

## *Text Summary: Interview with Alexander Nuyken, May 21, 2021*

Impact of Digital Health on Collaboration

Interviewed by P. Verschure & Ferdinand von Siemens

Welcome to the Ernst Strüngmann Forum podcasts—a series of discussions designed to explore how people collaborate under real-life settings. Joining us in the series are high-profile experts from diverse areas in society, whose experiences will lend insight to what collaboration is, what it requires, and why it might break down. This series is produced in collaboration with the Convergent Science Network.

**Paul Verschure** This is Paul Verschure and together with my colleague, Ferdinand von Siemens, we are meeting for the second time with Alexander Nuyken to discuss digital health and its impact on collaboration. Alex, perhaps you could get us started by giving us a background into digital health and how it relates to your professional activities.

**A. Nuyken** Consider, for a moment, the massive amounts of data that are generated each day in hospitals by doctors as well as through patients' daily activities. Most of this data does not get collected. It is completely lost. Why is this important? Well, on an individual level, each patient-doctor interaction generates information about symptoms, medications and their efficacy, current state of health, further problems, etc. When aggregated across multiple groups of patients, this information becomes very valuable, because aggregated data creates a big picture and allows us to better understand the development, patterns, and risk of disease.

Take diabetes, for example, and sugar consumption in our diets: Aggregated data from millions of patients allow us to correlate eating behavior and disease outcomes. If an individual were to receive feedback on the impact that a certain lifestyle will have on his/her health, at a stage in life when there is still time to do something about it, then long-term health outcomes could be improved. In other health conditions (e.g., Alzheimer), our understanding of etiology, treatment, etc., is not complete, and here, data collection would help. As data is aggregated and analyzed, our understanding of what causes the disease, its trajectory, which early warning signals should be taken seriously, when a person should consult a doctor, etc., will increase. This, in turn, will create value for the wider community.

Another area important to digital health concerns the extremely high infrastructure costs of treating people in brick-and-mortar settings (e.g., hospitals, intensive care units, all sorts of rehab infrastructures). Our system is basically at the point where we will soon be unable to afford this expensive infrastructure. One way to reduce costs is to keep people in their home settings, where they want to live anyway, rather than warehousing them in a bunker in order to conduct continual monitoring. Continual monitoring, however, can be conducted remotely, and this has potential benefits: people can remain in their homes while important health details (e.g., rehab, disease progression) are monitored. Importantly, remote monitoring could enable a better quality of life for people. This is an area where digital health is creating big opportunities.

Another area concerns diagnostics. If you go to a single doctor with a problem and ask for a diagnosis, you may or may not get the correct answer. There's a lot of potential for human error, and your doctor may not be best suited to analyze test or monitoring results, etc. Connected telehealth solutions, however, would enable patients to consult more easily with the best experts anywhere in the world, as much of a diagnosis can be done remotely. Algorithms can aid the process. For instance, out of 1,000 tests conducted, the majority (say, 995) will probably fall under "standard" interpretations, and these could easily be recognized by a machine. The other five results, however, do not, and thus need to be scrutinized closely by an expert, who could be situated in China, the U.S., Finland, etc. Their sole job would be to analyze such tests and give their expert opinion. Here data comparability is crucial.

All three of these areas will create value for the patient and community. In addition, they would reduce costs and permit the savings to be redirected toward developing medical knowledge further and addressing disease.

