



Catalyzing Computing Podcast Episode 28 – Global Security and Graph Analytics with Nadya Bliss (Part 2)

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[Intro - 00:10]

Khari: Hello, I'm your host, [Khari Douglas](#), and welcome to [Catalyzing Computing](#), the official podcast of the [Computing Community Consortium](#). The Computing Community Consortium, or CCC for short, is a programmatic committee of the [Computing Research Association](#). The mission of the CCC is to catalyze the computing research community and enable the pursuit of innovative, high-impact research.

In this episode, I interview [Dr. Nadya Bliss](#), a [CCC Council Member](#) and the Executive Director of Arizona State's [Global Security Initiative](#). Before joining ASU in 2012, Bliss spent 10 years at MIT's [Lincoln Laboratory](#), most recently as a founding group leader of the Computing and Analytics Group. In this episode, we discuss the work of Arizona State's Global Security Initiative, how to combat the spread of misinformation, and the impact of sustainability on security. Enjoy.

[Nadya's Academic Background - 01:06]

Khari: So can you kind of lay out your timeline, as far as from when you went to undergrad until you got to ASU?

Nadya: Sure. So, as I mentioned, at about six I decided I was going to be a mathematician. I know you said undergrad but we're going to go back to six.

[Laughter]

So at six I decided I wanted to be a mathematician, at about ninth or 10th grade I decided that that was not necessarily a career that would allow me to pay off my future loans, so I decided to major in computer science. I wanted to go to a top CS program. At the time, as a high school senior, I remember I was deciding between Cornell and Carnegie Mellon, and I just fell in love with Cornell on my visit. I have the best memories of my time there.

At Cornell, I was a computer science major. About a little bit into my computer science degree, I realized that I had quite a bit of AP classes that I took in my high school back in Ohio, and what I actually was thinking of doing was getting a double degree. I wanted to do a double degree in computer science, which would be a B.S. through the engineering school, and a math degree through the college of liberal arts and sciences; but when I went to talk to my undergrad advisor they actually gave me some really good advice, which, I don't remember this person, but that was probably really valuable.

He basically said, "Look, why do you want to do the dual degree? You're already taking a ton of math in your computer science curriculum, why don't you do a Master's? You can do a Master's in four years." So I finished my undergrad in about 3 1/2 years and then I did a Master's in just one more semester. When I graduated from Cornell with a Master's I went to Lincoln Laboratory.

At Lincoln Laboratory I considered getting a Ph.D. because I had always wanted to go get a Ph.D., but I was having so much fun and I got to do research. You do the Ph.D. to do the research and I was getting to do the research, but then also having impact. So I was publishing a ton and I was doing very interesting research in a number of different areas. Eventually I got promoted to a level....I mean, I essentially broke the Ph.D. ceiling at Lincoln Laboratory, so there wasn't really career motivation for a Ph.D and I, intellectually, was very happy doing the work that I was doing.

Then in about 2012, my husband, who is a professor here at ASU, decided that we should go to ASU. He didn't decide, we discussed it, obviously...

[Laughter]

But it was something that he really wanted to do because he wanted to be a professor, that's been his lifelong dream and he had an opportunity to do it. He was a senior scientist at Lincoln as well. So he came to ASU, and once I came to ASU I realized that in an academic environment it's really helpful to have the Ph.D. credential, and I actually had my advisor, Manfred, approach me, and he said, "Why don't you have a Ph.D.? You have all these publications, why don't you have a Ph.D.?"

I said, "Well, look, I did the stuff that was the interesting thing. Do I really need this credential?"

He's like, "You should have a Ph.D."

I said, "OK, can I get a Ph.D. in 18 months?" And I put out a plan because I'm a planner. I mapped it all out and I said, "If we can do it in 18 months and fulfill the requirements that are necessary, I will do it," because at the time I was an assistant vice president, had a little kid, and a husband pursuing tenure. I was not willing to stop my job and obviously I needed to spend time with my kid.

So, that's how I got my Ph.D., but it was great because I got to write up that body of work. I mean, a dissertation is a really nice thing to have. There's something very meaningful about it, and to be honest, like, it's a neat thing to show my daughter. Like, "Look, I could do this and you could do this if you want to. You don't have to, but you could do this." So that's kind of the trajectory and that was five years ago.

