Collaboration in Science

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P. Verschure	This is Paul Verschure with my colleague Andreas Roepstorff for the Convergence Science Network and Ernst Strüngmann Forum Podcast on Collaboration. Today, our guest is Theo Mulder. Theo, welcome to our podcast interview. It's great that you could join us. Maybe you could by describing the trajectory that brought you to where you are now, the main steps in your professional career, and your experience with collaboration.
T. Mulder	I trained as an experimental neuropsychologist in Nijmegen, and from 1994 to 1999 was professor of movement disorders there. Thereafter I went to Groningen as professor and head of the Department of Human Movement Sciences. A remarkable career switch took place in 1999, when I became Director of the 19 institutes that comprise the Royal Netherlands Academy of Sciences, as well as its Scientific Director—a rather grim job positioned at the edge of politics and science. I did that for ten years, before serving as the Director of the Netherlands Institute for the Advancement of Sciences (NIAS) for one year. Then I thought: this is the end of my career, so I gave a lecture in Nijmegen in which I criticized the Radboud University, run by the University Hospital, the Sint Maartenskliniek, and the Technical University in Twente, for not cooperating enough on human movement disorders, because they were all specialized in it. There was not enough cooperation in the world that was organizing itself into larger consortia. Under the umbrella of the Royal Academy, I thought it made sense to make such a statement, and I thought nothing will ever come of it. But that was not the case. The boards of the respective institutes phoned me and said, "well, you have a point," and that was the spark for a new career as head of a large scientific cooperation between five partners.
P. Verschure	Are you still in that collaborative process?
T. Mulder	Yes. I gave that lecture in the city theater in Nijmegen in 2017, I think. Then they invited me to create a consortium of about 200 full positions in science between the five partners. So we set up an organization, called the Interdisciplinary Consortium for Clinical Movement Sciences and Technology (ICMS) and until today, July 1, 2021, I have been the chair of the board. Now, happily, someone else is taking over.
P. Verschure	When you look at the jumps you made in managing complex processes of collaboration or cooperation, what are the defining features of collaboration? What makes collaboration? What does it mean?
T. Mulder	That's a simple question, but it requires a long answer because cooperation has many aspects. One aspect reflects the change in science policy that occurred in the Netherlands and Europe. Instead of a single, brilliant person applying for money, it has become policy to form larger consortia, which in turn apply for huge sums of money and incorporate many brilliant individuals. This has become a political necessity. The other aspect is that if you create an interdisciplinary group, you are scientifically much more powerful. Many more viewpoints are available to you than if you were to work on your own on a scientific island.
P. Verschure	That might be the objective of constructing large consortia, but what would make such a consortium collaborative? What are the defining features?
T. Mulder	Trust. In Dutch, we have a saying that means that if a group of people have joint interests and trust each other and are able and willing to share, then that is the root of cooperation. It is a human affair. Even if there is political pressure, it will not work without trust and the ability or willingness to share. In Groningen University Hospital, there is a large sign in the hall that says: "If you cannot share, you cannot multiply." And that's true.
P. Verschure	Let's jump to the period when you were running the institutes at the Royal Academy.

