And I think that Steve thought, "Oh, this could be a solution to our problem," that they've been trying to solve for a long time. So anyway, so yeah, so I started to work on the dock, and other things for Mac OS X, like some visual design around-- I worked a whole bunch on the-- that would later was called the Aqua User Interface.

Weber: Yeah.

Ording: The glossy buttons, the blue user interface elements. And I worked on other effects, like the Genie effect that everyone probably knows, where windows gets sucked into the dock.

Hsu: Yeah, Steve really like to demo that one.

Ording: Yeah, it was fun to work on, too. And it's definitely fun to demo! So it's--- and we added stuff in like the slow motion effect that people have seen. And the funny thing is it's like it was not meant for demonstration purposes, but it was more for while we're working on it that we could see if it was doing exactly the right shape. That there was not like weird jumps in it, or that we didn't calculate it right, how far along it was. And so it was basically meant just for during development time. But then we end up leaving in the final version that you can also slow it down still. So.

Hsu: How did you come up with that, the Genie effect?

Ording: The Genie effect started when we were thinking about-- so there was these dialog panels that you can get when you print a document, right? It comes down from the title bar. Because that was a new thing back then.

Hsu: Oh, the sheets.

Ording: The sheets, yeah, so that's where it started. Because that concept was like pretty new when-- they already thought of this before I started there. That it would be attached to the window that it applies

to. Right? But we wanted to animate that, instead of just like appearing. We wanted to have an animation. But the problem was like if the window is smaller than the sheet that comes out of it, then how is that going to work? <laughter> So I was thinking about a whole bunch-- and there was some other people on the team as well-- that we were trying to think about how can we animate this in kind of an interesting way that makes sense. So that's how the Genie sort of started. More of an upside-down kind of way, right? We just come out this way. And then expand. And then later on we applied it like this way out of the bottom, so. So that's kind of how that came about. So.

Weber: The NeXT OS, I mean, were they-- I mean, obviously, they wanted a new look, but were they asking you to look closely at it? Or not? Or just sort of clean sheet of paper?

Ording: Yeah, I mean, I've seen it. I guess I saw it then, but I didn't really study it that closely from what I remember. So it was more like just come up with new ideas for this new thing. So.

Hsu: Where did the-- I mean, the design of Aqua being these candy-colored lickable buttons and things, and the-- where did that design come from? Was it motivated by the iMac, the colors of the iMac? Or--

Ording: Yeah, from what I understand it, because other people from the team then were also working on those ideas for the styling individuals, and they-- I guess they were really basing it off like-- were inspiring by the iMac itself that had the sort of more colorful, shiny plastics that created a certain kind of quality, and I think the direction was to kind of try and make-- design the OS so that it would go with the hardware as well. So even the sort of pinstripe pattern that was in the background, that was from the iMac as well. And those kind of things. So yeah, I was definitely-- we even tried to do like all the five colors of the iMac, like red and green and like all that stuff, orange, and it was pretty cool. So we explored all these-- the whole set. And but in the end, I guess it was like more complicated to build it that way and also the problem is like, if you have a red iMac, and if all your buttons are red, red is also-- has a certain association like it can be a negative thing, or it can be for delete or cancel-- or so that didn't work so well. So we just ended up with just the blue, which is really nice. And then later we added the graphite look that is a little bit more subdued and professional. So.

Hsu: Yeah, but what about the stoplight buttons at the top of the window?

Ording: Yeah, that one was a bit of a sort of a, I guess, a struggle to kind of do that, because for so long the Mac always had, Mac OS had the zoom box on the right, and the close box on the left, and like but Steve really wanted to have it all just on one side. And he wanted to, I guess, I'm not sure how it came to be, but he wanted this stoplight thing, the red, orange, green.

Hsu: Oh, he specifically said that he wanted red, orange, bright yellow--

<overlapping conversation>

Ording: He said, yeah, "Like a stoplight." So. We were-- on the one hand, I'm thinking, "But it's not really a stoplight. They don't work like that." But that's something that's very-- everyone knows those colors, right? So in that sense it's a strong concept, I guess, from that way. But the meaning of it, in my mind, doesn't quite connect, but yeah, so that became sort of the iconic color buttons for Mac OS X. So.

Weber: Can you talk a little bit who you were working for? Who were the main people that you were working with, as well?

Ording: The team? Yeah, there was like, gosh, I may be forgetting a bunch of names here, but there was like Tim Lasco [ph?], for example. I'm not sure if you've talked with him. Because he was doing a lot of the visual design in the earlier phase as well. And he worked a lot on iTunes and that kind of stuff, so. It was like-- when I started the group it was a little bigger, and at some point, there was some changes, and people left, and then later on new people got hired again. So yeah, the group has been changing over the past couple of years. So but yeah and there was a mix of people that were doing more the real interaction design, which is not necessarily always the visual design, right? And some people have the combination. And I personally like to do, I guess, more the dynamic stuff and the interactive like lively dynamic animations. That's sort of my bias usually. Although, I do like to do some more static visual design as well. But I like the stuff that moves. <laughter> And so like bouncing icons in the dock, and that kind of stuff. And yeah.

Weber: And who was your manager, though?

Ording: It started out being Cordell Ratzlof. And then later we had Don Lindsey.

Hsu: Oh, Don Lindsey, yeah.

Ording: Kevin Tiene [ph?] for a little while. And then Greg Christie.

Hsu: And was Imran [Chaudri] already in the group when you joined?

Ording: No, he was in the QuickTime Group at that time. So I met him later outside, and then we ended up talking and I saw the stuff he was working on for QuickTime VR and that kind of stuff. And we talked some more, and I'm just like, "Join the HI team," and so he ended up talking with the manager at the time, and, yeah, he got to join the team as well. So. Which was cool. So, and from then on we ended up working closely together like a lot.

Hsu: I think Greg Christie mentioned that at the time there were various-- there were HI people scattered around the company, but then later there was reorganization and everybody got centralized into one group. And that's how Greg Christie ended up joining the group.

Ording: Right, yeah, so I'm trying to remember, because when I started, that was already more centralized, and maybe it was like a few that were still not part of the main group. Because I think in the earlier days they teamed up people closer to the engineering groups, as well. Which is also a great idea, but then later it just got like sort of consolidated into one big group. So yeah, that's-- and Greg Christie was part of that team, too. So.

Hsu: Mm hm, yeah. So when did you first meet Greg?

Ording: About like, well, that second day that I interviewed at Apple is when I talked with him at the end of the day.

Hsu: Oh! Okay, so he was part of the team-- the group that interviewed you.

Ording: Yeah, so they asked him to talk to me, too. So I think at that point he wasn't like officially in that team yet, I think. I don't even know. But I did talk with him, so. Yeah, so.

Hsu: Interesting. So then you said you met Imran in the parking lot at Apple.

Ording: Yeah.

Hsu: So could you tell us that story?

Ording: Oh, we were just like smoking cigarettes on a break. <laughter>

Hsu: So you were both on smoke breaks.

Ording: You just run into people, you know, talking. And you're like, "Oh, hey, what do you do?" First you chat about all this stuff, and then later on you're like, "What do you actually work on?" <laughs> And then so that's sort of what happened. And then we just ended up talking more, and yeah, and then he became-

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Hsu: Interesting.

Ording: Became part of the group as well.

Hsu: Okay. <laughs>

Ording: Designer.

Hsu: Cool. So did you ever feel like-- was there any criticism over the Aqua interface as being too much about eye candy? <laughs>

Ording: Oh, yeah, you get all kinds of feedback. Yeah, yeah. And I think, yeah, of course, especially from what the Mac used to be, which was more subdued, flat gray, and like it was quite a change. But I think at that time Apple wanted to be-- have a big change. This was like the new Apple, I guess, that's what Steve called it. And he wanted it to be different and fresh and new, and maybe some stuff went maybe a little too far, but then later on it got more and more-- especially if you compare with the current Mac OS X, it's way more subdued again. So I think it just went through that phase. And it's the same for the hardware, too, I guess. Right? So those bright color iMacs and stuff, it's not there anymore. Although, I guess, iPhones, you can have cool color cases, and cool color Apple Watches and all that. So but for a long time the bias was towards more aluminum and white and just sort of-- or black. So I guess the OS went through a similar phase, almost.

Hsu: Right.

Weber: And that the "i" in iMac and later on has been described as standing for "internet," as well as "I," like personal. I mean, did that-- was that part of the-- a big part of sort of the design philosophy? The internet or--

Ording: I don't know. I don't remember thinking about that all too much like that.

Hsu: In later versions of OS X, you started to introduce things like brushed metal, and other sort of real world textures. What was sort of the motivation behind that kind of a thing?

Ording: Actually that was a good one for Imran to answer that kind of stuff. And like where-- I don't know, I guess also Steve was into materials. Especially iTunes has always every year changed the texture, slightly different and better. And actually Tim Lasco worked on that, too, and he could probably tell you a little about that, too. Steve was into materials and the quality of stuff. And like so I guess he was pushing for that, so. And it started with iTunes, but then later made its way into other apps as well. And then later on, especially the Dashboard widgets had their own sort of styling and textures and materials, and yeah, it was pretty cool. It was more expressive. And some people liked it; some people didn't. But I think it was kind of nice. It had its own pretty strong identity, and there was something fun about it. And it had definitely something about like a quality that's not just a simple gray computer rectangle. It's something a little bit more to it, so.

Hsu: Yeah. How did the design language of OS X evolve over the years? I mean, you mentioned it got more subdued.

Ording: Yeah, I guess it got more refined. Like the buttons got like a little crisper. Everything got a little more flatter, I guess, but still trying to keep that sort of glossy quality to it. Yeah, and played with the shadows to make it a little-- or some of the shadows got bigger and more diffused. Others more sharp. And I guess at some point, we even got rid of the round corners on the menu bar, that kind of stuff. And just to kind of try and clean it up, and yeah, different elements of the OS went through different stages, I guess. Like the dock, first it was pretty flat, later it was more in perspective, and then it had like a glassy sort of surface, and then but now it's back to being more straight up, and it has this frosted glass kind of background. So yeah, it's just like fashion, almost, I guess. <laughter> So.

Hsu: I mean, did you guys just changing things up just for the sake of changing them up. Like you mentioned fashion, right? Was it that was the reason? Or--

Ording: Well, I think it wasn't just for ch-- well, no, it wasn't just for-- because we were trying to make it better, or to give it a certain kind of new cool look or something, or to match the hardware, or just in general just to kind of give it a certain feel and to make it feel more-- I guess, yeah, give it more like quality, but also refinement. So.

Hsu: Mm hm. Oh, he wasn't there before that. Okay, how about Exposé?

Ording: Yeah. <laughs>

Hsu: How did that come about?

Ording: So I think this was the same year that movie came out "Minority Report."

Hsu: Ah, yeah!

