Nigel Goldenfeld Interview, Part 1

SHIELD COVID-19 Modeling Team, University of Illinois Urbana-Champaign

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SPEAKERS
Paul Gilbert II, Nigel Goldenfeld, Jessie Knoles (Tech)

Paul Gilbert II 00:02
Okay, so, my name is Paul Gilbert. I'm a graduate student at the University of Illinois Archives, and I'm joined by...

Nigel Goldenfeld 00:12
Nigel Goldenfeld, emeritus professor of physics at the University of Illinois. I'm currently Chancellor's professor of physics at the University of California, San Diego.

Paul Gilbert II 00:27
Today's date is November 10, 2022. We are here on Zoom to discuss Nigel Goldenfeld's work on the University of Illinois's responses to the COVID-19 pandemic, with particular emphasis on his work with SHIELD for inclusion in the University of Illinois COVID-19 Documentation Project. So, just a couple of warm up questions…Nigel, do you remember the first time you heard about COVID-19 or the Coronavirus? What was that day or that timeframe roughly like?

Nigel Goldenfeld 01:11
That would have been in January 2020. I don't know exactly, exactly when. And what were my initial thoughts? Well, initially, of course, I didn't quite know what to make of it, that, then people started dying in China, and then it was the lockdown. So it became pretty obvious to me that this was a situation that would require, you know, be a major, major challenge just to society.

Paul Gilbert II 01:54
And I know most people went home around mid-March of 2020. Did you work virtually at all during the pandemic? And if so, do you remember what that last week of in person work was like?

Nigel Goldenfeld 02:11
Yeah, let me let me, let me backtrack, segue, between the first two questions. In by February 2020, it was obvious that there was a pandemic. And I had worked, I usually worked at the Institute for Genomic Biology at the University of Illinois, I lead the biological complexity group by perplexity group. And a lot of my research in the last 20 years have been on microbes and viruses, ecology, and so on. And my next door neighbor there was another scientist trained as a physicist, Sergei Maslov. And so sometime in late February, we started talking about that, and early March, we started doing some [poll?] calculations to try to see when the, the growth of the pandemic would likely be in Illinois and at

the University of Illinois. And we--that's been covered in a press in and there's a good article in American Physical Society news about that. We in early, maybe the first or second week of March, I'd have to look at the article to be 100% sure, we did a calculation using the [scans?] available data, but there was a few handful of cases in Illinois. And we could anticipate that there would be overwhelming of the health care system, both in Champaign-Urbana and in Chicago. So we communicated the results in our calculations to the Provost at the time, and recommended that the university close after the spring break, which it did. And then we did another calculation for Chicago and recommended that there was a point of estimation, but not being prescriptive, suggested that there was a window of opportunity of a week or so where if there wasn't a lockdown, which, of course was what everybody was doing at this very early stage of the pandemic to try to buy time, if there was going to be locked down. If one did it quickly, then the likely cause the pandemic wouldn't be such that the health care system in Chicago would not be overwhelmed in the same way that it had been in New York City. And this was ultimately sent to the chanc-- to the site, the provost, and the president of the university, who [-ed?] you personally, and they communicated those results to the governor's office and we spoke with the governor a day or so later, and then the Illinois--State of Illinois--lockdown was announced. I think on March the 20th, 2020. I think within a few hours, Chica--um, California, also was the other state that had a lock down. So at that point, we were already prepared. I remember vividly about working from home, after we did those calculations and we've had meetings with the governor, Sergei and I met in our offices at the Institute for Genomic Biology and said goodbye to each other and that we doubted that we would see each other in person again for quite some time. And that turned out to be true. And then we went home, and then we were locked down just like everybody else was.

Paul Gilbert II 05:53
So at what point in this timeline, does your involvement in SHIELD begin?