T. Mulder	Seventeen at this moment.
P. Verschure	We are talking about hundreds, if not thousands of researchers. How well did collaboration function in that context?
T. Mulder	That context was a totally different than ICMS because the institutes of the Royal Academy are rooted in the domains of biology, neuroscience, and the humanities. Within the humanities, cooperation existed; within biology and within neuroscience, I stimulated cooperation very strongly. But *between* the humanities and neuroscience, there was none. There were simply these three pillars.
P. Verschure	How did you engineer the cooperation? How did you detect or measure it? What efforts did you undertake to improve collaboration within and between these institutes?
T. Mulder	The humanities institutes are, for example, quite well known, but they are small. The impetus for cooperation was that if you unite these six or seven institutes into a Royal Academy Humanities Institute, they become much more powerful when compared to the much larger institutes in neuroscience or biology. That was not an easy process, because not everyone was convinced that working together and joining together would result in purely positive aspects. Splendid isolation can be a lovable concept.
P. Verschure	It sounds like you tried to stabilize an existing situation without having real control over improving the collaborative process within or between these institutions, or did I misunderstand that?
T. Mulder	Partly that is true, but there was one main aspect. We managed to get a substantial amount of money to stimulate the institutes to work together and to open new research labs. In a way, it protected the institutes as they were, but also facilitated more internal cooperation than had previously existed.
P. Verschure	That would be a big incentive for members of such an institute to collaborate because more money would be made available to them.
T. Mulder	And more possibilities to create larger, long-term research programs.
A. Roepstorff	I am very interested in your three points: joint interests, trust, and the willingness to share. Could we return to the Dutch phrase again. I'm trying to unpack that one.
T. Mulder	*Als je stinkt, zal ik niet met je samenwerken.* Translated, it means if you smell bad, I will not cooperate with you. It is a metaphor that means people like to work together when there is some mutual trust and perhaps even sympathy. If that's not the case, then working together becomes a top-down process and that almost never works. Cooperation should grow up from the bottom.
A. Roepstorff	What can be shared in these processes within the scientific community? What is it that people are sharing? Is it only a matter of sharing economic resources? Could you talk a little bit more about what you have successfully seen people do?
T. Mulder	You can share funds, but there is a wealth of other resources to share: knowledge, infrastructure, methods, databases. By sharing these things, you'll become a much more inter- or multidisciplinary power, able to solve problems that nobody can on their own.
A. Roepstorff	This point about sharing is critically important. Did you encounter reservations or obstructions to sharing? Did people feel that they lost something by sharing? Was there an unwillingness to do so? What was the mechanism?
T. Mulder	It is a very human mechanism. People are not willing to give up something unless they can profit from it. Returning to the concept of trust, if you don't trust the other parties in the consortium, you won't be willing to open your infrastructure or to give them access to your data. At ICMS, the researchers, the professors, saw that there was added value in joining together and creating new, mutual interdisciplinary research programs.

	I feel strongly that if the dean had been running this process, it would have been much more difficult to create such a consortium.
A. Roepstorff	Would that mean that it has to be conceived as a plus-sum game, or a zero-sum game, or a negative-sum game? Is that really what lies at the core of these collaborations? That the participants somehow imagine that this is not a zero-sum or a negative-sum game in which they are engaged.
T. Mulder	That's absolutely true. If participants are not convinced that they can profit from the cooperation by receiving large grants or having more scientific power in the university or scientific community, they will be unwilling to cooperate or join that consortium. They must see practical, pragmatic, as well as scientific or theoretical advantages.
A. Roepstorff	You describe very different levels where this plays out: economic resources or power within the university or the possibility to gain knowledge that they wouldn't be able to gain on their own. How would you balance these things against each other? You might lose on one of these accounts but win on one or two of the others. What does it take to create an environment where, even though so incommensurable, things are being exchanged during collaboration?
T. Mulder	The word you used, *environment*, is the correct term to use. You must create an environment with people from different backgrounds who perceive, more or less immediately, the advantages of working together. You cannot manage all aspects; it's not possible because a social dynamic takes over. For example, ICMS has a board, but at its core is a council of researchers and clinical leaders. Together this council decides on future trajectories. Of course, on one side you lose something, but on the other you gain something. That's the dynamic of groups, the dynamic of science amid political changes, especially in Europe.
P. Verschure	But there are two parts. ICMS is still an experiment that is running while your experiment at the Royal Academy is finished. If we look at the latter period, can you point to a real successful case and then explain why it was so along the lines of the model of collaboration that you proposed?
T. Mulder	Let's start with the Royal Academy. I think the Netherlands Institute for Neurosciences is a successful case. In 2006, the institute was in turmoil. It did not receive a very positive evaluation and there was enormous instability. The merger between two institutes was not well balanced, and there was mistrust. (I am fascinated by science. I'm not a technical board member. I have a passion for science.) By recreating that institute, injecting money into it, hiring two new directors, and reorganizing it into a much more social community, it became a success story within the realm of the Royal Academy. This institution is now quite successful.
P. Verschure	In this case, it could sound like you are saying that you just have to pick the right people to lead. But what about the sharing that you highlighted earlier? Within that context, was the sharing of knowledge and infrastructure a decisive factor? Or did success hinge more on the leaders of the process?
T. Mulder	It was the leaders of the process—the leaders, together with the Royal Academy, reorganized the institute so that senior group leaders had a more decisive voice in the future trajectory of the institute. The institute was also governed differently than before. They managed to get the whole community within the institute behind the programs that they had designed. It was not totally a top-down process.
P. Verschure	What were key features, or change in the governance structure, that made the difference?
T. Mulder	The division into groups and the more powerful role of the group's leaders in redesigning the future of the institute.