[Vice President for Research at ASU - 05:07]

Khari: So, I guess that kind of leads us up to where you are currently at Arizona State. As you mentioned, when you were getting your Ph.D. you were a Vice President for research strategy...

Nadya: Assistant Vice President.

Khari: Assistant Vice President for Research Strategy at Arizona State. So, what does that job entail? What does an Assistant Vice President for Research Strategy do?

Nadya: Yeah. So an Assistant Vice President for Research...it was research strategy. Essentially, your role is to support the executive vice president in a diversity of initiatives. The thing that I think I really appreciated about this is — and I probably learned quite a bit about myself is — I am super interested in how organizations function. Before ASU I've only worked at Lincoln Laboratory, and you would think that MIT Lincoln Laboratory and another university are very similar but they're these quite distinct parts of the research ecosystem. We're still in research, you're still in the research ecosystem, but while MIT Lincoln Laboratory focuses on that 6.2 and up, for the most part universities focus on 6.1, the basic research, and just barely touch on 6.2. *[Note: 6.2 refers to the Department of Defense budget code for Applied Research; 6.1 is basic research. Read more about DOD research appropriations structure [here](#).]*

Then there's all these other aspects being in a huge university like ASU: obviously, the students, the amazing access mission, and the diversity of disciplines. Up until ASU I

basically spent my entire career in a very technocentric environment. When you are an Assistant Vice President (AVP) you are working with all disciplines. You're working with humanists and you're working with the law school and the business school and all of those areas. So I felt incredibly fortunate and privileged, first of all, to be mentored by Panch — Professor [Sethuraman Panchanathan](#) is the Executive Vice President for [Knowledge Enterprise](#) at Arizona State University [*note: in June 2020 Panchanathan was confirmed as the [Director of the National Science Foundation](#)*], and I got to work directly with him on an almost daily basis in the AVP position. I still report to Panch as the Executive Director of GSI, but it's a different, obviously, reporting relationship because I run my own organization.

But I got to work with him all the time and see the challenges he faces, the different decisions, prioritization, the focus on mission, the focus on charter. A lot of what I did day to day was to sort of look broadly at the university and see where the research was growing, where there were opportunities to seed some research, and how we could support the big institutes and initiatives in the university. That was kind of my job, and [I was] also working with the associate vice presidents for science, humanities, and social sciences on identifying big potential initiatives in the university.

Khari: Ok, um...

Nadya: But mostly I just learned how everything worked! And I'm under no delusion that I know how everything works, but I got to see a lot of things, and that's really exciting.

Khari: So, many people think of a university as being where you go to get an education and then you get a job, but obviously universities do a lot of research. Can you explain a little bit about how that ecosystem, sort of, interplays with each other?

Nadya: Yeah, that's an awesome question. I actually think that we do tend to think about the academic side, which is the academic programs, and the research side — at ASU we actually refer to it as the knowledge enterprise and it encompasses not just research

[but] it also encompasses economic development and innovation and a lot of working broadly with companies and lots of different initiatives under that umbrella: corporate partnerships, medical partnerships, et cetera — while those two are potentially separate parts of the university organization chart or ecosystem, they obviously feed into each other.

There's absolutely no reason...At ASU this is actually broadly encouraged, and there is a ton of participation of undergraduate students in the research ecosystem. On top of it, as you're moving into the college space at undergraduate, graduate, or really any level, there's so many open questions. So, the professors that are teaching the students are active in research and how their research results come back into the classroom and affect the curriculum. On top of it there is research on the most effective ways to educate and what methodologies work. Right now we're living in this remote environment and there's a ton of research on remote education and online education and synchronous and asynchronous models of education.

The way that I sort of see it is, yes, there's absolutely a broad set of concerns on the academic and the research side but they're tightly coupled and that system works so closely together. They inform each other. You know, sometimes the best ideas on the research project are going to come from an undergrad student because they have not actually spent 20 years being, essentially, set in a particular idea in the field. And similarly, you know, your professor may change the way they teach their class because of a new research result.

In a university like ASU, I mean, our research expenditures are in hundreds of millions of dollars, so this is a very active research environment.

Khari: Ok, and you mentioned part of your role is to seed research within the university: what form did that take? Was Arizona State themselves giving money or did you help to find federal or state resources that contribute to research or...?