Nigel Goldenfeld 06:00
It begins, well, so after, what I just, the event I just explained, then my initial activity...you know, we were the first computation, first people to do computational epidemiology for the state of Illinois. And the governor was impressed with that, and so decided to set up an advisory group. I recommended that it includes also a group that studied influenza at the University of Chicago. And so there were three groups initially that were part of the modeling group advising the governor and the Illinois Department of Public Health. And in April, the lockdown was extended, April 24, I think, and I gave a press conference with the governor to explain the scientific reasoning for that, shortly after that, the Provost contacted me, I don't have the exact dates but, and said, you know, we want to put together some response, would you help lead it with Marty Burke and a few others. And so it began, very, very early on planning for that, and the, you know, the type of modeling that you're...the role of modeling was to help design the mitigation that we were going to do at the University of Illinois. So in those days, nobody had any idea how to respond to a pandemic of this sort. And there was very little guidance, certainly, guidance from public health. And, and so, you know, the purpose of the modeling was to design an operations process by which the transmission of COVID could be minimized on campus, allowing the maximum possible opening of the campus with in-person instruction and so on, to the extent that it was safe for people to do so. So that was the purpose of the modeling. And so very early on in probably early May, I started thinking about how to how to do that along with my main collaborator on that, Ahmed Elbanna, professor of civil engineering.

Paul Gilbert II 08:35
And besides Sergei, Dr. Becky Smith, and Ahmed [Elbanna], who would you say were your primary collaborators on the SHIELD project?

Nigel Goldenfeld 08:46
Well, it's complicated. So I want to make sure that you understand, we had a modeling group that was doing two things. One, it was advising the governor, it was, and then, we were helping to do SHIELD. And then we were also doing other things like talking at public meetings, interfacing with other groups, and so on. So our modeling group had two purposes to both of those things. And we met daily for several hours. Each day, the members of the group... we only accepted volunteers and we had two volunteers who are students, Zack Weiner and George Wong, [Georgia Wong?] who was, George was an astrophysicist, Zack was a cosmologist, both very skilled in computational physics. And then Alexei Tkachenko, who was a scientist at Brookhaven National Lab and a collaborator of Sergei. And then with Ahmed and me, that was the modeling group. So we collaborated intensively on that. Most of the SHIELD related stuff was done in collaboration with Ahmed, and I want to make that clear because our work with SHIELD involved two things. One was designing a model and so on. And so there's some technical work that was done on that. But there was much more than just building models and running simulations, we were also interfacing with public health people, with people at the university, or helping stand up the SHIELD process, or giving talks, meeting with leadership and so on. And so Sergei was not so active in sort of formally being assigned to SHIELD, as it were. I was the sort of group representative, if you were, on the SHIELD governing group. And so I was involved in every aspect of SHIELD including in data analytics, once SHIELD started, you know, working with the people doing communications and logistics, and all those sorts of things, those sorts of things weren't done by the other members of the group. So I was interacting essentially with a vast number of people on the on the SHIELD team, as well as people like Awais [Vaid], who was the Deputy Director of Champaign-Urbana Public Health. So it was an outstanding partnership with people at the Student Health, McKinley, health center, and so on, and so forth. So there was a lot of, there was a lot of interfacing with other aspects of it. And some of that work was explaining what we were doing. Some of it was sort of helping people understand as the pandemic evolved in real time and trying to explain to them the biology and epidemiology and so.

Paul Gilbert II 12:05
Speaking of your public facing role, in her interview, Becky had discussed how you were the public face when it came to talking to the media and in interfacing with the other interested parties. Considering all the other hats that you wore, as part of the trying to abate this pandemic, how exactly did you become the designated spokesperson, I guess?

Nigel Goldenfeld 12:41
So, I don't know that I was the designated spokesperson per se, the, what virtually every sort of public facing presentation involved explaining to people the likely cause [cost?] of the pandemic, and that required forecasting. And so since I was the main person responsible for forecasting, that I was, you know, I [wasn't?] actually included for that reason. So my involvement in public facing activities was really a reflection of the, my unique expertise on focusing on--sorry about this, there's a helicopter

