

# AICSCSHistory\_Interview002\_AustinTate

## **SPEAKERS**

Austin Tate, Vassilis Galanos

*Please note that this transcript has been lightly edited relative to the original audio, in order to improve readability.*

### **Vassilis Galanos 00:02**

This is Vassilis Galanos. Today I'm here with Austin Tate. This is the 17th of April 2024. And this is part of our project with Professor Christopher Williams and Ms Xiao Yang, looking at the history of artificial intelligence, computer science and cognitive science at the University of Edinburgh. We have the pleasure to have Austin Tate with us today. So before we delve into the specifics of your notable career, and the evolution of AI in Edinburgh, could you please share an introduction about yourself highlighting your major contributions in the field and your personal journey within AI?

### **Austin Tate 00:43**

Certainly. Thanks for inviting me along to do the interview. I'm Austin Tate, I'm now retired. So I'm an emeritus professor of Knowledge Based Systems at the University. But I still maintain a link to the university as in 2024, as we've been interviewed, I'm an honorary staff member at the School of Informatics still. So my background is in AI planning, in particular, planning and dealing with collaboration between humans and systems, especially where you've got teams working together. That's been my research interest really right throughout. And if we get a chance or maybe we'll just go back to some of the early days, because I started work on that even before I came to Edinburgh. The other side of my work has been in AI applications. And I guess you could say that's the main thing I've done in my career. I was Director of AIAI from when it was formed in 1984-85, I took over as Director from Jim Howe, who was the Head of School. So he was the acting director at first, I was Deputy Director, and then became Director a year after it started. That was 1985. So AIAI had been operating then, since 84. We did that right through to when AIAI was incorporated into what is still AIAI but with a slight name change. It was originally the Artificial Intelligence Applications Institute. It's now the Artificial Intelligence and its Applications Institute. But it's still AIAI. So it's nice to see the name continue on. A lot of my work has been in applying technologies of all kinds and leading that work at Edinburgh. I've been involved a little bit as well, in the last 15-20 years or so, in virtual worlds (VR) for education, that really links to my interest in distributed collaborative teamwork. That's originally why I got interested in virtual worlds as a way of bringing teams together worldwide into these virtual environments, where people meet and exchange things across time zones, and so on. But more recently, I was using it for education purposes. I helped create the Virtual University of Edinburgh in the University (Vue). And that's been a part of my work more recently. So I think that's kind of the introduction. My work started just before I came to Edinburgh in fact, I did my undergraduate degree in computer science, my first involvement in that subject, at Lancaster University, and they had courses there which used the Edinburgh POP-2 language. That was an interactive language you could use. So that's going back to 1969. And that brought me in contact with Edinburgh through the POP-2 language originally on my courses. But then because I did a project there, my undergraduate project in AI planning, and I corresponded with the teams at Edinburgh as part of that. So my involvement with Edinburgh predates me coming here by a

couple of years, because I worked with Donald Michie. Professor Donald Michie in Edinburgh, and Jim Doran, were the people working on search and planning, and they helped me with my project, which led to me being asked if I'd like to join them to do a PhD here. So my formal involvement with Edinburgh started in 1972. And I've been here since doing various different things. Does that give you a feel for where we're starting?

**Vassilis Galanos** 04:08

Absolutely. Yeah, it very naturally leads me to my next question then. So the University of Edinburgh has been a significant hub for AI research for many years. In your view, what factors made Edinburgh a pivotal place for the development in these fields during these early days? What brought you to Edinburgh, what brought you in correspondence with Donald Michie?

**Austin Tate** 04:33

They were publishing a lot of work. There was quite a few different people here. I think one of the successful parts of early Edinburgh AI was that it did attract visitors from all over the world. All the time I was a PhD student here, there were visitors, really nice people coming along, giving talks, but also staying here for a period. And I worked with a number of those as people who were doing their PhD at the time at MIT, Stanford, SRI International, they came through, and that was a big influence. You had a lot of discussions with a lot of blackboard sessions in Hope Park Square, which is one of the places that we were using for the AI work. So I think it was, well, you've got to first of all understand that at the time, there was perhaps four world-wide centres. So, you know, there was MIT, there was the Stanford/SRI complex, and there was Edinburgh, really.

**Vassilis Galanos** 05:28

CMU?

**Austin Tate** 05:28

Well that was a little bit later, okay just a little bit later. [post interview correction: CMU was indeed an early pioneer of AI. Austin explained that his own interaction with CMU started in the early 1980s with their Robotics Institute] I'm going back to the early 70s. Now, in the late 60s and early 70s, when I was attracted as a PhD student, if that's the period we're talking about, that would be 1971/2. And at that time, there were lots of other people working in AI, but they weren't really the world leading centres at the time, I believe that's true. So you've got Edinburgh as really the European Centre for AI, that's definitely the case anyway. So it was an attraction, from that point of view. Donald Michie had a lot of interesting things going on. With robotics work on the Freddy robots as well at the time. But there's natural language work, there's work in search, there's work in a range of different topics. So it means there was a mix of things going on, and quite a few people. It was a centre of excellence, really. So that's what attracted me to come up. But also because they were working in planning and I got interested in planning, I thought planning was an important part of intelligent systems, still do. So I wanted to see if I could come and participate in that and also do my PhD.

**Vassilis Galanos** 06:37

This is extremely interesting, I guess a bit of a follow up, you mentioned all these directions. So for example, knowledge systems, robotics.

**Austin Tate** 06:45

Knowledge systems a little bit later, really. Although my work has been in using knowledge in planning, early on, we wouldn't have really thought of it that way, we would have thought of it as setting up a search space, you know, somehow defining a space that you search through, and then trying to navigate that space using heuristics and using ideas from the domain. So kind of knowledge is there. But really, the expert systems/knowledge-based systems approach was coming in in the early 80s, late 70s, early 80s. So that's almost a decade later, with people such as Ed Feigenbaum, you know, at Stanford, these were the people who were early in that game. So there wasn't really a group doing expert systems as such, at that time.

**Vassilis Galanos** 07:28

Yeah, yeah. But you also mentioned that natural language processing, ... and search, and ...

**Austin Tate** 07:35

As you know, there were other departments here who were interested in the cognitive science side of things, natural language side. So there were lots of other things going on within those groups.

**Vassilis Galanos** 07:46

So today, we talk about all these kinds of applications as forms of AI. I'm wondering whether the language was the same at that period when you came from Lancaster, when you moved to Edinburgh, where all these branches of AI?

**Austin Tate** 08:00

Well, Donald called it machine intelligence. His Professorship was Machine Intelligence. When I joined the group, it was the Department of Machine Intelligence, later the Department of Machine Intelligence and Perception, to do with the robotics and vision side. So there was work in vision, remember, as well. So the Freddy robot is an example. That dates to, what would that be, 1969? The first one or so. Freddy 2, which was the one I worked with was just after that period, but it was basically 1970-74 or so. And then they were doing visual recognition of objects, they were doing manipulation. They were doing robotic control. So it was to try to do all aspects of an intelligent assembly robot. That was what Freddy 2, and Freddy 1, was trying to do. So it was a more holistic approach. That got criticised by other scientists in some disciplines who reviewed AI at that time, like in the Lighthill report. The James Lighthill report was criticising it as trying to be too general. And they didn't see the value of taking that holistic approach, which Donald Michie definitely did.

