Code Together Podcast Episode #32

Title: AI in Gaming: Empowering Game Developers

Radhika (00:04):

Welcome to Code Together, a discussion series exploring the possibilities of cross architecture development with those who live it. I'm your host, Radhika Sarin.

Radhika (00:16):

Today's topic is artificial intelligence in gaming. First, some years now, AI has been penetrating all aspects of our digital lives. AI does play an important instrumental role in several aspects of problem solving and adding value to daily life. AI concepts have been around for several decades, however, AI and specifically machine learning, are more recent additions to the game development pipeline.

Radhika (00:46):

Let's talk to our guests today about the significant impact that artificial intelligence has had on game industries' success. It's my pleasure to invite our first guest, Adam Goodrich. Adam is the founder and general manager of Procedural Worlds based in Sydney, Australia. They are the leaders in procedural world creation tools for the Unity Game Engine. Adam is working to give people the tools, technology, and education to make a living by doing what they love and bringing their dreams to life.

Radhika (01:22):

Adam, it's great to have you here.

Adam (01:24):

Hey, Radhika. Thanks for having us. It's great to be here.

Radhika (01:28):

Our next guest is Peter Cross from Intel. Peter has spent the better part of last 25 years as a senior software engineer. He's responsible for managing Intel's graphics and game development community engagement program, including the external graphics innovative program. Outside of Intel, he's an enthusiastic game developer creating AR and VR experiences in Unity and publishing them on Steam.

Radhika (02:00):

Peter, thank you so much for joining us.

Peter (02:03):

Thank you so much, Radhika. This is an exciting topic. Looking forward to it.

Radhika (02:07):

So Peter, tell us a little bit about the history of how AI in gaming got started.

Peter ([02:14](#)):

Yeah. So as you mentioned, the concepts have been around for many decades. I would go back so far as Alan Turing, who's widely considered the father of computer science, theorized many of the concepts for AI algorithms for playing chess. Of course, back in those days, there wasn't sufficient silicon or vacuum tubes, I guess, more appropriately to power those algorithms, so he had to wait many decades after his death, before those were realized.

Peter ([02:42](#)):

As we moved into the 1970's, we started seeing primitive AI in games like Space Invaders and Pac-Man, where the computer adapted to the player a little bit as the game progressed. As we move into the '90s, you start seeing more intelligent path finding heuristics for NPCs, meaning non-player characters, and all those systems that were driven by advanced state machines, which many, I guess, purists in AI would argue is not truly artificial intelligence. They would say it's maybe a category of weak AI.

Peter ([03:15](#)):

So the challenge is for game developers as they try to implement these technologies for AI is, of course, there are many. I have a quote I wanted to share, at least paraphrase. There's an article in the Verge a couple years ago where Tanya Short, who's co-founder of the [Kitfox Games studio](#), she said that most AI in games is equivalent of smoke and mirrors, just sophisticated enough to make you think you're interacting with something intelligent, but controlled and predictable enough to keep everything from going off the rails. That was kind of what she viewed as a challenge. How do you resolve all of that?

Peter ([03:52](#)):

So Adam, with your experience in the game development industry, what is your take on those challenges?

Adam ([03:58](#)):

As a game developer, what you're trying to do is create great experiences for your players and sometimes AI is too unpredictable to create good experiences. There are some amazing work that's been done by DeepMind and [OpenAI](#) on [AlphaGo](#) and [Dota](#) and those AI systems are actually unbeatable. They're beating grand masters and the best professional players in the world.

Adam ([04:27](#)):

So sometimes deep AI is not the best way to do this, because the experience isn't great. Some of the other aspects that come into play with AI is rogue AI and unpredictability. So often when you're training an AI, you're giving it an outcome and so if your AI finds a different way to achieve its outcome, that's not necessarily the experience that the game developer is trying to

create for the player and so what you start to get is this crazy unpredictability and that can stop the story from progressing.

