AI and You

Transcript

Guest: Jonathan Bowen, part 2

Episode 129

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Hello and welcome to episode 129! This week we will conclude the interview with Jonathan Bowen, co-author of the book The Turing Guide, an immense definitive reference to the life, works, and legacy of Alan Turing. Jonathan is a fellow of the British Computer Society, a fellow of the Royal Society of Arts, Emeritus Professor at London South Bank university, an adjunct professor or visiting professor of many universities, including Kings College London, and winner of the IEE Charles Babbage Premium award.

His study and research is in the area of formal methods, but we were talking about his knowledge of Alan Turing, and last week we talked about what Turing meant to him, how he started researching connections between Turing, who was a Cambridge man – I have to get that in there – and Oxford, where Jonathan was a senior researcher at the University Computing Laboratory and where, in 2012, he co-organized a celebration of Alan Turing's centenary, called *Turing's Worlds*. Let's get back to the interview.

There's just no other historical figure that I can think of that would so obviously have made such a great contribution to human progress, had their life not been cut short and yet, we can't know what that is, this is the frustrating thing. To know what he would have done, you'd have to be Alan Turing. You we can't, we clearly can't know what that is, if you try fantasizing about where he would have gone, you've talked about the quantum computing. What was it quantum computing, or was it quantum physics?

Well, I think he was looking at the quantum physics, but I can imagine him going on to quantum computing from that, with his background, and I think he would have put two together. So, I think we would have advanced, I think that was the next thing he was thinking about nothing really written down. So you know, I predict that the next paper would have been another brilliant one on quantum effects and maybe predicting quantum computing, but we don't know. But he's the sort of person who would have put two and two together there. You know, this is with all these expertise that computability, and so on, he would have realized the quantum effects have computing aspects to them and so I think that's an area where I think we could have been a decade ahead if he had had lived, for instance.

And yet, quantum computing is so nascent right now, that one imagines that he might have been thinking of these things, and being intensely frustrated that they were 30 years away from being realized, physically, although maybe they would have happened, as you say, sooner, thanks to his influence. So, we had 40 years of the von Neumann architecture of computers being unchallenged, because no one came up with anything else other than, recently, neuromorphic chips and then quantum computing; and do you think Turing might have pushed

the edge on that and said, “Look, you’re taking this Turing computer thing too literally ,I never meant, you go out and build that and nothing else.”

When he was certainly his Turing machine was just a mathematical concept. You know, it’s not, yes, it’s very incredibly inefficient. He just tried to produce the simplest possible machine for his purposes. Von Neumann, although also another brilliant mathematician, did something a bit more practical with the von Neumann machine? Yeah, they’re essentially the same, they’ve got the same computing power and so on. But you know his is more practical with the memory and so on. I mean, sharing obviously, realize that because he went on to design computers at NPL with the ACE computer, and so on. So he wasn’t going to build a Turing machine. Obviously, people have done that, since then, just to show that you can win, there’s even a brilliant one of the Game of Life, Conway’s Game of Life with a Turing machine in it, because they’re both equivalent; the Game of Life has got exactly the same amount of computing power. So, I find those sorts of things interesting, where you can actually embed the Turing Machine within the game of life, which is pretty amazing.

Exactly and it strikes me there’s this symmetry in that the two concepts that are most associated with his name, that his name is part of the title book-end computer science. We have the Turing Machine, which defines computation itself makes basically makes computer science possible and then we have the Turing Test, wasn’t called that perhaps when he was around, but it is now which defines the point at which the boundary between computers and humans is crossed, there’s kind of beautiful symmetry to that they’re. Talking about the Turing test. how much did that it obviously plays a huge part in the conversation about AI right now, how much did it mean to Turing?

Well, I think when he wrote that paper, he was just having a lot of fun. If you listen to him, he was talking to Gandy of the time, Robin Gandy, who was one of his very few PhD students, but also a friend and colleague and Gandy writes, as he was reading out parts of the paper, and with a big smile on his face and I can imagine sharing, doing that he was he was, it’s quite a playful paper in parts. You know, it’s a philosophical paper. So, very different from his computability paper, for instance. So, I think Turing obviously could foresee these things that other people couldn’t see. But he was doing it in a playful way, of the time. He thought that we should be thinking about thinking machines, by the end of the 20th century is one of his things that he saw, which perhaps has been a bit delayed. I think we’re getting there with machine learning, and so on. I think we had a great period of doldrums with the AI where we, we had logic programming and so on, and that made some advances in the 80s. And then 90s nobody really got anywhere until the 21st century, when people sort of just let things rip with neural networks and so on. I think we were trying to be too much control freaks with AI during the 20th century and once we let the AI just sort of do its own thing, then suddenly, we’ve had huge advances. So perhaps we should have done that earlier. Obviously, maybe would have done it earlier if Turing had been around.

