Rashmi Mohan:
This is *ACM ByteCast*, a podcast series from the Association for Computing Machinery, the world's largest educational and scientific computing society. We talk to researchers, practitioners, and innovators who are at the intersection of computing research and practice. They share their experiences, the lessons they've learned, and their own visions for the future of computing. I am your host, Rashmi Mohan.

Rashmi Mohan:
If you want to boost your brain power, improve your memory, or enhance your multitasking skills, then you're often recommended to learn a foreign language. For many of us, that option has become a reality, thanks to our next guest and his creation. Luis von Ahn is a serial entrepreneur and Founder and CEO of Duolingo. An accomplished researcher and consulting professor of Computer Science at Carnegie Mellon University, he straddles both worlds seamlessly. He's a winner of numerous awards, including the prestigious Lemelson-MIT Prize and the MacArthur Fellowship often known as The Genius Grant. Louis, welcome to *ACM ByteCast*.

Luis von Ahn:
Thank you. Thank you for having me.

Rashmi Mohan:
Wonderful. I'd love to lead with a simple question that I ask all of my guests. If you could please introduce yourself and talk about what you currently do, and also give us some insight into what drew you into the field of computer science.

Luis von Ahn:
Sure. So my name is Luis. I am currently the CEO and co-founder of a company called Duolingo. Duolingo is a language learning platform. It is now the largest language learning platform in the world, so it's the most popular way to learn languages in the world. There are more people learning languages on Duolingo in the United States than there are people learning languages in the whole US public school system. I am, of course, a computer scientist by training. I have a PhD in computer science.

Luis von Ahn:
Before Duolingo, I used to be a professor of computer science at Carnegie Mellon University. And there, I worked on all kinds of different research. I also started two companies before Duolingo. And what originally drew me to computer science or computing in general was, it was

early on in my life, I was eight years old, I wanted a Nintendo and my mother instead got me a computer. And I was pretty upset, I just wanted to play games like all my other friends, but all I had was a computer. So I figured out how to use it, and that's what did it

Rashmi Mohan:
That's wonderful. Very creative of your mom to start you off on that journey. But also, it's incredible what you say about Duolingo being the largest platform for learning languages. I know, I have two children in high school and they do a number of years of learning language, it's mandatory. So it's pretty incredible the kind of impact that you've had via Duolingo. But I'd love to get into that in a little bit. I wanted to tap into your history when you said you started two companies prior to this one. I know a lot of our listeners probably know that you invented CAPTCHA. Could you give us a little bit of history on, what sparked that idea? Were you interested in a related field in computing when you hit upon this idea? How did that come about?

Luis von Ahn:
Sure. So, CAPTCHA is these distorted characters that are all over the internet when you're, for example, trying to get an email account or buy tickets on Ticketmaster. So that's a CAPTCHA. The reason that's there is to make sure that you, the entity filling out the form, are actually a human and not a computer program that was written to submit the form millions of times. And the reason it works, or at least... it used to work much better, it still works, but just not as well, is that humans are better than computers that reading these distorted characters, or have been historically.

Luis von Ahn:
The idea originally came up, this is a long time, it was 20 years ago. I was just starting my PhD in computer science. I was a first-year PhD student at Carnegie Mellon. And I went to a talk that at the time it was given by the person who was the chief scientist of Yahoo. Now, again, this is the year 2000, Yahoo was the biggest internet company of the time. The guy who was the chief scientist came to give a talk. And in the talk, he described 10 problems that they didn't know how to solve at Yahoo. And one of them was that they had a bunch of people who were writing programs to obtain millions of email accounts, and the reason they wanted to do that was to send spam.

Luis von Ahn:
So, the idea was, they wanted to send spam from Yahoo accounts, but each Yahoo account only allowed you to send like 100 messages a day or 500 messages a day or something, and people who wanted to send spam wanted to send millions of messages per day. So what they did is they

would write programs to obtain millions of email accounts, and from each one, they could send like 500 messages per day or something. So they didn't know how to stop them. And I listened to this talk. I went home and started thinking about it a lot. Then my PhD advisor, Manuel Blum, who's a very celebrated computer scientist, and I started thinking about this idea of, how do we prevent this problem?

