



# The Risk Calculus

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## The Game's Afoot

Host: Andrew Reddie  
Guest: Bethany Goldblum  
Series: Shall We Play A Game?

*S1 E1*      *02.2024*

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Andrew Reddie

Welcome to the Risk Calculus, a new podcast from the Berkeley Risk Security Lab. I'm Andrew Reddie, the lab's founder and your host for our first season.

At BRSL, our researchers are trying to understand and manage emerging risks at the intersection of security and technology. These include the combination of rapid innovation in areas like artificial intelligence, new forms of cyber risk, quantitative and qualitative shifts in nuclear weapons, all compounded by rising competition between the United States, China, and Russia.

In later seasons we'll be talking more about the issues themselves, from the impact of frontier military capabilities to the challenges of technology governance. But to kick things off, I want to do something slightly different.

In this five part miniseries, I'll be introducing you to an old way of thinking about risk experiencing a renaissance, both here at the lab and beyond. I'm talking about war gaming.

As you'll hear from across the five episodes, wargaming methods have been with us for a long time, but the insights generated from war games have never been more needed.

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While new technology also makes wargaming methods an even more compelling tool for teaching, for training and, importantly, for analysis.

To unpack wargaming, it's past, present and future. I'll be joined by friends and colleagues who are working at the cutting edge of research and practice.

So, shall we play a game?

[MUSIC PLAYING]

Andrew Reddie

In this series we'll be talking about war games - tools traditionally used by militaries and governments to ask and answer strategic questions.

But increasingly, and excitingly, these tools are also used outside of a military context and we'll get to some of that across this series.

I come to wargaming as an alum of the Project on Nuclear Gaming, a partnership effort between Lawrence Livermore, Sandia National Labs and the University of California Berkeley, funded by the Canadian Corporation of New York, and specifically from a social science and academic perspective. And it's that perspective that we're gonna be primarily focused on in this series.

We've designed games that run the gamut of pedagogical, experiential, and analytical applications. Games take a variety of forms from seminar based games to rules based games that look a little bit more like chess or risk. We've got games that are over a board. We've got games that are online over a computer and games that are engaged in kind of competitive and then also cooperative dynamics.

I've also been one of the pioneers of using war games as experiments and in today's session, you'll actually hear from one of my colleagues Bethany Goldblum from nuclear engineering in terms of how we think about using war games as an experimental setting. And not just about playing games in ones or twos, but actually playing games that are gonna be data collated from



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tens hundreds of games, thousands of games and then able to be used for causal inference purposes in the service of answering a research question.

Our team at Berkeley with partners from the national labs, University of California, San Diego Stanford University's Hoover Institution and MIT is increasingly looking to use wargames as a synthetic data generating tool.

And we have a particular interest in how some of its characteristics from immersion, the consequential decision making strategic interaction might offer a corrective to our over-reliance in the social sciences on formal approaches.

The simulations and models are excellent, but one of the major problems is there's no human inside the loop. And so if you have a research question where you think the human is important, you really want to have a human inside of that process. And obviously, if you're building a model, you don't get that.

And then of course, one of the ways that we kind of address that problem in the academy is by using survey experiments where I get the human in the loop. But ultimately, I'm not entirely sure if they give you a piece of paper and you bubble in a couple of answers whether I really got a good sense of who you are and what you want to do.

And so war games kind of offer a corrective to both of those challenges, particularly where we don't have empirical data. And, indeed, one of the reasons that I'm so excited about war gaming and I think some of the speakers that you'll hear from in the series are so excited about wargaming. It's because you're able to actually get answers to questions that we don't have data for. And those are the questions that ultimately we as academics are often getting from policymakers.

So policymakers come to us and say, well, if I adopt this strategy, what's likely to happen or if I procure this capability, what's likely to happen. And traditionally, we're not able to answer those questions. But war games offer us a way to do that today.

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Andrew Reddie

My guest is Dr Bethany Goldblum, a professor in the Department of Nuclear Engineering here at the University of California Berkeley, and a research scientist at Lawrence Berkeley National Laboratory.

Bethany is also to blame for my own foray into wargaming, leading some of Berkeley's work on experimental applications.

In this episode you'll hear about what war games are, how they're used and how variations of an old method can help us think through some of today's most urgent questions.

So Bethany, what brought you to the field of wargaming?

Bethany Goldblum

So I kind of fell into war gaming really. There was a call for research opportunities through the Carnegie Corporation and there were a variety of different projects being pitched. And so I was actually at the airport and received a call from a colleague at the national labs that said, do you want to participate in a wargaming project? And I said sure, because you know, why not?