Again. Why do you think that he wrote that paper and explored that so much? It is, as you say, a different tone, it’s philosophical. It doesn’t exactly advance the science of the mathematics of

computers at that point; it's speculating about something that people still think could be an unknown distance in the future and opens you up to ridicule, even now, so, why did he do it?

I don't think he worried about ridicule. I think he probably quite enjoyed it. I think he'd been thinking about it for since the second world war with talking to Shannon and so on. He'd had these ideas. They've been floating around in his mind, as he said, he wrote some things down whilst at Bletchley Park and I would imagine that you think, right, I just need to get these out into the public domain so, it's recorded. And then you'd have this brilliant paper that starts things off.

What was the reception to that, was there a reaction?

Well, I guess people like John McCarthy, presumably, read it and some thought, there's something to this, but I don't think there was widespread. None of Turing's ideas took off immediately. In that sense, certainly the morphogenesis that he also worked on with theoretical biology, looking at patterns you know that that was written, and nobody took any notice for a decade or two. So, I think that was a bit similar with the AI paper, perhaps, that was slightly more advanced because of the meeting in the 50s. That started off for AI and so on. But he was a sort of scientist who decided, right you know I'm not doing this because I've been given a grant to write it, I'm doing it because I'm a scientist and I want to write it. Certainly his 1936 paper was like that: he just got inspired by lectures by Newman and started thinking about it, wrote the paper an entirely novel way. Fortunately, Newman realized this is a novel paper. Other people who read it may have said, this is a load of rubbish. He was just lucky to have Newman, reading it and then saying, this is a worthwhile piece of work, and getting it published or help him get it published. So, I think, the work on morphogenesis, similarly, he wasn't being paid to work on morphogenesis, it was just some ideas he was having. Amusing, excuse me, in this club called the Ratio Club, which met, and it was mainly young scientists and I think that was probably when he started to get the ideas on morphogenesis, for instance. I suspect the machine intelligence ideas must be swilling around at Bletchley Park. And I think probably the discussions with Shannon would have helped a lot because he would found somebody else who could actually discuss that sort of thing. I'm just trying to think who of Bletchley Park would actually really discuss that sort of area. Shannon, and Bell Labs is certainly the person I can think of where have you been able to sound off ideas and get interesting ideas back? And I think morphogenesis, at the Ratio Club, you could have done that.

And as you say, some of these ideas must have gotten back to McCarthy, because two years later, at Dartmouth, they thought that they could create something that would pass the Turing Test - not using those words, but other words equivalent to that - that summer, which turned out to be ambitious and too ambitious. Talking about getting paid, what was he paid for?

Well, at Bletchley Park, he was paid for he worked at the National Physical Laboratory, basically to design a computer, which he did, but the problem there was, compared to the wartime where, in wartime, you know, things needed to be done, money could be provided and we saw the very dramatic version in *The Imitation Game* really wasn't quite as dramatic as that that's basically he could go all the way to Churchill and he'd say, yes, this needs money; the money will be poured

in. National Physical Laboratory when it goes back to normal peacetime style where there isn't much money around, and I think Turing got fed up therebecause he was battling against the admin. I'm sure he hated the admin as many academics do. Then he went on a sabbatical to Cambridge with a part completed to design for the, the ACE, and never came back because he was then offered a job up in Manchester by Max Newman, who by then moved there and they already had a computer that Manchester Baby. So he went there to help them write with the software side of it. He didn't actually design the Manchester computer at all. So, he was paid by these fairly academic places. I mean, NPL is a research establishment. Manchester, you know, he was being paid, not as a lecturer, but to do help with the software on the Manchester computer.

So, he was paid by them for that kind of work, and then came up with things like The Imitation Game paper in his spare time?