Ording: And it wasn't a conscious thing, like, "Oh, I'm going to make the same thing or whatever," but like, and oh, and it's not even the same-- it's just like, it was definitely inspired by it because I thought there was something super cool in that movie where he's like with these weird gestures he's like navigating these sort of these memories, or the future, basically, right? This sort of video stuff. And he was digging through stuff and trying to find things. And one day I'm just staring at my screen, and I have a bunch of windows and they're overlapping each other. And I'm thinking like, or I was sort of imagining like, "I wish I could just sort of like go behind that window, so I can just see them all. Or part of it, whatever. I wasn't even quite sure what. But I'm like, "Well, let's do this, start really simple. What if I just have two windows, and one is above the other one? What would you do to see them both?" I'm like, "Well, I can just like separate them. That would be easy to do. And then if the windows are too big, if they won't fit in

the screen, I can just like scale them down. So it's still--," and then I'm like, "Oh! well, if it's three windows, then well, it gets a little more complicated, because how are they going to move?" Right? So I thought about it for a while, and I came up with this sort of algorithm, or way to do that, where you can just sort of, it's a whole iterative process where it just like basically gradually shuffles all the windows apart a little bit, until it reaches-- until none of them are overlapping anymore. And then you scale the whole thing down to fit in the screen. But that happens behind the scenes. Because you basically animate straight to where they need to be. So that's basically what like how that came about, I guess. Because I guess everyone had the same issue where you have a whole bunch of windows, and you know it's somewhere in the pile, but you just can't get to it, you can't see it, right? So that was really fun to work on, and then I worked together with John Louch, from Engineering, and he's super good. And he worked on the Dock to get that all to animate, like high frame rates and get it really working really well. And I knew that he could acce-- because of the Genie effect, that was owned sort of by that Dock-- the process that runs the Dock and that has to basically grab a window and morph it, right? Or and manipulate it. So I knew that like John Louch knew how to access the windows on the screen. So I'm kind of like, "Hey! If you can grab these windows, you can grab any window, right?" "Yeah, yeah!" "So, okay, well, let's run this algorithm on these rectangles, basically, and see what happens." So we started to do that, and of course, like his code went like ten times faster than my code. So it was super cool, and it worked super-fast, so it was super exciting! So because of John we could get all this stuff to work in the real system, too. And we could just play with it and like really use it for real. And then we could demo to Steve Jobs and a bunch of other people, and they got all excited, and then, of course, you got all the other ideas. "Oh, yeah, it needs to be just the app windows!" Or, "It needs to be all the windows!" And then yeah, we added this thing where you can hide all of them. So you can push them all off-screen, right? So to show the desktop. And so yeah, so a bunch of stuff got added to it, features and I think it became pretty useful. And it's still-- I see people use it. And meanwhile, it's also been like further developed. There's more other, yeah, I guess, more features and it has changed a little bit, but it's good.

Hsu: Yeah. So how did you develop that, the prototype? Or the mock-up?

Ording: Oh, so I used this program called Director. It used to be Macromedia and it's Adobe [now]. And so that's basically what I used to make basically most of my-- all my demos and prototypes. So that I can animate things, or I can just write little programs that can do those algorithms, and yeah. That was my main tool.

Hsu: So then you collaborated heavily with John Louch to implement the one that actually goes into the OS.

Ording: Right, yeah, yeah. The same way we worked very closely with the Dock for a long time to get all the animations, all the behaviors in, and of course, John knows a lot more about actual system level stuff to make it really work for the real thing, which is apparently also not so easy. <laughs> But yeah, same thing, for Exposé we worked really closely as well to kind of get all the details and all the how you trigger it, and you try to come up with ways, like for a while we had-- this is silly, this like round blue button that we had sitting on the screen that you could drag around anywhere. If you click it, it would just do Exposé.

If you click it again, it goes back. But this button was kind of in the way. It was kind of useful, but also in the way. So you end up putting it all the way in the corner, and then we were like, "Well, if we put it in the corner, we may as well just use the hot corners like you use for your screensaver as well, right?" So that's what ended up being one of those features. You just put your mouse in the corner, and all your windows go, "Psht!" So, yeah, it's kind of fun to explore all these ideas, especially if you can build them into the real system right away and really use it. So that's fun stuff. So.

Hsu: Yeah.

Weber: And how did that-- so you would do in Macromedia, but at some point, you'd sort of hand that over, they implement it in the real thing. And then you're just giving feedback. You can no longer directly control, you're giving what, verbal feedback, or sitting in both going over it? Or--

Ording: Yeah, and sometimes I can read some C code, so I can see-- I can still help thinking about like what the function should do or how it should work. But yeah, then it's implemented into the real system and then it's, yeah, it's not just like a fake demo anymore, it's the real thing. So and then, of course, there's all the help from the other teams, like the Core Graphics. And they're helping with the performance, the graphics performance and that it's like super smooth, and that there's no hiccups and stutters in there. And that it runs at full frame rate as much as possible. And yeah, just get that really like super smooth fast experience, right? So there's-- actually the real important thing, I find, in general, just to make it feel really good, but also if you're busy, and you're trying to get your work done, it should be really quick, and shouldn't be too much latency, and so the animation-- you spend a bunch of time on just working on the timing, that it's not too fast, and not too slow, and so yeah.

Weber: And testing it on users at all, or mostly internal?

Ording: Well, it was internal. So we just use it ourselves and yeah, that's how we work for the most part, so.

Hsu: Oh, were you not using the user testing lab at that point?

Ording: No, we weren't. No. I know back in the day, they used to do that. But for those things, we didn't really do that, so.

Hsu: Was this before the Core Animation framework was available?

Ording: Yeah, that didn't exist at that point.

Hsu: Right. So like all the animations had to be just done by hand.

Ording: Yeah, we had like basically we had the program all the, the animations.

Hsu: Right. Directly in OpenGL or whatever.

Ording: Yeah, I guess it was probably using OpenGL, or I'm not sure. The window server was basically dealing with that part, the Core Graphics side, window server. I forget what it's called. But-- yep.

Hsu: Could you talk a little bit about Dashboard?

Ording: Yeah, well, it's mainly Imran worked on that like a ton. So he would be the one to ask about those things.

Hsu: Oh, right, yeah.

Ording: Yeah, I'm trying to remember if there's anything specific there that I can add, but I'm not sure.

Hsu: Okay.

Ording: I helped out with like a couple little things in there, but the majority was like Imran.

Hsu: Okay. Before we move on to the phone, are there any other important designs in OS X or like applications that you would like to mention or talk about?

Ording: Let's see. Well, this is lots of little smaller parts that are, I don't know, that are interesting, or that weren't really done at that time, and that I think made a difference somehow. In like, for example, the progress bars, like they had the animated pattern in there. And that's something that kind of came from before then in Mac OS 9 or 8 and before, if there was a problem with your Mac, if that progress bar didn't move, that meant probably that you had to like reset, reboot it. And you're like, "This is not good!" So and I remember that feeling where you're like, "This progress bar is not moving. I think-- I don't know. <laughs> I think this machine is stuck." So when we were like doing sort of the Aqua version of this control, I thought, like, "Oh, it'd be kind of fun if there's something animated in there." Actually Tim Lasco also worked on this stuff as well, and I don't quite remember how some of these ideas came to be. But anyway, we had animations and stuff. So I think that's an interesting thing where, even if it sits at sort of the same sort of percentage on the progress bar, you still see there's animations, so, "Oh, the computer's still fine. It just takes a while, but it's fine. The thing is not frozen," right? So.

Hsu: Yeah.

Ording: So those kind of things that add little-- that adds something dynamic that's sort of more fun to look at, but it's also super functional. So that's, yeah, often the things that we were going for. So it's not just to make it look fun or something. It's like there's an actual reason why it's there.

Hsu: Right, especially since in OS X you have multitasking. So it's not-- even if that one app is stuck, the whole system isn't stuck, so you don't have to reboot the machine.

Ording: Right.

Hsu: Yeah.

Ording: So, yeah, and because of that we could do things in a different way.

Hsu: Mm hm, yeah.

Ording: Just trying to think of other examples. Hm.

Hsu: Any major apps that you worked on? Like Sherlock or iChat or Safari?

Ording: I didn't really work on apps that much, but no. Well, I guess-- no. I worked on the System Preferences like how if you click on something, the window sort of morphs through the panels and sort of expands and then crossfades the content. And so I worked more on those kind of things. The transitions and like just the mechanics almost of the UI. And I haven't really done like a whole app or something like that.

Hsu: So just moving on. So Brian Merchant in his recent book, talked about the formation of this group to explore new rich interactions. So that included you, Imran, Greg, Brian Huppi, Duncan Kerr, Mike Culbert, Steve Hotelling, Josh Strickon. So who else was part of the group? How did the group form? And what were you guys exploring at first?

Ording: Yeah, I think that was about right.

Hsu: That's everybody? <laughs>

Ording: Yeah, I think so, yeah. Unless I forgot someone. But I think that was it. It was very small. And yeah, we just started--

Hsu: How did you all get together? I mean, because not everybody was part of HI, right? So there was--

Ording: Yeah, there was people from different teams. And I think, I don't even remember who initiated it, but I definitely know that Duncan Kerr, he was helping to sort of like support the-- give it some structure, basically, the ideas, and he would just sort of help kind of push it a certain direction, I guess. Which was great. So I put the whole creative process, and trying to come up with different ideas for what we could do. And we ended up talking about the multitouch stuff. Because and I don't even know-- I don't even remember anymore how it started, really, but yeah, I definitely remember having a bunch of those meetings where we were brainstorming about what we could do with multitouch. So. And meanwhile they were like developing hardware that we could use to actually build some sort of prototype, something that we could interact with. So yeah.

Hsu: So were you guys exploring multitouch from the very beginning, or was that something that you guys had already formed and then you discovered multitouch?

Ording: Well, for this particular thing, I think it was pretty much right away about multitouch, so yeah, I'm trying to remember.

Hsu: So it's almost-- so you guys essentially convened to explore multitouch?

Ording: Yeah!

Hsu: Huh!

Ording: From what I recall.

Hsu: Okay.

Ording: Yeah.

Hsu: And so what did-- so and this was not like a formal group, right? This was just-- like this was not a formal division in the company, it was just sort of a--

Ording: No, it was just a bunch of people from--

Hsu: Like an interest group.

Ording: Yeah, mm hm.

Hsu: Kind of a thing.

Ording: Yep.

Hsu: And did you guys give yourselves a name? <laughs> Or anything?

Ording: I don't remember that we had a name. <laughter> That was just we had this meeting about multitouch or whatever we called it, right? <laughter>

Hsu: Okay.

Weber: And how often did you meet down there?

Ording: I guess, once a week, or two weeks. I don't remember. And depending on what was going on, more often, but yeah. But the cool things was the ideas were going, the brainstorming, and then they were bringing up the hardware platform, I guess with the multitouch, the touchpads from FingerWorks, and combined with like other software and hardware stuff. And then we could start building an actual-- yeah, something you can interact with. Like, I don't know, you probably heard this story with the projector that we mounted on a thing to project onto the tablet with a piece of paper, and connect it to the Mac. And I was using a Director demo to run the thing. And we could move stuff around on it on the screen. And yeah, that was sort of the very early beginnings of that. So it's pretty exciting, because it was the first time you could move stuff with your finger in such an easy lightweight way. It was not even-- you didn't have to press hard or anything. It was just like magical sort of-- you're touching the light. It just kind of worked. So it was-- yeah, it was just fun. Where you go like, "Ooh, you just-- you can do all kinds of stuff with this." And it felt very direct. And even though it was still sort of not the best prototype, in the sense that you would get-- I mean, you would get like a shadow from your hand, because of the projector. And so it wasn't ideal, but it was enough to kind of get the point across, how you could feel like, "Ooo, yeah, this is something interesting." So.