Nayda: Yeah, so, Panch's office, the Executive Vice President's (EVP) office, oversees a number of internal investment funds. This is pretty standard across multiple universities. So from that perspective there's absolutely work on supporting faculty and pursuing external funding, but a part of the role of the EVP's office is to, essentially, look at what internal resources are available — some of those come from state funds and some of those come from other other places in the university — and align those to research potential.

Where are the big challenges in the world? How do we address problems that are of particular relevance to Arizona? That's really important. For example, we think a lot about issues of water as a resource and water security, water scarcity, laws around water, that's a key Arizona issue. That's kind of the focus. Essentially the responsibility of an office is to align internal resources to make some of these investments, to seed some of the research, and then make sure those seeded investments have everything that they need to then pursue external funding.

[ASU's Global Security Initiative - 13:13]

Khari: Ok. So, following your time doing research strategy, you are now the Director of the [Global Security Initiative](#), right?

Nadya: I'm actually the Executive Director.

Khari: Executive Director, sorry.

Nadya: Yes, but that's reasonably new. That's only a year old.

Khari: Ok, so there are sub-directors I'm assuming, or...?

Nadya: Well, what I mean is...I do actually have directors under me, but my title was Director of the Global Security Initiative, and then I was promoted last summer to Executive Director just as the organization scales.

Khari: Got it. OK, so what is the Global Security Initiative (GSI) and what does it do?

Nadya: GSI is one of the big pan-university, essentially institute level organizations. Our goal is to be, effectively, the face of the university in the Department of Defense, the intelligence community, Department of Homeland Security, and more broadly security research areas.

We sit at a level of a college. The way that the university is structured, we have a president, [President \[Michael M.\] Crow](#). My boss, Dr. Panch, reports to President Crow. Similarly, on the academic side, there's a provost, the deans report to the provost, the institutes report to Panch. The fact that we sit at a level of a college creates this space where essentially we are not focused on any particular academic discipline we're focused more on a problem space, and then we can work together with the academic units to pull together teams to address those problems in security.

So GSI, as an institute level organization...we currently have three centers under GSI: we have a [center on cybersecurity](#), we have a [center on human, AI, and robot teaming](#), and then we have a [Department of Homeland Security Center of Excellence](#). And then we also have an emerging effort in disinformation and a few other working groups underneath the GSI umbrella.

We're also now starting to look at educational initiatives; so not necessarily degree programs, but how do we work on, for example, supporting the STEM pipeline in the context of DOD careers. Again, it's always going to be mission focused. We're going to be engaged where it's security related — not necessarily DOD because we work with private industry as well, but it's going to be some sort of security related initiative.

Khari: Ok, so GSI is solely research focused? It does not grant degrees?

Nadya: It does not grant degrees, but actually one of the changes that we have implemented...So we've existed now for about five years, and for the first, I would say, probably about four of those we really were research only, we were like a research institute. As of about a year ago, we have formally added [education and workforce initiatives](#) as a vertical of activity; so, while we may not be degree granting, we may partner with a college on a degree or a program, or we may do certificate programs, or we may do...for example, we run [Cyber Day for Girls](#) out of GSI. That's sort of an education initiative that is not necessarily a degree...and we also have a pillar of activity that's more focused on events and outreach. There's actually three distinct pillars and the research is one of them.

Khari: Ok...

Nadya: But research is obviously, kind of, the biggest one.

Khari: Right, that makes sense. So can you define what you mean by global security?

Nadya: So the way to think about it is, when Dr. Panch and President Crow presented this opportunity to potentially conceptualize an initiative, my first thought was where is there a big need? As I mentioned, I really like to think about the why. We're going to stand up a new activity: why? What need are we addressing? And a lot of the national security problems that we see, really at this point, are kind of borderless. They're not actually national, they span everything.

If you think of things like cybersecurity, if you think of things like biosecurity and pandemics, if you think of disinformation, if you think about the impact of AI — all of this touches on lots of things that are not limited to geographical borders. If we also think about the fact that, increasingly as we have resource insecurity, the way we think about geopolitics, we can't really think about the U.S. only aspects of it because things are interconnected. So, if we come back to my research on graphs, everything is interconnected and what happens in one part of the world tends to affect lots of other

parts of the world. That's why it's a very deliberate naming of the organization and it sort of signals that the problems that we focus on are not constrained to geographic borders.