P. Verschure	The engagement of a broader group of stakeholders in the process?
T. Mulder	Yes, absolutely.
P. Verschure	By contrast, in that same period, what would be an example of a failure where the model didn't work?
T. Mulder	That's a difficult question. You have to think longer about a correct answer.
P. Verschure	The easy one first, Theo.
T. Mulder	There were famous institutes with very powerful historic traditions that played a large role in society. It was very difficult to change these institutes, which had been stable for centuries, and create the Royal Academy Center of Humanities. There was a lot of negative press about the change. Someone wrote, "maybe the right place for Theo Mulder is somewhere in the Dutch canals." I love the humanities, but I learned a lot about those institutes.
P. Verschure	Was it inertia? Would organizational inertia, or tradition, go against successful collaboration in this case? What other features in these humanities institutes made change so difficult?
T. Mulder	In general, the mean age of researchers in the humanities institutes was ca.55, whereas in the neuroscience and biology institutes, it was around 32 or 33. Age certainly made a difference. Another factor was that not all research traditions in the humanities fit together. In a way, a scientist is quite conservative: he embraces the methods he likes or finds successful and is very reticent to change. Although an overarching umbrella may span the humanities, the individual institutes have different traditions, different outlooks, different fields of interest. It took a lot of work to bring these institutes into a consortium, but it took place and is now quite successful.
A. Roepstorff	I would like to follow up on the role of the Dutch Royal Academy. My interest stems from my involvement in the Danish Royal Academy of Sciences and Letters, and the high esteem that we hold for the Dutch Academy—so much interesting work is coming out of the Dutch Academy. There is a complex relationship between the Danish Royal Academy and the Carlsberg Foundation. The Carlsberg Foundation is run by members of the Academy, who are elected, but they do their own thing, and they don't have research institutes. I'm very interested in a potential role for something like an academy designed to facilitate collaboration, both in terms of setting up specific institutes, as you're doing in the Netherlands, as well as in creating a more general academic environment that would promote collaboration. I know the Danish case very well, but I am interested to hear your take on the Dutch case.
T. Mulder	The Royal Netherlands Academy of Sciences has a history of more than 200 years and its own institutes, which is not the case in all the countries. The role of these institutes was, in the beginning, quite clear: they had a definite role in the scientific landscape. As universities became more powerful, the role of the Royal Academy of Sciences changed, creating tension between them. One of the interesting tasks of the director of the Institute of the Royal Academy was to lessen that tension by increasing cooperation between the institutes of the Royal Academy and the university. Together you are an international power; separate, each is just an institute. That tension always exists because Royal Academy Institute members have no educational obligations. They are purely devoted to science. Over the last 10-15 years, the gap between the Royal Academy Institute and the university has grown smaller, and together they are a real scientific power in a small country like the Netherlands.
A. Roepstorff	How are the institutes of the Royal Academy funded? Are they funded directly from the state budget, or do you have independent funding that allows you to make independent decisions?