Yes. I mean, it's like Tim Berners-Lee invented the web in his spare time, you know, the story with him similarly, you know, he went to his boss when he was meant to be doing things for CERN and he said you know, I'd like to invent the web, not quite like that and his boss essentially said, well, I can give you three months to do it. Go and do it. Well, I think Turing didn't even bother asking for the time to do it. I think that's the nice thing about academia, that you can go away and do things. If you read about Crick and Watson, in academia to do anything interesting, it's very important to be slightly underemployed. While Turing was slightly under employed, because he could work on the software of the Manchester computer, write things that generated music and so on and think about chess, and so on. But then also, you can think about anything you wanted. So, he's thinking about machine intelligence, and wrote that he was allowed to join the Ratio Club, which was only for people - professors were not allowed. So, fortunately, he was only a reader, which is the sort of Associate Professor level at Manchester, so he's never a full professor, even at Manchester, which may be a good thing, because that meant he was at the Ratio Club, talking to younger scientists and getting some interesting ideas there.

And not getting paid for working on theoretical biology, either by the sound of it, yet he found time for that to do you know, what stimulated triggered his interest in that?

As I said, the Ratio Club because I think he was by I mean, again, there's not much written that down about the Ratio Club, but it was for academics, not a professor level. So, younger academics could just come together to discuss interesting ideas. It was interdisciplinary, so, it wasn't all computer science or mathematicians. It was general science and so I think discussions there, people would have sparked his ideas. Again, we don't know exactly how, because it's not written down. But I think that's where it would have been originally generated from maybe his ideas on quantum was also from that club as well.

That there's just so much opportunity here for anyone who's got talent for writing alternate history science fiction to speculate on encounters between Turing and Einstein, and well, all kinds of all kinds of things. Ray Kurzweil has this rather unique view - not totally unique, but relatively unique view - that artificial intelligence is eventually going to evolve into beings that possess every characteristic that we value in humans. The ones we also traditionally say set us apart from computers like compassion and humor and curiosity. He says, eventually, that AI will

have those things as well. In Kurzweil's case, that eventually equates to about 25 years from now, that's the unique part. But timeline aside, do you think Turing would agree that AI would eventually get to that level of equality or even superseding humans at the game of humanity?

Well, I think AI is probably not necessarily going to be humanlike. It can do lots of things that humans can't do. We can already fake people's faces on in films and so on. Using AI techniques. I mean, AI surpassed things that humans can do. Humans can still do things that AI can't do. So, personally, I think AI is going to go off and do interesting things that are not necessarily able to be done by humans. Maybe it's going to do things that we don't even understand. I don't think we're there yet. I think what Turing certainly thought about it in human terms with the Turing test. So, he was thinking that they would be imitating humans. But I think he would have developed his ideas and thought, beyond humans, maybe if he lived longer, he would have developed his ideas. Because, you know, the Turing test is quite old fashioned. Now thinking you have to just pretend to be a human. I mean, to pretend to be a human, you have to be able to not be able to multiply very quickly, other things which computers can do very quickly anyway. So, you actually have to downgrade yourself, to pretend to be a human, as well as trying to upgrade yourself in other areas. So, I think probably Turing was thinking, maybe along human terms of the time, that I think he would have developed these ideas as time went on.

It seems to be more taking a potshot at philosophical stances that there's something unique to human thinking, that can only be instantiated within wetware within biological neurons and Turing saying, look, if you accept that it could be possible somewhere else, then you need a way of telling that, and the only way that you can tell is by what it does, if you are not restricted by some chauvinism about what it has to be made of. Do you think he was trying to convince someone of that philosophically?

Well, I think he was working around those sorts of areas. I mean, since then, Penrose has developed Turing's ideas and, saw that there are quantum effects happening in brains and that's why we can do certain things, you have a spark of something, maybe that's a quantum effect. And maybe that's something Turing would have thought about before Penrose if he'd lived on with these ideas that he was thinking about quantum. You know, it's just amazing what he was thinking about at that time, given where they were then. And as things developed around him, I'm sure he'd develop his ideas, with quantum developing, and so on. So, I think we have to accept he was living in times when there wasn't much computing power, and it's amazing he could think outside the box. And I think he realized that it was all going to be exponential and that's like Moore's Law, we were going to have doubling every 18 months or something, things you can do. So, I think he certainly sort of maybe extrapolated on that, maybe not explicitly for the thought, right? Computers are going to have huge amounts of memory and a huge amount of computing power. What could you do with that? I mean, consciousness, yes, is another interesting area of this. For me as a mere computer scientist, you know, consciousness is the one thing that is inexplicable. I'm seeing you there, I believe you're conscious. I'm sitting here, I think I'm conscious. But what makes us conscious, it's very difficult to know, isn't it? Everything else you can sort of explain with, with physics and other phenomena, chemistry? So, how does consciousness happen? Obviously, a philosophical question, and I'm not a

philosopher. That's the one conundrum I think, underneath all this. I mean, maybe a computer will be able to fake consciousness, but then you don't know if it's fake, or if it's real.