Luis von Ahn:
And when we came up with a general idea first that one way to prevent it would be to come up with a test that can distinguish whether something is a human or a computer. This may sound familiar, this sounds like a Turing Test, which 1940s, 1950s, Alan Turing came up with this thing called the Turing Test, which was a test that could figure out whether something was a human or a computer. So we realized we needed something like that. But, there was a twist, we needed something that was also graded by a computer.

Luis von Ahn:
So the original Turing Test, there was a human judge that would decide whether they were talking to a human or a computer. In this case, we needed a computer judge that was deciding whether it was talking to a human or a computer. And so that was the general idea of what we needed. At some point, we came up with this idea that, well, it turns out that you can write a program that can put some letters on you on a canvas, distort them a lot and display them and then ask the entity on the other side to read those letters, and it turned out that humans could read those letters pretty well but computers could not.

Luis von Ahn:
And so that's what turned into CAPTCHA. Pretty quickly after that, Yahoo started using it, and then essentially every other website in the world started using it.

Rashmi Mohan:
Yeah. What is incredible about this, this incident, is the fact that you weren't able to find a real world problem and work on that as a part of your PhD. That interaction between what is considered an industry problem that somebody is trying to solve and bringing that into the academic world, do you see that happening often enough, Luis?

Luis von Ahn:
It happens. I would say it doesn't happen that often. I find, now that I'm running a company, I find there's a little bit of a disconnect between what companies care about and what academia cares about. It's also difficult to share data a lot of times. Many problems nowadays require quite

a bit of data to solve. It's just difficult to share the data. Not only are there privacy problems, but also a lot of times there's just quite a bit of engineering is required to even make data sets that are clean enough for somebody say, in academia to use them. I do think it happens, but I think it probably could happen more. Now, I don't know if it should happen more, but it probably could happen more.

Rashmi Mohan:
That was going to be my next question. Do you find that there is inherent value or like a missed opportunity there if we don't collaborate between the two streams, as it were, in this specific manner? I'm sure there are many other collaborations, but solving problems in academia that are surfaced in industry but are being solved with the brightest minds in academia. Do you think that that's a missed opportunity if we didn't do more of that?

Luis von Ahn:
I definitely think there's value. It's hard for me to know how much of this should happen. I definitely think there's value. I think generally my view is that academic research has a longer time horizon when you're running a company, unless you're an extremely large company... If you're a company like Duolingo, we do some research, we have people we have maybe 30 people with PhDs. We do some research, but our time horizon is a lot shorter. We just cannot afford to do things that are going to be valuable in 15 years, that's just not a timeframe. Whereas I think in academia, depending of course, on the field, some things are things that are going to be valuable in 100 years or maybe 50 years or something.

Luis von Ahn:
If you think about a lot of the research in quantum computing, it may not be valuable in the next five years, but it is still very valuable. So I think there's a little bit of a difference in the time horizons. However, I do think that when things do match up, I think some of the best technology in the world has come from collaboration between industry and academia.

Rashmi Mohan:
Got it. Yeah. No, I think that's a very valuable point that you bring up. The timelines may not always align, but how easy was it for you? Coming from an academic career to running a business or working for a company, how do you build that muscle in other areas of running a business other than just solving the technology part of them?

Luis von Ahn:

Yeah, that's a good question. So, like I said, Duolingo is not my first company. I would say where I really learned a lot more about how to run a business with my previous company, which didn't grow that much in terms of number of people, it just got to maybe about only 15 people. But I did learn quite a bit there. I never really wanted to be an entrepreneur, I didn't really want to start companies, this was not a desire. I was not against it, but this was not a desire, it just happened for me.

Luis von Ahn:
So the previous company that I started was related to CAPTCHAs. It was not exactly CAPTCHAs themselves, so it was a second go around of CAPTCHAs. So I can tell you a little bit about how that happened. The original CAPTCHAs came out in the year around 2000. Then by the year, maybe 2006, I was no longer a PhD student at that time, I was already an assistant professor at Carnegie Mellon. And I was just thinking about how many CAPTCHAs, what type of people around the world, I thought a lot of people that knew me would send me angry emails every time they saw a CAPTCHA, and they saw them pretty often.