rescue, helicopter just flying overhead--so, so I didn't really speak to every aspect of the pandemic, of course, because some of those things aren't my expertise. But because, you know, our work had real world outcomes and affected everybody, it was important that the university administration know about that--[coughs] excuse me--in the university community, too. And this important thing was perhaps explained to people, why they had to be tested, why you had to be isolated or quarantined, the frequency with which they had to be tested, which was one of the main outcomes of our work. And, you know, I shared some of these responsibilities with Professor Smith. She was in media presentations for all sorts of other reasons, what to do with sort of a broader picture of the epidemiology of a pandemic, she was the only one of the group that had training as, as an epidemiologist. Her work was not involved in modeling and forecasting. It was it was other aspects. And, you know, I want to--I don't know if she mentioned this, but-- you know, one of the most remarkable presentations that I saw during the pandemic was one that she made, rather bravely in my opinion, to students in Bromely Hall. These were a group of students who were very recalcitrant to efforts to, essentially behave as responsible citizens on campus. And she gave a wonderful presentation, a Q&A, which was in the face of really abusive behavior from those students. She kept her calm and presented information in a way that I would not have been able to do effectively. So I would say, just to summarize, depending on what the kind of information was that needed to be presented, the, if it evolved modeling and so on, then, since I was the leader of the modeling group, that's why I was involved in that. And that kind of mirrored what was happening elsewhere in the US at that time, you know, people were just wondering what the heck is going on? So this was like weather forecasting. And so a lot of modelers, both here, and in the UK, you know, became relatively prominent in the media, like Professor Neil Ferguson, for example, at Imperial College and others. Anthony Fauci, of course, people who are trying to tell people look, this is what's going to happen. And it's important that people knew what was going to happen so that they could take seriously the mitigations that people were proposing to do.

Paul Gilbert II 16:19
So you hit on this a couple of times, and I want you to, to elaborate more on this as having to respond to the people who either weren't willing to take the advice of experts or, or at the very least, were spouting out things that weren't necessarily the most up-to-date or accurate information as part of your role as well as Becky's role interfacing with the community. How did you both as an individual and your team as a whole respond in those situations?

Nigel Goldenfeld 17:09
So yeah, let me try to, let me try to...there's a lot to say about that. Perhaps the biggest, most the presentations I made were very informational, and they were not in a situation where there was any real pushback or challenge just by the nature of the format, they were sort of informational meetings set up by the University communications people and there was a bit of Q&A. And so sometimes I would, I would be talking to the Senate faculty. That means, perhaps the most, the best example of what you're talking about was when Sergei and I were asked to appear before the Republican caucus for the state's state government. So this was perhaps less associated with SHIELD, but more associated with the role in, in modeling the pandemic for the governor of Illinois. And there was, as you say, that there were there was a lot of disinformation floating around, there was a lot of misconceptions. There was a lot of pushback and resistance. And at that stage, nobody knew that, you know, more than a million Americans would die, in the next, in the next ten months or so. And, you know, the way we responded,

was simply to be, to not be combative, but to just sort of give people facts and information, show the results of modeling, showing how these predictions had worked in the past and the likely, in allover selling what we could say in the future, but explaining the likely cost of a pandemic, things that eventually did turn out to be true. I do remember that these, the Republican Leader of the House--and I'm forgetting, I'm blanking on his name, I can let you know afterwards, if you wish--after we had a, you know, a very long meeting, which the Provost also attended just as an observer. He commented to us that we have done a really spectacular job of presenting the information and giving them hard facts and explaining some of the policy steps that have been made, informed in part by the types of modeling that we were doing. I want to [set?] that there was a lot of misconceptions about a what models are, what their role is, and also whether what we—[Paul gives Nigel the name of the former Republican leader of the Illinois House of Representatives via Zoom chat]--yes, Jim Durkin, that is absolutely right, thank you. You know, there was a lot of misconception about, you know [what well?], models were informative or prescriptive and things like this, and we wanted and because there were also people who I think, identify themselves as anti-vaccination people, even though there wasn't a vaccine at the time, they started a campaign, a sort of smear campaign, they started firing emails and things like that. At one point, we even needed, Sergei and I even needed, to have police patrolling where we lived. And so it did become kind of contentious.

Paul Gilbert II 20:51
So when you said that you needed police protection from people who not only didn't believe in what you and other experts were saying, but were actively encouraging harm against you and your colleagues...did anyone ever dox you?

Nigel Goldenfeld 21:13
No. Not that I know of, but threats were made more to Sergei than to me, because he was obviously from a different country, I suppose. So I'm obviously from a different country, too, but I'm a US citizen, I guess Sergei is too, but for some reason, they focused a bit more on him. And so, you know, we communicated that to the authorities and to the police or FBI, I don't remember, originally, and then there was also an attempt to have us fired from the University, and things like this, which were unsuccessful. So we weren't, we weren't doxed in public, to my knowledge, but then I wasn't, I wasn't, I don't have time or the interest to sort of watch public media all the time. So.

