

## SEI Cyber Talk (Episode 10)

**Games that Work**  
by Tom Longstaff and Rotem Guttman

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**Tom Longstaff:** Hi, I'm Tom Longstaff the CTO with the Software Engineering Institute. Welcome, today, I am talking to Rotem Guttman on the idea of serious games and what we can do in the world of gamifying various kinds of the future of software research. Rotem, welcome.

**Rotem Guttman:** Thank you.

**Tom Longstaff:** So, first of all, can you help me understand what is a serious game? How does that really change between what we think about as normal games and serious games?

**Rotem Guttman:** So, a serious game is really any game where you have some sort of benefit or some sort of goal that it is outside of the gameplay itself. So, to give you an-- there's sort of a hierarchy in the way that I think about it is you have things that you do as a business, things that you want your staff to do. And usually these aren't very game-ful, very play-like. It's work. And so, the kind of first step in gamifying that that a lot of companies and organizations have taken to is what we call Playful Design or Game-Like Design, where there isn't really a game to it. They've just added elements of game play to the normal work process.

And a lot of times, this can take the form of badges and leader boards that I've seen where it's not really applied in the context of a game. They just kind of slap it as a layer on top. They make the normal work more fun. And these aren't really representative of really anything.

Then the next layer after that is actual gamification, where now these badges and leader boards maybe have meaning. And I'll be perfectly honest, I'm-- the two things that I hate most in gamification are badges and leader boards because they're misapplied a lot. But they will take those, and now they have meaning. Now there's something that they're doing. This team is trying to complete their tasks faster than that team, and they're starting to maybe compete about it.

But the point where we move from gamifying the business practice to a serious game is now it's a concept where it's an actual game. You are playing a game, but you are deriving a benefit from it. So, either-- maybe I'm trying to train my staff on something. And so, I let them go play this game, which is just a fun game to play. But as part of the game play, they gain the skills that I need them to gain.

So, to give you an example, there's a game called Pulse. It was designed by a nurse, and it's for nursing students. And it's just like a first-person shooter, interactive virtual world, except for you have people coming into an emergency room, and you have to make treatment decisions on them. And so, you're just sitting, playing the game, trying to manage this ER, but you're gaining actual skills.

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Whereas, there's another game that's a similar genre is something called Surgeon Simulator. And so, in that game, you gain no real-world skills, no real-world knowledge. You crack somebody's chest open and throw organs out and try and not accidentally put your tools in their chest cavity. It's a lot of fun. It's very amusing. But it's not really teaching you any useful skill. And so, that one's just a game. Whereas, in the serious game, you're actually acquiring that skill where, okay, now for having played this game, I am actually better at some sort of skill or technique that I need to pick up for my work.

**Tom Longstaff:** So, Rotem, really isn't this just for kids or just for sort of new people entering the workforce? Badges and leader boards, and first-person shooters, this sounds a lot to me like sort of the transition of kids into the workplace. Is there a more or better use of this kind of technology?

**Rotem Guttman:** Oh, absolutely. Now, to clarify, yes, it's great for children and for younger adults just because it allows us to capture their attention for much longer spans than we normally would be able to. And that's not only true for kids and young adults. That's true for everybody. When the training or the education task is fun, you'll stick with it longer. But that being said, there's no reason that those skills that are encapsulated in a serious game can't be really niche, really technical skills at a level of graduate student work or above.

We had a program here actually that I ran called CKEI, Cyber Kinetic Effects Integration. And as part of that program, we actually trained in-depth cyberattack and defense skills. So, you have people actually reconfiguring networks, exploiting services, actually getting into the network in support of a larger game. So, you had actual people in a first-person shooter environment trying to go and rescue a hostage. And so, the systems that were connected to that that had accessibility via the network, alarm systems, lighting, all of the systems were attackable. And so, the team could gain the advantage in rescuing the hostage by disabling the alarm so that they didn't know that they were there, or cutting the lights so that the rescuers who had night vision were able to see. Whereas, the guards who weren't in full tactical gear suddenly were blacked out.

**Tom Longstaff:** That's really excellent. So, how do we know that people are really learning from these games? How do we know that after we've played a game or after we've sort of gotten really good at playing the game that we actually have real world skills?