I didn't know much about it. My flight was about to board and then when the dust settled and found out that we were starting this effort, I discovered that I was the project director for the Project on Nuclear Gaming at UC Berkeley, which was done in collaboration with Lawrence Livermore and Sandia - as you know.

Andrew Reddie

And what are the opportunities that excite you? What led you to say yes and take on this project?

Bethany Goldblum

I think one of the big powers of war gaming is the ability to integrate human direction into the simulation of warfare.



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And this is a, I think unique opportunity to, or unique method really, for collecting data because you can leverage both the technical and the kind of analytical aspects of simulation but also integrate in human decision-making in the process.

Andrew Reddie

Yeah and that way, it offers a really nice alternative to some of the tools that we also have in our toolbox, right? Simulation tools, modeling tools, et cetera, that sometimes maybe take the human less seriously than perhaps we would like them to when we're thinking about crises.

So in this conversation to kind of launch the series, we really gonna want to get to brass tacks and think about what is a war game or to put another way kind of what makes a war game.

So in your view, when you're looking across the suite of what the defense establishment, defense community, call a wargame, what is that for you?

Bethany Goldblum

Well, so I think there are many different definitions of war gaming in the literature where I see war gaming is, it's a human directed simulation of warfare. It could be at the tactical operational or strategic level.

I think really that human aspect differentiates it from other data generating processes. Like for example, you could have analytical methods that integrate human input calculations where probabilities for the next thing to happen in some conflict scenario are based on human input.

But I differentiate that as a wargame, or from a wargame, in that wargames are more directed by human decision making.

Andrew Reddie

Yeah, that consequential aspect of it, right, where you're inside of the wargame environment and what you do is going to impact the way that you see the game in the next phase is something that kind of sets wargames apart from say a survey experiment for example, right, where I bubble in an answer that doesn't really matter what my answer was for what the next



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round that I see. So that's something that I see as well where kind of that consequential decision making element is really key.

How important in your view is strategic interaction to how war games are unique?

Bethany Goldblum

Well, I feel like war games can be applied and used at a variety of different levels. And so it really depends upon the resolution of the question or the phenomenon that you want to study.

I mean, you can look at how things are done or you can look at what should be, like how things are done at the tactical level in some kind of conflict, what should be done in establishing operations.

Or you can look at the kind of grand strategy type questions at the level of a nation state. How would you use resources like your military or your infrastructure or economic factors to engage in some conflict.

Andrew Reddie

Yeah, spot on, if an adversary X is doing Y then you should do Z et cetera.

Bethany Goldblum

So one thing that I think is pretty neat about using war games at the strategic level is that you can design a game with different levels of resolution to be able to probe different questions.

And so even within the same type of game environment, as you add more complexity or details into the processes that a human could play out, then you could get at all of these different levels of decision making.

So like for example, in the economic aspects, you could say I'm gonna generally put resources towards a certain activity. Then you could go down to a more operational level and say I'm going to put resources into X or Y. I'm going to put resources into building infrastructure. I'm going to put resources into shoring up defenses and so on and then you could go down even further and say I'm going to put \$10, and so on.



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And so I feel like that's a really powerful aspect of war gaming is that you can get to a wide range of aspects about the question that you're exploring.

Andrew Reddie

Yeah. And we would describe that and some of our work as kind of dialing up that contextual realism, moving that granularity up and down. It's one of the really nice things.

I mean, I think that that is one of the really nice things about war gaming as a tool - the degree to which the researcher has control over the environment that you're putting your players inside of.

So you kind of got to it with your answer to the previous question, but there's lots of different reasons to play war games. So you pushed on already the training aspects and educational aspects. And so I'm just kind of wondering from your perspective, how you break up the why? Right, like why do we actually engage in wargaming as a practice?

Bethany Goldblum

So I think historically, war gaming has focused more on education and exploration.

So wargaming is unique in that you can simulate an environment for humans where they can explore some scenario that they maybe haven't encountered yet in the real world. And so it can give them an idea about what are the things that they didn't anticipate or what resources might they wish to have available in that scenario?

More recently? I feel like there's been this big push, in part due to the science article that we wrote, in further integrating analytical aspects into the wargame environment. So executing war games as experiments and there you see a lot of engagement from the academic community as well. And how do you use war games to test hypotheses?

Andrew Reddie

Yeah. Well, let's have that conversation now because I think because you've led us into it really nicely.