Paul Gilbert II 22:15
Going back to people misunderstanding, or especially egregiously misrepresenting the modeling and forecasts that you and others made, would you say a fair comparison points would be describing your work as, as similar to that of the weatherman, where you make a decision of what's going to happen, and you say, there's a likelihood of something happening. And all because that thing doesn't happen does not mean that you're wrong, it just means that the percentage that this thing didn't happen happens to be the case?

Nigel Goldenfeld 22:56
You're absolutely right, I've written down some notes in response to the questions that you previewed to me, and I've made exactly that, that analogy. So that's true. So there's part of that. And there's a scientific point there, which I think is interesting and I want to get back to, which is why were some of

the early pandemic predictions, not ones made by me, but by others...why were they so extreme? I want to get back to that. The second thing is the, as you say, the models are meant to predict trends, and not actual numbers. The model is factual. Models are factual in a sense of the, you know, there's a well-defined set of calculations that you do. The problem is that you don't--and the same is true for weather forecasting--you don't know what the current situation is. You could do weather forecasting really well, if you really knew the temperature and humidity everywhere. In the region weather, you don't have perfect knowledge of that, and that uncertainty propagates into the model predictions. So that's the issue. There is another thing, which I'm sure you will want to come back to, which is, when we do epidemic modeling, the state of the art at a time was modeling the spread of the virus of a population. Model epidemic molds ignored, for the most part, or at least oversimplified, the effects of population heterogeneity--people are different--and also people are different in their social activity. And later on, we were able to, include those things in models that we published in the scientific literature. So even today, here's an example of uncertainty that you simply can't model, which is, look at the uptake of vaccine boosters. Right now, 23% of the US population of age 65 have received the updated booster. So you would think that after, you know, all of that, what has happened, and with all the money spent on scientific research and rushing these wonderful vaccines through to being able to be disseminated for free to the public, that people would embrace them, because they are such an important part of defending yourself. And yet, the majority of people, even those who are the most threatened by the pandemic, are just giving them a miss. So this sort of behavioral aspect, which at the University of Illinois translated into non-compliance with recommendations and campus policies and legally binding public health mandates, you know, that couldn't be predicted at the time, nor could the extent of it be predicted neither by us, and neither by any of the social scientists that we talked to. me. I mean, so that was the biggest uncertainty, I would say, and challenge, for us.

Paul Gilbert II 26:07
Speaking of the non-compliance issues at the University, my first introduction to your work, unfortunately, was the New York Times article that we mentioned, you know, further down in the questions document, in particular, the XKCD--

Nigel Goldenfeld 26:29
Yeah, yeah.

Paul Gilbert II 26:30
--that make fun of you and Sergei. How reflective of the general view of those in the media was that article and, by extension, the comic depicted in the article, and how much of that had changed as the pandemic progressed?

Nigel Goldenfeld 27:00
Well, let me jump to your question that you've sent me. I want to talk about that because I think it's important to get the right context for that article. I didn't mind the article, if you're asking me about my personal reaction to it, however--and that article was leveraged on the XKCD comic, which was also leveraged from Twitter--so this is a good example to talk about misinformation. So the event that caused that New York Times article and the XKCD comic was the spike in cases around August 31, 2020. Now let's just look at what that spike was. The positivity, which is, you know, is the number of