**Vassilis Galanos** 09:08

I mean, the rise of the general purpose, we'll return to that. Yeah, later on.

**Austin Tate** 09:13

And in a way, that's the benefit of the multidisciplinary side of things, it's because you've got these groups who are doing all these different things. There's only a few projects worldwide that, at that time, the early 70s, were trying to do truly integrated devices like that. There was Edinburgh with its Freddy, 2, Freddy assembly robots, and there was SRI International with Shakey. And again, they were trying to do everything that you would need to make an intelligent robotic device. They weren't just trying to do one thing or the other. You know, a vision system or a recognition system or a speech system or control or a planner, that tried to put everything together and that had all these benefits. So in my own field of planning for instance, SRI International and Stanford University with the Shakey robot had a planner called STRIPS, which early on was really a good example of trying to do a lot of different things. It was

trying to do planning. It was trying to plan monitoring and execution of plans. It's trying to repair plans when things went wrong. And that holistic approach is something I tried to do in my own career. You know, we're trying to do all aspects of intelligent planning, execution and control in the research that I've been involved in, rather than taking one little bit of it.

**Vassilis Galanos** 10:27

Extremely interesting. So today, multidisciplinary scenario has become a kind of a currency. So Edinburgh has been very pioneering. What made people work in that way in Edinburgh at the time when you arrived here, what kind of research culture did you encounter?

**Austin Tate** 10:44

Well, it's interesting, it obviously comes down to the people involved, they have this broader interest. They aren't narrowly interested in one or two things. I mentioned that early on at Lancaster, we used the POP-2 language from Edinburgh. At the time, a guy who's now at Edinburgh, Malcolm Atkinson, was their computer manager. And he introduced POP-2 alongside other languages for working on the mainframes rather than interactive computing at that time. But that POP-2 language itself came via a company that was spun out of the AI people at Edinburgh. Again, so Jim Howe, Donald Michie, Robin Popplestone, they formed a company called Conversational Software in the, I guess it was late 60s, early 70s. So that's probably one of the first AI spinouts anywhere in the world from a university. I mean, it must be one of the earliest anyway. And they were trying to make sure other people could access it and use it for applied purposes. They weren't selling it just to universities. And they were trying to get people to use it because they saw the value of some of the applications. And I mentioned the robotics applications, even then, the GPO, the General Post Office at the time, had a contract with Robin Popplestone in Edinburgh, to use the Freddy robot and to think about moving parcels and stacking parcels and things like that. They were always interested in these applications. They weren't just interested in writing technical papers. They were genuinely wanting to see this stuff put to use. And it's got to come down to the individuals involved. Donald Michie was a very entrepreneurial guy. He was very aware of applications, he was always thinking of how to apply the different technologies, as well as doing the research itself and the underlying stuff. Just early on, actually I've just been reminded that even when I was at secondary school, I remember getting my parents to buy me the volumes of the machine intelligence workshops. Donald used to run an annual workshop on machine intelligence to bring people together, not just Edinburgh people, but from all over the world. He brought a workshop group together, and he had these machine intelligence workshops. And they're lovely volumes that produce really a good summary of AI at the time, with all the different kinds of papers in it. And I had the first volumes of that having got my parents to buy me that for one Christmas present. So these machine intelligence volumes were a great example of early popularisation and communication of the subject to other people, the scientists and youngsters like me, who would become interested in AI and go into the field.

**Vassilis Galanos** 13:26

Wow, this is extremely interesting. I have one of those volumes, and it's the fourth or fifth one. Yeah, it includes,

**Austin Tate** 13:32

I think it went up to 13 or 14. I presented at a couple of them later on in my career. But they were very good nice workshops, very friendly workshops. But bringing together all this network of scientists

across the world, and again, pulling people into Edinburgh, some of them weren't held in Edinburgh, but in various places, but a lot of them were held in Edinburgh.

**Vassilis Galanos** 13:52

And I guess for younger people who might be listening or reading this interview, we need to stress how difficult it was at the time to correspond with all these people and send these invitations.

**Austin Tate** 14:06

no e-mail

**Vassilis Galanos** 14:07

no e-mail.

**Austin Tate** 14:08

I assume I wrote, I don't remember ever using telephones to speak to folk. So I assume it was literally me finding the paper, that would have been a paper, I'm sure it would have been in one of those machine intelligence volumes on their work on the what's called the graph traverser, that really I was trying to reimplement originally, and then trying to extend and show how it could work in different domains. But the fact that the group at Edinburgh and the individuals pick up on it, and correspond with you as a young school child or scientist is important. I've continued that, I always make sure that any letter that comes from any school child, I try to give them a reply, because I think it's really important to encourage folks into the subject from that point of view.

**Vassilis Galanos** 14:55

Yeah, our pedagogical responsibility right and why should we not respond to people's dreams? You mentioned Freddy, Freddy 2, you've mentioned POP-2, would you like to discuss any further initiatives, projects, academic programmes that you believe have contributed to establishing this legacy of excellence?

**Austin Tate** 15:22

If we continue on a little bit, I'm thinking of it linearly in time. So I came to do my PhD with Donald Michie as I said, in Edinburgh, doing that in planning. That itself, as I mentioned, brought us in contact with a lot of interesting visitors. So although Donald was my formal supervisor, Harry Barrow, who also worked on the Freddy robot was probably my main technical supervisor, he gave me most of the kind of feedback at the very technical level. The semantic database I used, for instance, was a derivative of something that he'd worked on. But there was other people. Danny Bobrow from Stanford, was here at the time for a period, I think, a year or two. And he was definitely an influence as well, because he was seeing what we were doing and relating it to the work at Stanford. So you get all this kind of interaction and connection. So that was kind of the PhD period. But just after that, I worked just briefly on the Freddy robot to do assembly planning for the Freddy robot. So that was my first research associate position. That was with Robin Popplestone. And then with, Professor Bernard Meltzer, who headed up the Computational Science Group at Edinburgh, he had a grant with Robin, to look at planning using AI and OR approaches, again, interdisciplinary, he wanted to bring scientists together, who were operational researchers and AI planning people. And I worked with Lesley Daniels on that, she was the OR PhD to do work on, again, an applied application, it was with the Central Electricity Generating Board, you can see all the time, you've got these influences of applications and science, and robotics people all mixing together. So we worked on that "planning: a joint AI and OR approach", and that