What is your current area of research? And to what extent does that overlap with Turing's interest?

Well, I guess I'm now retired formally, but like all academics, I keep doing things. So, I've got, although I've worked a lot in formal methods, which is quite mathematical working on doing software for so for instance, after I officially retired I worked on air traffic control. So, I used formal methods for that, which I'm not allowed to tell you much because I've signed my nondisclosure agreement, but fortunately, I don't know many of the secrets anyway. But certainly, that was an interesting area to be working in. And then since then, I've got more and more interested in actually just digital culture in general. So, I work each year I work on a conference called the Electronic Visualization and the Arts Conference. So, at the moment, I really love doing interdisciplinary things. So, I love connecting areas together which may not be obviously connectable. I always think if you're writing, I guess, perhaps showing if you're writing a paper in computer science, well you ought to be able to write it yourself. But if you're writing a paper in, something is connecting with some other area, whether you need somebody in that area, who knows enough about it, to bring that in, you need to be able to talk to each other enough to actually come up with something interesting, combining those two, two interests, and then you've got something that neither one of you could have produced. I guess, in the case of Turing, he had so many different types of brain, if you like, that he could combine these areas with single author papers, nearly all his papers were single authored, essentially, even the ones you haven't heard of he didn't really collaborate very much. I think he wrote one, I think with Max Newman, professionally, everything else is single author. But he was brilliant enough that he didn't have to collaborate, whereas sadly, I'm not.

And yes, I don't know how many single authored papers we get these days now, if any. Do you think that the recent attempts to make amends putting them on the 50 pound note the pardon, the statue? Do you think that they go far enough?

Well, I think you should be Turing's family forgiving the government, Turing wasn't doing anything wrong in the scheme. I mean, obviously, it was illegal, then and times change. But it's just a sad situation. I've got my 50-pound notes, which I collected. With some difficulty I might add, because it was all during COVID and then we had to go to the bank three times before they'd given me some 50-pound notes and I don't know what's going to happen now. With the sad state of the Queen dying, and so on, whether it's going to be new 50-pound notes, with Turing and King Charles, on whether that will, be it? Sadly, I've hardly used money during the time of COVID. So, although I caught my 50-pound notes, they're framed in my office, so and I'm unlikely to use them. But I think all these are nice things to, to have happened and you certainly know, that is a snowball effect, isn't it. But once you get to a certain level, then the next thing happens, and you become more and more in the public consciousness and then more and more things like that can happen. I mean, there was a program on BBC where they were voting for the most important person ever and Turing won that I mean, I guess it was fairly British based, but this is looking at all areas, you know, people like David Bowie in music and so on.

So, and in the end, it was Chris Packham, I think who gave a wonderful sort of oration on him, or were again, I think he's on that sort of area of spectrum of mentality was Turing and he gave this amazing talk, you know, basically just holding up his smartphone and saying, you're all holding a Turing Machine in your hand. He's going to live on and you're all remembering him because you're holding a Turing Machine. So, yes, I think when you get things like that happening, you know, it's amazing what is going to continue basically.

If something could bring Alan Turing back to life for five minutes, what would you say to him?

Well, I suppose I'd want to know about the quantum ideas he was having. I think I'd like to know about the things that weren't written down. So, I'd like to know what he talked to Shannon about. Yes, I'd like to know what his ideas on quantum were, and was he starting to think about quantum computing or just quantum effects? That'd be really interesting to know some of those things never got written down.

Wow, it's been a fascinating time. It's been wonderful talking with you about this. And I'm just struck by how inadequate I failed to do justice to Turing's name, but he has certainly influenced me so much that I had to go and find you to be able to do this interview to get this idea of just how much Turing had shaped our modern world of computing mathematics, and you have certainly been done that for us. Is there anything else you'd like to draw attention to for listeners to follow and learn more? Of course, we'll have a link to the Turing Guide. Anything else you want me to? To refer them to?

Obviously, yes, Turing guide would be great, because I get a small, small amount of money for free. I get about 25 p per copy, just so you know. Which is about 25 cents, because of the way the pound is at the moment. But yes, I mean, if anyone wants to go and learn about Turing in Oxford there's a YouTube recording of that talk. So, I'd be happy to give a few extra links of things that I've done since the Turing guide, like that, basically, has YouTube videos and slides and so on. So, I can certainly send those to you and you're very welcome to add them to this podcast. Thank you.