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- P. Verschure      These three areas – big data, at-home treatment, and diagnostics or telehealth – exemplify the ambition and dream of digital health. Can you point to actual examples where this dream has substantially been realized?
- A. Nuyken          Yes. For each field, examples already exist. Telemedicine or telediagnosics already exists, but it's not yet a fully established practice. The primary hurdle to overcome is the medical profession's attitude of "we do what we are used to." Technology advancement cannot be implemented if doctors are unwilling to adapt and innovate how they treat or deal with patients—how they go about their business. The COVID pandemic created a surge in telehealth; many more applications or treatments have been done remotely, prescriptions made remotely, things like that. I don't recall the exact number, but it was clearly more than double-digit growth. Probably more than 100% growth in prescriptions. Take the example of the collaboration between Johnson & Johnson and Apple, through Apple Watch applications; you can now get medical-grade information from your watch and conduct your own monitoring. There are, of course, other examples, e.g., the da Vinci Surgical System: Here, a surgeon can sit anywhere in the world and use a robot to conduct very complex, complicated operations, where otherwise it would be impossible to bring the patient to the doctor. This is a very interesting way to get a patient treated with laser-sharp accuracy. I've seen this tool myself and watched demonstrations of how the da Vinci Robot operates. Precise, millimeter cuts can be made. It's fascinating.
- P. Verschure      I know da Vinci very well and have used it. This development in distance health, though, is disrupting the current organization of how healthcare is provided. How can change be positively enacted? Do new stakeholders need to be brought into the process? What motivates stakeholders in the end to participate in that process?
- A. Nuyken          This is clearly at the frontier of innovation in the healthcare sectors. The sharp distinction between health care and technology has become blurred. New players have entered the healthcare universe. Amazon and Google have entered the space, and Apple is interested in joining. Microsoft has engaged in a lot of life science activity, is genuinely interested in the space, and is developing a business case for it. So, a lot of interested players who are not normally associated with the healthcare sector are becoming involved, and they want to play in this field big time. That's clearly a shift. In terms of the classic pharma players, they also have a role to play and are particularly interested in new payment or reimbursement models for their products. In an insurance model based on outcomes, drugs only get reimbursed if they help the patient. Thus, monitoring a patient's progress becomes very important: You need to have tools to monitor the patient's health and confirm that robustly to the payer organization. You need to demonstrate that this medication prolonged the life or, if it's possible to prove, cured the patient. In many cases involving cancer, though, treatments do not offer a cure -- just a prolongation of life. How can this be monitored, and how can one prove that a particular drug was responsible?
- P. Verschure      Let's look at this a bit closer. If we want to change the way medicine is practiced, we must overcome the current way of doing business (e.g., treatment guidelines, medical staff training), otherwise the move toward digital health will be inhibited. How can we get the medical community on board with this process?
- A. Nuyken          Through education and proper incentives. It's easy to throw up your hands and say that change is hard to accomplish. Education must start in medical school and continue during internships and residency. Thereafter, doctors practice medicine according to how they have been trained, even to the extent of using devices encountered during their training. Thus, MedTech players are very keen to expose medical students to their innovative products. By getting new doctors to use their innovations, a new life cycle of a product will be created—a cycle that could well persist until their retirement. At least that was the case in the past. So, the first issue concerns education: How can MedTech break into medical education? How

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can it be used to get doctors who are already actively practicing medicine to change direction?

The second issue concerns incentives: Clearly, monetary incentives work. If a medical practice benefits from a tool in a way that directly translates to the profitability of the practice, this provides a very strong incentive.

