CREATIVE INTELLIGENCE
WITH JAMES INGRAM

EPISODE SIX: CREATIVE INTELLIGENCE, NEUROSCIENCE AND AI
WITH GUEST ROMY LORENZ
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James: Hello, and welcome to the Creative Intelligence podcast, with me, James Ingram, host and CEO of Splashlight. It's a series of conversations exploring tools and technologies that fuel creativity and inspiration. In this episode, we will be talking to Romy Lorenz, a cognitive neuroscientist with a multidisciplinary background in psychology and biomedical engineering. Sounds impressive! Romy is a Sir Henry Wellcome Postdoctoral Fellow at the University of Cambridge, Stanford University and the Max Plank Institute for Human Cognitive & Brain Sciences. Her research interest lies in developing brain-computer interfaces (BCIs) and artificial intelligence, as a new experimental paradigm in cognitive neuroscience. Romy, welcome. Glad to have you.

Romy: Thanks! Thanks for having me.

James: That is an amazing background to get into the human brain, right? What got you interested in studying the human brain just to begin with?

Romy: I started with psychology, and actually business psychology. Over the course of my study, I realized I'm not so much interested in the business side, but more in the cognitive psychology side. But I went more into engineering psychology first and started working, for example, as an intern at Daimler. We were investigating how driver assistance systems are used by humans, and studying how we can make them basically more user friendly. But this was all very psychology based. We asked questions, and we observed the behavior. After a while I was, "Well this is all nice, but actually I really want to know what's going on in the brain," so then I started...

James: Something simple!

Romy: Yes! But it just... these indirect measures they kept not really satisfying me, so I started a master's called human factors, which basically still is about trying to adapt technology to humans, but I got more and more interested into brain computer interfaces, and I had amazing professors there who really fueled my interest, and I had the possibility to work in the lab there.

James: A more direct feedback of what is going on in the brain.

Romy: Exactly, so basically I came a bit via the more engineering route. There was a lot of machine learning technology they used. Actually, I'm also just interested, not just in the signal processing side, but understanding the sources of the brain activity and trying to understand what's actually really going on. I started a PhD at Imperial College London in more cognitive neuroscience combining these two backgrounds, basically.

James: This is something. So you're trying to get input through observing people, is where you started, then you realize it's not conclusive enough. You wanted to try to get, without a person having to tell you what they're thinking, the feedback, and combine this together. Is that the next evolution that took you to this algorithm? I hear there's this algorithm you've developed to help understand brain activity.

Romy: Yes, it's more a framework than an algorithm. The algorithmic side was developed by... it's called Bayesian optimization. This is just an approach that has been around in the field of robotics and artificial intelligence for a while. Nobody has really been using it in cognitive neuroscience though. So we started using this technique and combining it with human brain imaging. We basically realized what huge potential this can have about the questions we can now ask.

James: Like what? What kind of question with something that was revolutionary or enlightening? Like, "Wow, we could go after this now"?

Romy: Yes. Maybe I need to go a bit back and first explain how we usually do experiments in cognitive neuroscience. As a cognitive neuroscientist, I'm interested in studying aspects such as memory, attention, language, all these higher-level abilities that made us humans, basically, so successful as a species. Often, because of the cost and differently associated with brain imagining, you put them into this huge scanner. Every hour costs a lot of money, so you need to be very thoughtful.

James: To monitor the brain activity.

Romy: To monitor the brain activity. You get these really nice images in 3D every two seconds, so you have a huge and rich dataset. Often, we just choose one or a few cognitive tests we use in the scanner to probe the brain, basically. Then we can see what brain network is associated with memory, or what brain network is associated with attention. But these are all several experiments. The problem though, is that this field of cognitive testing derived from psychology. So the problem was that these tasks were designed prior to having these insights into the brain. So often, we're actually probing more than just one process at a time. That's very complicated to study, especially if you're just then looking at

one task at a time. What we're doing with this kind of AI is now that we're saying the AI can decide what cognitive test do we test in the brain scanner. It does it in a really efficient, and a really intelligent way.

James: That's incredible.

Romy: Sometimes we call it also the AI neuroscientist, or the automatic neuroscientist, because we, as an experimenter, are completely left out of the loop of choosing the experiment, basically.