We'll put those in, well Jonathan Bowen, thank you very much for coming on AI and you.

Thank you very much. I really enjoyed the talk. Thank you.

That's the end of the interview. There's a link to The Turing Guide in the show notes and transcript. So if you could bring Alan Turing back to life for five minutes, what would you want to ask him or say to him?

Here are all the links provided by Jonathan:

Alan Turing at 110 - and at Oxford! (YouTube talk)

https://www.bcs.org/events-calendar/2022/june/hybrid-event-alan-turing-at-110-and-at-oxford/

Recent publications (in reverse time order):

Alan Turing and Oxford

https://www.computerconservationsociety.org/resurrection/res97.htm#e

The Digital Renaissance from Leonardo da Vinci to Alan Turing

https://periodicos.unb.br/index.php/museologia/article/view/37241/31901

The impact of Alan Turing: Formal methods and beyond

https://www.researchgate.net/publication/332451239

Turing's Genius – Defining an apt microcosm

https://doi.org/10.14236/ewic/EVA2018.31

Life in code and digits: When Shannon met Turing

https://doi.org/10.14236/ewic/EVA2017.9

Alan Turing: Founder of computer science

https://www.researchgate.net/publication/345163755

In today's news ripped from the headlines about AI, Baidu, roughly China's equivalent of Google, has revealed a design for a robot car from their electric vehicle firm Jidu, which has advanced design features including a steering wheel that retracts beneath the dashboard when it's in autonomous driving mode and lidar sensors that expand and retract from the hood. It has AI in the cabin that can communicate with passengers using voice recognition, and has hardware from NVIDIA that can deliver up to 254 trillion operations per second to manage the on board computing requirements. It's kind of hard now to remember that there was once a time when cars where we're engineered primarily for transportation and not as mobile data centres. Baidu says that it will be available for purchase in 2023 for delivery the following year. Their CEO claims that this is going to take market share away from Tesla and that they are one generation ahead.

So, just a bit of commentary now about one of the common discussions about what computers and AI do to our knowledge and expertise. A lot of people maintain that it's a problem that we lose our skills at doing things like map reading when we get tools like GPS or sat NAV that we come to rely on for doing those things. And I just want to say that I hold a contrary view to that. Of course I know how to read a map: in school I learned how to compute lines of sight on a contour map, but I no longer care whether I retain that skill or not. As long as I have devices that can do that for me, I am happy to use them. I use the navigation function in my car for the simplest and most repetitive journeys, because it is one less thing to think about. And also because sometimes it will pick a different route due to congestion or road closures. And everywhere I have used it, it has come up with a choice that is demonstrably superior to mine. I can rely on its estimate of when I will arrive to within a couple of minutes almost always. When I have used it for traveling across a freeway less part of Los Angeles it has often changed its route several times along the way, in response to train changing traffic conditions, improving the time that I would arrive hugely. But to address the question of losing that skill when a computer does it: I don't mind that happening, because I can use my brain for other things then. If we had taken that approach to begin with, we would still be rubbing sticks together to make fire. I would have been learning how to shoe

horses or cobble footwear in school. Every scientific advance that the human race has made has been built upon earlier work done by other people, which represents thinking that we no longer had to do or no longer had to do as intensely and brilliantly as they did. And so I want to see what happens next when we don't have to think about things that computers can do for us now. I have as much nostalgia as the next person for skills like navigating a library catalog, but the simple fact is that if Google can find an answer in a second that would otherwise take me an hour in a library, that is 59 minutes and 59 seconds of my life that can be used for something else, something that Google cannot do. The only argument that seems to be made in favor of retaining these skills is the possibility of being stranded on a desert island with no access to computers or the Internet. I would say that if that happens, you have bigger problems. But also that it is so unlikely to happen, that it is a very suboptimal use of your time to spend it retaining skills that are only useful in that situation. There is of course another argument, that these skills exercise parts of the brain that can be useful for other things, kind of like going to the mind gym, so that map reading strengthens the spatial visualization part of the brain. I'm quite confident that there are other activities back and provide that mental exercise that aren't so readily replaced by computers. Anyway that's the end of the commentary for this week.

Next week, my guest will be Handel Jones, a Silicon Valley technology consultant with expertise in geopolitics, who has a new book about the China's artificial intelligence progress, strategies, and goals which we will be discussing at great length. That's next week on *AI and You*.

Until then, remember: no matter how much computers learn how to do, it's how we come together as *humans* that matters.

http://aiandyou.net