probably led to what's been my technical contribution that's normally in the literature, which is hierarchical task network style planning, hierarchical planning, but using a lot of knowledge from the domain. So this is where we started to use the term knowledge-based planning in my work. And that's why I wanted my chair to be called knowledge-based systems, more broadly, but basically I'm interested in using that kind of knowledge you can get from the domain, the modelling of the domain, not just stuff you have found and mined and statistically put together, but coded knowledge. Now at that time of course, coded knowledge meant human coded. Nowadays, it would be quite different, you would have ways of doing it. But at the time it was a time consuming task to bring that knowledge together, once you had it, you had ways then of being able to constrain the search very, very significantly. And it was that kind of link across that led me to be interested in the applications side. But unfortunately, we did have a period of about five or six years in AI where there wasn't much investment in the subject. And a lot of that can be blamed on the James Lighthill report. It stopped some of the investments in the UK, and the interest in general purpose AI systems, at least in the UK, but it had an influence worldwide. If you go and talk to people at DARPA, in America, and you talk to American scientists at Stanford, they saw the influence of that same worry about people working on general purpose AI, so it had an effect worldwide. So although we did get a follow-on grant for that planning work, I didn't take that up. I actually had five or six years when I went off and did other things. In particular, I went to the Edinburgh Regional Computing Centre. Now again, you see that's been a big group. And it may or may not be something you're covering in your interviews, the Edinburgh Regional Computing Centre and its involvement in early time-sharing systems is actually another part of Edinburgh. It was led by Tommy Thomas, who was one of the people who worked on very early computers in Britain and was one of the pioneers of the early computer days. Tommy Thomas was the Director. And I joined that group in the database group. So that actually was interesting from my point of view, because I was trained as a proper formal software engineer, I got my software engineering and project management training then, because I had to do that because we were doing projects that were going to be commercially used. In particular, the Fortran Interface to IDMS was something we designed and built, and I led that project. Because I was trained, I've kept that kind of thread throughout. It meant that as we came to the early 80s, and money was coming in from these various commercial sources, we were able to think about how to improve interactions between academia and industry. Talking about maybe 1982, because of some of that funding, the IT groups the university were getting together, they were starting to see themselves as "Information Technology", what would now be called perhaps Informatics. See themselves as a whole rather than separate departments. And this went right across the different groups across the university. So in particular with the commercial income we had, they funded three fellowships, one in computer science, which was Malcom Atkinson, one in electrical engineering with Peter Denyer, and myself in AI. So we were given, I think it was 18 months funding, to look at ways that Edinburgh could extend its reach into industry and working with industry. So we all were able to start making links, I had to do a bit of travel, starting to promote Edinburgh, talk about Edinburgh, write papers on what we were all doing, interview people. And make sure the story was written down, create some brochures. So there's various things that we were looking at doing together. And a lot of outcomes came from that, lots of different systems got spun off. All three fellowships had successes in terms of what was created. But in particular from my point of view and the AI point of view. Jim Howe who as Head of the Department of AI, was able to form the AI Applications Institute, AIAI, My group and planning became a part of that, because we already had significant external funding at that stage. So we had two groups, we had the group under Robert Rae, who did the Edinburgh Prolog work and the programming systems work. And we had my own group working in planning technology and planning applications. And then we extended that when we started to recruit people, we got funding, we got grants to put in place other people and start recruiting them, where we didn't have external funding

already for them. So we're able to start growing. That would be in 1983. So there's an outcome of those fellowships that was useful in terms of longevity of some of these initiatives, which have led us into more applied areas. So you're seeing all of these groups working together and joining together. And a lot of those people were involved in IT became members of the Board of AIAI to help steer it with IT and cross-disciplinary directions. So that's what led to that. I took over as Director about a year later, as I said. I was looking at joining a commercial group and becoming their AI Director at the time, and we were advertising for a director because we assumed you wanted a kind of a managing director type person. So I was just encouraged to apply for that as well, rather than just going off and doing something in the commercial sector. So I took over as Director in 1985. And as I said, and continued that work since. But we grew, we grew quite large. We were a separate group in the University originally, AIAI. It was a separate nonprofit, but completely cost covering group. So it had to pay for all its facilities and all its offices and staffing and everything like that. And that continued for quite some time. Later, the formulas changed, you know, so we paid the overhead to the university instead of retaining the overhead, but having to be completely self covering. And we changed when we joined inside the School of Informatics. And then inside the different groups, as I said earlier, when we became part of what is still AIAI, but with a slight name change, so it reflects the more academic side, as well as the applied side.

**Vassilis Galanos 23:59**

It's very interesting. I have a very tiny follow up on this. Since Donald Michie called the field machine intelligence, what led to the decision to call it AIAI?

**Austin Tate 24:08**

AI was a term used in the States. So there was, you know, quite a kerfuffle, in the in the early 70s. There was a lot of argumentation between some of the principals involved. The people involved were all very strong-willed characters. So there was a little bit of a falling out between some of these folks. And what was the Department of Machine Intelligence and Perception was really split into a continuing Donald Michie unit, which was called the Machine Intelligence Research Unit, MIRU, and what became the Department of AI. Then it went School of AI, and Department of AI, and I can never remember exactly the orders of those but there's some online information that gives the exact dates that these different names applied. [Added post interview: <https://web.inf.ed.ac.uk/aiai/history-of-ai-edinburgh>] But basically what was the Department of Machine Intelligence and Perception became the Department of AI effectively, and a separate Machine Intelligence Research Unit. I was the only student that stayed with Donald. So Donald had his small group and I was the single PhD student. David Warren, who was my flatmate at the time, he worked on the Prolog side of things, and programming and logic, and he went to the Department side. So I was on the Donald side, I stayed with him for that period. It was interesting because that was around the time that we got the PDP-10 at Edinburgh, which was connected to ARPANET. So that would have occurred in about 73 or 74. That was a time-sharing system or interactive computer system you could use and connected to ARPANET. So we actually had access from here to Stanford and MIT PDP-10s as well over ARPANET. So we were very early users of the ARPANET really in Britain. There's only a few other sites like in London and elsewhere that had the connections. So because I tended to work in the mornings as well, I often had access to the PDP-10 at Stanford as well as Edinburgh before everybody else came online. So almost sole access to the PDP-10s for AI. Edinburgh ran the PDP-10 service as a UK service. Robert Rae was involved in that as well. The guy I mentioned who became a deputy director of the programming systems group for AIAI. He was heavily involved in that work and POP-2 ran on it. You could use POP-2 interactively then. So you were able to interact with the programs. But because I came in sort of early in the morning until mid

morning or late morning, there was effectively no one else on those systems for that period, which was very convenient.

**Vassilis Galanos 26:46**

Very interesting. It was kind of a Western influence or globalising influence in calling it AI.

**Austin Tate 26:51**

Yeah. So as I said, Jim Howe founded AIAI, and then that was my career effectively for 30 years after that, leading that group. But that meant we were really very serious about the link between industry, business and academia. We wanted to get our stuff out there. And we had a whole series of initiatives to try to do that with a training programme and with trials laboratories where people could come and use advanced equipment. We hosted Lisp Machines, various associative memory systems that were experimental at the time, we had a Parallel Architectures Laboratory with novel parallel and different computers that were intended to be early examples of some of what you would be using later on. We ran INMOS transputers. We had an ALICE, which is the Applicative Language Imperial College Engine. So these were novel machines. We ran those as a service for industry and academia to use. And the Science Research Council at the time gave us a grant that allowed us to run an AI for Engineers programme. That's AI for engineers and other subjects. And again, they could visit Edinburgh, they could work with us, or they could use our facilities. And that's at the time when AIAI took over the running of the AI library, which was a very extensive library, and supported Olga Franks as the librarian. So we could run a professional library service, it was professional before, but I mean, run it with support and with funding to grow its services and give a lending facility that could be used by people outside Edinburgh as well as inside Edinburgh. We had an Associates Programme for industrial affiliates of the AIAI, who could use our library there, for instance.

**Vassilis Galanos 28:44**

Do you know what led to the initiative to create that library?