Weber: And was it the main-- this was the main thing you guys were doing, or was a side project?

Ording: Oh, that was side, because we were still doing like Mac OS X and--

Weber: So it was really just-- yeah.

Ording: Yeah, it was a side project. Yeah.

Weber: To see where it went.

Hsu: Hm.

Ording: Yep.

Hsu: And this was started before you acquired FingerWorks, so you were sort of buying their devices and playing around with them? Or--

Ording: I don't know what the timeline is there. Because all I know is at some point we had this thing, and I didn't even know that-- I heard about the FingerWorks name, I guess, but I wasn't aware of what the whole situation was with that technology and Apple and that. So--

Hsu: Okay. So then the next thing you knew that somebody had built this projector table thing. Or were you involved in that?

Ording: Yeah, well, I didn't help building it, but like Brian Huppi and Greg Christie and like they and they end up putting together this rig, or whatever you call it. So yeah, I saw this happening and I was like, "How do you use that stuff to kind of get the demos going."

Weber: Isn't that the one Greg said was in some top-secret room, particularly?

Hsu: Yeah.

Ording: Yeah, that was actually the old Usability Lab. Unfortunately, it wasn't used very much at that point anymore. But yeah, there was no windows and stuff, and there was just like a key for that room, and that's where we had that setup. And yeah, no one could get in there unless you had the key, of course. So this was a good room for doing that secret project, so, yeah.

Hsu: What was the-- you mentioned being able to-- I mean, this was the first time you could do direct manipulation, right?

Ording: Yeah.

Hsu: So what was the attraction of that? And what did it feel like when you first got it to work?

Ording: Well, I guess it was just a magical-- it felt magic that you see this light projection of like-- it was something very simple, just like a picture of like-- I don't even know what it was, but you can touch it and you can drag it around, and that felt very magical. And then, of course, we added behaviors to it, so you could flick it, then it would just like, "pshew" go. Where it had sort of an elastic kind of feel to it. So it would bounce against the edge of the screen, and sort of like a jelly kind of thing. And it was just like fun to play with! And you feel very connected with it, even though it's just light, and yeah, that was the magic.
<laughs>

Weber: And did pinching and zooming come in immediately, or did that follow later?

Ording: It came pretty early on, because when we started about what you can do with multitouch, it's like pinch to zoom, like on a map especially, or zooming into a picture. It came up pretty quickly, I think so. And same, like we built like a demo, too, where you can zoom into a map and rotate and all that stuff. And it also became super easy, like stuff that usually you would have to select five different tools in a software program to like zoom and rotate, and like all that stuff, and now you could just do it with your finger just like that. It was like no effort! <laughs> And so it was pretty cool.

Hsu: What other sorts of interactions or gestures did you come up with during that time?

Ording: Well, I'm trying to remember. I mean, we tried to just also, we had these demos that were just sort of fun to play with. But they weren't super functional. So we tried to think of some other stuff that was more usable. Well, I guess the map zooming was usable. But how to select from a list, or how to scroll through a webpage or that kind of stuff. So we worked on more of those demos. So I built one that was like a web browser. So I basically took a large image, an actual snapshot of the website, basically, and I just moved that image around on the screen, but with momentum, so you could just like fling it, and it would just go "chu." And especially on that, yeah, I guess it was on that piece of paper with the projection, it just felt very, yeah, fluid. And later on we got an actual screen, and like a real touchscreen, and then it felt even more magical, I guess. Because you wouldn't get the shadows and stuff like that, right, so.

Hsu: Oh, wait. When did the touchscreen come in? How long before you got that?

Ording: Yeah, I'm trying to remember when that happened. That was-- yeah, that was later, of course. And I'm not sure-- that must have been, gosh--

Hsu: Huh.

Ording: I mean, probably a couple months in-between or so before they were able to build an actual screen that had multitouch integrated. So.

Weber: And I mean, the scrolling, of course, one finger works. The true multitouch, pinching and zooming is it's necessary for-- but I mean, where did-- it just seems some of the idea is more about a new way to use a single touch. Some is genuinely using multitouch.

Ording: Right, yeah, so most of the demos were actual single-touch. <laughs> But and some of them had multitouch on it with the zooming. And we tried-- I'm trying to remember if we were-- we were trying to do all this stuff with like with multiple fingers if you tap, or drag. But I don't remember the specifics of it right now. But yeah, a lot of stuff ended up being single finger, which is fine.

Weber: Do you remember any major kind of gestures you were thinking of that didn't make it into the-- that were too complicated or too-- what were some of the things you explored with multitouch that got dropped later?

Ording: Hm. I can't remember an example right now. Yeah, that's, yeah.

Hsu: Did you adapt the gesture language that FingerWorks had already been using, or did you come up with completely new things?

Ording: I personally didn't know much about FingerWorks at all. So I-- later on, of course, I heard also from Wayne Westerman, and but yeah, I guess I wasn't aware of what they were using really, so.

Weber: And what did you envision this all being used for initially?

Ording: Well, at that point, we were-- the assignment basically was to work on this sort of iPad kind of size screen. And we didn't call it iPad then. It was just the touchscreen. And basically Steve wanted us to, I guess, I heard this from Greg Christie, Steve said, "I want a sheet of glass that I can read my email on," that was sort of the big assignment. So there was this slab of glass, and your email, but, "How do you read it? How do you type on this thing? Or how is that going to work?" So we started looking through that, too. How do you have an onscreen keyboard, and then later, "Is this going to be part of Mac OS X somehow?" Or-- because there was no iOS. So all we knew was Mac OS X, right? So we were trying to make it work with Mac OS X, but then there's a pointer, and there's the tiny close boxes, and all this other stuff. And it was not easy to make that work. Or I feel like we didn't succeed, and therefore, it also did not become-- we just didn't know what to do with it. Combined that there was other, I guess, technical things that were hard, like the thermals and battery life and all that. Or just the cost of the whole thing. So for a while, it was sort of undefined what this was going to be. Even though everyone tried really hard, but there wasn't an actual product, so--

Weber: But was there ever any thought of a Mac, a laptop with a touchscreen in addition? Or that was ruled out pretty early on?

Ording: Yeah, it was all about this sort of more tablet kind of thing. From what I know. So yeah, and then, yeah, we did a whole bunch of explorations with like onscreen keyboard stuff, and touch typing. It's tricky.

Weber: Did you look at all to stylus-based interfaces from the Simon or the Palm, or--

Ording: No, I mean, I didn't--

Weber: Symbian, or--

Ording: Also, we were told by Steve actually, that he didn't want it to work with a stylus.

Weber: Right. No, but I'm saying that the other touch interfaces that happened to use a stylus. Were you studying those? Or kind of more blank sheet of paper?

Ording: I guess at some point, I saw the Newton, but I hadn't really like played with it a lot. Just a little bit. But yeah, yeah, so and other than that there was not a whole lot of other stuff out there that I can remember that you could even play with really that was of any interest for to me. So yeah, so we just-- it was kind of nice, though, in a way, I find, because it was more of an open-- a new open field where you can just-- you have to come up with the new ideas for how stuff is going to work now. So I thought that was super exciting. It's also a little hard, because there's really nothing there yet. But also I think that's kind of an exciting thing when that happens. When there's a new sort of technology, or a new sort of thing that you have to figure out, "What are the new rules, or what is the new way to do stuff?" So you have to develop sort of a new kind of language of how to operate it and how to use it.

Hsu: So this was always more of like just like an exploratory project that was never-- it was never really gotten to the stage of actually being a product from--

Ording: Well, yeah they tried to push it towards becoming a product, but that didn't go anywhere. And I don't know the exact reasons why. But I mean, I just mentioned a couple of them, but I don't know who decided that at some point, "You know what? Let's not do this right now."

Hsu: Right.

Ording: Even though, there was something super cool about this multitouch. So and therefore, I think, at some point I remember getting the-- I was sitting in that lab working on stuff and I remember getting a phone call from Steve, and he's-- Steve says like, "Oh, we're going to do this phone. We're going to do a phone." And like, "Wow, oh!" Because there was already some rumors that Apple would do a phone, and but there's always rumors I guess. But then Steve said this thing, and like, "Yeah, and it's not going to

have any buttons. It's just a screen, it's just with touch. There's no keyboard. Like a keypad, right?" And so I'm, "Oh!" So yeah, he basically asked if we could work on making-- or exploring demos or ways to like, "How do you scroll through your list of contacts? And how can you call someone?" and that kind of stuff. So we just used-- because we had that larger sized tablet basically with a cable connected to the computer, but so we just used a corner, just masked it off basically. And we just used the corner that was the size of an iPhone, so you could just sort of hold onto the corner to pretend like you were holding a phone, sort of. And yeah, that's how we started with some of these very basic demos. Like you just-- a list of names, and you scroll and you pick one and it slides over, and you can just pretend like you called someone. So. <laughter> Pretty exciting.

Hsu: Before we get too far into the phone, I want to-- there's a couple more questions I wanted to finish up with. So the-- let's see-- can you talk about your primary design influences? Like what were you-- what was influencing you in the kinds of interactions that you would design, or the kind of interfaces you would design?

Ording: Hm, that's a good question, but I'm not sure actually. I guess like I said, still from like the school time, when like other people also-- I guess we're all sort of inspiring each other with making sort of dynamic demos. And of course, not everyone was doing it, but like a bunch of people were into that. And that was sort of, I don't know, I feel like that was sort of the-- you always want to make something that's kind of fun, or kind of alive somehow, and that you can share with other people that they also want to play with it or try it out. And so I think that's how it started basically, the way I create certain things. And I always just sort of kept doing that, I guess.

Hsu: Hm. Brian Merchant says that you were influenced by typesetting and video games?

Ording: Oh, yeah, so you see, it's not like then I'm going to go, "Oh, let's study all this stuff, or let's like closely analyze everything." But if you see video games and that kind of-- and games, they often spend a lot of time to tune it in such a way that it's fun to play the game, right? So the animations are nice, or it's like the way the controllers work, or the way you can control your little character or your little spaceship, whatever it is. It's like usually they make it so that there's something cool about it, or something feels good, and that's why you want to keep playing. So I always wonder why if you make a word processor or something, why does it have to be so super boring all of a sudden? <laughter> It's like it's something you have to use the whole day, and it's like why it can be much more fun or intuitive and it doesn't have to be so static. And so that's why whenever I work on something, I try to add something to it that makes it feel more alive and not boring. But I don't want to-- it's also hard to not overdo it. Because it shouldn't become like a crazy party when you're just trying to type your document. Right? So it's finding the right balance between the functionality and also the playfulness. So, yeah.

Hsu: Do you remember Steve's reaction when he first saw the projector table rig?

Ording: I don't really remember. I mean, I remember that he looked at stuff, and there was a bunch of other people in the room, too, I think then. And I just don't really remember it. I guess, I mean, I remember that there was excitement, but also a slight skepticism maybe about certain things. Or maybe the things that I find fun, if you can drag around this jelly looking picture, then I thought that was fun, but he was like, "Yeah, what are you going to do with that?" Well, it's like, so he thinks more like, I guess, practical, or, "How can I make a product out of this?" And but there was also, I think, enough stuff in there in the demos that we had to show that he did see the point of. And so but yeah, I don't remember the specifics of that meeting. So. Hm.

Hsu: Hm. Could you describe what it's like to be in meetings with Steve Jobs? Was he-- does he like to micromanage interface decisions?