cases detected per test, rose to 2.86% on one day. The previous days, it was lower, and the day after, it was lower, too, and within a couple of days it had dropped to 1% or less. Nevertheless, it was a spike that was unexpected. And, you know, after, when that happened, halfway through the subsequent week, even though the spike was dropping all by itself, the Chancellor then ordered an "essential activities" period for two weeks. So that spike. Now, let's look at, so remember that the purpose of modeling was to see if we could control the pandemic and prevent transmission. So, let's have a look at what other universities were experiencing that weren't doing SHIELD at that time. An example is Eastern Illinois University, this spike was about 20--ten times higher than ours--about 25, 28%, as far as we know, it was probably even more than that, talking about the positivity there. If we look at what happened at the University of Illinois, just a couple of months ago, at the beginning of the fall 2022 semester, at that, by then, the Chancellor had removed essentially all mitigations. And the University experienced a spike in the positivity that was also about ten times higher than what we had, at the Univers--in 2020--a spike of about 25% with one in ten undergraduates infected by COVID in the first week of the semester. So, the influence that was drawn was twofold. One was that surveillance testing didn't work, which is clearly not true. Because when you remove surveillance testing either at the time, we know universities that were not doing surveillance testing, or the University of Illinois itself with surveillance testing was removed, you had ten times higher, at least ten times higher, incidence of COVID. So that's the first thing. It's not that the inference that, what we were doing did not work, it was, our control was was simply contradicted by the fact. Then the sort of the humorous aspects of this, which sort of initiated the XKCD comic, was the idea that the, the models had been invented by two physicists and we were too nerdy to know that students had parties [inaudible], because we didn't take that into account...we made a huge mistake in our model because we didn't realize that people had parties...and that was also factually incorrect. Of course, as you said, the physicists were generally understood to be Sergei and me, because we had both been in the spotlight for our separate work with the governor of Illinois. But in fact, as I said, Sergei was not actually heavily involved in SHIELD, it was actually Professor Ahmed Elbanna, who is a civil engineer. And in fact, the models that we were using for SHIELD for the University were completely different from the models that we were using for the State. So, they weren't even the same models. And the comic also implied that the University had shut down, when in fact, that was not correct. The University stayed open and remained open, but there was a two weeks essential activities order. And then lastly, the comic, of course, implied, for humor, that we didn't know that there were things called parties. In fact, we had taken into account parties, we knew, when we built the models, we found out how many members of the fraternities and sororities there were on campus, it's a large number, about a quarter of the student body or something like this, I forgot the exact numbers now, certainly in excess of 7,000. We knew that they partied, we took those parties into account, the way that we did our modeling, which is another question of yours that we can come to later, I suppose, is that we sort of understood, very early on, actually before most people had, that COVID was transmitted by aerosols. It was airborne. It wasn't anything to do with any failure to wipe down your groceries or anything like this. So we already had modeled parties with no masks and things like this. The only thing that we haven't modeled was the fraction of people that would literally, you know, violate the COVID testing, isolation, contact tracing, and quarantine protocols. And those were, in fact, the students who were the most socially active, and perhaps, in later events, perhaps the most politically-oriented away from mitigation, the same way that masking has become a political issue in the United States. At that time, it was too early for that to be the case, but we didn't anticipate that people would break the law related to CUPHD health ordinances. And nobody else had predicted that, the

social scientists hadn't told us that, and even today, nobody can, or can predict, what level of compliance we should have put into our models, if we had even thought that this was going to be a significant effect. So later we did figure out how we could calibrate this, we took our models, and saw what we would have to assume in order for the models to recapitulate what we were seeing in data. And we got a figure of about 60% compliance. We also, when we got into the data analytics of testing, which was what I was mostly involved with following fall 2020, with Ahmed, we discovered by looking at the data from McKinley, we could see that the compliance with the University's testing regulations was also about 60% of compliance. People [weren't?] testing at the frequency that they needed to do. And we had computed how frequently people have to test based on our predictions about the transmissibility of COVID. And so those two things sort of lined up. So there was no way we could have known those things in advance or made our predictions or scenarios more accurate. So I think, you know, in retrospect, you know, the event was interesting, because it was perhaps the most public example of what was going to turn out to be a major factor in the response to the pandemic in the United States, namely the fact that a certain section of the public, of the population, which simply refused to believe it was true, refused to do these public health activities, you know, refused to acknowledge the legitimacy of scientific modeling, all of those things. So we got to sort of preview events for this particular episode. There's another point that I want to make about this, which is the XKCD thing had started--from what I understand at least--exploded into people's consciousness because of Twitter. And I didn't, I wasn't reading Twitter at that time, so I don't, I have not--so I'm just gonna just tell you what I was told, was that some people were upset that there were physicists doing modeling, not real [inaudible] epidemiologists. I think Becky told me that some of these complaints were led by economists who were also [?] about this, so it was kind of ironic. So there wasn't an appreciation that a physicist like Sergei and me, who are biophysicists, had had a lot, 10, 20 years of training in modeling population dynamics, bacteria and viruses, and doing mathematical modeling of complex biological and physical systems. So they didn't really understand that we had an understanding of the technical requirements for doing this, even though we didn't formally have degrees [such] as epidemiology. And so, Sergei and I, Ahmed, I think as well, are examples of physicists who don't stay in their lane. We study complex systems. And by that, by its very nature, means that you don't stay in your lane. That's how I was trained to do. Not stay in my lane. Now, there's a very interesting point that that comes from this, which is that we realized that there was a lot of knowledge about epidemiology that was incomplete and was critical for understanding the spread of COVID. So this goes back to the idea of herd immunity. And it goes back to the predictions that scientists like say, Neil Ferguson and others, were making. So we discovered, and we weren't the only people to discover this, that the fact that people are different in terms of their susceptibility, and a social activity has a major effect on herd immunity, and so on. And so we wrote a paper that was published in the *Proceedings of National Academy of Sciences*, about that. So we were, perhaps amongst the first, if not the first, people to recognize those things. The second thing that we did was we realized that a lot of predictions that were made were not accurate. They predicted peaks that were too severe--even though the actual, the actual outcome of pandemic was terrible, you know, more than a million people in the US dead, and so on-- but some of the predictions were even more startling. And they also didn't predict when the pandemic would peak very well. And it took us a while to understand why that happened. We built the first model which looks at the stochastic behavior of a pandemic with people's social activity. And that model explained why there's plateaus, why the pandemic didn't just go up and then come down, and that would be the end of it. Which is what the standard models that people were using predicted. We