- P. Verschure When we spoke last time about collaboration in your broader business environment, you emphasized the notion of goals and motivation. Today you seem to be emphasizing the idea of bringing up a new generation because the current one is already lost for this purpose. Is goal setting not an option anymore?
- A. Nuyken It is. In the medical profession, the goal or purpose is to treat the patient in the best possible way and ideally cure or prevent him from getting a disease. Using that definition, anything should be considered. The next step, then, is to align the goal (i.e., making the patient's life a better) with what the doctor is permitted and incentivized to do in the surrounding environment. What are the implications of data protection and how will this affect doctors? Remember: medical professionals are not lawyers and tend to be wary of legal matters. Then there is the ease of using new technology. Remember: medical professionals are not technicians and thus won't necessarily understand a device, the technology itself, or the software – what it does or how reliable it is. One further element involves buy-in. It is important to make their life as easy as possible and as beneficial as possible. Digital health needs to have a proven positive impact on treatment; it needs to be beneficial and easy to use.
- P. Verschure So you're saying that for stakeholders in the medical profession, the idea of higher quality of care will continue to be a relevant component in getting their buy-in?
- A. Nuyken It's a component. I truly believe that most medical professionals are genuinely eager to improve the lives of their patients and better treatment outcomes. But new technology must be easy for medical professionals to use, and it must be supported by the organization or system. Due to the scarcity of resources and constraints imposed by the reimbursement system, doctors must be certain that they will be reimbursed for using new technology. If not, this creates obstacles to change.
- P. Verschure Let's look at thing from another stakeholder's perspective: the patient. Previously, the patient went to the hospital but would now be expected to stay at home and interface with the medical professional via technology. How do you get patients to go along with this new approach? Doesn't the same hurdle hold: people do what they are used to doing. Patients might, e.g., prefer to speak with a human directly or physically at the hospital.
- A. Nuyken Yes, that is an interesting aspect to analyze. During the COVID pandemic, people did not want to visit their doctor's practice, but they did want medical advice and diagnoses. Think about online shopping where one selects a product online, clicks a few buttons, and receives the product at their doorstep the next day. This process is applicable to other aspects in life. You just need to get used to the new process. Once the pandemic is over, I doubt that people will want to return to earlier patterns. Who wants to sit in the waiting room of a doctor's office for two hours to get a prescription filled, when this can be done online more easily and with far less hassle? You wouldn't need to get in your car, drive through traffic, sit in a room with coughing and sniffing people who are really ill, only to become ill yourself after being exposed. Once people experience the ease of interacting and conversing with a doctor online – like we are doing now per Zoom – I believe that people will embrace the change.
- P. Verschure Here, again, emerges the issue of trust. As one constructs this new pipeline of communication to provide telehealth care, how can trust be built into the system to lend confidence to the patient?
- A. Nuyken First, proper regulation must be in place to protect all data. It is crucial that all stakeholders have confidence in this regulation. People need to be able to trust the system: that it's not

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being abused or hacked; that it's safe and their data is secure. Clearly, that's an important prerequisite. Generally, I think people are willing to contribute to medical developments by providing their data, because it serves a higher good and people identify with this.

Second, there is a long-term return on providing this data – a type of quid pro quo: If I'm a diabetic and share my data points on my disease development, perhaps in four or five years' time, aggregated data on disease development from millions of diabetes patients may positively impact how I will be treated in the future, once we are much smarter about the disease, have better ways of predicting disease trajectories, and can intervene earlier. Today when we intervene, it is often too late to respond to the medical problem. Sometimes the best outcome is to keep the status quo, which may already be an advanced disease state.

- P. Verschure      Returning to the issue of trust, the issue may not be “do I trust this person with my data” but rather “do I trust what this machine is telling me to do?”
- A. Nuyken          That is true. I have the feeling that people seek guidance when a situation is unfamiliar and they don't know what to do. When people become ill, they look for guidance, and the doctor is usually viewed as a trusted person. In this situation, my sense is that people will follow guidance from a computer, if it tells them this is now the right thing to do. For example, currently there are digital health apps that are used to control for side effects of certain diseases. After entering data into the app, it might respond: “Since you're vomiting, you need to do X or Y.” A simple algorithm guides this action, and people follow the advice.
- P. Verschure      In terms of digital health, having an AI system guide an intervention and inform the patient on what to do could become increasingly important. And this guidance might not be matched one-on-one to a human expert. That could raise the challenge of ensuring that the end user trusts the guidance. As in our current situation with COVID vaccination, where hesitancy is surprisingly high, people are very easily manipulated. Even though the risk for blood clots is 0.001%, it seems that one story about a person getting a blood clot from a vaccination is enough to prompt a third of the population to dig in their heels. To advance a digital health agenda, can instilling trust be managed in a coordinated and rational way?
- A. Nuyken          That's a good question. I think it depends on the situation. If you have cancer and you understand your options, you will probably be willing to follow the advice given to you. If you are in a normal state (i.e., not ill or at least not yet diagnosed with anything) and enjoy certain habits or lifestyle, you may be reluctant to follow advice that tells you to change (e.g., not smoke, not drink) because you are enjoying these things, and consequences seem far removed. But once you've received a diagnosis of cancer, liver disease, etc., you realize that something needs to change, that you need help, and you will trust the experts on what to do.
- P. Verschure      Currently we have certification schemes and ISO standards. With more complex technologies, will it be sufficient to say: “This AI system will tell you what to do, and it is certified by the European Medicine Authority.”
- A. Nuyken          I don't think that a stamp of trust will make a difference. Trust is created through lived examples, use cases, the conviction that others are using it and have had good a experience. Such examples make it real, bring it to life. Trust cannot be imposed by a stamp.
- P. Verschure      Okay, but that's what we do with many complex technologies; airplanes, e.g., get certified.
- A. Nuyken          Yes, but I'm not saying that we should not certify things. Standards are needed and can be implemented with a level of certification. But certification does not create trust.
- P. Verschure      Sure, okay. It's a necessary condition, but it's not sufficient. What would then suffice? What would be the magic transition to assure trust?
- A. Nuyken          I think a big element involves knowledge. There must be a convincing and transparent way to showcase the benefits versus the downsides. If people feel that you are hiding something, or you are just showing the positive side and not presenting the entire picture, you will not get buy-in. You see this in the current vaccination situation. A single bad message creates