**Austin Tate 28:47**

The library itself really goes back to Donald Michie days. Very early on, he was very keen on that. Even when he went to the Turing Institute, he created a very extensive library there from scratch again. I'm not sure of the exact influences. So I'm sure multiple people were involved in it. It was quite common at the time for departments to have their own libraries, prior to being more centralised later on. So I don't think it was uncommon for subjects to have their own library facilities, especially for all the technical journals, and the technical papers that may not really be book style things. AI ran a lot on technical papers from groups. So we had all the different technical papers from MIT and Stanford and other groups. So you got early access to papers that were technical reports as well as published papers. I think that was probably more the norm then than it is now, where more things tend to be centralised in the main libraries, just from an archival and curation point of view. But I would think Donald Michie was heavily involved in those decisions. He wanted those libraries. He was very keen on them. Because as I said, when he left Edinburgh in the early 80s, that would be I guess, he formed the Turing Institute in Glasgow. And again, he set up a library there that was a very extensive library. Later on when the South Bridge fire destroyed the AI library completely, unfortunately, was just after we bought the remains of the Turing Institute library. So when the Turing Institute in Glasgow closed, which would be around early to about 2000 or 2001, we purchased the Turing Institute library and incorporated into the Edinburgh library. Unfortunately, both then were destroyed, the physical material.



**Vassilis Galanos 30:44**

Yeah, I mean, that's part of the justification I've made for the creation of this project.

**Austin Tate 30:50**

Yeah, it is. Very often it is critical. I was just mentioning to you earlier on that we had a lot of materials. Remember, this is pre PDF, and pre word processing almost, a lot of these papers, and we had a lot of originals, AIAI's own work on technical reports and project reports. And a lot of that material isn't in fully electronic form, even now. You know, the scanning still awaits one day to be done. Luckily, a lot of that material is well preserved in paper. But that doesn't mean it's not at risk.

**Vassilis Galanos 31:29**

I absolutely agree. And it's part of our mission to preserve as much as possible. You have returned a couple of times to the issue of challenges and issues in the early 70s. Yes, so I want to more formally invite you to elaborate more on the challenges that Edinburgh had faced, during the...

**Austin Tate 31:52**

Well, it was definitely a period which affected AI, and affected the people who thought of that as a career option, perhaps, and to move into the area. It was a confidence diminishing time, even though funds were still around. A planning grant to follow-on from the work on the Nonlin planner and the planning joint AI/OR approach was actually granted, but then I decided to leave. But, you know, it wasn't that there wasn't funding there, it was just a feeling that there wasn't the momentum in the field. And that lasted for quite a period, there's definitely a quiet period worldwide in AI, if you look at the literature, you look at the advances, it just flattens off, a little bit down even, but definitely flattens off. And a lot of people say "what happened in this period?". For instance, my own field of AI planning, what happened in that period? There's a lot going on, all of a sudden, there's a flattening, and then all of a sudden it starts to take off again after this five/six year period. But anyway, it did take off and you know, by the mid 80s, there was the interest in expert systems, knowledge-based systems as I said, that was perhaps one of the things then that kicked off real applications, people using it for productive work. And my contacts were mostly with people like Ed Feigenbaum on that, at Stanford. So we were likewise in Edinburgh doing similar things through AIAI and other groups. So, that definitely gave us the opportunity to start growing. The other influence though was that there was the work on the Fifth Generation Computing Programme in Japan. And they adopted a sort of declarative engine approach which suited logic programming, suited Prolog, and Edinburgh was well placed there. We had a lot of clients in Japan, Edinburgh Prolog was well marketed into Japan and taken up and used by companies and academic groups. And it was Edinburgh Prolog, it wasn't, you know, the variants of Prolog, it was Edinburgh Prolog they were using. So Robert Rae's group in AIAI did support a lot of that work and commercialise the systems. But that led to real applications, real income, real companies wanting to form AI groups. And that was the difference then. People wanted to create AI groups, that was what we were trying to do. We weren't really trying to get work for us as much as make sure there were people who understood AI and could use it in their businesses. We had a programme called a Study Programme in AI Applications, which had visitors come to Edinburgh for a period of perhaps three months, mostly three months, but we had a few who came for a year or 18 months from all over the world. A lot of Japanese clients for instance. I still have great connections with some of the people, now retired, who came in that period and really had their early exposure to AI for the companies such as Hitachi and Toshiba. We were working with those, and those people went on to lead big groups who were very influential in their own companies. So we did a lot, Rolls Royce and Associates created their AI group, we helped them create their AI group, and then they went on and used it in their applications.

So it's very typical of what we were doing. We taught hundreds of people, trained hundreds of people, let them do their own projects, but alongside our staff. It's like doing a mini MSc, that's how we used to think of it. We had training courses that they could take, depending on what they already knew. Had to get them quickly into a position where they could do an application that was relevant to their business or indeed was the thing the business wanted to build, and prototype it alongside our staff, with our staff giving them the systems and the help that they would get if they were doing an MSc. That was the model we had. And we had hundreds of people through that programme. So it was quite effective to make sure all of that could be done. But also, when you made this big connection with people, we still get people coming back to us and saying, you know, I worked with you 25 years ago. I did a couple of months in Edinburgh. Now my company wants to do X, you know, where could we do that? Do you have any connections? Or can you put me in contact with? So that kind of connection still trickles on. It means that Edinburgh still gets a lot of these secondary connections. It also means that all those people went out and became project leaders, CEOs of companies, they formed their own businesses, you know there's a massive network of people who have had an influence from Edinburgh, much like I said, early on, we had the visitors who came from other sites here, they had a short time in Edinburgh, which means they knew Edinburgh people, and could bring that into their own work. And that went on for a very long period, a very successful period. That continues on, of course, but now in a kind of a super accelerated way, with what's happening with Large Language Models and the more statistical side. For myself, I think that when we get back to using hybrid techniques, and we start using Large Language Models alongside more reasoning-oriented search and planning-oriented methods, task support methods, there's going to be a much bigger acceleration in AI. When we're not trying to do everything with one technology. There'll be this super acceleration that will exceed what's even happening today. And that'll be interesting.

**Vassilis Galanos** 37:29

That's also a topic we can return a bit later on. So Edinburgh influence to contemporary landscapes. But I'm struck by the relationship between Edinburgh and Japan. I didn't know much about it. You mentioned Feigenbaum,

**Austin Tate** 37:45

Feigenbaum was of course at Stanford.

**Vassilis Galanos** 37:46

So yeah, but I wonder if there was a connection between Edinburgh and Feigenbaum. And also, I mean, there are a couple of follow ups I have

**Austin Tate** 37:57

Remember that Feigenbaum would be a contemporary of Donald Michie.

**Vassilis Galanos** 38:00

Exactly.

**Austin Tate** 38:00

So again, I don't know the personalities exactly there. But because a lot of my own research work was sponsored by American groups like DARPA, and the US Air Force and US Army. So I did a lot of work in America. Ed was on the same programmes. So I came across him really six times a year. You know, at one time I was flying across the Atlantic six times a year for the work we were doing on the Planning

Initiative, for instance, which was a DARPA and the US Air Force Research Laboratory programme in advanced planning technology, and Ed and the others were all involved in that.

**Vassilis Galanos** 38:45

Would that be during the period you were working more closely with computing or AI?