Luis von Ahn:
And so I just did a little back of the envelope calculation, and the number I came up with was maybe something like 200 million times a day somebody types of CAPTCHA around in the world. I started thinking, "Okay, that's a lot of times." And each time you type a CAPTCHA, you waste about 10 seconds of your time, because it takes 10 seconds to type a CAPTCHA. And if you multiply that by 200 million, you get the humanity as a whole is wasting about 500,000 hours every day typing these annoying CAPTCHAs. So, I started thinking, "Is there any way in which we can make good use of that time?"

Luis von Ahn:
See, during those 10 seconds, while you're typing a CAPTCHA, your brain is doing something that computers cannot do. So could we make you do something useful? And I had this realization, which led me to create a company. Which was that, while you were typing a CAPTCHA, you could be helping us digitize books. So, let me explain how that worked. At the time, there was a lot of projects trying to digitize all of the world's books, basically take all the physical books that had been printed and then putting them on the internet. And the way the process works, the digitization process works is, you start with a book, then you take a digital photograph of every page of the book so that then you're left with a bunch of pictures of words.

Luis von Ahn:

And then the computer needs to decipher all of the words in these pictures. Now, the problem was, especially at the time, for older books, the computer could not recognize many of the words, like 30% of the words, it could not recognize, but humans could. So the idea is, we started taking all of the words that the computer could not recognize and we started sending them to people on the internet while they were typing CAPTCHAs. So when you typed a CAPTCHA, the words you would type, as opposed to being these randomly made things, were actually words that come from a book that had been digitized that the computer could not recognize, and we would use what people would enter to help us digitize the book.

Luis von Ahn:
Now, at first, it was a research project at Carnegie Mellon, and I was pretty proud of the research project, and it was good. And at some point, I went and gave a talk somewhere, and I had this whole idea, but I didn't have anything to digitize. It's not like I had a bunch of books to digitize, so I just had the idea of how to do it. And when I was giving the talk about this, it happened that at the time, the CTO of The New York Times was in the audience. And then he came to me and he said, "Look, we have this huge archive of all editions of The New York Times for the last 140 years, and we've tried digitizing it and just computers cannot recognize most of the words, but seems like you can help."

Luis von Ahn:
So I said, "Sure, we can do it." And then we signed a contract to do it. We started digitizing The New York Times with people typing CAPTCHAs on the internet. And it turned out that it was working really well. And at some point, they were paying you $42,000 per year of content. And it was taking us like a week of time to digitize a whole year of The New York Times. And so we started getting these checks of like $42,000 every week or every other week. And at that time, Carnegie Mellon found out that we were doing this, and I didn't really know the legality of any of this, but they came and they said, "Look, hello, professor, it's nice that you're doing this, but here's the thing, you've got to get out of Carnegie Mellon. You start your own company. This is work for hire. We're a nonprofit, the university's a nonprofit. You've got to go start a company."

Luis von Ahn:
And so I did that. I went and started a company, but this was not something I wanted to do, it just happened. And from then on, I started figuring out what it is that is required to start a company. I now realize the first thing you need to start a company is you need to find a lawyer that will start the company for you, like actually do all the papers, this I know. And then you start learning all kinds of things, but yeah, that was the transition for me.

Rashmi Mohan:
That's incredible. I'm also amazed, Luis, at how you've found yourself in these situations where the work that you're passionately doing in terms of solving a problem has an immediate application that has such far-reaching impact. Harnessing the power of crowdsourcing with this project, it's incredible. It's probably transformed what New York Times wanted to do as well as many other companies that have benefited from this.

Luis von Ahn:
Yeah. In some sense, I've always been on the more practical side of things when it comes to my research, so that's what happened. I was also fortunate that immediately had applications, I think.

Rashmi Mohan:
That's great. And so how did Duolingo come about? Where did that idea spark from?

Luis von Ahn:
Yeah. So Duolingo, what happened, I was working on this company to digitize books, and it was doing pretty well. At some point when we had about a dozen people, a little over that, actually Google came and just acquire the company because they were digitizing so many books, this was useful for the book digitization process, so they acquired it. The company was called reCAPTCHA. To this day, when you get many CAPTCHAs online, they're served by Google, and it basically comes from the same team that they acquired many years ago. So after that, I went back and I was a professor at Carnegie Mellon, and I was just thinking about what big project to work on next.

