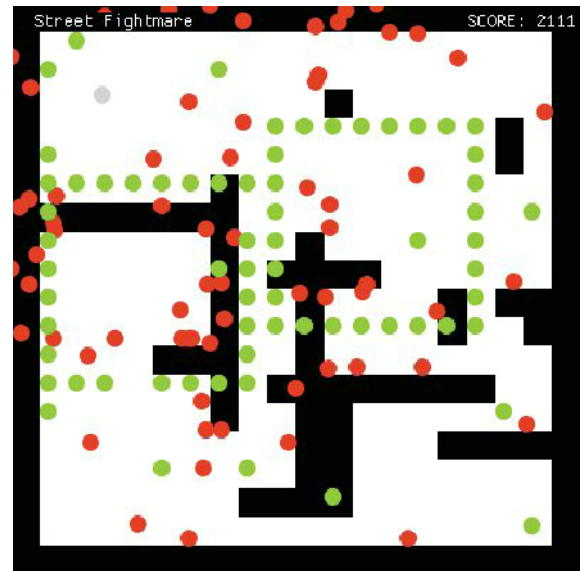
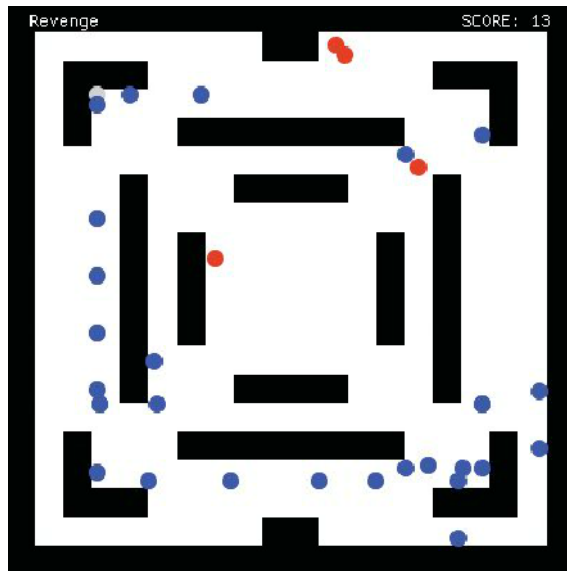


# Hello Game World

Not content with just handling pathfinding, AI systems are now designing their own games. **Douglas Heaven** looks at a trend that could see the dev sector undergo its own industrial revolution. Could machines really take creativity from the hands of us mere humans?



Mike Cook, creator of AI game designer Angelina, says the technology behind it acts as a good method of exploring new ideas through evaluating play patterns. Right: Angelina-made titles *Revenge* and *Street Nightmare*



ANGELINA is a remarkable games designer. At only a year old, she's designed several arcade-style games, a handful of platformers, and is ready to tackle point-and-click adventures.

She's also not human. Halfway through a chat over coffee in a university cafeteria, Mike Cook – gamer, computer scientist, and Angelina's creator – stops himself. "I have to avoid calling it 'she' and 'her'", he admits. "Slightly unhealthy, but there you go."

Angelina is an AI system developed as an experiment in automated game design, part of a vision in which AI is not simply a source of increasingly sophisticated NPC behaviour, but also has a hand in designing games.

"Almost everywhere has a bit of procedural content generation, whether it's narratives, music, whatever", says Cook. "And all of that is backed up with what we would call AI."

Cook is part of Imperial College London's Computational Creativity research group, which, as he puts it: "investigates processes we call creative when we see humans do them and tries to simulate them in AI".

## THE PROCEDURAL GENERATION GAME

In the past, members of the group have collaborated with studios such as Introversion on content generation and Rebellion on automated assessment of player experience, whilst another of its members is also an award-winning boardgame designer.

"But higher-level stuff had never really been tackled before", claims Cook. "We can already procedurally generate levels, rule-

sets and behaviours – what would happen if we just put them next to each other?"

Angelina's novelty is in the way it brings together existing procedural generation techniques and produces something bigger than the sum of their parts. This creates not just a layout or a game mechanic in isolation, but integrates both into a playable whole where layout and mechanic must work together.