T. Mulder	It is a combination. A lump sum comes from the Royal Academy, but about 60% of all funding comes from grants from the science foundation, or from Europe, or from other granting institutions.
A. Roepstorff	Who funds the Royal Academy? The state?
T. Mulder	Yes, the state. Funds are provided from the Ministry of Education and Science and Culture.
A. Roepstorff	So, public monies get funneled into the academic institutions via the Royal Academy.
T. Mulder	Yes.
A. Roepstorff	Are there members of the Royal Academy who are not working in institutes but are university professors in their own right? How does it work?
T. Mulder	There are indeed members of the Royal Academy who are not part of the institutional community. They work at the university or somewhere else; they don't work at all at the institute. At the institute, and don't forget I'm no longer at the Royal Academy, there are about 1,700 people working.
P. Verschure	The relationship between the Academy and institutes, and universities or academic institutions, happens on a level where collaboration must be organized around the same objectives: trust, perhaps methods, and concepts. In addition, collaboration happens with the state, which is funding the Academy, as well as with the national research council, which provides additional funding. How effective is this process? How is the process managed? What are its key features, and how can you make it successful?
T. Mulder	Those are three intermingling questions. Let's first focus on the differences between the Royal Academy Institutes and the universities. One of the characteristics of the Academy Institutes is that they have the possibility to focus on very long-term research programs: 10 or 15 years or longer. The point of cooperation between the institutes and the universities actually is based on the same preconditions. As I said before, there has to be a joint interest, a joint advantage, and there has to be a willingness to cooperate. The directors of the institutes have quite a lot of influence to manage that by themselves.
P. Verschure	You are describing now collaboration within the Academy and between its stakeholders. But how do you manage the collaborative process, for instance, of the funding council? That also brings you closer to a political-strategic level of decision making where other forms of interaction might drive the process.
T. Mulder	In the realm of the Academy, it's more at the level of facilitation because of the powerful position of the institute directors themselves. ICMS utilized a much different process to build cooperation between universities and the Royal Academy Institute, because all the directors of the institutes are also university professors. That created a bridge between the institutes and the universities and brought educational obligations into the institutes, although they're not obliged to do so. By creating these co-roles, and these professorships, the traditional tension between the institutes and the university decreased.
P. Verschure	There are also different levels of competition within the system. As a psychologist, you will appreciate the potential collisions or trade-offs between attaining personal objectives (e.g., building your career, advancing your theory, validating your hypothesis) and having to find ways to interact with a person with a similar ego-driven agenda. This could set up a trade-off: people might have to sacrifice personal goals to be successful in the collaboration. Do you see that collision as a process that must be actively managed and understood? Or does it resolve itself automatically?
T. Mulder	Such a situation takes place in larger organizations and is not specific to the Royal Academy Institute. In larger social institutions, such tension exists between people who

	work together. If you create an atmosphere where these tensions can take place and resolve themselves, then it's part of the social dynamic of the group; they will fade away or not.
P. Verschure	Would you try to detect these kinds of collisions and actively step in? Which buttons are then pushed to try to remediate it? Or would you say that such is the nature of the beast, and nothing can be done, so it just has to run its course, and maybe someone will drop out of the process.
T. Mulder	Somewhere in between, because don't forget how it works: the headquarters of the Royal Academy is in Amsterdam, the Trippenhuis, whereas the institutes are scattered around several cities in the Netherlands, mostly in the west. Although you might perceive tensions from a distance, it's extremely difficult to manage them from a headquarters in another city. Managing this calls on the director, but it's extremely difficult to understand in detail human affairs taking place in institutes that are 70 kilometers from Amsterdam.
P. Verschure	Today we are celebrating your last day as Chairman of the Board of the ICMS, which you built up working with many people across different universities and clinics. From your time at the Academy, were there lessons that you could use to build this network and complex collaborative process from scratch?
T. Mulder	There were a number of lessons. When I was Royal Academy director, my work was much more top down, because of the literal distance between the headquarters and the institutes, as well as the organization of the institutional work. Lesson #1: when you create a consortium, you should create it step-by-step, bottom up, and it should be content driven. That was one of the main lessons I learned when they asked me to improve cooperation between the partners (the university hospital, the technical university, and the clinics). It took time (we started in 2018), but now this cooperation exists and is very successful. Lesson #2: Slowly build the supporting frame of the content bearers: the professors, the senior researchers. Those were the lessons I learned from my experience at the Academy. It takes more time to involve everyone who has a role in the process (step-by-step or as a group) in the building of that new construction.
P. Verschure	That also means that you're shaping the process over time.
T. Mulder	Yes.
P. Verschure	First, you prepare the ground. You identify the key players with whom you then prepare the next phase. How many phases have you gone through?
T. Mulder	All total, the process took about four years. Phase one involved "grand meetings" to find out whether there was a need for more intensive cooperation between the five partners and two cities. If that willingness was not there, or if there was too much hesitation, then it's doomed. In my opinion, it's not possible to create a large consortium through totally top-down efforts. Phase one was aimed at establishing the willingness to cooperate.
	Phase two involved creating the social organization to manage the cooperation. This meant creating groups of senior researchers and clinicians and let them talk with each other.
	Phase three is a bottom-up process, if you have all the money you want. We asked: What are the three large programs you would like to work on over the next ten years, and how would you subdivide them?
	Phase four asked: How would you like to fill in the content of these programs? After phase four, the framework was in place, the people were there, and the grand process could start. That's the phase we are now in, and everybody is on board and staying on