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uncertainty in people. “I don’t want to get a blood clot. I don’t have COVID right now, so why should I be vaccinated?” If you contract COVID, you might then respond differently.

The other factor is this: if people feel that they are being pushed in a direction without proper explanation, they will resist. The *Querdenker*, for example, views obscure arguments and lack of transparency distrustfully and resists at the first sign.

- P. Verschure Okay, but do you believe that knowledge or evidence is sufficiently developed in all domains? There is, of course, a risk that evidence may be very opaque for an uninformed outsider. For example: here I am, I now have cancer, and I receive some complicated immune therapy. It would take me ages to figure out what is involved and what everything means. Then there is also the role of the expert in today’s system: I talk to my doctor because my doctor knows, so I don’t need to know because I trust my doctor. If we remove that authority from the delivery of health care and replace it with technology, how do we find an alternative to that authority? In some sense, our traditional health care system has reduced collaboration by disempowering the patient, taking away patients’ autonomy—the patient is told what to do. The move to digital health involves a different kind of system where the end user, the patient, becomes more empowered, autonomous, and an agent in the whole system. That requires quite a cultural change in how health care is delivered. Is this realistic in most societies?
- A. Nuyken I think it is realistic to some degree. The issue is that patients need options to be able to make a decision. If you have a deadly disease at an end stage, where the doctors tell you that you have six months to live, you are clearly running out of options. So, you take what you get and rely on the medical opinion because you cannot make a judgment call yourself. You have nothing to base your judgment on except a gut feeling. You don’t understand your condition or the treatment or even your options. You simply need to be steered; otherwise, you’re not doing the right thing. Increased autonomy may be more applicable for the preventive space, where you have the option to continue your disastrous lifestyle or change it. Change your habits, stop smoking, stop drinking, stop whatever because it is detrimental to your health, and find alternatives to have a life that is satisfying and gives pleasure.
- P. Verschure That’s interesting. The transition to health care is more preventive than reactive. That’s also what you’re describing now. It requires more agency from the patient to say, “Look, I’m part of this broader society, and I want to be a productive member of the society without becoming a burden to myself, my family, and society.” That, of course, requires a very different mindset. Can we educate people sufficiently to step into that boat?
- A. Nuyken I think this will take time. Looking back at the environmental movement and how people think about the environment today versus how they thought about it twenty years ago, we can observe dramatic shifts. I think the same is going to happen when it comes to health and a person’s own behavior. This is not something that can be accomplished overnight.
- P. Verschure Sure. But will we achieve this point in time before our healthcare system collapses?
- A. Nuyken Good question. I don’t know. I feel that it is always at the brink of collapse. Surviving somehow because we are subsidizing it out of tax income, etc. We’re putting down the level of services. There are different ways to do it.
- P. Verschure But there are different moving parts in this, and we haven’t yet highlighted the role of tech companies. There are new markets to tap into: it might be adolescents, it might be group “X.” Health is a great market for us. Are the issues we just discussed – goals, quality of life, health, trust – goals that these stakeholders can easily or sincerely relate to?
- A. Nuyken Ultimately, businesses try to generate revenues. I don’t blame anyone for doing that. Even someone who is a doctor or running a hospital is ultimately someone in business.
- P. Verschure I understand, Alex. But consider this example: If Facebook would give me health advice, I would really be very concerned because we know that Facebook is engaged in a full-out