explained why there's plateaus and why there's peaks and so on. And that work was published in a journal called *eLife*, and it was edited by the nation's foremost epidemiologist Marc Lipsitch, at Harvard, who is now the Director of the CDC's new forecasting center. And he actually wrote an interesting editor's evaluation that you can see on the *eLife* website published below [it?] because that's what *eLife* does. And paraphrasing roughly what he said, he said, "Look, this work is a great example of what, you know, theorists can contribute to epidemiology, because it resolves an embarrassment in the field that we don't have understanding of this. And our work in fact made predictions that we could compare and so that they weren't, they were much better as a result of them using data in the Midwest. And so the point I'm making is that the fact that we were not epidemiologists was not a barrier to us making important and actually profound contributions to the science as well as the actual practice. And then last comment I want to make is about not staying in our lane. When we do the calculation about coupling the spread of the virus with people's social activity, we developed a mathematical model, which turned out we could relate to a mathematical model of interest rates in quantitative finance. I had worked in quantitative finance in the middle 1990s. I had even started a software company making mathematical software for, that could be used, amongst other things, for looking at financial software, financial derivative securities. And the mathematical models that were used at that time to model economics turn out to be exactly what you need to model the pandemic and social activity. So anyway, long answer to your question, but I wanted to put this on the record. All of these things were very subtle and sophisticated intellectually. You know, most people have a view of physicists as well, you know, you study black holes, or, you know, quantum mechanics or something like this. What are you doing studying pandemics? Well, you know, they don't know that there's, there's a brand of physics where people are very, very interdisciplinary and are able to mix ideas from different fields in a way that is unique and predictive. So I think that sort of sets the context for that whole event. Is there anything else you want to ask me about that? Because I don't, I gave a very long answer. And I want to make sure that I did answer the real question you asked.

Paul Gilbert II 41:24
So the gist of the question was essentially, what were your feelings about not necessarily the article itself, but what it represented, which you did a very good job of explaining just all the ways that, while the article itself doesn't upset you, there were a number of misconceptions and misrepresentations that you want to debunk, which also answered the follow up question of what clarifications you want to make in order to make it clear that this thing that my untrained eye recognized as not necessarily the most favorable or accurate descriptor of what happened. [Nigel agrees.] I feel like a natural bridging off point from that topic, since it's one of the things that you kept coming back to, was assumptions, and the process of developing a model is…just giving us a broad timeline of the development of the SHIELD models that you used, what assumptions were initially made, and how much tinkering that you had to do in order to get to a model that you felt was a very good forecaster for what was going to come in terms of pandemic waves.