[Combating Misinformation - 18:45]

Khari: So you mentioned one of the new focuses, I guess, of GSI is on misinformation, and that's been a hot topic of late. For context this is being recorded June 3rd, 2020, so there's a pandemic happening currently, within the U.S. at least there's some widespread social unrest around police brutality and racial inequality within the criminal justice system. But these issues have led to a lot of misinformation online. So, I guess, what do you think about the role of detecting and combating misinformation both from a technical perspective and also in terms of how it impacts national or global security?

Nadya: Yeah, it is a strange moment that we're in. It seems sort of an unprecedented confluence of a lot of major challenges. The way that I would frame the current moment is what's different about it. Clearly, computers have been around for a while. Clearly propaganda has been around for a while, and disinformation and misinformation. But the confluence of technology with non-technical methodologies that have been deployed at a much smaller scale previously has created this environment that for an individual is very difficult to protect against.

Essentially, if you think about it, every time you log into any social media platform, you are just one person — so I am just Nadya — but what I am facing is basically the supercomputing, high-performance computing power of the entire social media ecosystem and a few actors or groups potentially could be manipulating in such a way to make me think a certain way. So this is what's different about this moment, because I do want to distinguish what is happening in misinformation today versus what has existed previously, and I do think this is a fundamentally different moment.

I do also think that if we think about it in a sort of most trivialized set of terms, if we simplify it to the simplest sort of pieces of this issue, fundamentally, the incentive

structures of social media platforms have amplified all of this. While a company like Facebook, Twitter, or Google itself — or any media company I don't mean to call them out — may not necessarily be interested in amplifying mis- or disinformation, if their incentives and algorithms are structured to emphasize things that are going to produce the most clicks then essentially what ends up being amplified is things that are exciting people in a negative or positive way. And from psychology we know that a lot of this information that is polarizing tends to make people go and see more, and if you are manipulating that aspect of human psychology and bringing in technology at scale, this essentially creates this environment.

I do want to pause here and say that one of the really, really fabulous researchers in this field is [Professor \[Kate\] Starbird](#) at University of Washington, and one of the things that she has shown repeatedly with her results is that a lot of the times what ends up being a key goal, or at least studied goal, is discord — where essentially people don't know what to believe. I think we're seeing a lot of that right now around the pandemic, the social unrest, all of it. We see a lot of discord and messages being amplified and it's just difficult to parse. So I think this is a challenging environment to be in both as an individual and a researcher.

Khari: So, I know one of the things that's sort of contrasted is misinformation and then disinformation, and a component of that is information operations. So, could you sort of explain what those are and how those play together?

Nadya: Yeah, sure. I also just want to pause here and say that people define these terms differently. I don't think that there is a full agreement on definitions, but generally there is a consensus on what the difference is between mis- and dis-.

Misinformation generally is false information that is spread without intent to deceive. So, if you share something by accident because you didn't check your source or, you know, it looked real, that's sort of what would be considered misinformation; and obviously, you can imagine this at scale.

Disinformation there is intent, it's on purpose. The term information operation typically applies where you have specific campaigns focused on deceiving or misleading to achieve a particular outcome. I think there's widely accepted analysis from the U.S. intelligence community that, essentially, Russia utilized information operations during the last U.S. election, and it was on purpose and it was a long stage set of processes that were in place to do that.

Khari: What kind of tools are out there currently to detect misinformation? Like what can an individual do to make sure they don't intentionally spread something that's untrue?

Nadya: Let me start with the individual aspect of it — and this is going to be less researchy, though kind of researchy — and then go into a little bit more of some of the technical areas, and particularly some of the areas that we're working on within the Global Security Initiative at ASU. This is coming from our collaboration with researchers, particularly [Dan Gillmor](#) and then [Dr. Roschke](#) at the [Walter Cronkite School of Journalism](#).

One of the things that I think is really important as an individual is that you check your sources. And I realize what's challenging about this is that it puts more burden and more work on the individual, but that is, unfortunately, the environment that we live in right now. My personal [opinion] as someone who works in this area, in addition to someone who just lives in today's world — my general approach is I have a few go to sources and if I see something pop up that seems particularly inflammatory but potentially could be true I will usually go to one of my go to sources to check if that also shows up there. One of the news sources I really like is NPR, and, you know, NPR has really great reporting practices and also will provide corrections if they report something inaccurately.