Luis von Ahn:
And I knew I wanted to do something that was related to education. That's always been my passion, that's why I became a professor, I wanted to teach. So I knew I wanted to do something related to education, but I didn't know what I just wanted to do something where computers would teach people something. One thing that was really influential in my thinking was the fact that I'm from Guatemala, so I was born and raised in Guatemala, and it's a very poor country. And a lot of people talk about education as something that brings equality to different social classes, but I always saw it as the opposite, as something that brings inequality.

Luis von Ahn:
Because what happens, particularly in countries like Guatemala or generally poor countries, is that people who have money can buy themselves really good education and therefore they continue having a lot of money. Whereas people who don't have very much money barely learn

how to read and write, and because of that, they never ended up making money. So I wanted to do something that would give equal access to education to everybody. I started thinking about that. Then I had a PhD student, his name was Severin. And together, we were like, "Okay, let's try to do something related to education. What should we teach?"

Luis von Ahn:
At some point, we came up with the idea that we should teach languages. At first, we probably wanted to teach math; we're both really math nerds. But we realized that actually teaching languages, in particular teaching English, can be really transformative in people's lives. There's something like one and a half billion people in the world wanting to learn English. In my case, having learned English allowed me to come to the United States. It completely transformed my life. And in most countries in the world, knowledge of English can immediately double your income potential.

Luis von Ahn:
So we thought, "Okay, let's do something that teaches languages and teaches them for free." And so that was the idea. And so we launched Duolingo in the year 2012. And this time I knew better and I knew that I should just start a company at the time. And so I went on leave from Carnegie Mellon and I started this company. And we were very fortunate that soon Duolingo started really growing a lot, and pretty quickly it became the most downloaded app in the education category. We were fortunate we also did some things right, which in retrospect, we didn't know that we were doing them so right, but in retrospect, it makes a lot of sense. We made some good decisions kind of by accident. Yeah, it's been going up since then.

Rashmi Mohan:
Oh, fantastic. I recently heard a TED Talk by Adam Grant on original ideas, and he said like, the first idea we usually encounter tends to be raw or unfinished. So a little bit of procrastination in this whole ideation process help. It sounds like you started off with math, but then you hit upon this language as idea, which has obviously become incredibly, incredibly popular. What I'm also hearing so much from you, Luis, in terms of passion for the product and the idea, from being deeply involved in solving computing problems, how does that translate into running this company? What are the largest pressing computing problems that you're trying to solve?

Rashmi Mohan:
And when you become a CEO or when you become a co-founder, do you have to focus on so many other things that you leave solving those really deep problems to others? What is your role in that whole space?

Luis von Ahn:
Yeah, that's a great question. Early on, I was very involved in the things we were doing. Now, early on, the main thing we needed to do was make a thing that works, a thing that actually teaches you languages. There, one of the things that we realized quickly was the hardest thing about learning a language is staying motivated. So we spent a lot of effort, and I was very involved in this, spent a lot of effort in trying to make the process of learning a language through are now as fun as possible. So we basically used a lot of tricks that games use, so we made it really feel like a game.

Luis von Ahn:
That was the first order of business, is just make a thing that a lot of people use. Over time, now, eventually, a lot of people start using it, etc. By now, there's a number of problems that we face that are really interesting. of course, I'm not the one having to solve them or even able to solve them, just because there's just many other things that I have to do, and so we have people whose job it is to solve them. But the types of problems that we are solving at Duolingo are things like, for example, we have access to probably the largest data set of people learning anything in the world.

Luis von Ahn:
There are somewhere between half a billion and a billion exercises are answered by our users every day. So every single day, we get somewhere between half a billion and a billion answers to exercises every day. The question is, how can we use this data to teach better? And we've been able to really improve how well we teach by doing all kinds of things. For example, this is one of the first few things we did, we do A/B tests on our content. So for example, we imagine that when we're teaching a language, imagine we're teaching Italian to Portuguese speakers, and we don't know whether we should teach plurals before adjectives or adjectives before plurals.

Luis von Ahn:
For many of these concepts, nobody really knows what the best ordering is to teach. The beautiful thing about something like Duolingo is that we now have the data to figure this out ourselves. So if we want to figure out whether we should teach plurals before adjectives or before plurals to these users, what we do is we just run an A/B test. So for the next 50,000 people that sign up, to half of them, we teach them plurals before adjectives, to the other half, we teach them adjectives before plurals. And then we figured out once and for all, at least for our user base, which ones learn better, which ones are more motivated, which ones stick around for longer. And we can actually figure it out.