Nigel Goldenfeld 42:57
So, the main, the main thing that we did in our model was, for the State's [model], we just made a population-level model. We didn't try to look at what individual people do. But we knew that the University population is very heterogeneous, the students who go to bars and so all the time, there's staff and faculty members who, you know, fuck off at five o'clock and go home, get their kids from

school and help them with their homework and have a different type of lifestyle. So we felt that it was very important to model people at what's called the individual level. So we made a model of something like 46,000 agents, which were representing the [senior?] students, staff, and faculty.

Nigel Goldenfeld 43:48
We knew from the data from the University what classes people were taking, so we could go and ask ourselves the following question: if students are meeting on campus, the University is open, how will the pandemic spread? So you've probably heard of, you know, six degrees of separation? You know, how many people separate you know, you from some Barack Obama, or somebody like this. So, typically, the answer is something like six or seven. There's someone that you know who knows somebody who knows somebody who knew somebody who knew somebody who might then know Barack Obama or something, if there turns out to be something like that? Well, we discovered that in the University context, because people are going to classes and therefore connecting through that way--and this was work, by the way, that that Sergei led, Sergei Maslov--one of the things that we discovered from that is that there's about two degrees of separation. So it's very easy, say for a student in, in computer science to be infected by a student in art history. Even though they might, you say, they do completely different things, but they go to some of the same general education requirements or they may go to the same dining hall or various things like this. So that was what one of the things that we did in our model, was that we really tracked people's activities and we knew what spaces they were in. The second thing is that we realized very early on, I realized, that the pandemic was occurring so rapidly because of aerosol spread. Now, at that time, everybody was saying, you know, wash your hands, wipe down your groceries, all of that. But it was obvious that that didn't explain some of the key events in the pandemic. And so there was a choir practice in Washington, in the state of Washington, for example, where everybody got infected, but they weren't touching each other, and things like that. So, there was a literature, in the scientific literature, from the solar physics and engineering communities going back to the 1930s. And so Ahmed and I built our models using that knowledge. And then we recalled engineering data to find out what the air exchange rate was in different types of locations, in coffee shops, or in lecture halls, or in basement laboratories and things like this. And that's important because as the air is exchanged, and circulates through a room, it will blow away. Cigarette smoking will blow away COVID aerosol particles, and if the airflow is not sufficient, then they will just linger. And then it will be a hazard for people. And that's still something that's not really well understood even today. And, and so we built those things into our models. So I think that was the most important thing. The, you know, there were minor tweaks and things that we made during the course of it, but the most significant was the compliance issue that we've already talked about. And then once the, fall 2020 had started, and so on, we didn't really work very much on model development. What was more important then was trying to create a sort of feedback, a control feedback loop, where we could take data that we were getting in granular detail from the University and then use that to make sort of fairly targeted mitigations. For example, if we could see an outbreak happening in a hall of residents, we will say, “Okay, everybody in that hall of residence is at risk, you need to test and isolate and quarantine three times a week rather than two times a week.” And those, the frequency of those, things came initially from the models. But eventually, the virus evolved to being so infectious that essentially, surveillance testing on its own, and masking, will not be enough to control it. But luckily, then vaccines became available, and so that helped with the pandemic.

Paul Gilbert II 47:52
I want to make sure I didn't skip over anything on the first page…okay, so thinking back to the time where you experienced the spike around August 31, 2020…that wasn't as big of a shock as spikes at schools both at that time, as well as Illinois now since we've relaxed our protocols, experienced. Um, were you in favor of us returning to some semblance of normal around that time, and as more things were opened back up on campus, did you agree or disagree with the exact timeline?

Nigel Goldenfeld 48:56
When you say around the time of opening up, at what point are you talking about? You mean, this semester [fall 2022]?

Paul Gilbert II 49:00
So starting with us returning in fall of 2020. What were your thoughts about the process of opening back up around that point? And what were your opinions on each subsequent stage of reopening to where we are now?