I mean, it's OK to check on...there's a lot more new information that you can see coming out on places like Twitter, which I do. I am on Twitter and I check Twitter for sources of news, but then I usually go and cross-reference.

The other thing that I think is a little bit more personal is trust. You know, trust matters quite a bit in the system. If you trust someone and they retweeted something, that is often how I will think that this is probably trustworthy. Of course, there's a lot of assumptions in that and sometimes it is precisely those assumptions that are being manipulated by malicious actors; but if you have good, trustworthy sources like my colleague at Walter Cronkite or Kate Starbird it's...I'll see what they are retweeting even if it's not NPR and will trust that often.

From a research perspective I think a key aspect of this area is....As we started talking about it one of the things that I highlighted is this is a quintessential problem where computing is central, but it's not alone. This is not a computing only problem; and therefore, I don't think we can solve it purely with computing. I think what it's going to take is a significant computer science research effort, but those computer scientists need to bring in folks from all those other disciplines. Disciplines like psychology to understand influence and disciplines like journalism to understand journalistic practices. Disciplines like marketing to understand how this has been done in the past and in other areas like advertising, and disciplines like humanities and narrative theory to understand what are the structures of narratives that people may put out there as they start down the path of a disinformation campaign.

We have a number of efforts within GSI where we have folks on the computer science side looking at precisely the structure of networks and the influence of trust in those networks on how that information spreads. And then we have folks looking at narrative structure to see if you can identify...if you know that there's a particular influence narrative and you know that it starts with this kind of element and then proceeds to this kind of element, if you can detect that in the beginning [and] if you combine that with some machine learning, artificial intelligence research, you can build an early detector of a narrative of disinformation.

So those are some things that we have going on in GSI.

Khari: As far as your, like, personal background, do you think graph analytics has a particular role in which it can be used to analyze social media and detect...?

Nadya: What do you think I'm going to say? Absolutely!

[Laughter]

So, as I mentioned, what's novel about this moment is that you have these massive interconnected networks backing up the different disinformation narratives. If you understand the structure of those networks, the patterns of those networks, how the information spreads on those networks, and how various attributes of the edges....For example, trust between you and me may be very different than trust between me and one of the other parents in my daughter's school, right? There's a different trust relationship and you understand those trust paradigms as well.

There's a ton of graph theory and, quite frankly, work in disinformation often references or uses aspects of graph theory throughout; whether it's to study the discord — because sometimes you can actually formally see the discord, because you have, basically, a graph that's splitting based on which narratives are being amplified — to how information spreads and understanding...

I mean, if you think about it, if the piece of information spreads on a network, [then] if you figure out that pattern of spread and then you identify [or] you detect somewhere that it was a piece of disinformation, you can roll it back to try to tell people that that was disinformation. There graphs can come in as well. There's many opportunities where people are already using graph analytics or are going to be using graph analytics, and there's lots of really interesting research questions.

So, yes, the answer is yes.

[Laughter]

Khari: So this is a pretty personal question, but how does your background emigrating from the USSR to the U.S. influence how you think about misinformation and its effect on society?

Nadya: I don't know how much of it is my being an immigrant and how much of it is me being a security professional, a national security person, but I do tend to have this, what I would call, security mindset. I always think about the possible vulnerabilities. Always.

To be honest, not to get into any kind of psychology, I probably have some trust issues. So, I tend to be very...I mean, I don't even click on links that my mom sends me sometimes because who knows where that link came from, right? And I tend to be very, very careful with my sources. I also always try to...so, I've never been the type of person that was comfortable with just [the] "do this" sort of thing. I want to always understand the why.

For example, in the context of the pandemic, I spent a lot of time reading medical journals and virology papers that are outside of my area of expertise, but I want to understand how can I map the national guidance to what I can get from those papers and where do I have questions? Then where I have those questions I go to the sources that I may have that understand the virology and medical journals. I think that just extra level of skepticism and questioning is where both my immigrant and my security background come in.

I do operate under an assumption that if there is a vulnerability someone is going to find a way to exploit it. This is what I consider a security mindset, but I guess it could also be a Russian one.