Ording: Well, yeah, he was like-- he wanted to see everything. He wanted to know all the little details, even the little preferences panel, or just like, "What does this checkbox say? And what does this one say?" And he was very particular about all the details. And ideally, he didn't want to have any settings at all, but if you had to have them, they had to be well-thought out, and they had to be-- the wording had to be good. He would spend sometimes minutes talking about the wording. "How will we phrase this?" And like, wow, there's so much other stuff to do, but he would spend time on those things. And I think it was good, because it prevented having preferences panel with 10,000 settings in it that no one knows where they even find them. And so he was really trying to make it-- simplify it, I guess. And get to the point. And only add preferences or settings if they're really needed. So.

Hsu: How would he direct you guys?

Ording: Well, there's like there's times where he came in, walked in the room with-- he has an idea, he starts right, "Oh, I have this idea, let's da-da-da. I want this, I want that. You guys go build something. Or kind of try and figure this out." Or there were existing things that we were working on and we would just go through the list of stuff that we had to review with him, and we'd just go, "Yeah, what about this? We have designs here, da-da-da. These examples, and then which direction do you want to go?" And there were also enough times that none of it was good, so we had to start from scratch. So yeah, that's often how we worked. So it's pretty, I guess structured, and yeah, very focused on all these different elements. So. And yeah, very, very particular about the visuals and the precision of the icons or the styling or the-- yeah, so we spent a lot of time on that. So sometimes it was pretty hard if he-- if stuff wasn't what he wanted, and you couldn't quite figure out what he did want. So you just have to make ten things or more, or a hundred things, and then hopefully he could pick something. Or like sort of that you get some idea of like this direction, that direction? And there was a mix-- sometimes he was very clear about exactly what he wanted, and other times he wasn't sure, and he-- or at least he knew what he didn't want. So which can be helpful, too. So. But then, yeah, the funny thing is there's been times where we had the meeting with Steve, and he-- afterwards we would talk with the rest of the team to discuss what came out of the meeting, and we-- I remember sometimes the meeting would be-- I would say like, "Well, the meeting went great, but we have to basically start all over now!" <laughter> So the thing was, the meeting went great, because a) he didn't blow up. He didn't go like all super mad at us. And also we got some direction,

because this is not it! So <laughter>, so that was kind of what he-- anyway. And of course, there was also actually good meetings where he was like super happy with the designs and he-- because you hear a lot of stories, I think, if people talk about Steve, that he can be super negative, and there's definitely times where that happened, very critical and negative. But also there've been many times where he just loved it, and just thought it was amazing, and he was like, "This is great!" And lots of enthusiasm. And he wants some-- just keep it going, and do more stuff. And then it's just super fun. So but yeah, there was sometimes also the hard part that you didn't know, depending on his mood or on how good or bad our designs were, like what would happen. So it was always pretty intense and a little bit scary sometimes, too, to go to those meetings. Especially, also the frequency. Because usually every two weeks, and they would last about two hours or so. And for a while, we had them every week, and it used to be on Mondays, so the whole weekend, you're kind of like, "Oh, my demo's not ready! And I don't want to get yelled at on Monday," so you'd just work the whole weekend to get the stuff better. So.

Hsu: Wow.

Ording: So yeah, definitely pretty intense. But--

Weber: What time of day on Monday?

Ording: It would usually be just after, like at one o'clock or something, just after lunchtime. That basically also meant that you barely got to have lunch, because you're still scrambling to get your demos ready. <laughter> Anyway, but it was all worth it. <laughter>

Hsu: So then, okay, so then Steve basically calls you and tells you that you're going to work on a phone. So when did that happen? Like what year was that?

Ording: I think this was in December of 2004.

Hsu: Okay.

Ording: That's when-- Yeah, he must have been, of course, talking with other people higher up that make this decision that they were going to go for. And so I'm like, "Wow, this is exciting!" Because I thought it was exciting for-- and I didn't even really care too much that it was a phone, I guess, but I liked the form factor, the size. It was an interesting challenge to kind of make stuff work on this small screen. And of course, if it's a phone, it means it's something that you will have with you all the time, so it's something you use a lot. But just from the design-- or an interaction design perspective, it's an interesting challenge to just make it work, and do something fun with it, too. So it's--

Hsu: Were you disappointed that you weren't working on the larger tablet thing? Or were you more excited now that there was a direction for a product?

Ording: Yeah, I don't remember feeling disappointed. I thought, "Oh, cool! Now we're going to do this other thing. And it's--," I thought that was great. So yeah.

Hsu: So let's see. At what point-- so you had by this point you already had a bunch of designs. So you had a bunch of demos. Did you have the rubber band effect already done at that point before the--

Ording: Oh, no that came later. That was while I was working on the scrolling list for the phone. And I'm trying to remember if that was—because at some point we had an actual screen that was the size of a phone with a big cable on it. But that may-- that may have been a little bit later. I think that probably-- Yeah, I don't remember what came first. Anyway, but at some point, yeah, I remember working on this demo where you scroll through the list and I had lots of times where because I was constantly changing stuff in my code, like, I thought I was running the code, but then it wouldn't scroll and I'm like, "Oh, I guess I'm not running the code yet. Like, wait." But then it was running. <laughs> But I'm like, "Oh, wait, I'm scrolling in the wrong direction because it's at the top of the list and it's not going to go any further," so I would-- It just wouldn't move because it was at the top. So and then I started to think, "Oh, maybe I need to add some white space or something that you can see that it's at the top, right." But then still, if you try to move it, and nothing will happen, it feels sort of weird as if the program is just stuck or something. And so that's when I started to think about what can we do to make it feel still alive somehow, that it has some kind of give to it or-- So I tried a couple of different things, I guess. And, you know, one of them was, like, adding this sort of this, yeah, thing where it moves but only at like half the rate of your-- that your finger is moving, just to get the feeling of, like, of some kind of resistance and-- <laughs> And then if you let go, it would just spring back to the top of the list and-- And then from there, like, if you were to scroll at higher speeds and it reaches the end, and it bounces back a little bit and all that. So all the behaviors that go with it, basically to make it feel right. So it took a little while, but-- <laughs> but it was fun to work on, so.

Hsu: <laughs>

Bas Ording: And I remember, yeah, showing that to Steve and he got all super excited about it, so that was cool, so.

<laughter>

Hsu: So it was, like, scrolling a list in the add-- in the contacts, it was the very first thing that you guys were working on?

Bas Ording: For the phone, yes.

Hsu: Yeah.

Bas Ording: Yeah. Yeah, that was I guess the main thing of your phone, it was like, at that point, yeah, you scroll through to find a name and you call them. That's it, so.

<laughter>

Hsu: And you had already had inertial scrolling already from the previous tablet.

Bas Ording: Yeah, we had it on the tablet project too, so, yeah. So like in this, yeah, in the particular case it was like that picture of the website where you could just scroll through--

Hsu: Right, yeah, yeah.

Bas Ording: And then you'd flick it and then it would just-- But that one didn't have that rubber banding at all. That was just, it would just, like, have a hard stop at the end, so.

Hsu: Oh.

Bas Ording: Yeah.

Hsu: Let's see. Are you able to talk about slide to unlock? Or is that something--?

Bas Ording: Gosh. I don't know. Let's not do that.

Hsu: Okay.

Bas Ording: I mean, there's been so much--

Hsu: Yeah, that's one of those--

Bas Ording: --patent stuff in the lawsuits--

Hsu: That stuff, yeah.

Bas Ording: And things. It's just like, oh, no. <laughs>

Hsu: Right.

Bas Ording: And it's unfortunate because it's, you know. I mean, it's an interesting feature. Or it's like well, it was sort of a necessary feature at the time to make it so that you can't accidentally unlock your phone when it's in your pocket or when you just pick it up or whatever. And that's basically the solution we had at the time and I think it was probably a good one. And but now you see that there's other solutions. There is fingerprint stuff or and just announced today was the face recognition and so, yeah, you won't need that particular gesture anymore or that element for unlocking the phone, so now there's other ways to do it. <laughs>

Hsu: How much did Dashboard influence the design of the apps?

Bas Ording: Oh, like a lot, so. But basically, well, again, you should talk with Imran and Greg that I mentioned.

Hsu: Right, yeah.

Bas Ording: Like, so, yeah, a lot of the styling and our just idea of these widgets basically were, like, say the weather widget that we had in Dashboard, and like, that's like the phone was sort of almost the perfect shape for it. Like, you fit like a nice like one, like a weather widget right there and it, so it had-- it didn't feel like a computer window or anything like that because of the way it was styled and so that was definitely the basis for a lot of the visual design. And then the same for the way it would interact with things. Yeah, you wouldn't have the standard, like, Mac OS X controls <laughs> in one of those things, because that didn't go with the whole feel of it, right. So you had to rethink how you-- how you would interact with it, so.

Weber: And how-- how much were you thinking of browsing as an important feature at that point?

Bas Ording: Like the web browser you mean, or--? Well, I think, well, at that time we didn't realize how big of a deal it was going to be. But it's definitely-- I think the big thing was that you were, you could render a website the way it actually looked because at that time other phones would to have their sort of web experience, but it was like a different version of the website and it was-- it was just not very good. And so this is the first time we were actually trying to make it work, even on this tiny screen. And you could just, like, zoom in and like later on, that double tap feature was added that you could just zoom perfectly into a piece of content, right, like a column or. But, yeah, that was the big thing, to have the whole web page was, like, visible right there on that little screen, so.

Hsu: And was the Home screen inspired by Exposé on the Mac?

Bas Ording: Yeah. Well, yeah, because for a while, again, ask Imran, too, but the Home button in his demos was called Exposé. <laughs>

Hsu: Oh.

Bas Ording: And it would be almost as if you got an-- like all your apps would be visible somehow, but then sort of miniaturized to, like, their little app icons, little chiclets in the-- So it was sort of an Exposé thing for a little while or some derivative thereof, so. And then later, yeah, we called it the Home button.

Hsu: And how did the notion of the Springboard where, I mean, the base of the Home screen being the place where you launch all the apps, come from?

Bas Ording: I guess that's probably again Imran.

Hsu: OK. <laughs>

Bas Ording: I suppose if you asked how he really came up with that. <laughs>

Weber: I mean, it's not that different than the desktop.

Bas Ording: No, but just, like, the way that it's laid out or something or, yeah.

Weber: But I mean, the idea of having a kind of Finder view before you launch.

Bas Ording: True, I guess. Yeah, I don't know, it has, it's--

Weber: But you weren't consciously thinking in those terms.

Bas Ording: No.

Weber: So, okay.

Hsu: And the decision to do only a single Home button, I mean, Greg Christie has talked about that and not having Back. Were you involved in that?

Bas Ording: Not really. A little bit, but not really, so. I don't remember some of the specifics there, so.

Hsu: Okay. Could you talk about how well that the whole team worked together on the project? So, let's see, Greg was your manager. The other people on the team included Imran, Steve LeMay, Marcel van Os--

Bas Ording: Yeah.

Hsu: Freddy Anzures and Patrick Coffman was the Project Manager?

Bas Ording: Yeah. And there were some more people.

Hsu: Yeah--

Bas Ording: Well, and also the team gradually started to grow, anyway.

Hsu: Growing.

Bas Ording: So it's there's times when it's a little, I forget exactly who was there at what point, but.
<laughs>

Hsu: Right.