Adam (05:01):

The other thing is a bunch of the AI techniques are actually not needed, so existing techniques, such as path finding and finite state machines and behavior trees are often quite enough to create this illusion of the story. Smoke and mirror is another way of presenting intelligence to your players is use things like triggers. So in Halo, when you get into a certain area, the AI players will shout, "Grenade," and these sorts of things, but there's no real AI there. It's just a bit of smoker triggers to give you the sense that something interesting is going on. Another area in which smoke and mirrors rather than true AI is being used is the creation of interesting and powerful rule sets that generate emergent behavior when they come together in different ways.

Peter (05:54):

Very cool.

Adam (05:54):

Yeah. Peter, you work at Intel. What are some of the examples and opportunities of how you're seeing AI being used today?

Peter (06:03):

It definitely is an exciting time for the industry. It's unlike anything I've seen in the past 30 years, as far as how AI is progressing. You look at tools like Unreal's Meta Humans and Ziva Dynamics, which Unity just purchased, they're creating hyper realistic humans and I read something recently that Ziva Dynamics uses something like 30 terabytes of training data for the digital avatar, the human that they used to announce the Unity acquisition. So that was really some interesting technology. Of course, there's the creation of these tools, but how do you bring those avatars, those humans to life? Adam, I think you had some input in that area, right?

Adam (06:49):

Yeah. Prior to Procedural Worlds, I spent 10 years actually working on what I call behavioral or contextual technology and exploring this space and my learning is that to try and create something that's realistic and contextually correct is really, really difficult. If you are trying to simulate people and give them some sort of interactivity, how are you going to control or express their personality? What about memory history and the actions they can take? Or biological needs? The interesting thing when you start to look at how we interact with the world, and we have to do that if we want to then teach an AI to do it, we also have this competing set of goals. "In this context of my life, I want to do this. And in this context of my life, I want to do that." So building an AI to do this is exceptionally difficult.

Adam (07:42):

Some of the interesting things we've seen more recently with what we're doing, we recently had an AI demonstrated to us. It was all about bringing your NPCs to life and this AI had relationships

with other players and it build up these internal tables, which would represent how you felt and your experience with these other players. The AI would interpret actions from these players, so in the example that I was shown, if you gave an NPC a sword, then the friend of the NPC would suddenly like you more because they saw you helping out this NPC. And conversely, if you go and bash somebody in the head, then all of a sudden the friends come in to attack you. It was really, really cool seeing how this stuff is coming together.

Adam (08:35):

Another interesting company we've been talking to, their background is from DeepMind and they built a lot of NLU and bot technology for Google, NLU means natural language understanding, and they're doing some amazing stuff. So they're looking at how can they build in world AI for the metaverse? So how do you create engaging experiences between an AI and a person? How do you scale an AI? Because AI can always be on 24/7, people can't. And then what are the sorts of things that the AI can do? Is is advising, guiding, supporting, entertaining? And then modalities: speaking, expressing, emoting, gesturing, moving, attacking. These are very, very difficult problems to solve and certainly the latest cutting edge technology in AI and some of the best specialists in the field are actually working on this.

Adam (09:32):

So the demonstration I saw was quite incredible. You could literally talk and the AI was a domain expert in the subject matter that you were interested in and it would respond in a meaningful way. So there is amazing tech that's going to hit in the next few months, six to 12 months even, that when you start to bring that to games into the metaverse, it's going to change the way we do things. So this is all very cool in terms of how do we start to give AI this semblance of intelligence.

Adam (10:05):

Peter, how do we make them move?

Peter (10:08):

That's a really cool topic. You have both navigation challenges as well as animation challenges. For navigation, what we've seen in the past is there was traditional breadcrumb path finding, which is basically the system replicates what the player is doing. It kind of follows them. It kind of traces the exact path that they're following and such. But you can imagine that would be somewhat unrealistic as it doesn't show a natural, smooth transition. So more recently, machine learning has come into play where it enhances, it provides that lifelike realism.