[Laughter]

[National Security and Sustainability - 34:02]

Khari: Kind of coming up on the end of our time here so I'll sort of lightning round through a couple of last questions. So, speaking of working in national security, what is that like? Do you have any interesting anecdotes or, sort of, misconceptions you think people have that you want to address?

Nadya: I generally really appreciate that space, mostly because there is this deep commitment to mission focus and the problems are very interesting. I guess the one thing that I would say is, it's interesting to be part of a lot of these workforce discussions where people say, "Oh, how do we get more people excited about national security?" And I'm like, I grew up on James Bond. To me, this has always been an interesting space to be in.

Khari: So you're also a senior sustainability scientist in the [Julie Ann Wrigley Global Institute of Sustainability](#). That's at ASU, right? Or is that outside...?

Nadya: ASU. I think I'm also a fellow at [New America](#) in their resource security program.

Khari: OK, can you talk about any work you've done as part of that institute? Why is sustainability important broadly for global security?

Nadya: Yes. So, some of the early research I did...we actually had a funded program. We looked at implications of resource insecurity and potential emergence of instability. It comes back to this whole notion of borderless threats and the fact that things are interconnected, and when people feel resource insecurity they're often actually more susceptible to disinformation, which all comes back to graphs. Everything is interconnected.

But, yeah, I mean, there's [a] diversity of resource insecurity. There's food and water insecurity, but then there's also supply chains. For example, we rely on particular rare earth elements that only exist in certain parts of the world, and access to those

elements potentially could cause all kinds of interesting geopolitics. I would call out [Sharon Burke](#) at New America. She does a ton of fantastic work in that space, and I still collaborate with her.

Khari: You also mentioned the need, in certain contexts like HPC but also just generally, to perform computation at lower energy scales. And speaking of sustainability and resources, obviously computing uses a lot of power and resources as you were just talking about. Do you have any thoughts on the future of computing within...considering those constraints?

Nadya: I do think that power consideration is one of these messy things, right? There's a lot of components to it. There is an element of consideration of power constraints as you have increasingly smaller computing devices, so a ton of performance optimization research has been happening in spaces like mobile phones and other mobile devices, like watches, smartwatches, all of those things.

Again, a lot of the power optimization and green computing today has been driven a lot by market incentives for smaller and smaller computers. Again, it comes back a lot of the time to incentivizing the ecosystem. Just like we don't have good incentives to minimize disinformation, it's not obvious that we've had the best incentive to minimize the power of computing except for these constrained environments. So, I think as resources become increasingly scarce, there will be more need that will change the market dynamics.

Khari: Do you have any concerns about current or future technologies that utilize graph theory and how they might be used to target individuals or, you know, minority populations within a larger population?

Nadya: I do think that...coming back to that little bit of a foil hat mindset, I think [with] any technology we should be considering how it can be misused, and absolutely I think if you're using graph algorithms to detect patterns you have opportunities to potentially compromise someone's privacy. One of the things that I have thought about quite a bit

is, it would be great to have a big research initiative that studied the limits of detectability given various privacy guarantees. If your goal is to identify patterns and networks, what is the least information that could be shared to construct that network while still preserving guarantees of detectability if you need that detectability for something?

I mean, this is all emerging right now in the context of contact tracing, in the context of the pandemic. I think people are starting to look into it, but without a doubt, any kind of technology that is going to look at data sets at scale should be considering privacy embedded by design and, furthermore, should be considering how that technology could be misused.

Khari: Sounds good. Thanks for being here, this was a great interview. Do you have any final thoughts, things you want to plug, [or] want people to know?

Nadya: I guess, first of all, thank you. It's been very interesting to talk through all of this. I think the other thing is we're living in this moment where a lot of things feel uncertain and I think, particularly as a computer scientist, we should think through where we can be mitigating challenges as opposed to amplifying them and consider what incentive structures exist and how do we move away from those incentive structures — whether it's protecting privacy or making sure racist rhetoric is not amplified. I think there's a tremendous amount of work that computer scientists can do for the betterment of society, and I think that is our responsibility as a discipline.

Khari: Yeah, I think that's a good way to sign off, so thanks for taking the time and take care, stay safe.

Nadya: Thank you too, stay safe.

[Outro - 40:46]

Khari: That's it for my interview with Dr. Nadya Bliss. We'll be back soon with new episodes. Until then, remember to like and subscribe. Stay safe out there, peace.