**“Angelina simulates playing the games it produces in a number of ways, based on varying levels of risk-taking in human players.”**

Mike Cook, Angelina

Cook is as careful with his terminology as he is with his pronouns. "The word 'design' might be too strong a word to use," he acknowledges. "Some people aren't too sure of the word 'designer'. At the moment it's definitely more compositional, bringing together ideas, but in the future that word 'design' will come in more prominently".

The analogy he gives is of an AI development studio where artist and designer collaborate on ideas. "At the moment there isn't much of that collaboration. That notion of working together is what's new. That's like the higher-

level creative design task, that's what we want to move towards".

Angelina uses computational evolution techniques to search design spaces for playable games. Using a fairly simple design language, Cook specifies certain parameters such as layout constraints and rule-set variations – effectively defining a genre. Angelina iterates through a vast number of semi-random permutations of these, where each permutation is a potential new game.

The evolutionary aspect of the process comes in when the system selects the better candidates of each iteration – or generation – and combines them to form the seeds of the next. But in Angelina's case, there are two phases to the process. First, selecting the component game-parts – layout, mechanics – and secondly; picking a playable integration of these. Cook refers to this as 'cooperative co-evolution'.

"On the one hand, when Angelina generates a level it looks at it and says 'Does this look alright? Is there a bit of symmetry here, are there some interesting passageways?' And that's one level of evaluation. Then it puts these together to form an entire game and plays it."

"Angelina simulates playing the games it produces in a number of ways, based on varying levels of risk-taking in human players that correlate with different degrees of skill."

It asks questions like how often did the player die? And where did the player die? Are they constantly dying in this one kill-corridor where I've made it really unfair? Looking at a level in isolation will always

return the same result for the same level. But it's the wider reflection on having played it – almost like a QA department – that changes every time someone changes the rule-set. That's where the context sensitive stuff comes in."

**ANGELINA'S JOLLY**

The idea is that games that are too easy, too hard, or simply unplayable, get eliminated during the many iterations of test and selection. But the difficulty with this technology is that any procedural content generation system has a chance of producing duds.

"One of the things about evolution I found is that I'll think I'm more clever than the system, having told it to design things in a certain way, and it will produce something that's absolutely awful but fits my specification perfectly. It will sit there with this smug grin on its face saying "This is what you asked for!"

The problem of a non-zero error rate is common to all such techniques. "It would look a bit weird if there was a palm tree in the middle of this carpet right now", he says.

But a machine wouldn't necessarily think so. While the approach works wonderfully for a game like *Minecraft*, which could be said to benefit from the random oddness of its procedurally generated worlds, it is less acceptable for a game that needs a world we can believe in.

"There's an infancy element to it", Cook says. "In the future I would love to think that we would produce systems that don't have this problem". But Cook adds it might also be a matter of selective use: "Over time the best games will be the ones that learn where and when to apply procedural generation".