**Rotem Guttman:** Well, okay so, that's a good question. And there's some data that supports that. There's definitely a need for more research in that field. It would be great to show that these training techniques generalize to just about every field. The issue is that a lot of the data that we have is, as you mentioned, on children, in an educational setting, schools, high schools, and so forth. And for these really a lot more niche technical tasks, there's not a lot of data out there right now.

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Now, what I can say is anecdotally we definitely have evidence of that. We've run a lot of these trainings ourselves internally, and we've actually gotten good results in seeing that okay now, when they go back to their normal job roles, they're actually able to use the techniques that they learned in the game. But actually having a good large study to be able to prove that these techniques transfer would be a good goal.

**Tom Longstaff:** So, what would a good large study look like for something like this? What would it actually take to gather that information to really understand the effectiveness of serious games?

**Rotem Guttman:** I mean really the gold standard that I'd like to get to is to be able to run concurrently, for the same population, multiple types of training. So, have one training that's the traditional classroom training that is expensive and hard to replicate because you have to actually fly people out, put them in a classroom, put an instructor in front of them. But that's kind of the historical gold standard is you work together with the instructor physically co-located.

Then the next group would have a virtual environment, just like we provide here for trainings, that really helps lower the costs in replicating those trainings. So, we capture an instructor training that class, and then we provide that captured content, as well as labs and exercises, in that virtual environment to anybody anywhere in the world. So, then we can take that and run the same class with a similar population.

And then the third one would get actually trained through the serious game. And then what I would want to do is run all of those groups through the same set of evaluations so I can actually have hard metrics on okay, here's how much of a difference it makes because here's the fact of the matter is even if serious games are effective, and they do give us a benefit, the question that kind of follows that up is is it enough of a benefit to justify the additional cost of developing them because really on that sort of scale you have-- the most expensive is having an instructor re-teach the class for every group because that just constantly costs a lot of money. Whereas, if you capture them and provide captured assets to the class, that's a lot cheaper, but the quality differs. Now, if you take that and create a serious game that utilizes those materials, now you've incurred an additional cost. We want to know is that cost justified because if it's an extra thirty percent to the cost of teaching that material, and you get a five percent benefit, it's probably not worth investing that. It would be better just to have more material to teach.

**Tom Longstaff:** So, are there sort of tools or techniques or research ongoing right now to help make it more cost effective or less expensive to develop these serious games and then integrate it into e-learning and other kinds of online education? Are we going in that direction?

**Rotem Guttman:** So, I'm not familiar with any tools specifically developed for that expressed purpose. There's a variety of tools that were developed more towards the game industry in

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general rather than serious games in particular that really allow us to replicate and create game play at much lower cost than it would have been even a decade ago. And so, a lot of these tools are-- and specifically these frameworks that you can build your experiences in are very useful. But specifically for the serious games venue, there tends to be a lot of reinventing the wheel that occurs as you transition between different topics. So, if you're teaching somebody how to do CPR, or if you're teaching somebody how to defend a network, a lot of the time you're redeveloping a lot of the tools that are needed for that particular venue.

**Tom Longstaff:** So, a lot of what we've been talking about is sort of individuals playing the game and sort of one on one, an instructor talking to a student. The modern way of doing games seems to be all these massive multiplayer environments, these big teaming environments. How does that interact with what we're doing today with serious games?

**Rotem Guttman:** So, let me clarify then. To give the example of the CKEI program that we did actually, that is a team-based environment. And it's actually multiple teams cooperating in that environment. And so, you have one team that is the kinetic operators. They're the ones that are effectively in a first-person shooter environment. You have another team that has to work together to attack the enemy networks and another team that has to work together to defend your network.

And now, those lines can get blurred. You can move personnel between the different teams. You can rotate through them, so everybody gets to try out every role. But these are expressly designed to have too much content in them, too much that needs to get done for any one person to be able to do it effectively because one of the skills that we really want to train in that environment is the coordination skill because sure, it's, I don't want to say easy, but we understand how to take a cyber operator, sit him down at a workstation, and teach him technical skills. But the really hard thing to do is teach him how to both use those skills, coordinate with another team that has a task that might not be cyber oriented, and also how to express what challenges he's facing or what he needs or what needs to be done to people that aren't cyber people, that aren't aware of that domain. And all of those are techniques that you actually have to practice in that environment.