Bas Ording: But, yeah, we were-- we were a pretty small team, which was cool, and I think we worked pretty closely together. In general, people had sort of their own sort of focus on specific parts of it but we also worked together a lot in brainstorming and, like, reviews, design reviews and or sometimes people would just collaborate on things and so it was a bit of a mix, but definitely, usually people owned, like, a certain part, so which makes it, like, I guess easier to focus on stuff, <laughs> you know.

Hsu: Yeah.

Bas Ording: But yeah, we would always review everyone's ideas and stuff, so. I mean, we'd talk with Scott Forstall and, and of course Steve. <laughs> Steve Jobs, yeah.

Hsu: What part did you own?

Bas Ording: Well, depending on the stages of the project, but like, on the, yeah, for some of these elements like the scrolling behaviors, I worked on the keyboard quite a bit too, with some of the-- the visual design and some of the behaviors of, I don't know, the way that the key pops up and how you can select your accents on the character and some of those kind of things. And I mean, I didn't, again, work on it all by myself, <laughs> but, like, together with the others, too, but I've-- there's definitely things that we would focus on, so. What else? Transitions between if you launch an app or if you go back to an app or <laughs> those kind of things. Or if you-- Well, that was a little bit later on, like on an iPad the way if you rotate the screen, like oh actually on the iPhone it's the same thing, how the apps sort of morph from portrait to landscape mode and it doesn't just like snap, it just, it actually animates and, like, it morphs. So I worked on a bunch of those things too and yeah, so mostly, like, some of the dynamic things, the animations or transitions, so.

Weber: How about text selection?

Bas Ording: Oh, yeah, text selection, yeah. So that came after we did on the keyboard and then later on we knew we needed to have a copy-paste somehow, and if you want copy-paste, you need to be able to select something. So, yeah, again there, like, a bunch of different explorations. There were a couple of other people also, you know, coming up with ideas there. And but, yeah, we ended up with the little some people called it the lollipops. <laughs> It's the, like, stick with a circle on it and you can just-- even though it's tiny, you can still just drag it around and I guess there's like a large, invisible hit region, right? So, yeah, that became the way to do text selection and copy and paste as well. Because as soon as you have something selected, then we added that thing that points right at it instead of having some kind of menu item that you have to activate. This is right there in line, so. And that's, like I said earlier, that was kind, so kind of the cool thing that we were-- that we could come up with, where we had to come up with new ways of doing stuff that are different from how it was done, like, before and on the Mac or PC and specifically for touch and it had to be on such a small screen, so how-- Text selection, especially, has all this precision that you need and, like, how are you going to do that with your thumb and it's like-- <laughs> But it's totally possible, so I thought that was really fun and a super interesting challenge. Like, the same with the address book. On the side, there's a little alphabet strip. It's tiny little letters.

Hsu: Yeah.

Bas Ording: But still, you can-- you can pretty much, like, select the letter you want, so it's-- I think that it's just super cool and that it all of a sudden turns out to work, <laughs> you know? And so and you have to try a bunch of different things, but it's, so. We have to sort of see in your head that maybe this could work and then you just have to go try and-- Or you discover new things that you didn't even realize could work, so.

Hsu: Text selection was-- that was not in the original iPhone, correct?

Bas Ording: No.

Hsu: Yeah, no.

Bas Ording: No, the first one didn't have that, so.

Hsu: Okay.

Bas Ording: Yeah.

Weber: Well, there was still insertion. You needed to be able to choose where you were typing, right?

Bas Ording: Yeah, you could move the cursor around, I think. I'm pretty sure you could move the cursor.

Hsu: Just between text fields, right? Yeah.

Bas Ording: Yeah. If you mistype one letter, you can just go back and change just that one letter, right?

Weber: Right.

Bas Ording: But you couldn't select anything, so.

Weber: But you could change the insertion point if you're writing an email or something, yeah.

Bas Ording: Yeah. You could move the insertion--

Weber: Right.

Bas Ording: You could tap on it or drag it. I'm not sure if at that point we already had that, that little loop magnifier thing. It <inaudible>.

Weber: Because depending-- Yeah.

Bas Ording: So I don't remember. <laughs>

Hsu: Greg Christie said that in January of 2015, Steve gave you guys an ultimatum to try to tell a more coherent story and--

Weber: 2005.

Hsu: Oh, sorry, 2005. <laughs> Why'd I say 2015? Yes, it's 2005. And that you had two weeks to-- you got two weeks to do this, to get this demo up. So, so what did you already have and why wasn't it adequate and what did you do to bust your ass <laughs> to get that done?

Bas Ording: Well, yeah. Yeah, so we worked with the whole team to kind of pull together some kind of coherent story there with all of that, because we had little elements of yeah, yeah, this is how you could scroll through contacts lists or this is what the, I don't know, the music player could maybe look like. But there was no, I guess we probably didn't have that idea of there's some kind of Home screen or, like, so all those basic things like how do you go to an app and how, what kind of different things did we have for mail and internet and all this,--

Hsu: You just inter-- <inaudible>

Bas Ording: That wasn't quite a solid story. Like, of course, you know, we sort of had an idea if we work hard enough, we will figure something out but, but there was not a clear-- clear story there. So we worked really hard to make like one big demo that's-- I see which one was the-- Yeah. Because later on we created another much richer demo that had much more detail in it. But earlier on, yeah, we had to sort of prove to Steve that we could have-- figure out the whole thing <laughs> instead of a couple of little pieces, loose pieces, so, you know.

Hsu: Well--

Bas Ording: So yeah, he basically said that <laughs> he would maybe give it to another team, so we were like, hmm. <laughs>

Hsu: <laughs>

Bas Ording: Good thing we got it to him, because I think it's-- <laughs>

Hsu: What were the elements of the demo that you completed that made him happy?

Bas Ording: Well, I guess, like the what you mentioned earlier, the reference to the Dashboard widgets and stuff. So I think that was a big one that the whole styling and just to have a better story about, like, what are the apps like and to tie them together, so.

Hsu: Oh, okay. So what all the apps-- what all the apps on the phone are going to be.

Bas Ording: Well, I'm not sure. I'm just trying to remember from that specific demo what was in there. But I guess we had-- there was enough to make it feel like, oh yeah, this can be-- now you can imagine all the other stuff on it too, so, <laughs> you know, so.

Weber: And you had the Home screen by then.

Bas Ording: I don't remember at that time what was-- if there was a Home button already or not yet, but.

Weber: No, but the idea of--

Bas Ording: Like a Home screen.

Weber: A screen with icons.

Bas Ording: I think so.

Weber: Okay.

Bas Ording: I think that it's all-- yeah. I don't remember exactly <laughs> at that specific time.

Hsu: And then there was the bigger demo for-- that was given to-- that was, like, several months later?

Bas Ording: Yeah. That was in May. That's when the demo was. And the big demo just basically meant that well, it was like a demo for the presentation at the Top 100 meeting where I guess basically all the responsible people from all the different teams across Apple were, like, coming together to, like, talk about what the direction was and what everyone's doing. And so that's where Steve wanted to show that demo. So we worked really hard to make something that looked like the real-- what the real thing should be. <laughs> So, so you could scroll through it, listen to music and play music and every song would work and you could-- we could play, like, touch all these things. And you can back home, you could get a phone call and then you could go check out the weather and you could go see the internet and all that stuff was, like, a part of that. So, so that was a lot of work to kind of make it actually mostly interactive, or enough that you would think it's all interactive just to tell the whole story. And if people go, "Oh, wow. Yeah, this is--" You've already seen what it's going to be, basically, even though not all the details were figured out, but, but yeah, that was-- that was a bunch of hard work to pull that off, so.

Weber: And how much of a priority was putting the iPod into the iPhone, iPod-like features?

Bas Ording: Well, I guess--

Hsu: I was going to get to that later.

Weber: Oh, yeah.

Hsu: <inaudible> later, but--

Weber: Yeah. No, no.

Hsu: How much of the eventual, like, Steve keynote demo was present in that Top 100 demo? Like how much would it--?

Bas Ording: Well, I mean, what Steve showed at MacWorld, that was of course the real thing.

Hsu: Right.

Bas Ording: So it's way more-- stuff is finished and done, but that model--

Hsu: Right. So it was engineered, but--

Bas Ording: But then he--

Hsu: But the prototype of the interface, was that close?

Bas Ording: Well, a lot of it was pretty close. If you would see it now, you'd be like, "Oh, yeah. That basically looks like an iPhone, yeah." <laughs> Yeah. It was a little bit of smoke and mirrors in certain places.

Hsu: Right.

Bas Ording: Where you could only tap on certain things. There was just one sequence that would work. But some of them were more interactive, so you could, like, like with the music one you could scroll through the whole list and you could pick any song and it would play and, like, all that stuff. So and you

could change the volume and so that was all working, so. But I guess the keyboard was probably not working then or, like, <laughs> you know, but, so.

Hsu: So let's see. All the various apps. Were you-- Who worked on the design of Safari including the zoom in Safari?

Bas Ording: Well, I worked on an early demo for that too where it just-- I'm trying to remember. It was a pretty basic one where it would start out with showing the scaled down version of the web page, it would fit on your screen and you could tap on like an input field somewhere to type your password or whatever. So you'd tap it and it would zoom into it and then you would get a keyboard. And you'd just tap and it would just fill in a word. <laughs> And then, but just to show that okay, this would be with the pinch zoom and you could do this and if you'd tap it would just zoom in. And but that was sort of, the, just the basic idea of it and that didn't have, that particular demo didn't have too much other detail in there yet, but. But yeah, I guess the key thing was that you could see the whole-- the entire website, so.

Hsu: And then the phone app, including Visual Voicemail, did you work on that?

Bas Ording: Oh. Yeah. I mean, we've all, like, helped with the brainstorms and all that kind of stuff, but, like, there's other people like Freddy Anzures was working on that and it was some other people, too. So it's, yeah, I didn't work on that specifically, so.

Hsu: So what other apps were you primarily responsible for designing?

Bas Ording: Well, I didn't-- I feel like I didn't do any specific apps, and so it's just like elements of it. Like some of the interaction and some of the behaviors. Like, I don't know, like in Photos, like, there's, like, some of the pinch zoom behaviors, but also if you swiped at it-- Say you zoom into a picture and you scroll to the side, the first time it will bounce, but if you do it again, then it will go the next image on your list, right. So, so there's like subtle little behaviors in there that I either helped out with, like trying to figure out or define how that would feel. So, like, you don't accidentally go to the next picture or you just-- you were just zoomed in and you happen to reach the border. Just trying to solve those kind of things.

Hsu: Right.

Bas Ording: So, yeah, so I feel like I haven't really worked on just like a specific app or something. <laughs>

Hsu: Right.

Bas Ording: Just details or certain behaviors that apply to many things like this, so.

Hsu: Right. So it's like similar to what on the Mac, you were basically overall dealing with--

Bas Ording: Yeah.

Hsu: Sort of specific interactions on-- in multiple apps or across the system.

Bas Ording: Yeah.

Hsu: And not specifically owning any particular app.

Bas Ording: Yeah and then maybe, yeah, I guess, yeah, in general you could say that, mm-hmm.

Hsu: Hmm, okay. How did the notion of-- the way that a lot of early iOS, iPhone apps worked where you would select something from a list and it would dive down into another screen and then maybe you could have multiple lists and you would just keep diving down, where did that come from?