**INDUSTRIAL REVOLUTION**

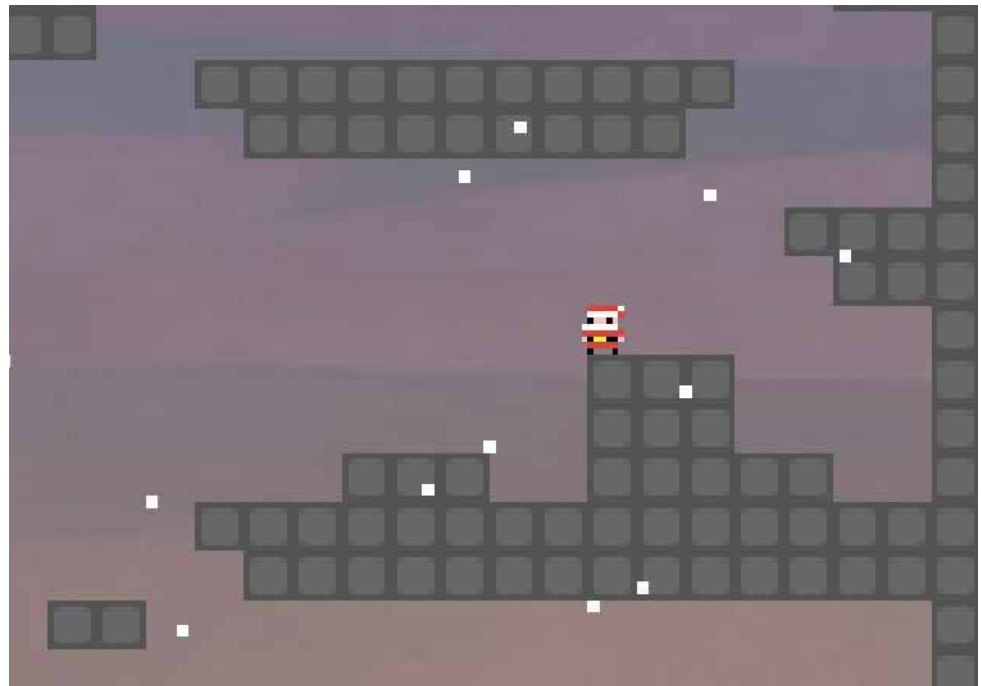
"People ask whether my research is going to cause designers to not be needed in the industry anymore", says Cook. "But I think the more procedural generation takes over from certain design tasks, the more we're going to realise what art there is in video games and the more we're going to appreciate this thing that we've never really taken much notice of before."

Indeed, as the tech industries have done in other areas, harnessing brute-force computation for creative tasks may simply be a way to focus our creative contributions.

"Artists and designers are not going anywhere. Programmers are not going anywhere. I like this idea that AI will become a collaborator in the design process, not replace it. I can't see anyone losing their jobs over this, certainly."

Instead, he imagines a collaborative dialogue: "A developer would sit down and program a design idea into Angelina and Angelina will say 'That's great, I had a couple of ideas, would you like to see them?'

Suddenly it will have changed one of your power-ups into something else and maybe it'll be terrible and you'll say 'cancel it and go back to what I had' or maybe it'll be this completely other twist on your game mechanic and you'll think 'wow, that was a brilliant idea!'



His favourite touchstone is *Braid*, a game that understands the conventions of its genre so well it turns them on their head.

"At the moment Angelina isn't inventing new concepts; it's exploring an existing space," he explains, but wonders what kind of system could discover new concepts and hopes to find out.

Cook is evangelical about the collaborative potential between researchers and developers. Seeing parallels between his research and the experimental character of many recent indie games, he recently took his ideas to the TIGSource community.

"The indie games industry and the indie games ethic, as well as that brand, has made them amenable to the idea of research



Angelina has helped develop games such as *Flixelvania* (top) from her home at the Imperial College London's Computational Creativity Research Group (above)

**"I like this idea that AI will become a collaborator in the design process. I can't see anyone losing their jobs over this, certainly."**

Mike Cook, Angelina

projects", he says. "That's one of the reasons I came to TIGSource. I said 'look, I'm not actually an indie game developer, but it looks like this is an indie game project, it feels like one'. I think that's why there's been such a positive reaction. People are in that mind set already."

**THE LANDSCAPE OF CHANGE**

It used to be that developers used procedural generation to solve a content problem, but more and more it's because players like what it brings to a game. Citing *Minecraft* again, he notes there are "websites

where they just discuss the landscape. Nothing else. They say 'look at this cliff formation I found'. People who think of gamers as these *Modern Warfare 3* junkies would be slightly weirded out by this idea that gamers are discussing geology."

Cook is understandably excited about the possibilities, but Angelina's future will be grounded in a player's mentality.

"There have been attempts to evolve balanced maps for *Starcraft*", he says. "But when they asked people if the maps were balanced, many said they weren't.

"Even though they could prove mathematically they were balanced, the players didn't feel they were. And ultimately that's all that's ever going to matter."



**Douglas Heaven** is a freelance writer, ex-computer scientist, and online editor for *i, Science* magazine. He has worked with robots, played in bands and currently lives with four feline automatons.