board. I learned that it is a massive advantage to involve not only the head of departments and senior professors as stakeholders, but the whole community.

A. Roepstorff   I would like to ask a bit more about the temporal dimension. What is the importance of the time frame that you set in front of you, be it one year, three years, five or ten years? Is there an optimal spot? Or is longer always better when you are trying to start up a collaboration?

T. Mulder   No, longer is not always better. Let's take ICMS as an example. ICMS is now a politically stable consortium, but it's still vulnerable. If in the next two years there are no large grant acquisitions, then it's possible that senior scientists may say: "We have grants, but we had grants before ICMS too, so I don't see any advantage in this." And the collaboration breaks down again. So, a longer period does not always yield better results. The proof is in the pudding: when members of the consortium see that the consortium brings more advantages than each group or each institution can achieve on its own. We are now in that phase. By taking time, you make the consortium socially solid.

A. Roepstorff   And this was the rapidity. Is that a weakness or is it a strength, or is it both?

T. Mulder   It's a weak strength. It's a normal part of the scientific deal. But if you bring together more than 200 senior scientists and behind them, maybe 500 junior scientists, and in one to three years, there is no visible advantage to the consortium, then there is no future. I'm not that pessimistic. On the contrary, I see a positive future for such a consortium, but only if it is based on—and this brings us back to the beginning—the willingness to cooperate, on mutual trust, and on the conviction that you can answer questions which you could not otherwise answer if you work monodisciplinarily. It's a political necessity in the science policy of Europe at this moment that you have these public and public–private consortia.

P. Verschure   I detect a possible contradiction in how you now describe the process. We started out by saying that people must see that they can gain in understanding, in methodology, and shared infrastructure. But if the senior people do not get more money in two years' time, then the whole thing will collapse. That seems to contradict the goal setting because what is the objective? Is the collaboration a vehicle to generate more money or resources for the principal investigators? Or is it the other way around? Is it really the generation of more grant money a measure of success? That would then contradict the idea of setting common goals in a more intellectual and idealist perspective.

T. Mulder   I think these things are intermingled. Science runs on ideas and money. If you have ideas and no money, there is no science. Alternatively, if you have money and no ideas, there is no science. Creating a consortium opens up new intellectual possibilities. Over the last 3 years, cooperation has been created that was not there 3 years ago. Nevertheless, if the willingness to cooperate is not there, and project plans do not end in real possibilities to work together, enthusiasm will wane. One must solve the scientific and social challenges. There are fragile aspects involved in bringing together 200 or 250 scientists in such a social experiment, but I'm not pessimistic at all.

P. Verschure   If you talk with the leaders of other large collaborative projects, like the American Brain Project, they say that if the next generation of researchers is trained to be more multidisciplinary and collaborative, then the project can be viewed as a success. In your description, the outcome has a two-year time frame. Are these as comparable objectives? Is that a sufficient justification to keep everyone on board in the project that you have set up?