Luis von Ahn:
And by now, with Duolingo, we have a pretty sophisticated system that just continually is getting better and better at teaching by using the data from our own users. So I think those are some of the more interesting problems that we're solving. And I think we've only scratched the surface of what we can do. I really think that over time, computers are going to be able to teach a lot better than humans. That's not true right now, we have a lot of data. Right now, I think for certain aspects of the language, Duolingo is about as good as a classroom, but not as good as a one-on-one human tutor.

Luis von Ahn:
A good one-on-one human tutor is known to be better than a classroom, and right now, Duolingo is about as good as a classroom.

Rashmi Mohan:
That's great. When I was preparing for our conversation, I just spoke to my daughter who does use your product, and I was asking her, I said, "Can you tell me a little bit more about what you find most exciting about it?" And a couple of key pieces of feedback that she gave me was, it's great that it adjusts to the learners levels, so you get content that's appropriate to the learning level that you're at. She said, "There's a great amount of information that's packed into a very small unit of time." Especially for the high schooler, it doesn't feel like an overload of information at one time, it feels like, you have just a small unit of information that you can absorb and then retain, and then go back for more.

Rashmi Mohan:
Those were a couple of things that she brought up, but the other thing that she brought up, she said, "The user experience of Duolingo is so engaging." And this is what you were referring to earlier also in terms of making it like games so that you bring your users back. Was that a conscious choice based on previous research that you did on terms of, this is how people learn languages, or how did you hit upon that?

Luis von Ahn:
It was a very conscious choice. It's not just about languages, it's just generally keeping people motivated. So one of the things, if you're going to teach something with an app, one of the things that you realize pretty early on is, you see, in a classroom, people are almost held hostage. Wait a minute, you can't really leave the classroom and also your parents probably paid a lot of money

to take the class or whatever. It's socially unacceptable to leave high school, it's just not acceptable. So generally, when you're in a class, you have to be there.

Luis von Ahn:
When you're learning something with an app, it's so easy for anybody to just leave. A lot of times people ask us, who's our major competitor? Our major competitor is not another language learning app or anything, our major competitor is like Instagram, or TikTok or something. It's just so easy for people to say, "Well, yeah, okay. I'm just going to go somewhere else." So we've spent a ton of effort trying to keep people as engaged as possible. And the way we do it is through gamification, and gamification on a lot of things. For example, a lesson on Duolingo doesn't take one hour, a lesson on Duolingo takes three minutes.

Luis von Ahn:
And again, it's just because we want people to be as engaged as possible. And this didn't take five minutes, we've been iterating on Duolingo for the last eight years to make it more and more engaging. And again, we use the data from all of our users to try to figure out... We do all kinds of measurements about, should each lesson be three and a half minutes or three minutes or two and a half minutes? What's the optimal? Also, we have a pretty sophisticated system that... For every exercise we give you on Duolingo, we actually know what the probability is that you as a particular user are going to get it right or wrong.

Luis von Ahn:
We have a user model for everybody that is using Duolingo, and we know for this particular user, this particular exercise, that user has a 72% chance of getting it correct. And we use that model to give you exercises that we know are going to keep you as engaged as possible. They can't be too easy because that's just not fun, if you have 100% chance of getting everything right, it's just not fun, but also they can't be too hard because then you get frustrated. So we actually target to give you things that are like 80%, that you have an 80% chance of getting correct.

Luis von Ahn:
And so we do things like that, and it really makes a huge difference, it really keeps you engaged. And in addition to that, with our user model, we also give you... Not only are we trying to make sure that you have an 80% chance of getting everything, we also give you things that try to exercise things that we think you're about to forget. So we know what you know and how well you know it for everything you've done on Duolingo, so we know that, well, maybe the past tense, you're struggling. So whenever we give you a lesson, we try to find an exercise that is in

the past tense, because we know you're struggling with it, that you also have an 80% chance of getting right, then we give that to you.

Luis von Ahn:
And it turns out that that makes a huge difference in engagement because it just feels good to get things most of the time, but for them to be challenging enough.

Rashmi Mohan:
Right. I think that you hit upon the nail on the head, just challenging enough to keep you wanting to come back, but enough to be motivated to actually say, "Okay, I think I'm moving ahead, I'm actually progressing."