**Austin Tate** 38:51

Well, really, I would consider what I've been doing as AI all along. Although, my first degree is computer science, and I did software engineering, as I said, and project led on database technology and other things. But I think of myself as an AI researcher, and applier. That's been the majority of the work I've done. So it's always been AI techniques in the context of humans and systems working together, and occasionally with a bit of robotics thrown in. That's the kind of field that I'm involved in. So my interests in parallel architectures and things of that kind means you're always looking at computing, you're always looking at general models. Because parallel architectures were really important to the way we foresaw future planning systems. One of our planners called O-plan was designed for parallel systems. It was designed to exploit a whole range of distributed parallel and fine-grain parallel architectures, including even synthesising chips at the time. I mentioned Peter Denyer at Electrical Engineering, he supervised with me a joint project that we did, where we actually fabricated a chip that did graph search in silicon. So there were all sorts of things like that going on. So computing more generally, but AI being the focus.

**Vassilis Galanos** 40:15

Very interesting. There is a general perception. I mean, maybe there was at the time, but I think it continues up until today in AI history books, that Japan's Fifth Generation Computer Programme was presented a bit as a threat to the West. So to DARPA, to the UK the Alvey Programme, but you say that essentially Edinburgh had clients in Japan?

40:40

Oh, we did, we had great connections with Japan.

**Vassilis Galanos** 40:44

Historically, how would you assess that? you make out of this general perception versus ...

**Austin Tate** 40:49

Well, you've always got something that might be thought of as commercial competition. So if Japan, for instance, were producing eventually with the fifth generation project machines that everybody bought, then it could be that would have a negative influence on manufacturers, let's say like ICL at the time, who were looking at producing personal computers, they were looking at producing parallel systems, and other things. So they may see this as a commercial threat. But from an academic point of view, we see this as a collaborative venture. So you mentioned the Alvey Programme, which was definitely a force for good for Edinburgh, we were in several areas that the Alvey Programme wanted to support. And at the time, we were just starting to seriously think of ways to better work with industry. So we were beneficiaries of the Alvey Programme. The Alvey Programme funded the knowledge-based systems side of things, as well as programming interfaces and programming architectures and other things like electrical engineering and chip design, so it was a force for good. And the guys who were involved in management of the Alvey Programme, were actually on the Board of AIAI at one time. So you know,

there was a lot of connection, that was to watch what was going on in us and support us and give us encouragement. So we were heavily involved in the Alvey Programme and it funded a lot of AIAI work.

**Vassilis Galanos** 42:22

Yeah. Interesting. People like Brian Oakley?

**Austin Tate** 42:25

So Brian was on the, I think, Brian Oakley was the Board member. So yeah, it was Brian that was heading that work up at the time. [Added post interview: e.g. Brian Oakley and David Shorter].

**Vassilis Galanos** 42:38

Just to return a bit to the to the Lighthill report. You mentioned that I guess the main wrong it did was the criticism of general purpose robotics. Do you want to elaborate on that? And do you want to mention any other things like the report sort of misrepresented in AI that caused?

**Austin Tate** 43:00

I think it was the generality issue, you've picked up on the main point, as I understand it. I mean, watch the film, you know, and look through the whole report. For those people listening, who don't know, it was a TV broadcast by BBC in their Controversy series. And they invited James Lighthill, who had written quite a negative report for the Science Research Council in Britain about the value of continuing to invest in general purpose, that phrase being important, general purpose AI systems, and that they should really not waste their money on it effectively. And the two people who James Lighthill was debating with were Donald Machie from Edinburgh and John McCarthy from Stanford. And it's a fantastic thing to watch, because these are two of the top scientists at the time doing AI. John McCarthy, known from the Dartmouth University Seminar, where he coined the term AI. So you've got Donald and John McCarthy, these are two fantastic individuals.

**Vassilis Galanos** 44:03

Richard Gregory as well I think

**Austin Tate** 44:06

Was Richard was on the Panel, right. So anyway, they are debating the points and they're trying to make the point, and showing some video of the Freddy robot and everything. So it's quite an interesting public debate. It means that at the same time they were trying to popularise and explain what they were doing. And again, that's a good thing. It's not scientists running into their own corner, trying to do their own little thing and not engage with the public about what they were trying to achieve.

**Vassilis Galanos** 44:42

My reading of the Lighthill report was that was actually it kind of pushed towards applications, it kind of said that, you know, you cannot produce too many applications. So therefore, do you have, like, a take on that?

**Austin Tate** 44:56

I'm not sure I can elaborate further, really. The influence was that general purpose systems weren't good, but it had a broader impact. The broader impact was AI is not up to much at the moment, so we're putting too much money into that. Let's do other things that are narrower in their focus. And that's what I remember of it. I saw the disillusionment that it created among some people. But remember, at

the time, I was still a PhD student, so you don't see everything going on. I'm sure this would have had a bigger impact on the principals when they saw their grants not being renewed and everything. That was what would have been happening, because what year was the Lighthill report?

**Vassilis Galanos 45:48**

It's 72. The video was 1973.

**Austin Tate 45:51**

Yes, yes. So you see, I was still PhD from 72 to 75. So all of that, it almost had no influence on me, but I was already funded. And then there was still a research grant. And we did get a research grant, even though we didn't take it up, to follow on with planning and execution work. Interestingly, when I said there was a kind of flat period, when we formed AIAI, we put back in almost the same application to SERC, Science and Engineering Research Council, almost the same application that we put in in 1977. Went in 1984. And it was funded, which is kind of an indicator that not a lot happened, at least in that narrow field.

**Vassilis Galanos 46:06**

Did you change the nomenclature?

**Austin Tate 46:43**

No, no, because it took a broad approach . It was one of these, again, trying to be broad. It was trying to take planning into the area of plan monitoring and plan execution for real applications. It was about extending planning technology to make sure you had knowledge-based plan monitoring, and knowledge-based plan recovery. And that's something that still is needed today. You know, that isn't a topic that will probably ever go away., it'll just be that different technologies would probably be around to do it.

**Vassilis Galanos 47:17**

Extremely interesting. You were a PhD student in the early 1970s, to 75. I want to ask you about influential figures at the time, you've mentioned a few names already, Jim Howe, Donald Michie, Harry Barrow

**Austin Tate 47:33**

Robin Popplestone. I didn't work with him. But there's also Rod Burstall, of course, he was the other main principal there. But he was more of a theoretician, so it wasn't quite overlapping with my work. But Rod was always there. He was one of the principals involved.

**Vassilis Galanos 47:49**

Would you like to elaborate on more figures and their influence? Maybe people who are not as sung as other people?

**Austin Tate 48:02**

Well, the names kind of come through in the papers. I was trying to mention the connections I personally had with people if you like. If you take the robotic side, Pat Ambler was the other the member of the team. So I mentioned the other individuals, but Pat was definitely one of the main roboticists here. Again, I didn't overlap so much with her particularly. But there was a lot going on, even when I was a PhD student. And during that first project, I shared an office with Aaron Sloman, for

instance. Now Aaron is a philosopher. And I'm reminded of the Hope Park Square coffee morning, when you went through for your coffee. There was always people there discussing, you could always go in and join in a conversation on the blackboard about something or other. And because you got that mix of technologists, scientists, philosophers, there was everything being discussed. So it's a fantastic kind of opportunity to do that. But sharing an office with Aaron is something, I still am in contact with Aaron, on various things. We've done a few things together over the years. And he was one of those people that's very different to the other scientists and academics that you work with, being a philosopher, he's thinking of different things and coming up with different comments and arguments, which is incredibly interesting.