James: That's the point of it, machine learning, is this algorithm is learning on its own of what to test, or what to try, or weighting criteria that it's looking at.

Romy: Exactly, yes. You just tell the algorithm, "This is the brain network I'm interested in. So now please find all the different cognitive tasks or cognitive tests that are out there that engage this brain network."

James: That is something. If we could go back a little bit, you set the stage for us of how you got there. I understand that there was some research you did using a video game, the Minecraft game. Could you tell us a little bit about that? Were there setbacks? Were there surprises you didn't expect? And how you overcame that, and the result?

Romy: Basically, the Minecraft project started with me starting my PhD at Imperial College London, having an amazing supervisor, who was just really open to everything I suggested. I said, "I want to do brain imaging in real time, and I want to do machine learning with it." We said, "Okay, let's just think of a really simple paradigm."

James: Had you heard of this before? Or you were really bringing something new?

Romy: I heard about this real time approach of imaging before, by a really inspiring professor who really... yes, I used a different technology before. I used electrodes on the head. Then I heard his talks. I was just really inspired that we really need to go into depth. I was like, "I really want to do this. I want to do this real time human brain imaging." But at Imperial, they haven't done the real time aspect. They usually just collect the data and look at it after. That's something I brought to Imperial College with my supervisor. He was just super open and said, "Yes, let's do it. I think we can do it." Then we thought about, "Okay, how about we're just taking a gaming environment, because it's engaging?" One problem is that subjects fall asleep if you bore them to death in the scanner. We wanted to keep them engaged. Basically the idea was that they just navigate this virtual world, and based on their brain activity, we wanted to change parameters in the game. So, for

example, we wanted to make the game going to a night setting, and then back to a day setting based on their attentional states.

James: Right, to see how that changed the range of their behavior?

Romy: Yes, so the idea was to basically constantly keep them in a high attentional state by basically if they were not attentive, that we wanted to go into night setting, so they had to focus more in order to get their rewards or so.

James: It's called the Hawthorne effect? I think there's a term for that when you change the environment, gets people's attention.

Romy: Yes, that was basically the idea. However, I think we went just a bit too far.

James: Oh, no! What happened?

Romy: I think it was just a very challenging experiment. We had a joystick, and just navigating through virtual world involves so many different centers in the brain, so many different networks, so we just couldn't really pick the right signal up.

James: Oh, so it was too complex of a situation?

Romy: It was too complex. I was halfway into my PhD and basically this experiment didn't really work the way we wanted. Then we were like, "Okay, what are we doing now?" Yes, we were collaborating also with a statistician from Imperial College London...

James: After the panic set in... no?

Romy: No, there was definitely panic. I mean I always had trust in my supervisor in terms of, "Rob, what are we doing now?" But it was really nice. Everything just kept, I don't know, flowing in a way. Then the statistician said, "Why aren't you trying Bayesian optimization?"

James: Right, the Bayesian optimization, yes.

Romy: And then also Rob and I were thinking, "Let's just do a simpler paradigm. Let's just start with the most basic experiment we can think of. Let's just see if this whole closed loop circle, or cycle, as we thought of, actually works?" That was then my first paper.

James: That was the breakthrough.

Romy: Yes.

James: It unlocked that actually you could get some usable information.

Romy: Exactly, so this was basically just to show, “Oh, the method works.” It’s very much just, we can’t take too many steps at a time. It’s still science. We still need to take baby steps. Then after the method was basically validated, we could go and ask more interesting questions about the brain.

James: That must have been a great feeling.

Romy: It’s also something... once this worked, we started realizing the potential of the approach also for other questions, and for other kind of scenarios. Then, with time, I think also the level of excitement grew, I would say.

James: Would you consider that a revised research framework? Is that what it was? It’s a way of researching differently than you might have thought?

Romy: Yes, that’s always how I put it. I always say we turned the normal experiment on its head, how we usually conduct experiments, that’s what’s been turned around. When I talk to colleagues in the field, I say it’s an additional toolkit we can use. It’s not replacing other methods, or yes, frameworks we had before. It’s just another toolset answering different questions.

James: Right. So then now you’ve got this new framework. You’re excited. You get this done. Then that’s the groundwork that led you to be able to create the framework or algorithm to do it, because that’s how you taught the algorithm to go through that complex process, in the brain?

Romy: Yes, this is always a combination of things. Maybe I should also explain how the loop works.