T. Mulder   In the Brain Project, there were many tensions. It's larger, but these tensions are there. Until now, I see a much smaller mass that doesn't have these tensions. They could appear, but they are not present now. It's a combination of these idealistic aspects to

solve large societal challenges, and especially the view that you have more possibilities in a group than on your own. I'm not pessimistic, but I see how complex it is to create such a new and larger community between cities with different traditions.

P. Verschure	At the ICMS experiment that you're stepping out of today, looking back, do you feel like: "I've made a few mistakes. There are some things I could have done better."
T. Mulder	Yes. It's again a question of top-down and bottom-up. I learned from the Royal Academy, but if I were to repeat the process, I would from the very start bring more people together than I did. Now I'm focused on the senior leaders, on the department heads, on the professors, on the associate professors. But under that umbrella, there is a group of hundreds of junior scientists, assistant professors, who are actually the force to drive these experiments to a good end. If I could start again, I would take more time to involve a larger group of junior scientists.
P. Verschure	It makes sense because as you described earlier, it's a multi-year process. The ones who are junior at year one are already more advanced at year three or four. They also carry the flame of the idea. Stepping back a little bit from the concrete processes you were involved in on collaboration, do you feel we learned anything from the last one and a half years of COVID-19 ruling our reality?
T. Mulder	How many hours do we have?
P. Verschure	[Laughter] It's a sort of collaboration.
T. Mulder	Let's make it a simple answer. What COVID taught us is that to solve these sorts of problems, you have to cooperate. Normally, it takes years to create the medicine and now it took one and a half years. Along with this trust and a willingness to share and the societal pressure, of course. What is also important is that COVID showed that you need science to solve large societal problems: the social sciences to manage all those complex theories and socially insecure thoughts, and biological science to develop the medicines we need to cope with this new disease. Politics alone cannot solve these problems.
A. Roepstorff	You mentioned that the collaborative environment was very important. I wonder whether your final point about the need not just to talk to the principal investigators and heads of institutes, but also to talk to the more junior researchers is also part of creating a collaborative environment? Could you talk a little bit about how, if you were going to start from scratch designing a collaborative environment that's not just about principal investigators optimizing their own needs, how you would do that? It seems to be critical in this collaborative environment.
T. Mulder	Yes, Andreas. One major effect of COVID is that it prevented the organization of in-person meetings. It was not possible to organize a symposium with 200 or 300 people. That's not possible on-screen. If COVID were not out there, we could reach junior scientists more easily. You can reach them in one institute, but you cannot reach 300 or 400 PhD students. I'm sure that if there were no COVID, we would have organized many symposia with junior speakers, with senior speakers, with interesting international speakers, creating junior groups, having dinners. All that which is needed to build up a social-scientific community, was not possible. We met each other in boxes on the screen, which is also part of the answer. What would you do differently? But some things were not possible to do differently.
P. Verschure	Do you believe humans, in a general sense, will ever be able to really and truly collaborate? Or do you think that from a psychological, biological perspective, there are intrinsic limitations in the human condition that will prevent us from fully developing the potential of large-scale collaboration?
T. Mulder	Evolution has taught us that cooperation is one of the core characteristics of *Homo sapiens*. It's a group animal. If you look at *Homo sapiens*, you see an angel and a devil,

and in between is everything. I think cooperation is one of the social needs which is characteristic for *Homo sapiens*, as well as physical contact and sharing thoughts by means of social gathering. I think it will be possible and all large scientific cooperations have shown that it is possible.

P. Verschure   If you could change one thing in humans what it would be?

T. Mulder   Repeat that question please.

P. Verschure   Let's say I give you the ultimate technology. You can change any piece of the human phenotype, the *Homo sapiens* phenotype that you want. Which bit would you change to more fluently create constructive collaboration among humans?

T. Mulder   I would lower the level of jealousy.

P. Verschure   Okay. Very good. Well, Theo Mulder, thank you very much for this conversation.

T. Mulder   Thank you too.