Nigel Goldenfeld 49:29
At that time, I thought that, you know, I thought the campus was doing the right thing, so I was confident that the work we were doing would be effective. In fact, I used to go in to the Institute for Genomic Biology when we were allowed to do so. Because I was, I didn't feel there was hardly anybody there. It was, it was a very safe place to be, so I didn't, I felt that that was, that was good. In terms of the sort of policy, not really a modeling thing, but a policy thing, what we didn't, we didn't do very well the re-entry in August 2020, we learned a lesson from that, that was the sort of lesson learned, which is to do a much better job of phasing people's entry into campus and doing entry screening, and staging that. And well, we have advocated for that. But if I remember correctly, the campus didn't really want to do that. But in the, in January 2021, they did do that. And it, we didn't see the same sort of spike that we had seen in the fall. So I think that that sort of went pretty well. I wasn't super happy about various campus events, like football and so on, which I could see were going to cause spikes, which I felt would be mitigated…positivity spike briefly but then we would come down again, in a predictable way. But I was more worried about the effect of that on the surrounding community. So I was, you know, that wasn't my decision to make but later, when I left the University of Illinois in summer of 2021, fall 2021, and what my colleagues told me was that, from the summer on, there was, essentially SHIELD was sidelined or shut down or just not consulted by the University administration. And I think that was a mistake. I'm not really too worried about the short term effects of getting COVID, for most people. I mean, there's plenty of people, for who I think it's a problem, if you're immunocompromised, or whatever it may be. But the long, long COVID is still very poorly understood. And repeated exposure, the long term effects of that can be devastating. And I personally know, people who have had enormous difficulties as a result of long COVID completely unrelated to their previous health and so on. So that yeah, that for me was something I wouldn't have agreed with if I'd been at Illinois then in the fall of 2022. I think there's a duty of care. And I think the campus had to scramble, when the situation got out of control. So.

Paul Gilbert II 53:02

As I was saying, the main reason I was asking you about things even after you left is because when I talked to Becky earlier this semester, she expressed increasing frustration with, as you stated, the [precede?] sidelining or the very least desire to put SHIELD in the past instead of looking at it as still a necessary part of the present and future. And then, I don't know, it just felt like a funny coincidence that around the same time that you left the University was also the same time that SHIELD stopped being…I don't want to say consulted, but the very least, it felt like that was the moment where the University decided that it can do things without necessarily following SHIELD's guidelines to the letter. Becky was especially upset when they announced at the beginning of fall 2022 that students were not required to wear masks in class. And I wonder if you feel the same way?

Nigel Goldenfeld 54:27
Absolutely. Absolutely. I haven't really talked much with Becky about this since I've left or so but, absolutely, absolutely. I've talked with Ahmed who sort of succeeded me as sort of modeler for SHIELD, and data analytics person for SHIELD. You know, this sort of happened as I, as my activity declined and I left the university. I think also the Provost left as well. And he was a strong advocate for, for SHIELD. And I give him a huge amount of credit for really pushing that through. And I think, you know, he was the dean of engineering and I've known him for many, many years. And he knew me of course so I think he understood the scientific issues in a way that—and also Tim Killeen for that matter--in a way that perhaps others in University administration might not have done as clearly. And so, but I mean, you know, what Illinois did, it also reflects the general feeling in the country. You know, President Biden famously said a couple of months ago, the pandemic is over and that sort of thing. Well, you know, 400 people are dying a day, every week we have a 9/11-scale event, in terms of number of Americans dying, and it's, it's not over, we have the tools to manage it. I'm hoping that right now, we have a triple threat of different viruses, obviously, and flu as well as COVID in our hospitals, so that's causing a lot of pressure on the healthcare workers. So I think the, you know, the University administration chose to not seek scientific advice, and I think that's perhaps a reflection of people's getting sick of the pandemic, but I mean, so yeah. If I had been in Illinois, I would have advocated very forcefully against that. Because I, you know, had been at Illinois for 36 years, by the time I left, I was well known. And I was, for what it's worth, a prestigious scientist in my field and so on. You know, I might have been able to have more of an impact than some of the other members of the team. So, I'd like to continue this on, but I'm gonna have to go to a committee meeting, I'm afraid. Do you want to continue this next week?

Paul Gilbert II 57:26
Yes, we can continue next week.

Jessie Knoles (Tech) 57:29
We'll email you with a few times—

Nigel Goldenfeld 57:31
Yeah, let's coordinate over email and find a time, maybe the same time next week, but let's do it in email.

Paul Gilbert II 57:39

Alright, thanks again for meeting with us.

Nigel Goldenfeld 57:41
Absolutely. Thanks very much for your very well thought out questions.

Paul Gilbert II 57:46
Take care Nigel.

Nigel Goldenfeld 57:47
You, too. Have a good week. See you in a week or so.