Luis von Ahn:
Yep.

Rashmi Mohan:
But the point you brought up about, obviously you're collecting data, you're modeling users, etc. So what are your thoughts or data privacy concerns in the space that you are in?

Luis von Ahn:
We obviously take data privacy very seriously. The fortunate thing is we don't collect very sensitive information, we don't know almost anything that a normal social network would know. So we don't collect very sensitive information. The types of things that we have, if somebody were to get all our data, the types of things they may find out is that you're not particularly good at the past tense of Spanish, which again, obviously, we take it very seriously, but it is just not quite the same as figuring out that you've been Googling how to, I don't know, how to build a bomb or something like that. That's a very different thing. So yeah, that's how we see it.

Rashmi Mohan:
Got it. And that makes a lot of sense. I think the value that you see in data that you collect is valuable for your product alone, but does not compromise another person's privacy into deeper manner.

Luis von Ahn:
Yeah. I'm sure there are people who wouldn't want this to get out and that's why we take it seriously, but what it is, it's just not quite the same as your social security number is out now.

Rashmi Mohan:
Fair enough. Fair enough. And do you find that with this whole pandemic situation and everybody's now of course learning things online, and that was the model that you started with, but have you seen ways in which Duolingo is now getting used that you didn't anticipate or any aha moments through this madness that we're all living through?

Luis von Ahn:
Yeah. We've definitely seen increased demand due to the pandemic. Actually, this was an interesting thing when this whole thing started, because we have users in every country in the world. You could see which countries were going into lockdown by looking at our traffic, because whenever a country goes into lockdown, our traffic does go up, and for multiple reasons. One of them is just kids who were using it or who were going to learn in school now are more heavily relying on Duolingo because they have to do at home, or just generally adults, maybe they're more bored at home because there's a lot less to do now that everybody's in lockdown. So we do see that.

Luis von Ahn:
In terms of aha moments or anything, this has been our vision all along that people can learn by themselves, and we've been very touched to see how much impact we've been able to have in the world. For a lot of people, we've made lockdown a lot more meaningful because at the very least they're not completely wasting their time, and lockdown passed and at the very least, I got a lot better at French or something like that. So we feel pretty good about that.

Rashmi Mohan:
Yeah. That's terrific. I think that's definitely something that a lot of us have felt that the time that we have gained from maybe not spending on the road commuting to work, or other means, that has been put to ways in which we want to improve ourselves, whether that's learning a language or any other hobby that we want to pursue. I'd like to go back to something that you said earlier about languages, especially English, learning English being the gateway to jobs in many developing countries. One thing, and I was recently chatting with a friend who was not a computer science professional, not in the tech industry.

Rashmi Mohan:
And one of the questions she asked me was, do you believe that native English speakers have an advantage in computer science? And we see mainstream programming language is a role in using the English alphabet. Do you think that's a barrier for people entering the technology space?

Luis von Ahn:
Yes. I believe that English speakers have an advantage. Is it impossible to be able to program without knowing English? No. You can become a very good programmer without knowing English, but I do think that English speakers have an advantage. Not only are the programming languages in English essentially, but there's just a lot more documentation. If you know English, you can read how to do things with stack overflow. There's way more content in English like that, way many more books in English than everything else. So I do believe there's an advantage. I think there's a similar advantage when starting a company.

Luis von Ahn:
I know that's not quite the same as computer science, but I think knowing English just gives you access to just the world, whereas if you don't, you only have access usually to your country. And so I think that's a pretty big difference. So yes, I do think there's an advantage. Again, that's not to say that it is impossible to go through life without knowing English, but just like with income potential, knowledge of English in most countries doubles your income potential. It doesn't mean you can't make money without knowing English, you just can make more if you know English, and I believe the same is true in computing or in starting a company.

Rashmi Mohan:
Right. That's very true. And I think that it's incredible that Duolingo is actually helping people bridge that gap, and in some ways, adjust that inequity that we may see. And also, it's a great responsibility that you are undertaking in order to be able to give these people the ability to enhance their skills, and hopefully, make a better life for themselves. One of the questions I had for you was also, when you look at both for yourself as a technologist, as a co-founder, as a CEO of a company, or for the company itself, how do you measure success?