**Tom Longstaff:** Great, great, great. So, these days, there's a lot of immersive kinds of simulation environments where it's not just playing against a screen or looking at-- against screen for a game but something much more immersive. Does that have a role to play within the serious games?

**Rotem Guttman:** Oh, absolutely. So, one of the core things in serious games is you really want to capture your audience's attention. You don't want them to feel like they are in training when they are in training. You want them to feel like they can get lost in this world where they are just participating. They get to experience it.

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And actually, one of the key ways that I kind of like to focus my design when I'm planning out one of these experiences-- and I'll note that I tend to, when I'm speaking internally, I don't call them games. I call them experiences.

**Tom Longstaff:** I bet.

**Rotem Guttman:** Because there's a certain connotation in games where there doesn't necessarily need to be a goal, there doesn't necessarily need to be a winner or loser. If you craft the experience correctly, participants can immerse themselves to such a degree that they forget that they're-- what they're involved in. They forget how long that they've spent in it. And that's one of the things is we'll have participants that will spend hours and hours on what is effectively training in their spare time, in their free time, because it's just so enjoyable and so immersive. And AR and VR techniques, especially VR, are very helpful in this.

Now, casinos have known this for years. That's why there's no windows, no clocks. You get lost in that. You walk outside, and it's, "Whoa, what time is it, and how much money did I spend there?" Well, I'd love for our audiences to have something a lot more positive from that experience of, "Whoa, how long did I just spend? Wow, I got really good at this. I didn't realize that I spent this much time training it." But it wasn't an effort to do it. It was just an enjoyable experience.

And now so, the key, the way that I think about that is to realize that each individual person that plays that game is going to be looking for something different out of that experience. And so, many, many years ago, I'm showing my age here, I used to play on something called MUDs.

**Tom Longstaff:** Yes.

**Rotem Guttman:** I don't know if you--

**Tom Longstaff:** I remember it well.

**Rotem Guttman:** Oh, okay. So, MUDs, MUSHs, MOOs, MUCKs, etc., but the-- M-U there is multi-user. And it was essentially an early text-based multi-user game. And so, there was this guy, Bartle, who made a taxonomy, Bartle's player types taxonomy, where he tried to capture what different people want out of that type of game. And he basically put it on two axes. There are the players who are either looking to act, to have their effect, or to interact. So, either they want to affect the world, or they want to affect other people and interact with them. And on the other part of that taxonomy is do they want to interact with other players or interact with the game. And so, from that-- I'm going to use Dr. Kim's verbiage because--

**Tom Longstaff:** Sure.

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**Rotem Guttman:** Bartle is somewhat less politically correct. But basically, they're classified into players who they want to explore.

**Tom Longstaff:** Yes.

**Rotem Guttman:** They want-- or they want to compete, or they want to socialize, or they want to collaborate. And so, I find that most participants in an experience actually want to participate in multiple parts of those, though generally not all four. And-- but when you design the experience to answer the needs of all those different types of players so that there's something for them to do to compete with one another, but there's also something for them to do where they can come together and work as a team, or there's something for them to do to explore the environment, or something for them to do where they can gain achievements and show off what they're capable of doing, everybody can then find their own fun in that environment.

**Tom Longstaff:** So, this is a great way to segue between this is the way it worked in the past. Give me a sense of what does this look like in the future? What can we expect sort of in the sort of mid to long term about how do serious games really interact with our lives?

**Rotem Guttman:** Well, I think in the medium term, I think we're going to be seeing more and more of these serious games coming out, being adopted more and more fully in sort of non-traditional training capabilities, ways that we can do a lot more on-the-job training, a lot more ways to integrate it into education. What I'm hoping that we will see, with the proper investment, on the long term is more suites of tools that make converting traditional training and traditional education techniques into a serious game a lot more lightweight so that the overhead of actually making the game becomes minimized and you can really have your educators focus on the education value and creating really compelling content and not the technical details of how to actually get this into a game environment.

**Tom Longstaff:** That's a really exciting future. Well, thank you very much, Rotem. For more information on the work that we do, check out the link in the description. This has been Tom Longstaff and Rotem Guttman. Thank you for watching.

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