**Vassilis Galanos** 49:36

That's extremely interesting. Under different occasion, I've spoken to Aaron and he told me he sits at the Controversy BBC show. He's in the audience, a version of him, right. Yeah, it's extremely interesting.

**Austin Tate** 49:53

So it's interesting, a lot of those things you see. You come across these things very early on. I went to my first IJCAI, for instance, when I was still an undergraduate, and that's a time when you don't have funding and stuff to do all these things, you know, but you come across people, you start to meet people, you start to make connections, these things are always useful. While we're talking about the various people, I mentioned Malcolm Atkinson in the past as well. So Malcolm had connections to Edinburgh and just happened to be the computer manager at Lancaster at the time I was there running the computer service. So I didn't know Malcolm at the time there. But it's later I understood that was the connection, and why POP-2 was down there. But I've had a lot of overlaps with Malcolm. Malcolm has been someone who is a technologist, a database person. And he has worked on a range of topics to do with high performance computing, and applications of parallel systems and things of that kind. So Malcolm is another one of these people, he's now also retired. So Malcolm is a person whose thread goes through a range of things at Edinburgh, and has led different groups at different times.

**Vassilis Galanos** 51:14

Do you think there were people you can remember from that period who had, in a sense, potential, but perhaps the Lighthill report influenced them in changing

**Austin Tate** 51:24

Moving away? I can't really remember folks who were like that. I do remember some of the people who visited from Stanford, though, and MIT. At the time, you'd got people like Earl Sacerdotiover at Stanford SRI, who was a PhD student like myself, and he was working in planning, and we had a sort of a mutual influence on each other's work, I think. He was working on abstraction-based planning, and then hierarchical planning and nets that were hierarchical. And this all led to the ideas that we put into what became the Nonlin hierarchical task network planner. So you know, the influences were there with all of those folks who came to Edinburgh.

**Vassilis Galanos** 52:13

Interesting. Speaking of nets, Geoffrey Hinton was also a PhD student around the same time

**Austin Tate** 52:19

Yeah, I never overlapped with Geoffrey. So remember there was the group in Cog Sci, and the people who were more interested in neural nets and things like that as well. So that wasn't the overlap I had with that particular group. Some of the groups who were working in the natural language side did overlap with us, because we were interested in natural language interfaces to planners, front ends, and we could generate natural language with our planners. We had projects with British Telecom, for instance, where we had people from those groups, CogSci, working with ourselves on both AI plan recognition, but some recognising structure in text that became task plans. And also generating descriptions from plans that were in natural language. So paragraph length descriptions, writing manuals, operational manuals, repair manuals, was something that we were working on with BT, with British Aerospace, with Dassault Aviation in France. So these were all groups. And because of that overlap, some of that wasn't just with Edinburgh groups, we did have projects with Essex University, for instance, that was natural language and planning as well. Because sometimes you can't just work with your own universities, groups, people sometimes forget that, that when you bring together a team, to do a piece of work, to apply for larger scale funding, it's sometimes best to have the teams from different groups across Britain or the world. I've been involved in quite a few of these larger collaborative projects. And sometimes people wonder why you're not going down the corridor to get your colleague to work with you. And there's a reason for that. Its because you can't say Edinburgh University, Edinburgh University and Edinburgh University as the three collaborators. So we've had a few times when we wanted to put together big collaborations, but we've used a natural language group, for instance, in America, or a team in another university, or a team in a business to form the element that was needed for the bigger project.

**Vassilis Galanos** 54:31

That's very interesting.

**Austin Tate** 54:33

One of my biggest projects actually was called CoAX, the coalition agents experiment. CoAX involved about 30 organisations in four countries working over a period of two and a half years. It was to look at coalitions of agents. And they were working in search and rescue domains, but it was meant to apply to any coalition for any purpose. And it was agent-based technology. There we put together a whole series of groups to showcase their agent technology in a way that brought it to the forefront and could be demonstrated to people. The whole idea was to put together scenarios that made everybody look good in the context of the application, and to try to make their element of what they were contributing, shine, basically. That project was very interesting. I enjoyed that project a lot, because it brought us in contact with a wide range of companies and universities and organisations that wanted to use agent technology.

**Vassilis Galanos** 55:38

What period was that?

**Austin Tate** 55:39

That would be 2000-2005, something like that. [Added post interview: actually 2000-2003] That was a follow on to the Planning Initiative. It was at the end of the Planning Initiative when people were applying the technology. I'd have to look up the website [See <https://www.aiai.ed.ac.uk/project/coax/>]. But there's a project website that has all the results and the videos that show some of the demonstrations. But that was an interesting time, you know, because these were big projects and, and we were able to use resources to showcase the work that we were doing. So we were able to use

professionals to make the audio-visual materials for instance, and have a demo facility in Newport in Rhode Island in America that was set up so that we could go in there and showcase it to multiple audiences. That was an interesting time because it was the biggest collaborative project I've been involved in.

**Vassilis Galanos** 56:39

Extremely interesting. You've mentioned those coffee mornings.

**Austin Tate** 56:44

Hope Park Square. Yeah. Good fun.

**Vassilis Galanos** 56:46

Are these related to the School of Epistemics?

**Austin Tate** 56:49

So this was really the Machine Intelligence side. I'm sure the School of Epistemics and the folks there had them too. Hope Park Square physically is about 100 yards from Buccleuch Place where the Epistemics people were. So people who don't know the geography in Edinburgh, we're all still pretty much close together. And even Forrest Hill, which is only a quarter a mile from that, that's where the robotics originally was. And now where we're sitting during this interview, and where the School of Informatics is just near, this is in the middle of that little triangle of spaces. So all of this is with, really, I think to come to work, I've only had to go between a quarter of a mile of different places.

**Vassilis Galanos** 57:35

Absolutely. And I think that this kind of geographical proximity might also be a factor. You know, the multidisciplinary

**Austin Tate** 57:43

Absolutely, that was the argument when the School of Informatics was brought together. If you bring people together, encourage them to work together, you can get these economies of interaction involved. But the School of Epistemics was over in Buccleuch Place. I did work with Julian Davis, for instance, who was in that group, because he was working on a language called Popler, which was a kind of declarative planning-like language. So we did have all these overlaps. So I was aware of the work, but only in the sense of how it overlapped with what I was doing, or with PhD students. I'd hear talks then found overlapping interests. You don't get involved in everything. But yeah, so when I talked about the Hope Park Square coffee discussions, it was around the blackboard in the coffee room where people went up. As I said, there was always something. Every day, you could spend all morning there, productively. It was a very good thing to go. And even if you sat there and just listened to the others discussing, it because it wasn't something you were going to be involved in, that was fascinating discussions. So I enjoyed those immensely, those mornings.

**Vassilis Galanos** 58:41

I'm tempted, I want to ask you to share any anecdotes or stories from these mornings?

**Austin Tate** 59:02

Oh, I wouldn't remember any individual stories. But the fact that it was different things as well, you know, but it did mean that when you were really wanting help and information and you started to raise



points, there were people there that would definitely input to it. You know, the comments when you try to explain what you're trying to do and you try to sketch it out. The inputs were always the serious, helpful inputs that you want from a mentoring group, as opposed to just your supervisor. For PhD students, that's like gold dust.