Peter (10:45):

There's a company out of Korea NCSoft who gave a demonstration a couple years ago at GDC, where they showed Intel's OpenVINO technology being incorporated with inverse kinematics to drive an army of NPC enemies, hundreds of NPC enemies, and they were all moving independently in a very realistic fluid motion. So it was very cool. That's still online, I believe, in the GDC archive, so definitely folks should search that out. It's good stuff.

Peter ([11:13](#)):

But beyond creating lifelike characters and animation movements, there's the worlds that those characters reside in, Adam, I think you have quite a bit of experience in that field.

Adam ([11:27](#)):

Yeah. I've spent the last 10 years focusing almost, what's the right way to say it, obsessively into this space. I built a company around helping people to create worlds. And it's interesting, you were talking about natural motion of characters as they animate and move through environments. When you start to think about how the world works, you need to start to look at, well, how does the world work? So what are the natural processes that we need to understand?

Adam ([11:58](#)):

So for example, with the land, what are the geological processes that shape the land? And then how does water influence land over time? That's your erosion. And then you have biological. Where does the vegetation go? And when you start to look at nature, the vegetation and what's happening on the land is often determined by water and water flow. It's interesting. My observation is water is the key to everything.

Adam ([12:26](#)):

And then the other interesting thing when you're creating environments is what is the impact of people and civilizations and cities and time and how these things are connected together? So when you're building these environments, these are all the sorts of things you need to consider and that's expensive and it's time consuming to build these massive environments. Some of the interesting things we're doing in this space at the moment, we're starting some research into how we can use machine learning to simulate some of these processes and do them very, very quickly and we're looking forward to bringing out some papers in conjunction with you, Peter, later this year.

Adam ([13:08](#)):

Another company that's done some really amazing stuff with the generation of massive worlds, or the Earth, is [Asobo Studio with Microsoft Flight Simulator 2020](#). From my own personal experience in trying to build tech that build worlds, it's huge. And actually the metadata you get from mapping systems when you're generating these 3D versions of the world is very low quality, so you need to start to use interesting approaches to filling in the detail with something that should be there. And so the way Asobo have done it is they've actually got the topology of the Earth from Bing Maps. I know they had to license a whole lot of extra information, and then they used machine learning to generate that topology and not just the topology, but also all of the buildings.

Adam ([14:01](#)):

So when you look at these amazing environments in these cities that are actually accurate, they had a team of, I think, something like 200 machine learning experts taking mapping metadata and photos and satellite imagery.

Peter (14:15):

Had to be expensive for sure.

Adam (14:17):

Oh, crazy expensive. But the team that built that game is a huge team and it took them a long time. The other challenge that they've done incredibly well is how do you represent that richness and make it run at 60 or whatever frames a second on the average computer? So they've done magic at a whole range of different levels. It's a bit of a masterpiece.

Adam (14:43):

So speaking of making worlds look incredible, what new technology is Intel bringing to the general game dev community?

Peter (14:52):

Yeah, there's actually a lot of stuff going on in there. Last year we announced, of course, XeSS technology, AI super sampling, which really adds just another dimension of game fidelity. 4K gaming, it brings that whole experience to the average gamer, so really excited about what's going on in that space.

Peter (15:12):

Beyond that, just this week we released the Intel® Game Dev AI Toolkit, which runs on OpenVINO, our AI inference engine for machine learning, so we're really excited to bring that to the game developer community. Essentially how that got started was we had several tutorial on our Developer Zone Intel site developed by an incredible machine learning expert, Christian Mills. We published those last year and got incredible response to those but developers complained that the process to integrate it was very time consuming. The OpenVINO installation process could take them several hours. A lot of them gave up. So we thought to ourselves, "What happens if we could create magic one touch installation packages to add all this stuff to the games and really reduce the pain threshold for gaming developers to get into this technology?" So that's what we did.