Luis von Ahn:
For me, it's always been impact, how much can you positively impact the lives of people and how many lives can you possibly impact? I've always just wanted to impact as many lives as possible in a positive manner. That's impact for me, I can tell you, probably the proudest I've been of our work at Duolingo was a couple of years ago. In the same week, I learned two facts that juxtaposed made me very proud. On one end of the spectrum, I learned that Duolingo was being used by a ton of Syrian refugees all across Europe to learn the native language of each country.

Luis von Ahn:

And in fact, in many refugee camps, they had actually dedicated Duolingo programs because they didn't have anybody to teach them the language, so they would just set them on a computer to learn with Duolingo. So on one side of the spectrum, refugees were using Duolingo to learn a language. Now, if you're a refugee, you usually don't have much money to your name, so it's usually some of the poorest people in the world using Duolingo to learn a language. That same week, I learned that Bill Gates was using Duolingo. And so that to me was really amazing.

Luis von Ahn:
It's like, "Look, this is one of the richest people in the world, they can afford anything they want, and they happen to be using the same educational system as Syrian refugees." And it's not just Bill Gates, a ton of famous people that have used or that use Duolingo, like Tom Hanks and the Jonas Brothers, and stuff like that. So the fact that these people for whom money is just no issue, they could do whatever they want, and they happen to choose the same tool to learn a language as somebody who doesn't have very much money.

Luis von Ahn:
That to me is exactly what motivates me. Basically more money cannot buy you a better system. To me, that's what makes me the proudest.

Rashmi Mohan:
And it's an incredibly heartening thought Luis, because I think that that impact, I think not just as a technologist, but just as a human being to think that the product that you're putting out there can be a value to anybody in the world, and doesn't have any barriers for entry, is pretty amazing. So thank you for sharing that. The other thing, it feels like you do so much path-breaking work. The other thing that I found very interesting is, I happened to be in Pittsburgh sometime last year and I saw hoardings for Duolingo in the area, you started a company, a technology company in an area that was not traditionally a stronghold as a tech hub. What were the advantages or what was some of the challenges that you faced with that decision?

Luis von Ahn:
That's a great question. The reason we started here was because of Carnegie Mellon. I was a professor there and we were here anyway, so we started. If I were to go back and do it again, I would do it again in Pittsburgh, I think it's been pretty advantageous to us. And I'll tell you, it's not all good, there's some good and bad things. The good thing has been, we've have been able to hire really excellent computing talent, particularly coming out of Carnegie Mellon, but it's not just Carnegie Mellon, and I think people have moved here from a lot of really amazing universities. So that has helped a lot.

Luis von Ahn:
Another thing that it has helped with a lot is, we have little competition in terms of hiring. Pittsburgh is a relatively large enough city, that there's a good number of people that for one reason or another, just need to be in Pittsburgh. A lot of times it's because their family's here or their aging parents are here or something, they just need to be in Pittsburgh. When there isn't that much competition... There are other tech companies in Pittsburgh, for sure, there's just not very many, but when there isn't that much competition, it just happens that we have been able to hire people out of our league, but it's because Duolingo is the best job in town.

Luis von Ahn:
So many of the people in our executive team, for example, a good fraction of our executive team is here because of aging parents, because they have aging parents that live in Pittsburgh. They usually have been in either New York or Silicon Valley. And if they were there, they would be part of an executive team of significantly larger company, but they just happen that they need to be in Pittsburgh, and we're the better job in town for them, so they choose to work with us. So that has been pretty advantageous for us, and it has worked. Where it hasn't been so good, is there are certain roles for our company that there's just not very much of that role in Pittsburgh.

Luis von Ahn:
The one I'm mainly thinking about is marketing. There's just not a lot of marketing talent in Pittsburgh, there's not a lot. And we've had trouble getting people to move to Pittsburgh in marketing, particularly. In other areas, we don't have trouble with people moving to Pittsburgh, but in marketing, they say, "Look, part of my value is my network, I have a really good network here in the city that I live in, be it New York or San Francisco or something. And I could move, but honestly, I'll have much less value to not just to you, but to the world because my network is just not going to be where I am."

Luis von Ahn:
So in certain roles, we've had trouble hiring. What we've done of course is we've opened other offices, so by now, we have... Our largest office by far is our Pittsburgh office, but we do have we a relatively sizable office in New York City. We have another one in Seattle, and we have one in Beijing. The Beijing one is not... A lot of times when I talk to people, they say, "Oh, you have cheap programming talent in Beijing." You would be surprised how expensive it is to hire programmers in Beijing. It is not because of trying to save money, it is because we're trying to grow in China, and we figured that the best way to do it is to have a local office there. So we also have an office in China.