**Vassilis Galanos 59:39**

Absolutely, and probably more interactive than a search engine or

**Austin Tate 59:47**

Search engines... of course the world wide web wasn't there. So research meant talking to people, reading papers, trying to summarise them, writing things and getting feedback. And as you were saying earlier on, you know, the discussions couldn't be a simple e-mail early on. I mean, e-mail did come in, around that time I mentioned the PDPs is coming in, PDP-10s [Added post interview: 1974]. So we were then able to exchange electronic mail messages between our colleagues in Stanford and here. That was the kind of early days of e-mail, it isn't like today.

**Vassilis Galanos 1:00:30**

I mean, that brings me to another follow up. So there is this period of disillusionment,

**Austin Tate 1:00:35**

In the context of the whole of my career, if you take that as from you know, 72 ish to now, it's a tiny period. So we may be over stressing the fact it flattened. And remember, it's grown like crazy now. So it's just it had that influence at a point in my career where it meant something. I probably could have ridden through it if I'd just taken the grant, or Robin Popplestone or Bernard Meltzer had taken the grant, we'd done the work. A bit like I said, during the PhD time, I didn't recognise anything about Lighthill's impact until afterwards, after the PhD, so that was three or four years after Lighthill. Just because you're running along, you're doing your own thing, you know, you don't see necessarily what's going on. I never saw the Lighthill report. And the Controversy programme when it was on TV, for instance, I only saw it 20 or 30 years later, actually, for the very first time, but I'd read the report. So I don't want to over stress it in the context of a 50 year career. Yeah, it's a four or five year period, but from my point of view, a very helpful period. Because if I hadn't been trained as a software engineer, and I hadn't approached the way we do quality control, the way we do project management, because of that training that had to be there for the work I was doing at the time, I don't think I would have seen everything quite the same way. And taking on the larger projects I did later on, with the leadership of those projects, I wouldn't have had the skill set and the toolkit to be able to actually think how do you manage an organisation with 30 people all doing their own thing, all with their own grants, and you're wanting to bring them together around a scenario based whole. I kind of had a background that showed me how we would approach that at least. Whereas I wouldn't have had that scale of involvement, or task capability, otherwise. So I always think of myself as a trained software engineer from just that point. I like to think it's something that helped influence the way we approached the management of projects afterwards.

**Vassilis Galanos 1:02:57**

That's extremely interesting. And that touches on that question I have, I wonder if that was true for other people as well?

**Austin Tate 1:03:04**

I don't know. I am a chartered engineer, for instance. It was quite funny because I was already a professor, and I'd done all of the various projects and so on and worked on a range of things. But when I tried to become the Chartered Engineer, I had to be interviewed by people at the British Computer Society, to prove that you understood ISO techniques and project management, ISO 9001, and things of that kind. That not only that you understood them, but that you're using them in your projects. So this isn't something you can kind of go back and think, oh, I wish I had written that quality manual. You did it because it was natural to do it and it was better to do it, not because you were trying to become a Chartered Engineer. So for a period I worked at the European Space Agency. We were working on the Proba spacecraft design. So I had a tiny part in that to do with AI. Proba was a series of spacecraft that were meant to be more autonomous. I worked on a little AI part of that. The way that European Space Agency worked was that they made you an employee,. I was really more a consultant in other words, but you have to be a Chartered Engineer to do that work. So again, this all fits together. The opportunities are there because you have that background, and you've gone through and done all that work. And because you're chartered you can do those tasks. So you're not then kept on the outside of certain pieces of work. And that was important for AIAI. It was important that we had people who were skilled in project management and doing and completing projects on time to cost . You know, all the rest of it, as well as the fact that they were academics and interested in trying to promote the subject.

**Vassilis Galanos 1:05:07**

This is extremely interesting. So I would like now to move to more contemporary landscape. And you already mentioned a few connections of continuity between the past and the present. So you mentioned CoAX, you've mentioned open problems in planning, that are incomplete yet. So could you elaborate a bit on your work, but also work you're aware of that happened in Edinburgh in between the 60s and the early 90s or so, that have influenced contemporary landscapes in AI and further, relevant neighbours.

**Austin Tate 1:05:45**

So maybe there's two different things here, which we should try maybe to separate them. Of course, AI from many people's point of view today means Large Language Models. If they say, AI is in a certain thing like ChatGPT, they're talking about a particular technology, which is immensely successful just at the moment and has a big impact. And will continue to have that. But that's one part of AI. And Edinburgh is involved in that, it's got a background in it, some of the principals who were, you mentioned, Geoffrey Hinton and others, some of the principals who were pioneering this technology, were through Edinburgh and doing their studies here. So there's a big input on that. It isn't the side of AI I've worked on, but there's enormous impact. In terms of overall AI, rather than this interview, that's enormous. And any input there's been on that from groups like Edinburgh is just having fantastic commercial impact now. Of course, there's the issues of privacy, trust and misappropriation of copyrighted data, all of these are very worrying things, that worry me, that worry other scientists. It concerns me that large companies are running a little bit too close to the wire in terms of not thinking through how you properly use data that other people have created. So trust in systems, explainability of systems. Honesty in how you create those systems, making sure people are properly credited, rewarded, or given the opportunity to opt out. These things are massive. Now we're fortunate in Edinburgh that we've got the big interdisciplinary side of things, the Edinburgh Futures Institute now, groups in Informatics, are looking at many of these things. So I'm sure we'll continue to be heavily involved. But there's another side of things, which is the other AI technologies, the spin offs from that, the work in collaborative task support systems of various kinds, all of that's still going on. I got very heavily interested in distributed, collaborative task support for people, independent of whether you're

using computers or not. And that led me into the virtual worlds things and indeed VR and other things I'm looking at. So we could have a meeting like this, where we might be completely distributed, not just in terms of spatial distribution, but time distribution as well. Where you know, you're in Japan, I'm here, so you don't want to synchronise your time zones of work. Just because the two of us are working together, we want to take advantage of time zones. But we want to overlap enough that we can be effective collaborators. And I see a big opportunity for AI in terms of intelligent meeting room support, and intelligent spaces, as I think of them. And we've had a project over the years that's been involved with instrumented, intelligent spaces, that know about the participants, that know about the instruments and know about the tools, and can help teams work together to use those tools. And that's kind of influenced the work I've been doing more recently. So intelligent spaces, using the technology we call I-X, intelligent things that just means, intelligent X's, things. There's a planner in that space, but there's also other things. A lot of it is about modelling agents, modelling tools, modelling services, and then looking at how they can be brought together collaboratively to carry out tasks. And I see a great future in that. So the fact that knowledge is needed in those, you need the task descriptions, you need the processes, the manuals, the standard operating procedures, you need all of that. And before we've maybe had to manually mine that out of these things or get experts to be interviewed, and to look at how we extracted knowledge and information that we could use. Nowadays, Large Language Models have an opportunity to go back and look at those sources of information, and get the descriptions of tasks, get the standard operating procedures, get the checklists, and put that into a form that can be used inside planning, and task support, and collaborative distributed collaborative systems. So there's a real opportunity to see all of that coming together in what I call the "Helpful Environment". So that's just a term I used over the years in writing papers and explaining things. And it's about an environment where you know things, you characterise things, you have models of things, you have models of agents, you have lots of tasks, you have models of the material and resources in the domain. And you're somehow making sure all of that is brought to bear when things go wrong, or things you want to do need doing. So in terms of emergency support for after earthquakes, bringing international teams together to support people, without them physically going there in some cases, but just bringing all that knowledge to bear at the right times, to have a helpful environment for doing things is I think, the long term Grand Challenge, if you like for what will come, I hope, one day following the investment in these individual technologies, when we get these more hybrid kinds of technologies.