Peter (16:08):

We worked on it the last, oh, I'd say seven or eight months and it adds a lot of incredible tools for style transfer, object detection and it integrates with third party asset providers, which, Adam, you're well aware of as you're doing some work in that space. Do you want to kind of expand on what you're doing there?

Adam (16:27):

Yeah, absolutely. You commented about ease of use and, yeah, I remember are hearing some feedback about the ease of use of the early releases of that and we are publishers into the Unity ecosystem and the people that use our tech are often beginners or students all the way through to high end professionals. So with Gaia ML, which we're releasing as part of the Intel® Game Dev AI Toolkit, our focus is all about making it really easy for people to create beautiful worlds

within which to explore and start to experiment with the amazing tech that Intel are introducing with OpenVINO, so we're very pleased to be able to contribute to this project and Gaia ML, which is basically Gaia 2020 minus just a couple of features, fully powered, same core code base as our top end Gaia Pro, is available for free as part of the Intel® Game Dev AI Toolkit.

Adam (17:27):

So with that, you can just basically press a couple buttons, get a world, choose your machine learning, whether you're doing object detection or style transfer, press a button and then press play. And that's a great place to start if you're going to actually make beautiful worlds.

Peter (17:40):

Yeah. Really good stuff.

Adam (17:42):

Yeah. Very exciting.

Radhika (17:43):

Well, we're nearly out of time. Before we end this discussion, how can developers make sure that the computing of AI leverages cross architecture platforms and get the most out of CPUs and GPUs, Peter?

Peter (17:59):

Yeah. So that's a great question. One of the things that we took into account when we built the Intel® Game Dev AI Toolkit is that we wanted to use standard imprinting engine technology that Unity already builds in with their Barracuda system and take that to another level and integrate our OpenVINO systems into that. So what that does is it gives game developers very cool machine learning technology that will run on a mobile platform, versus a desktop, versus a console. So the whole universe of AI machine learning platforms has really opened up now with this kind of technology, so very exciting.

Radhika (18:39):

That's great. And lastly, I'd love to ask where do you see AI heading in the next five years' time, Peter?

Peter (18:47):

Sure. Obviously everyone's talking about the metaverse. I think that's really the next big step and with AI powering characters in that metaverse, it's kind of a natural progression for the technology where when you enter the metaverse, you may be unsure if you're talking to a real person or to an AI digital avatar. So it's really an interesting space and I think that's going to be where we are in the next five to 10 years.

Peter (19:13):

Adam, I think you also had some opinions on that.

Adam ([19:16](#)):

Yeah. We've been thinking a lot about the metaverse and how do we at Procedural Worlds play a role in the metaverse and what can we contribute to the metaverse? And there's a huge amount of interest in this space at the moment, and then an FT in crypto and a lot of other stuff that's going on. And there's a huge range of divergent opinions in this space. My personal opinion is I think the metaverse of the future is going to be an open experience. It's going to be something where you're connecting the 2D internet, which is your typical browser and screen based stuff, with the 3D internet, which is more your immersive technologies. And it's going to be connected, so just like a browser goes from site to site, we should be able to go from experience to experience in different spaces.

Adam ([20:08](#)):

So the way in which we are looking to contribute in that is to basically modify our tool set, which is all about creating worlds, so that we can now create worlds across platforms and devices. We've also looked at what are the typical things that we see that people who are creating games and worlds for themselves have problems with? So we've created a learning space, which we call Canopy, which is all about educating and empowering creators.

Adam ([20:39](#)):

And then the next thing we've done is we've been working for several years now on a thing which we call Meta Worlds, which we named just before Facebook rebranded their name. So Meta Worlds is all about creating a platform in which people can create, publish and monetize their assets and games, and then to create an MMO on demand. So the way in which we're architecting the software as we go forward is we just want to help you to create beautiful experiences and environments and then plug them into whichever game engine or whichever metaverse platform you want. And I think in that way we can be meaningful and help other people to get into the metaverse as well.

Peter ([21:22](#)):

Yep, it's all powered by AI.