Rashmi Mohan:
That's wonderful. The one thing that COVID has taught us as horrible as it's been otherwise, is that talent can really reside anywhere and add tremendous value to companies across the world. So I hope that that solves some of your marketing talent issues as well.

Luis von Ahn:
I hope so too. Although, we really did solve it with the office in New York. That pretty much solved it.

Rashmi Mohan:
Right. I have one more question for you, Luis, which is, a lot of the times, you are talking to an audience of mostly folks who are practitioners and folks who are in industry, but there is always as we're going through our lives and careers and trying to add impact to the problems that we're working on, there is always sometimes a spark of an idea that comes in and saying, "Oh, I'm going to go out and start my own company." What would be your advice, both to people who are in academia or in industry as to how does one scratch that itch, if you will?

Luis von Ahn:
Well, my biggest advice, I can tell you a few things, but I would say my single biggest advice I would give is, just do it. The number of people that I know that have come to me and have said, "Look, I've been thinking about it, I've been thinking about it for years, I just never do it." The hardest thing is just to get started, so just to get started. Your idea doesn't have to be perfect. Your idea, like you said, your idea will probably change 50 times before you actually make it big, so the biggest thing is just get started. Other pieces of advice, I personally have found it a lot easier to start companies with other people, because they keep me in check and also keep me motivated because then there's somebody else that I will disappoint if I don't work on it.

Luis von Ahn:
So if you find yourself a co-founder, I think that would be good. Another thing that I think is important is, if you're going to start a company on something, you probably either you or your co-founder should have a good amount of expertise on that, whatever the hardest problem is in your company. For example, if the hardest thing in your company is something related to computing, you or your co-founders should be in computing. The companies that don't work super well are companies where it's like two MBAs wanting to do something really deep in computing and they think that they're going to be able to hire some [lurkees 00:39:00] to just do it for them. That doesn't work super well.

Luis von Ahn:
But on the flip side, if the hardest thing of your company is going to do is like a sales problem and you're in computing, you probably want to start the company with somebody who knows a lot about sales. So I would say, figure out what's the hardest thing related to your idea and make sure that in the founding team, you have somebody that knows about it, because otherwise, it just doesn't work super well. I would say another piece of advice is, be very, very picky on who you hire. This really matters particularly early on in terms of... There's a huge push at first when you say, "Oh, we just need to hire somebody who will code."

Luis von Ahn:
You pay the price dearly if you just don't have high bar of quality for the first few people you hire, because the thing to realize is the first few people you hire are going to set... It's like the seed that is going to set your company for years to come. And if you hire a bunch of really good people, your company's probably going to be full of really good people. Similarly, this even counts for diversity as well, if you hire a bunch of men in your company, the first 10 employees in your company are men, it's very hard to hire the first woman, if that's the case. So I think you want to make sure that the early team is as diverse as possible, and is as high quality as possible because that's the seed for the rest of the company. I really strongly believe in this.

Rashmi Mohan:
Yeah. I think that's excellent advice whether we're starting our company or not, I think making sure that we're hiring talent that also questions and brings in that diversity of thought to make sure that we're actually solving for all parties involved as opposed to just a small section of society. Wonderful. Luis, and for our final bite, this has been a great conversation, but what are you most excited about either in the field of computer science or in technology over the next few years?

Luis von Ahn:
Related to what I do, I am pretty excited about our computers being able to teach most everything, just with a computer, that you'd be able to learn a lot of really meaningful things just with a computer. I'm pretty excited by that. We're not quite there yet for most subjects, but I think we will be able to figure this out. That's something that I'm particularly excited about. I would say, I'm pretty excited about virtual reality. Again, something that's not quite there yet, but I think it's going to be pretty transformative. I guess those are the two things that I'm pretty excited about.

Rashmi Mohan:
Wonderful. Well, thank you so much for joining us today. This has been an incredibly fascinating conversation. We really appreciate that you spend time with us here at *ACM ByteCast*.

Luis von Ahn:
Thank you. And thank you for the great questions.

Rashmi Mohan:
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