Bas Ording: I guess the first time we needed that for the iPhone was with the music player where you would just drill down like artist, album and then like a song, a list of songs and that kind of stuff. Or even in the phone app, I guess you could do the same. You have the list of names, you pick one and it slides over to the list of the phone numbers for that person, right, so. Or it could be a group <laughs> inside of it, so, yeah.

Hsu: How did that idea come about to do it that way?

Bas Ording: I don't know.

<laughter>

Bas Ording: I don't remember.

Hsu: All right. Let's see.

Bas Ording: I guess the iPod used to do the slide over, too, so.

Hsu: Oh, yeah. I guess that's true, yeah. <laughs>

Bas Ording: It's similar to that, so. <laughs>

Hsu: Okay. So at what point were you asked to work on the P1 iPod phone design? Because, you know, everything you had been doing was on the touch screen version of the phone.

Bas Ording: Yeah.

Hsu: So now-- but then now, you know, there was this iPod phone also going on that--

Bas Ording: Right.

Hsu: At what point did you find out about that and then were assigned to work on that?

Bas Ording: You know, this is, like, I don't remember the date, but it was like probably a couple of months after that big demo that I was telling you--

Hsu: The big main one?

Bas Ording: So--

Hsu: Yeah.

Bas Ording: I think that because Steve called a big meeting with a bunch of people where you want to talk about this because he thought that the P2 or the iPhone, the touchscreen iPhone basically, that there were too many uncertainties. Like it's a research project. He's like, this could take years, we don't know when this is going to be done. And it's like, let's do something that we know how to-- that we can do. And that's basically sort of what he said, I guess. And we're going to do this, like, iPod-based phone and it's, like, based on the Nano, a small thing. And so that's the direction where we're going for a while, so and put the touchscreen phone on hold, so. So, yeah, so we started to explore how with a click wheel, how are you going to make a phone call or how are you going to type a text message to someone or-- <laughs> So pretty tricky stuff, but we got pretty far with it, which is cool, but-- <laughs>

Hsu: So most of the team stopped working on the touchscreen version and just moved over to the iPod version during that period?

Bas Ording: Well, we worked with a-- Like me and Imran and I'm trying to remember, with the small-- a couple of people on it and--

Hsu: So not everybody.

Bas Ording: Not everybody because I think still-- I don't remember if the other project was still going and but there was also other, like, Mac OS X stuff as well, right.

Hsu: Oh, right.

Bas Ording: So there was plenty of work to be done regardless. So but yeah, we wanted to try and do stuff with the click wheel, so. Which is also kind of fun. <laughs>

Hsu: Yeah. So how-- You came up with the predictive typing for the scroll wheel initially to--?

Bas Ording: Oh, yeah. Well, that was a thing we-- Because it takes so much effort to choose all the letters from the alphabet.

Hsu: Yeah. <laughs>

Bas Ording: So I thought, like, well, if you choose the letter "H" or something, then maybe above all the little alphabet letters we show the word that could be the most likely one that you type, so it's just like "hello," for example. And then, but you can just select that word and then you can start typing the next word, but then it could already, like, have the most likely word again showing before you've even typed the next letter, it could make a best guess. Like, if you've typed other stuff in the past, like, so if you say, "Hello, how are you?" then maybe the word "how" is going to show in that bar on the top there so you don't have to type anything. So you can just, it's already pre-selected so if you just press the middle button, it says, "Hello, how--" and then "are you," is like likely words to follow, so it goes really, really quick that way, so. And that demo that I built, like, had, it would-- it would just build up a database as you go. So anything you type, it would sort of store and it would just sort of learn what kind of things you or which words get-- are followed by others, so. So that worked pretty well for that little click wheel thing, <laughs> so. But, yeah, it does not compare to how fast you can type on a touchscreen iPhone, but-- <laughs>

Hsu: Yeah.

Bas Ording: But at least it was something, so.

Hsu: Was that inspired by anything or was it the idea of having predictive--?

Bas Ording: I don't-- I don't know. <laughs> I don't-- I just thought that that was a nice way to do it, <laughs> just add the words right there, so.

Hsu: Okay. Yeah. How did you-- How difficult was it to make the scroll wheel work for the phone?

Bas Ording: Well, there's a--

Hsu: What challenges were there?

Bas Ording: Well, the hard part is, like, well, there's the just the physical-- to have to build it a certain way. And then the sensing. And but also if, yeah, from a user interface design perspective, like, well, the way you select stuff and the way you can navigate the menu structures and it just-- it's just very limited with just like that one scroll wheel and the button. And so, it's just, yeah, harder to make it super intuitive. <laughs>

Hsu: Yeah. <laughs>

Bas Ording: So.

Weber: But for the predictive text, though, did you look at all at, like, SMS on dumbphones, predictive <inaudible>

Bas Ording: Yeah, I guess on those simple phones. But then, you know--

Weber: Nine-key.

Bas Ording: It would-- that would-- Yeah, that would—they had some kind of autocompletions or whatever you call it, right, so. But I don't remember-- But they had more things where you type a bunch of numbers and it would figure out which word that would map to then, right, instead of having to tap three times on the one key and six time-- and three-- and two times on the other one. You can just, like, type this number and then it makes the best word out of it. That's the one that I-- it was called T9, I think. But the ones that actually autocomplete words, I don't remember seeing that at that time, but--

Weber: Okay.

Bas Ording: Maybe it was around, but I hadn't seen it, so.

Hsu: How did you-- How did you feel about the two competing projects, P1 and P2?

Bas Ording: Well, I don't think they were, in my mind, I didn't see it as a competition. It was just like which one do we do first? <laughs> And I also thought that was a super cool, an interesting challenge, like, to make it work somehow. And the thing was pretty cool, too. It was a small, it was like kind of a rugged little thing. It was just a phone and it's been very basic. So I thought it was, like, a nice product as well. And it didn't have the power of the real iPhone, but <laughs> it was definitely a practical little thing as well, so.

Hsu: So you think it could have actually worked? Like it could have been-- it could have been-- How do you think it would have done as a product?

Bas Ording: I think it would have been all right. I don't know, it's like a fancier-- or it's just like a slightly more capable iPod because-- or an iPod Nano, whatever you call it, like. So it would have been okay and it would have been because it was more rugged, easier to just toss into your bag or whatever and, like. But it was limited in many ways, like, compared with a touchscreen iPhone because your, if you think about it, like, your touchscreen iPhone, it's not a-- it's barely a phone because you barely use that functionality <laughs> because you use the internet and chat and this and that and the photos and the majority is not the phone part, really. And that little guy it was, I guess, music and your phone but everything else would have not been so great on it, I think, so no web browsing and no-- <laughs>

Hsu: So it wouldn't have been a web browser. It wouldn't have--

Weber: Yeah, it would have been a feature phone, not a smartphone--

Bas Ording: Yeah.

Weber: With music added, basically.

Bas Ording: That's what I think, yeah, so.

Weber: And but the ROKR came in--?

Hsu: 2005, right, the ROKR was?

Weber: Right, because I mean, how much--

Bas Ording: With the iTunes thing on it?

Hsu: Yeah.

Weber: Because there's no-- I mean, essentially, it's the same target uses, right, to have a phone with music. I mean, a feature phone with music.

Bas Ording: Yeah. I guess. I mean, that was-- I didn't--

Hsu: It's more like the reverse. It's more like an iPod with a phone. <laughs>

Weber: Right.

Bas Ording: Right. <laughs>

Weber: Sure.

Bas Ording: Yeah, it was iPod with a phone.

Weber: But, I mean, you don't get smartphone--

Bas Ording: Yeah.

Hsu: Right.

Weber: In both cases, you're not getting general smartphone features.

Hsu: Right.

Weber: You're getting--

Bas Ording: But yeah, it's like, I mean, I wasn't, like, thinking about that stuff, really.

Weber: The ROKR would--

Bas Ording: Like, that, you know, how would the product [be] positioned, there's a blah-- [ph?] I was just like, "Oh, the UI and now how can we make this work?" and, like, and it wasn't at all my decision, like, whether this should be a product yes or no, or like <laughs> I guess I thought both of them were kind of cool and just, yeah, it's a very different product, yeah, so.

Weber: But the ROKR you were aware of at that time?

Bas Ording: Yeah, I think so. That was around that time then, right?

Weber: Yeah.

Bas Ording: With the iTunes, yeah.

Hsu: Yeah, in 2005. I mean, it was--

Weber: But it didn't make a big impression on--

Hsu: It introduced at the same time as the Nano.

Bas Ording: I thought it was a little weird personally, but, like, <laughs> and I thought it was strange that there was an Apple thing inside someone else's phone and that didn't seem, like, right to me, but. <laughs> Anyway, that was what happened to it. <laughs>

Hsu: So there were no-- there were no multiple apps in this version, right? There was just the iPod function and--

Bas Ording: It was the iPod user interface, so you could scroll through the list in the main menu through, like, I forgot what's in there. Yeah, music, phone calls, and then you probably have, like, yeah, text messaging and then settings.

Weber: That's enough.

Bas Ording: And, like, I don't know what else. So your alarm clock and <laughs> that kind of stuff, so.

Hsu: Right.

Bas Ording: Just basic, basic stuff, so, yeah.

Hsu: So then at what point did the decision come down to stop doing the P1 phone?

Bas Ording: Well, I don't remember when exactly that was, but we were pretty far along with it. A lot of stuff was figured out and even on the hardware side, I think they were pretty close as well, but.

Hsu: How long did you get--

Bas Ording: I think Steve went, like, you know, this is probably not a great product, in fact-- Because he'd seen that, what the iPhone was going to be and he probably, I think he-- I think he made the right decision that, you know, like, this is not an iPhone. This is like, let's go for this really cool thing. <laughs> It has way more of a future and like, I think yeah he was right, so. <laughs>

Hsu: How long had you guys worked on it at that point?

Bas Ording: A couple months. Maybe longer, I'm not sure.

Hsu: Half a year?

Bas Ording: Yeah, something like that maybe. I don't remember. <laughs> So.

Hsu: In terms of, like, the-- I mean, just thinking about the politics of it, like, the HI group reported to-- Did the HI group report to Forstall in the chain of-- in the chain, or--?

Bas Ording: Yeah, at that time, like, iPhone time, yeah.

Hsu: Right.

Bas Ording: Yeah.

Hsu: So was it weird that, like, you were also doing this thing for the other group, even though you were reporting to Forstall?

Bas Ording: The--? Oh, the iPod one.

Hsu: Yeah, the iPod one.

Bas Ording: Yeah. I mean, and there was some weirdness there with what we-- I mean, we couldn't help it. That was just sort of it happened, I guess. But, yeah, I couldn't imagine-- Well, I mean, I didn't even think about it right away, but later I'm like, "Yeah, this is kind of weird, because we're basically <laughs> now taking the other people's projects sort of," and we were-- we were sort of made to do this. But also, totally happy to work together or whatever. Like, you know, I'm fine with it, so. <laughs> I just want to make some cool products, so. <laughs> But yeah, there was definitely, I could sense there was some political stuff going on, so. But I usually try to stay out of that if I can. <laughs>

<laughter>

Bas Ording: So.