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So I mean, there is something of a class break right between what we kind of saw as experiential games built for high level policymakers to play through a particular scenario that they might see in their day to day career versus the work that we've tended to do, which is focused on an analytical question.

And from your perspective, what is the class break driven by?

Is it the fact that those traditional war games are only played once and thus you can't really perform causal inference on them or is there something else that is moving the needle?

Bethany Goldblum

So you mean what differentiates wargames for exploration and war games for analysis?

Andrew Reddie

Yeah.

Bethany Goldblum

From my perspective, board games for analysis are executed using the scientific method. And so this is often done using a control treatment experiment. And so there you have some scenario that you run in the board games, some base class and you need to run that at least once, ideally more so that you can build up statistics about your experiment and then you change one variable.

And so you can look at how play changes or how decision-making changes in response to that one variable. And I think what's really powerful about the scientific method applied to wargaming is that there are less requirements for fully simulating the conflict environment within the game because you only need to measure the change in behavior of the human in response to that one.

There may still be factors within the game environment that influence decision-making. But the relative change from an identical environment with only one variable changing is going to, the bias introduced by that is going to be less.





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Andrew Reddie

Yeah, you get that internal validity, but then on the flip side, you're trying to increase your N and so you're often also expanding who is playing your war games.

And so I'm just kind of wondering like who is it that you would want to be playing your war games if you got to choose?

Bethany Goldblum

I think that's a really hard question. I actually don't know the answer to that and I don't think that the community yet knows.

This is something we need to measure. I mean, there's been discussion in the literature that in order to really get value out of a wargame from a strategic perspective that you need to have senior military leaders or experts in national security or military strategy playing the game. I don't know if that's true because we haven't had a chance to measure it.

So if I could test this, I mean, what I would do is try to get as many different people as possible from different countries, from different educational backgrounds, diversity of gender and many, many different demographic factors and then bring them together and try to actually look at how does decision making change based upon these factors.

Andrew Reddie

Yeah, and that's one of the things that I think is exciting about the fact that war games have now kind of come to the universities is that it actually has democratized and opened up the war gaming space to those different types of voices that maybe weren't a part of the traditional war gaming conversation that did tend towards policy making elites, military leaders, et cetera.

[MUSIC PLAYING]

Andrew Reddie

So having talked a little bit about the basics of wargaming, we're gonna chat now about where we're moving into the future and why wargaming is in vogue now.



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And so, I mean, we talked about this a little bit when you talked about how you were getting into the field. Like why is it that Carnegie was interested in funding wargaming work? Why is it that the defense establishment community is interested in wargaming as a method. Why is it that we get to do this from our perch in the Ivory Tower now, sitting here in the 2020s, compared to the 2000s or 1990s.

Bethany Goldblum

Gosh, I feel like I have two answers to that.

I mean, one reason I think is there's a lot of opportunity to leverage the power of wargaming in examining emerging technologies, for example, or scenarios where we can't do an experiment in the laboratory.

I mean, in particular, you know, as a nuclear engineer, I think about this in the context of nuclear weapons use in, nuclear weapons in general, in war fighting or in deterrence, even in nuclear proliferation, how you can use war games to simulate different scenarios that you would really not want to see in the real world.

But I think that there's another answer as well is that right now we have the opportunity through electronics, through the internet where we can collect data at large scale.

And so we can run these games as a kind of video game and collect data in a way that really wasn't possible in previous decades and integrating those types of platforms with things like artificial intelligence in the game environment, it opens up a new vista of inquiry and, and so that's a really exciting thing about why war games now.

Andrew Reddie

Yeah, I think that's exactly right on the supply side and the demand side, right. So the demand side, we have all of these new questions that we don't have empirical data for.

When policymakers come to us and they say “how does emerging technology x transform the international security environment”, traditional historians and political scientists don't have



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the data to say, “hey, this is actually the answer to your question”. And so war games offer you a really nice tool to kind of engage with that on the demand side.

And then like you said, on the supply side, you've got all these new tools that we can actually rapidly iterate an experiment that, you know, 10-20 years ago would have been very difficult.

And so, you know, I think I very much agree with you in that supply and demand side is pushing us towards doing more of this work and I'm really excited to kind of see the academy take this as a method.

So what makes this tool a good match for the kind of questions that we tend to be interested in today? From your perspective?

Bethany Goldblum

Well, I touched on that a little bit in that as we're designing new weapons systems, as we're designing, for example, new situational awareness technologies.

When these technologies haven't previously been introduced into the conflict environment, there could be unintended consequences that arise from their use - even in technology that's not designed for kinetic purposes this could create the perception of an attack and that could inadvertently result in escalation.