Adam ([21:24](#)):

Yeah.

Radhika ([21:26](#)):

That's great. Adam, could you provide some more resources for where developers can go to learn more?

Adam ([21:34](#)):

The best place to get to us is at Canopy, so that's www.canopy.procedural-worlds.com.

Radhika (21:43):

Peter, do you have any additional resources or tools that our listeners and developers can use from Intel site?

Peter (21:51):

Sure. There's the Intel® Game Dev AI Toolkit links where we talk about how to use those and folks can go to www.developer.intel.com/ai for gaming, and they can get those and there's links to OpenVINO and all the other items that we talked about today.

Radhika (22:08):

Perfect. Well, I want to thank you both. Adam, Peter, this has just been such an exciting topic and there's just so much to look forward to as the gaming industry leverages new tools and technologies.

Peter (22:22):

Thank you.

Adam (22:25):

Thank you.

Radhika (22:25):

And I would like to thank all our listeners for joining us today. Let's continue the conversation at www.oneapi.com.

Title options (stay within ~70 characters limit):
1. AI in Gaming: Enabling The Next Generation of Developers/Games
2. AI in Gaming: Empowering Game Developers
3. Exploring AI in Gaming and Mobilizing Metaverse

Abstract

In the gaming world, artificial intelligence (AI) is proving to be a game-changer. It has played a pivotal role in enhancing game-player's experiences. Artificial intelligence is used to generate responsive, adaptive, or intelligent behaviors primarily in non-player characters (NPCs) similar to human-like intelligence. With the right tools and access to advanced technologies, developers can create more immersive game experiences and take advantage of machine learning algorithms. Listen in to learn how AI is influencing the gaming industry and the game-developers.

Key Terms and References

- Artificial intelligence
- Gaming
- AI algorithms
- Procedural Worlds https://www.procedural-worlds.com/
- Unity Game Engine https://unity.com/
- Stream https://store.steampowered.com/
- Pathfinding
- AR VR experiences
- NPC
- Metaverse
- Meta Humans
- Meta Worlds
- Modalities
- Animation
- Xess Technology https://www.intel.com/content/www/us/en/architecture-and-technology/visual-technology/arc-discrete-graphics/xess.html
- AI Super Sampling
- DeepMind https://deepmind.com/research/publications/2020/Navigating-the-Landscape-of-Games
- Intel® Game Dev AI Toolkit https://www.intel.com/content/www/us/en/developer/articles/training/ai-gamedev-toolkit-tutorials.html
- Intel OpenVINO https://www.intel.com/content/www/us/en/developer/tools/openvino-toolkit/overview.html
- Game Developers Conference (GDC) https://gdconf.com/
- Intel AI https://builders.intel.com/ai

Guests
- **Adam Goodrich.** Adam is the founder and general manager of Procedural Worlds based in Sydney, Australia
- **Peter Cross.** Senior Software Engineer at Intel.

Abstract [<600 characters]
In the gaming world, artificial intelligence (AI) is proving to be a game-changer. It has played a pivotal role in enhancing game-player's experiences. Amongst other capabilities, Artificial intelligence is used to generate responsive, adaptive, or intelligent behaviors primarily in non-player characters (NPCs) similar to human-like intelligence. With the right tools and access to advanced technologies, developers can create more immersive game experiences and take advantage of machine learning algorithms. Listen in to learn how AI is influencing the gaming industry and the game-developer ecosystem.

Learn more
- Procedural Worlds

- [Intel® Game Dev AI Toolkit](#)
- [Intel OpenVINO](#)
- [oneAPI Tool Kits](#)

Audio File - Attached
Transcript - Attached
PMRs – attached

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Social handles to ~potentially tag/engage:
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https://www.linkedin.com/in/adamgoodrich/
https://www.linkedin.com/in/peter-cross-az/

Promotion timing – Aiming for March -2nd release, prior to GDC on March 21-25th, 2022.