**Vassilis Galanos** 1:11:37

This is extremely interesting and very hopeful, a very hopeful message

**Austin Tate** 1:11:41

I'm hopeful, except that my concern, as I said about the companies seeing profit as a motive before the usefulness of the tools, and doing things which become then constrained because we have to put legislation in place to stop the misuse of the technology. So there's a lot that could go wrong in that rather utopian vision I've just mentioned. But a lot that could go right if we are able to encompass these different technologies and bring them together and use them productively for people.

**Vassilis Galanos** 1:12:16

Yeah, yeah. Would you give any advice to younger scholars who start their PhDs or even their undergraduate degrees here at Edinburgh, right now, how to think towards this vision?

**Austin Tate** 1:12:31

I would try to encourage people not to be too narrow in their thinking. Yes, you've got to focus, you've got to have a particular thing that you're trying to demonstrate in any PhD, or in any study you're doing. So you've got to have a task, you've got to know what you're doing, you've got to try to work towards that. But you've got to see just beyond that boundary, you've got to see that it fits into a context. Being an applied researcher, let's call it that, if you think of what it's used for, in the context of society, then see the place that the system and the technology and the idea has, then at least you can start to see the breadth of it. And you can start to talk to other people who could have an influence on the fringes of what you're doing, or around the boundaries of the context that you're in. So see the context of the subject, but also do good things, not do things for pure profit, you know that it helps if you are more collaborative and cooperative in your work. To see the benefits of sharing some of that information. I'm a keen open source software developer. And I like the idea of open educational resources. Now, you can't always do that in a commercial context. But there's areas where you can do it. And there's areas where you can share results and see the benefit of sharing because you see the feedback that comes back in, and you can see the longevity that potentially your systems can have. All the planners I've mentioned that we've worked on, we've made sure are made available in open source repositories. And some of them have gone into these archives, you know, like the Arctic Code Archive. So these things are meant to be preserved for the future. And these are kind of interesting ideas. I like the idea of archiving and making available material from an open source point of view. When we did our MSc module in AI planning that we do at Edinburgh, we created the MOOC version of it, a massive open online course version of it. And we did that deliberately to try to make sure the materials were preserved in an open source way, the videos and the other materials, and some of it is running planners that, you know, used to run 50 years ago. And we resurrected them and put them on simulators, so we could run them again, in order that we could video them to make available what was going on then, as well as the source code. And there's little things like that that can be done to make sure that the ideas and the techniques are there for others to study when the need arises, whether it's now or whether it's in the future. And with the planning technology we did, we tried to do that. So the MOOC itself was run over a period of three years, and reached about 115,000 students. And that means you've got those people, at least with a smattering of knowledge about AI planning, which can be brought in to bear when they're asked to work on projects in their businesses, or their organisations, or their schools.

**Vassilis Galanos** 1:15:39

Fantastic, any further pitfalls, you could raise awareness for younger scholars?

**Austin Tate** 1:15:47

Well, I would only repeat, so we maybe just don't need to repeat. But I do think that the worry has got to be the misuse of these techniques, because of fast moving profit. Large businesses who are driven to use the technologies in ways which have a negative impact on society, and yet they ignore that impact because of the need to grow and profit from it, or the need to outdo some competitor. And with Large Language Models, you see that now. And that's going to have the negative effect of leading to legislation, which may be inappropriate, and restrict things which could have been done differently. If you use other people's data as well, I just can't see how you can possibly mine data that is copyright data and has licence terms. Even open source systems have licence terms. A lot of my stuff is licenced under Creative Commons licences. But there is a licence, people aren't supposed to just use it without credit. And without any information. If they've just taken that off the web, or they've taken a book I've written off the web. If you've authored something, they can't just take your text and use it if you've said Creative Commons By Attribution, or even more Creative Commons By Attribution Non Commercial. I

mean, if that's now in a model somewhere buried in amongst another million of like systems, then that's misuse of your licence information. It was there for other people to use under your terms. And you were trying your best to do it. And that would've been misused. So don't do it is what I would say to people. But big companies are clearly doing it.

**Vassilis Galanos** 1:17:45

Yeah, that kind of fear of mis-legislation. Would you draw any parallels between that possibility, and say, the Lighthill Report?

**Austin Tate** 1:17:56

Well, it's interesting. I think that the background is very different. That was a scientist really doing a review, asked to review it. I guess you do get similar things, because we do have panels, which influence government initiatives. And some of the people on those panels are well respected AI scientists, computer scientists who know what they're doing, and are concerned about the same issues. I've been asked to participate in some of the feedback sessions for the AI legislation in this area, you know, so the people are getting involved. They do try to make sure they get good inputs from people who have got opinions and want to make them known. But, you know, there's always the problem that if you start to restrict certain things, and sometimes you have to, it can have unintended consequences. And that's the likely scenario at the moment. There's no doubt that legislation will have to come in to constrain certain uses of these technologies, they are having negative consequences. But that's not unique to AI. It's true of a range of technologies, not even unique to computer science and computing. It's any tool that comes along, you have to think how does that tool get mis-used as well as used? And the answer always with a tool is it depends on the people using it. So there's got to be some constraint on the way uses are made. And that means the big companies typically today, and it will be the smaller companies as well, because the technology will be usable in a range of areas. There will be open source large language models which can be trained much more cheaply on specialised datasets, which can equally well be misused as any of the larger companies will do. But remember that some of these things will have positives as well as negatives, but they should be presented in the context of what they can really do. And not use data sets which are not licenced, not correctly licenced.

**Vassilis Galanos** 1:20:05

In lieu of a better kind of closing question, you mentioned these letters you've written to children. Thanks for sharing these stories.

**Austin Tate** 1:20:16

There's a range of these things, because a lot of them are saying, how would you get into the subject? So many of the questions I get are similar in saying, I want to get into this field, I like the idea of robotics. Some of those, what I do is keep a Frequently Asked Questions web page. And if it's something that I can answer that's similar to before I try to use that as a base, and then point them at the Frequently Asked Questions page, so they can see what other people have been asking. Sometimes a unique question comes up. So that's the one where I try to do a little bit more, and try to add to the frequently asked questions. So there's a range of these things, but a lot of them are about I want to get into the subject. How would you go about it? Should I study x y z as precursors to doing a university degree or something of that kind? So I mean, some of that is feedback that anybody in the field who's had some experience of teaching or been involved in education can give, but it means you're just doing it to them individually. The main thing is you're saying it to them. And that's the difference between here's a frequently asked question, go look at the website. I'm giving a letter back to

them, which answers their question. And it's just that little personal touch. That is the same as I would have got in the early days when you wrote to Jim Doran or Donald Michie, it's worth doing. And it's an encouragement to people to see the field as one that is welcoming as well.

**Vassilis Galanos** 1:20:18

This is extremely interesting. We're nearing I guess the end of this conversation. I would like to ask you if you have any additional remarks or stories to share, something that you think is worth preserving, that hasn't been on record until now? Not really, well, this is fine. Thank you very much Austin for this amazing conversation. I will stop the recording now.

**Austin Tate** 1:22:24

Thanks for asking me to be involved.