Hsu: So then, of course, the other big interface thing was that, you know, the touch-- to do a touchscreen phone, you had to have a virtual keyboard. Did-- was there any pushback on not having a physical keyboard from anywhere?

Ording: Oh, yeah, a lot of people were like, "Oh, you have to have--," or there was in general some kind of-- like I said the reaction more from the outside world seeing that the Blackberry users or whatever, they were used to the keyboard, and like, "You have to have it." But I always--

Hsu: But this is before--This was while you were still working on the phone, right?

Ording: Oh, right, okay, so I--

Hsu: So internally, was there anything--

Ording: Well, we knew it was going to be tricky to get it to work. We had already done some keyboard stuff on the bigger touchscreen. And so definitely I go like, "Oh, now it has to be on an even smaller screen, like this is going to be-- this is not going to be easy." So it took us a long time, and like other engineers worked on it. And like come up with ideas, like all kinds of different things just to see, "How can we make something that actually where you can type on it?" And that was a bit of a struggle. And there was some interesting ideas, or stuff that worked really quite well, where you can't do it wrong really, but then it would be awkward, you'd have to do too much taps or too many swipes or it would just look too weird that you don't recognize it as a normal keyboard. And I think in the end, Steve decided that it needed to be like a QWERTY keyboard, of course, if that can work well, because as you see it, "Oh, yeah! Keyboard!" No big deal, everyone knows what that is. And you know how to type it. You don't have to learn anything. It's like you'd have to be a little more careful, I guess, but then there's like a bunch of

smart people that figured out like clever algorithms, how if you type a word, that it makes the best out of it and even if you're a little off, it still corrects it and all that, so it ends up working pretty well. I mean, maybe you can still get better, but it's definitely quite good. Because at first we thought, "I'm not sure how this is going to work at all!" So it's pretty impressive.

Weber: Were you familiar at all with the Simon, which had tried to do a soft keyboard back in '94.

Ording: No, I don't. I guess I've heard Simon, the name before, but like I don't-- I haven't seen it. Not the keyboard.

Weber: So again, you guys were doing clean sheet of paper, basically.

Ording: Yeah, we weren't-- or at least I wasn't actively like researching what somebody out there what's been done. We just like, "Oh, just dive in and let's make-- try and make something." So.

Hsu: And the keyboard, I mean, there was a contest, right? Like you opened up keyboard design to the engineers, as well. Everybody was designing keyboards.

Ording: Yeah, that's what I was saying. Like a lot of people were trying to come up with some way to make this work. So I thought that was kind of cool to do it that way.

Hsu: Because it was like that critical of a problem, so you wanted as many people coming [up] with ideas?

Ording: Yeah, I guess if that wasn't solved, that problem, then you don't have a real product. If you can't type on it, then it's going to be a big problem for everything. Like your passwords, your internet, your text messaging. All that stuff, it won't work then, right? So it's a big deal. If you take it away as a physical thing, it has to be replaced with something else. Yeah.

Weber: There was no consideration of doing a Graffiti, like Palm-style Graffiti thing with your finger.

Ording: Oh, it was probably one of the ideas, too, like where you write the letters and stuff. But it's--

Weber: Or Newton also tried.

Ording: That's not very fast.

Hsu: Yeah.

Ording: So--

Hsu: Or some sort of gesture-based thing.

Ording: Yeah, I guess on some other phones they had like-- I forgot what it's called, it's a different sort of--

Weber: Swipe.

Ording: Yeah, where different sort of letters that are easier to do with the swipe gestures, right?

Weber: Oh, well yeah, the Palm made simplified alphabet. Yeah.

Ording: Oh, that is it, yeah, right.

Weber: It's actually faster than the iPhone keyboard.

Ording: Oh, really?

Weber: But slower than a Blackberry keyboard.

Ording: I see. Yeah, and it's like a whole variety was explored there, for sure.

Hsu: So let's go back and talk about the collaboration with the Software Engineering team. So what were your initial interactions with the team like? What was it like when they first started moving in to your floor and you're starting to work with them?

Ording: Well, yeah, I mean, it's sort of a gradual start, and there were specific things like, of course, when we started to implement the scrolling behaviors, and people like Scott Herz, and also Andrew Platzner, and then gosh, I'm just trying to think, because there were so many different things were going on. And of course, Safari and [Richard] Williamson. And to get the web stuff to work, and then with the zooming and all those behaviors around there. Gosh.

Hsu: Who was disclosed first to see the UI?

Ording: Oh, I don't know. <laughter> Greg Novick was there. And who else? Gosh. I feel bad if I forget people's names. But anyway, yeah, I don't quite remember who really, yeah.

Hsu: So how closely did you guys work with them?

Ording: It all depends what kind of features were going on, because a whole bunch of stuff happened that was a little bit lower level, too, but UI-wise, like pretty closely, if it's important stuff. I worked like, for example, like Ken Kocienda, we worked a ton on all the details on the keyboard, and the text selection and all that kind of stuff. So it's yeah, that's fun.

Hsu: What was that back-and-forth like in terms of them implementing something and then trying to match your design? Did the design ever change in response, or were there--

Ording: Well, I mean, yeah. So I'm just trying to think of an example now, but like there was times where you, yeah, if it gets implemented for real, with the full-on everything working, then there's times where you run into things where you hadn't thought of before, you're like, "Oh, this is not really working," or, "It's different than we thought, and maybe we need to do something different." So that happens for sure. So yeah. And sometimes something new comes out of it that's actually even better than we thought of before, so that's also cool. Yeah, and I always find it amazing when stuff is actually built and it becomes-- it's a real thing, you can really use it. It's not just some demo. So it's pretty exciting. Was there a particular thing that you had in mind?

Hsu: No, just sort of just in general, the kind of interaction, the kind of collaboration with Engineering from the design side, how did that work.

Ording: Well, yeah, I mean, it depends sometimes on what feature it is or what stage we're in. In this case, a lot of stuff, the very beginning of the whole, I guess you could call it the iOS look and feel and behaviors was done before engineering was involved, really. Well, of course Scott Forstall was involved. He saw what was going on, but other people didn't really see it until the demo was at a certain point, certain level. And that's what's like, "Well, this is going to be the thing." And of course, then there's still lots of discussion about how it should be really built, but the direction was set. So and in other cases, in Mac OS X, there's been plenty times where the features kind of still changed while they're being built, and but I guess with some of the iPhone things were similar. Yeah.

Hsu: You mentioned Scott Forstall. How early did he know about everything? And how much input did he have in the earlier designs?

Ording: Well, he was like there from the-- pretty much--

Hsu: From the beginning, right?

Ording: From the beginning, yeah, yeah.

Hsu: I mean, as soon as you got the call that you were doing the phone, he was already in charge of that from that point?

Ording: Well, I'm not sure if at that point all the Software group, because there wasn't a real--

Hsu: Because he was forming the group, right, but he--

Ording: But I'm not sure-- that could have been just around that time. I'm not aware of like at what point that happened. Because there was no-- in the very early beginnings of that iPhone project, whatever, it wasn't-- it was just exploration, so there was no software to be built yet. At least not from the UI perspective as far as I know. So I'm not sure at what point. It must have been pretty early on that like, yeah, he got assigned to come do this. But if he signed up for it. I don't know how that happened. So. Yep.

Hsu: Right. But did he have any input into the designs?

Ording: Well, yeah, I mean, he was always in the meetings, too, and he was like, we spent lots and lots of hours of talking through every little detail and so he had a lot of input as well, so.

Hsu: Mm hm, okay. How important was it to not do certain things in the first iPhone, like copy-and-paste? Or multitasking?

Ording: Oh, right. Ahh hm. Well, I think that it's-- you have to really make choices. Because it's already like a big and complicated project with a lot of stuff going on, and you got to focus on the things that are most important for a successful product. And all the additional things like a copy-and-paste, and if you don't have it in the first version, it's not the worst thing, because there's so much other good stuff that people are willing to wait for the next software update or whatever it is where you do get that function. I guess obviously, there must be some way to add it in, but the product is not dependent on it, right? So yeah, you have to make those tradeoffs. So I guess Steve-- or I don't know who made the decisions with that. But you pick the right apps and the right things that you want in there, and then you go from there. So yeah, it's important to not do everything. As long as the things that you do have, those are built like well, so that you have the overall quality and feel of the product. So, yeah.

Hsu: After you stopped working on the P1 iPod phone, how much, and then you're starting, going back to the P2 touchphone again, how much more work was there between then and the demo, and the big keynote?

Ording: Oh. Well, there was a lot more finer details to work out, like because we had a bigger picture but then, yeah, there was so many smaller things that need to be resolved to make everything work well. And so it still takes a lot of time, and it's not as super exciting at that time anymore, compared with the early beginning where it's all super new, and you do all the big ideas. And then, I mean, of course, later on, there's also still ideas to kind of how to resolve stuff, but it just gets more into the smaller things, just to make it all work well.

Hsu: Can you talk about the keynote itself? How much work did you have to do for the keynote?

Ording: I didn't have to do much at all. <laughter> Engineering was sweating it, but like I say, because at that point, the design was basically, all that design stuff was like just done. Of course, little things here and there maybe, but in general, that was always like it. So it was mainly Engineering. They were like-- that must have been a tough time to get it all to work. Oh, my gosh! So I'm impressed! <laughs>

Hsu: Were you actually in the room during the keynote?

Ording: Yeah, yeah, absolutely. Yep.

Hsu: How was that?

Ording: Oh, it was just so exciting to hear all the cheering and to see Steve present that. It was just amazing! So it's very cool, yeah.

Hsu: Do you have any particular memories of that day?

Ording: Well, I had my parents there in town, and that was amazing. So for them to see that, too. Yeah, it was just something special. And I remember at the end of the keynote, all the press is like by the stage, by Steve, and then I'm standing sort of also by the stage, but like just away from all the crowd, and at some point, Steve, he notices me, and he's like, he's with all these press people, and he's like, "Oh," and he walks over to my side, and he goes, and he says, "Wow," he's like, "Yeah, I still remember the first time you showed me the scrolling stuff, and all that," and he's like all excited. And but that was kind of cool that he made-- came over to say something. <laughter> Pretty special, so yeah.

Hsu: And then how much work was there still to do after the keynote for you?

Ording: Well, I mean, we were, I guess, I'm just trying to remember, like we were really far with stuff, but like I said, there's still lots of little details and things that had to be worked out, especially for like the real final thing. Because at that point, it wasn't quite final yet, because it still had to go through the testing as

well, right? And I guess we were already working on new--other stuff, like copy/paste, and all the enhancements.

Hsu: Oh, you were already working on that even at-- that early?

Ording: Yeah, I think we were already--

Hsu: Because that didn't ship until--

Ording: Yeah, but that was already in the works a while before. Because we knew that we wanted that, so I'm not sure exactly when that started, but that was-- yeah, it could have been around that time. So.

Hsu: Hm, wow.

Ording: Because it still took like half-a-year or so before we actually shipped that phone, right? So the first one. So I guess in January was the announcement, and in June, so there was months in-between. And we knew that we wanted copy/paste, and a couple other things. So but again, I'm not a hundred percent sure when that started.

Hsu: I think Greg mentioned that there were three things that still needed to be designed, Mail was redesigned, Calendar, and YouTube. So were you working on those things? Or--

Ording: Mm, not directly. I mean, we were, of course, talking about this stuff in our meetings, and all that, but yeah.