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assault on health in our society, certainly in terms of mental health, in order to drive revenue, because, in the end, they are an advertising company. This highlights the dilemma. Facebook has proven that it is unreliable, because it has been proven that Facebook is undercutting and eroding the foundations of our society. How then can we welcome Facebook into a domain that is so central to our individual and collective well-being?

- A. Nuyken I haven't seen any initiative on the health side from Facebook yet, so I can't comment on that. I would also be reticent to pass judgment on all tech companies. There is a lot of good that anyone who has access to patient health data can contribute if it is used properly. I don't really care if it's coming from Google, which is also an advertising company to some degree, or from a company that's being built from scratch. If you look at the patterns that people are using, or the search words used to look for health advice, etc., a lot of information can be gained. I'm not saying that you are not getting the right answer from Google, so people shouldn't use it if they aren't sick. We can gain a lot of information from knowing what people are looking for when they have a certain disease.
- P. Verschure Sure. But if that information is with Google or Facebook, you're never going to get it unless you pay for it. It's more the other way around. We know that Google has been shipping a lot of NHS data from the UK to its own servers, and that data is no longer accessible to anyone else. I was reacting more to your point that for these big tech companies, it's ultimately all about revenue. As long as they optimize revenue by delivering health care, it will probably be okay. At least that's how I took your answer. That's why I wanted to push back by pointing out that this has not always worked out so well.
- A. Nuyken For sure. If companies just take data and store it somewhere where it's no longer accessible, then something went terribly wrong. I wonder who made the contracts under which this is being done, or why they're not being sued until they no longer exist. I don't know of anyone else who has the capability, the reach, and the breadth. Do you think the government should do it? I doubt that they are doing a better job in that, so....
- P. Verschure Therein lies an interesting challenge: We know that we have to bring in technology to advance digital health, but goals must be aligned and trust developed. What path – long or short term – do we need to take? One scenario could involve a conglomerate of more European companies as a fresh entry. Of course, that's difficult. Alternatively, Europe and different nations could set things up as a public organization much like public health care systems. We all should have public digital health care systems. Is that a plausible alternative?
- A. Nuyken If one looks at the public initiatives involved in COVID, I'm not certain.
- P. Verschure I agree. It has been a complete disaster. Then again, COVID represent an extreme case, which points to another dilemma. From the perspective of the current collaborating stakeholders in COVID and the shifting landscape, there has been an urgency to provide solutions in record time. For digital health, if we engage existing tech giants, we might also pay a very high price.
- A. Nuyken I think you need to define the framework, the accessibility of data, and the ownership of data. This is crucial; it is a regulatory thing to do. The rest I think, should be the market forces. If you force tech companies to keep data on European servers so that you still have access and control; if you engage a neutral surveyor who gets access to verify that everything is treated properly; if data needs to be anonymized, etc.—this can be enforced by law. And that's what the legal regulator must do. That is the framework that must be in place. The rest is to basically let them find the best solution that really works. There are businesses that need to make things work, otherwise, they are not going to succeed. When the state starts something and does not deliver, another government may be elected later.
- P. Verschure Sure. But that means you're trusting the markets to come up with the proper answers. However, I would see a challenge concerning the question of evidence. Another concerns the fact that the pharmaceutical industry does not purse R&D when there is not enough market

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interest. If we rely on market mechanisms, this might not serve the actual goals and values of the healthcare system that we want to build.