And so I feel like wargaming has a unique opportunity there to allow us to test these in a more real world, in a simulated real world environment.

And so we can ask questions about how, for example, in surveys, how an individual might perceive the introduction of a technology into a conflict, but that's really different than them experiencing that as they're engaging through a simulated conflict.

Andrew Reddie

Perfect.



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And while I have you, can we just run through a couple of the games that you've been actively playing a role in designing and what are the types of problem sets that you've looked at as an analyst using these wargaming methods?

Bethany Goldblum

So the first war game that I worked on was with you on SIGNAL, so this is a strategic interaction game between nuclear armed lands, a clever acronym. And there we were looking at the question of how the introduction of tailored nuclear weapons impact the likelihood of nuclear use. And we were specifically focused on high, low yield nuclear weapons.

And so there we had a game where there were multiple countries and they could interact through military means or they could build infrastructure or they could trade and do diplomatic deals. And so then what we wanted to do was change the weapon set available to the players in different treatments and then look how that impacts their likelihood of use.

So for example, we had two nuclear armed nations and then one that only had conventional weapons available and then we could change, do they have tailored nuclear weapons in their arsenal? Again, focused on the high precision, low yield weapons and then look at did their likelihood of using a nuclear weapon increase in that environment?

Andrew Reddie

And of course, we're contributing to this live debate, right, that was actually happening at the time around whether a country might want to proliferate that particular type of capability, where you had groups of very smart scholars on different sides of that debate with no data to kind of adjudicate who was right and who was wrong.

Bethany Goldblum

Right, I think it was at that time that the Trump Nuclear Posture Review came out.

Andrew Reddie

That's right.

Bethany Goldblum



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And I believe it was the debate around the W 76 Mark 2 and reintroduction or, or introduction of this capability into the arsenal.

And so it was particularly interesting that we could look at this question in a simulated environment and then add to the debate that was going on in the literature that was largely theoretical.

Andrew Reddie

Yeah, I mean, so, so the first example that obviously you worked on was a nuclear game, you know, is there something it predisposes us towards looking at nuclear questions using war gaming methods or do you think it's fairly agnostic to domain?

You know, do you think it's just as reasonable to look at questions in the cyber domain or the space domain using wargaming methods or is there something about the nuclear side of it?

Bethany Goldblum

So I feel like there's a real opportunity within nuclear and I'm kind of predisposed to look at nuclear questions as a nuclear engineer, but there's certainly no limitation on the questions that could be asked.

And although I don't know this personally, I understand or have heard from others that war games that have been executed with senior military leaders have often stopped when you get to the point of nuclear use.

And so it's not necessarily common at all that nuclear use or nuclear weapons deployment would be implemented in a wargame environment.

In fact, we've been looking at questions around cyber deterrence in collaboration with Sandia National laboratories using a wargame as well.

Andrew Reddie

Perfect. Thanks Bethany.



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So last question here, if we have, you know, students that are listening in or those that are interested in the field and wanna get more deeply acquainted with the field, what are your recommendations for what they should be reading or engaging with moving forward?

Bethany Goldblum

So when I was looking into learning about wargames, I came across a scholar, I believe he's at Georgetown now and also at the Center for Naval Analysis, Sebastian Bae. So I actually learned a lot just following him on Twitter, he also has some articles in War on the Rocks.

There's the kind of canonical work on war gaming as well from Peter Perla. There's a book I can't remember the title...

Andrew Reddie

*The Art of War Gaming.*

Bethany Goldblum

Ok, great.

And there's a lot of recent work really that's been discussed in the political science literature to work from Jackie Schneider, who I understand you'll be having on as well.

Andrew Reddie

Yes indeed

Bethany Goldblum

Reid Pauly.

So I would recommend all of those.

Andrew Reddie

Perfect.

Well, thank you so much for joining us.



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We'll include the links to some of the suggestions that you made in our show notes and we'll also publish a full list on the BRSL website as well.

In the next episode, we'll be taking a spin through the history of wargaming from the Romans in togas to the RAND Corporation and I hope you'll join us for that.

Thank you, Bethany, for joining us. Thanks to Andre Anderson and Citrus, our recording studio host. Special thanks to our amazing producer, Jane Darby Menton and finally to all of you for tuning in.

Until next time, I'm Andrew Reddie and you've been listening to the Risk Calculus.

[MUSIC PLAYING]

Andrew Reddie

And we'll always have Exploding Kittens.

Bethany Goldblum

Well, my kid always says that I like that Andrew. He's a good guy.