Hsu: Okay, yeah. So did you have a-- did you test the phone before it shipped? Did you have a phone that you were walking around with before it was shipping?

Ording: Yeah, I had a phone to test. Which is cool, but also not cool, because one is like you had to really hide it. And also sometimes because so far it wasn't quite perfect, so all of a sudden the battery would be dead, or something, or that kind of stuff. So it's-- but it was also very cool to use an actual iPhone, so it was just something special. So yeah.

Hsu: Were you finding lots of bugs? Were you--

Ording: Oh, yeah, you find stuff that's not quite right, or like yeah, I mean, because that was the whole point of it, of course, to use one for a while. And but yeah, you definitely find some bugs.

Hsu: How long did you have it before shipping?

Ording: Quite a while. I think I had one of the first batch, basically. Which I'm not sure when that was--

Hsu: Was that before the keynote, or after the keynote?

Ording: It was before the keynote.

Hsu: Before the keynote.

Weber: Months, then. Months, not weeks.

Ording: Uh...

Hsu: It's at least six months, more than that.

Ording: Yeah. Don't remember specifically, but quite a while. Yeah, like I said, it's hard, because you have to like hide it. <laughter> Which is difficult with a phone, but especially when people know that there's-- know stuff already, and it's like-- <laughter>

Hsu: What was the last thing that you worked on before the phone shipped?

Ording: Hm. I'm not sure. I'm not sure if it's one specific thing. <laughter>

Hsu: Okay. What was it like for you the day that it actually did ship?

Ording: Well, super exciting, of course, that it's finally out, and great to see how many people got so excited about it, and the lines at the Apple Store, and it was just unimaginable. And it's just very cool to see that. I've never seen it before that so many people are so excited. So--

Hsu: Did you go to visit any of the lines?

Ording: Oh, yeah, we went to go check it out, and visit the Apple Store, and see these people, when the doors open and people cheering, walking in. And it's just pretty cool!

Hsu: So earlier when I mentioned brushed metal on OS X, and of course, the iPhone also got a lot of skeuomorphism. It seems like it got more pronounced in the later versions of iOS, right, with like Game Center, the felt, and the faux leather. So you mentioned that was directly coming from Steve? That design direction?

Ording: Yeah, Steve was like, for the most part, he was like really, yeah, he was really into that. He cared about the uses of certain textures and materials. And so we spent a lot of time on that, too. So, yeah, which is fine, it gives it a certain character. Sometimes just from a design perspective-- I mean, I like the quality as well and I like it has a certain kind of warmth to it, or a certain kind of personality. But as long as the functionality is also on par, then yeah. There's some cases where I wish that-- I guess the functionality could have been better, and if we spent more time on a leather texture or whatever, and instead of making the actual functionality of the app like better. But that's always the tradeoff, the balance. But it definitely has, if you look at the iOS apps, or those things, they have a certain-- they're unmistakable like Apple and they have a certain kind of quality to them. And although, now these days, you see less of it, so it comes with waves, I guess.

Hsu: Yeah. So now that the iPhone had shipped, I mean, you mentioned you guys started working on copy/paste. What other things were you doing for the next version?

Ording: Well, there was also the whole international-- or the multi-- the localization. So yeah, for our keyboards, that meant like, "Oh, yeah, we need Greek and Thai, and this and that." And all these different keyboard layouts and different characters, and how you would enter that in Chinese and Japanese, and it's a big project, so it's a lot of stuff there. And you need people that understand these languages and so it's a big undertaking to get all that figured out. So a lot of that kind of stuff happened. Stuff that from a distance you don't even realize how much work that was in it, but it has to happen to make it work for all these countries. And of course, adding new features or making it more just feature-rich or more complete. Like for Mail that you can, I don't know a good example now but-- oh, with attachments or with this or that, and how that all works. Because I'm not sure if the first version you were able to send email, a photo from the Photos app, or something. So later on, we added that kind of stuff. And how does that work, and how does it animate, or what kind of state are you in when you're in the middle of that. And multitasking got added later. And--

Hsu: Could you talk a little bit about that, multitasking? I mean, you talked about—that, so multitasking and copy/paste both came out in iOS 4, correct? Is that correct?

Ording: I don't remember what was in what version. But I thought copy-and-paste was before. But maybe I'm turning it around.

Hsu: Maybe it was around-- I don't remember. Yeah, how was it working on both of those two features?

Ording: The multitasking, you mean?

Hsu: Yeah.

Ording: Well, I guess, I mean, I didn't work on that a lot. I think Imran did a whole bunch of work on that, too. It was some stuff that-- I'm trying to remember, like some of the transitions how you go from one app to the other, like visually how it animates and all that, and yeah, I don't remember specifics.

Hsu: Okay. So then the next big thing was the iPad. Especially with iOS 3. There's whole new ways of navigating with the iPad now. Could you talk a little bit about that?

Ording: Well, it wasn't like a totally new way. It's like a similar structure basically, but we had to deal with way more screen space now. So you have to rethink some of the apps, or the layouts and there's almost certain cases you have too much space. Because where we're used to designing for the small iPhone screen, and all of a sudden now it's like a huge screen area, relative. And so for some apps, it was a little tricky how to then make use of that space in a good way. So it took actually longer than expected, some of these apps to make sense out of it. So-- which was surprising in some ways, because, "Now we have all this space, so how hard can it be?" But <laughter> there was more to it. So, yeah, so.

Hsu: Was coming up with popovers, was that sort of a radical change, or was that like--

Ording: Yeah, I guess it was trying to find some solutions for how to deal with that. On the phone it was a different kind of situation, just because of the space. But yeah, I'm not sure what to say about that.

Hsu: Okay. Did you do any work on Siri later on for the interface?

Ording: No.

Hsu: What about the Apple Maps? Did you work on that at all later?

Ording: Mm mm.

Hsu: All right. What about the redesign of the UI in iOS 7?

Ording: I didn't work on that either.

Hsu: You didn't work on that. Okay. Were you involved in any of the later products like Apple TV or Watch?

Ording: Just a very little bit. Yeah, at some point I left Apple. But yeah, so it's just before that, yes, just a little bit, but not a lot.

Hsu: Oh, okay. Right. So you left Apple in 2013?

Ording: Yes.

Hsu: Was it just the right time to move on, or--

Ording: Yeah, I mean, I'd been there for almost 15 years then at that point, and I was ready for a break. A combination of stuff. Also I missed Steve, too, I guess. Because many more people did, of course, but I'd worked with him pretty closely. Actually he was a big part of my career, I guess, and I felt like, yeah, I just really missed that, too. And the other thing was like there was a lot of patent lawsuits going on, and I got involved in those quite a bit, too, so a lot of depositions and all that kind of stuff. And I got a little tired of that, too. And I felt like that was affecting how I was feeling about my work. I was like, "Well, if I'm working on stuff now, new ideas, this means that down the line I'm going to be in some other deposition about this what I'm doing now." I started to feel more like that. And that was-- I felt that hanging over my head the whole time, or something like that. And I just didn't like that feeling. And so a combination of these things. Not that one of them was necessarily enough reason to leave, but at some point, I felt like, "It's been a good run, and time to just take a break." So it was nice, for sure. And it was an amazing time to have worked on all these things at Apple. So a lot of great people, and pretty cool. Especially if you see now how the products get used around the world, and it's just pretty incredible.

Hsu: How did you feel when Steve passed away?

Ording: Oh, I mean, that was very difficult. Of course, we could see it coming, because he wasn't well for a long time, with little ups-and-downs and all that. And but yeah, this was very sad, so, for sure. So, yeah.

Hsu: So how would you summarize your time at Apple, especially working on the phone?

Ording: Well, that was an amazing opportunity. We were in a way super lucky that we got to work on that stuff. In that kind of setup with a company that can pull that off, and it's a risky project, because it's not easy to do at all. It's difficult on every level, it seems. Difficult from the lower level, like the hardware stuff to the software, to the UI, everything is complicated, where it's like new stuff has to be invented to like multitouch, the glass screens, the whole industrial design. And then the deals with AT&T or the cell providers, and all that. Everything combined, and then the Apple Stores, and the whole everything, the whole infrastructure for that. And then iTunes, and there's so many parts to it. It's just like incredible. So

it's a unique sort of moment in time where you get to do, work on such a product. And it's just super special. And it's been a super great honor that our team got to work on that stuff. And the funny thing is in some ways while you're in the middle of it, it doesn't feel like that. A little bit, of course, "Oh, cool! This is exciting stuff!" But also a lot of stuff is difficult or hard, and you have to struggle, and but there's, of course, enough excitement to kind of keep going, and it's great to try and come up with new ideas, and see if we can make it all work, and so yeah, it's a pretty unique-- it's a special time. So.

Hsu: What would you say was your legacy? <laughter> That was kind of a big question. But--

Ording: I think it's like, like I said earlier, I'm always trying to add something to the design where it has a certain feel to it. A certain kind of-- there's a little bit of fun, but it's functional, and it makes you want to play with it, and use it. And that's what I'm trying to do. So and it seems like with, for example, with the scrolling, with the bounce stuff, that's an example that's often used, but it's something that I think that expresses that. Where it's very functional, but it's also has a little fun to it. And apparently lots of people like to use it, so that's good.

Hsu: And last question, so have you been at Tesla since you left?

Ording: Well, I took a break for a while. For a year-and-a-half or so. And then I started to work at Tesla.

Hsu: And are you able to talk about what you work on now?

Ording: Well, user interface for in a car. <laughter> But at this point, I don't want to say too much about it, so.

Hsu: Okay, all right. Thank you very much.

Weber: And where would you like to see the future of mobile UI going?

Ording: Gosh. I think it's a hard-- I don't know. I find that a difficult-- That's a difficult question. Yeah, I'm not sure. <laughs>

Weber: Let's put it another way. Are there any features that you were excited about with iPhone that you would like to see go further? Or other ways of interacting with small devices.

Ording: Well, you already see stuff change now. What just got announced today too, with face recognition, or that kind of stuff. Maybe there's other things. Eye tracking. Maybe you don't have to use your finger anymore to scroll. You can just use your eyes to do that somehow, or some other way that's even easier. So I don't know yet what it will be, but I can imagine that there'll be another way to do stuff. All of a sudden, a new-- and maybe it was something that seemed obvious once it's invented. It's the same with touchscreen was kind of like, "Oh, yeah! It's just touchscreen." But it became this big

breakthrough because of the right combinations of different things. So I'm expecting at some point, there'll be another sort of breakthrough combination of ideas that people go, "Oh, my god! This is so much easier and it's more fun and it's better!" And they will all go do that. Right?

Weber: And in terms of-- I mean, the jury's still out on whether things like augmented reality, or wearable and other forms are working. Do you have any thoughts on other directions it might go? Have you explored watches, handheld, head-mounted.

Ording: Yeah, well, like I said, I think it's about-- I don't know. Someone will find the right kind of combinations of things for the right kind of purpose, and then that will become the next thing, or a separate thing that will have its own success. But I'm not sure what that will be.

Hsu: Is there anything you'd like to add?

Ording: Well, I guess, like I said I've been just super thankful to have been working with all these amazing people and to work on all this cool stuff. And it's just kind of blows your mind if you think about how many people around the world are using the products and it's just like super cool to have been part of it and to have made a little contribution to that. So it's, yeah. <laughs>

END OF THE INTERVIEW