- A. Nuyken Look at the rare disease area. There are diseases that affect, say, a thousand or a hundred patients globally per year, and you can find solutions by providing the right incentives. How is this done? Reimbursing a hundred patients per year doesn't make a huge difference to the healthcare system. If you reimburse the medication for a million dollars per medication per treatment, they do it, and that works. So, we have a treatment for deadly diseases that are extremely rare. That's one way to make it work for both sides: the pharma company sees value in spending money on developing the drug because they will earn money, and patients who would have died before now have a solution. I think those are the types of markets that you create by setting the right incentives.
- P. Verschure In what time frame do you think we can really start to speak, say in Europe, about digital health care being the standard of care?
- A. Nuyken In terms of the standard of care, we have a way to go. Currently, the digital health ecosystem is evolving. The COVID crisis has taught us many lessons, and will continue to do so, and some of the major advancements will remain in place even after COVID. Over the next 5-10 years, I think that we will observe dramatic changes in how patients are treated.
- P. Verschure And what's the biggest risk that we face in growing in that direction?
- A. Nuyken Losing the trust of the people. It comes back to what we discussed earlier: people are very nervous about single examples, even if they are statistically not meaningful. Even a single data leak can precipitate a loss of trust and reverse some of the developments or slow them down dramatically. We need to be very careful that this doesn't happen.
- P. Verschure How would the stakeholder landscape then shift by the time we're there? How many of the central stakeholders will have fallen out of the boat? Take hospitals: we might not need as many hospitals or health centers, because healthcare has moved to a home-based setting.
- A. Nuyken I think that there will be a shift, but hospitals will continue to exist. They will, however, adapt to this new environment. This will allow them to become more efficient, e.g., in terms of predictability of the length of a patient's stay or better manageable workflows. This, in turn, will allow hospitals to become more profitable, another part of the equation. Hospitals—at least if they are not part of a larger group—are not really profitable. They are usually loss-making enterprise. We need to solve this problem because we can only afford so much. As I said, the current system is on the brink of collapse.
- P. Verschure Would you expect that this will have a measurable impact on life expectancy in Europe?
- A. Nuyken It definitely will. I'm pretty sure that it has already had an impact.
- P. Verschure Could you give a number of that?
- A. Nuyken No, but life expectancy is growing, and I'm pretty certain that it will grow further, with prevention and change of lifestyle mentioned earlier: early monitoring, data collection, and increase knowledge about which behavior has real consequences.
- F. von Siemens I would like to pick up on something that we discussed before, a new sort of angle on this adoption issue. You said that doctors need to have the right incentives to adopt these new technologies and that, in general, they care about the health of the patients. I'm wondering whether there might not be more resistance from doctors for two reasons. First, these new technologies could make a lot of doctors redundant. If you don't need go to a doctor, but rather can just look into a screen to have a camera detect your health status, then a visit to the doctor is not needed. That might be the primary reason for doctors to resist these kinds of technologies. Second, these technologies could threaten a doctor's self-image. Doctors like to be recognized for their competence, and if a machine's prediction or diagnosis is not consistent with the doctor's expertise or opinion, resistance will result. Doctors could

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perceive that the technology undermines them, or they may not trust a machine's call because it does not align with what they thought. In actuality, the machine might be much better than the doctors. Could you briefly comment on this?

A. Nuyken

Yes. There is a notion that doctors may be redundant, or that we may need less doctors for certain things (e.g., standard diagnostics to evaluate MRI results or an ultrasound diagnosis). A computer may take over a lot of that job by preselecting or filtering the pictures. That is already under discussion. My sense is that doctors who recognize this more as an opportunity than a threat, will be the ones that are more successful, because by adopting this change earlier, they will be able to treat more patients and be more effective in how they do it. Such doctors see AI as a partner, as an enabler because it helps them to focus on the difficult cases. The standard stuff is being done by a very cost-efficient aide. After the acquisition costs, the rest is a little bit of maintenance, but it's not commensurate to the monthly salaries of doctors.

In summary, it is true that concern exists. I see this in various discussions. But I believe that those doctors who view this as an opportunity rather than a threat will be the ones who exact success with it.

P. Verschure

Thank you, Alex, very much for this conversation.