James: Yes, let’s do it.

Romy: The idea is that basically you’re exposing a human participant lying in the brain scanner to a certain cognitive test. Then, while the person is still lying there, we start to analyze the data, and basically feed this into this machine learning algorithm.

James: While they’re still conducting? Rather than in the past... okay, they did it. They’re gone. Now let’s look at the research.

Romy: Yes, so they’re still lying in there. Based on what we set is the target for this algorithm, which would be, for example, try to maximize brain activity in this network, it will then search through a large space of possibilities of different cognitive tests to try to find the one that is really engaging this brain network.

James: So changing the prompt for the person doing the test.

Romy: Yes, exactly. They're still lying in there, that's why we can also say it's a brain computer interface. The brain is basically...

James: Wow. It's looping back.

Romy: Yes, it's looping back. The task is being influenced by the brain activity of the subject. Then the subject's brain activity is influenced by the task.

James: So you're not only digging deeper than before, but you're doing it quicker?

Romy: We're doing it much quicker, much more efficient. Also, it had this really nice side effect, that we're, as an experimenter, we're not touching the data anymore. There has been this huge problem in our field, and also in other fields in science, where we started seeing that a lot of the seemingly well-established results failed to replicate.

James: Interesting.

Romy: This is due to experimenter biases when analyzing data.

James: Yes, so the heuristics and the biases that they have is how they've been processing this. Why do you think the algorithm doesn't have this? I mean, you had to give it heuristics, right? That was with some of the loop and the feedback the training were. But why do you feel it's not biased?

Romy: I would say it's less biased.

James: Less biased. Okay.

Romy: Yes. The algorithm, by nature, is taking certain prior... we're feeding in certain prior information and assumptions we have. But they're relatively unbiased, I would say. There could be bias, but it's certainly not as biased as other things in the field. But the way we go about, that we try to reduce bias, or human biases, in this case, that we, as an experimenter, we cannot reanalyze the data and keep sifting through the data until we get statistically meaningful results. The whole aim, unfortunately, in science and in academia with increasing pressure, is to get significant results that show something new about the brain. Then you can publish this in these really nice, high-impact journals, we call it, just scientific journals. People basically often start with a certain hypothesis they have. They start analyzing. Then, if the results doesn't come out as they want it to, they just keep looking at different areas.

James: Until they get what they want.

Romy: They use different analysis tools. We have to basically, with the AI, because it analyses in real time, we have to predefine exactly how it's going to process the data. So we're not saying you can use all these different brain networks, we're saying, "No, look at this brain network and use this kind of processing pipeline," but we can't basically hack results out of it.

James: So this is really remarkable. So could you say you're on the brink of a breakthrough in the way that research is getting done in these complex systems? Let alone just the brain, maybe there's organ systems, the other part of it. So this is some really refreshing work.

Romy: Yes. So we often say we hope that other disciplines are picking this up, just because we think it adds another way of doing experiments, like being still highly explorative in terms of what kind of cognitive tests or things you do to the human participant. But also being secured against these human biases we may have when looking at data. So it's kind of really like locking this processing pipeline.

James: This is really something. So then how did you end up making it? Did you partner with someone in the CS world or do you kind of do this yourself? Or how did you end up even getting the toolkit to go and make something like this?

Romy: Well, so we used an algorithm that has been described in the literature before, and I'm collaborating with statisticians and mathematicians who helped me with the implementations in a certain programming language that is useful for us. And then the part where we get the brain data in real time and do the pre-processing that's stuff I just programmed. And then also the tasks we program ourselves as well. And then we just put all these building blocks together.

James: You know, why this is interesting is there's a lot of pressure put on the data science world to find the answers. It is the inductive type, the scenarios, but they might not be the right ones looking for the answers.

Romy: That's true, yes.

James: Right? Whereas in your field here, you got data scientists maybe helping to get these things together, but you need your cognitive experience in what you've been trained in order to interpret and even guiding how the algorithm is made. It's a real partnership.

Romy: Yes, it is a real partnership. And cognitive neuroscience in general I would say is a huge multidisciplinary field. We have psychologists, cognitive scientists, computational scientists, mathematicians, statisticians, all working hand in hand because also our analysis tools themselves become ever more complex with the sheer data we have.

James: Right. So then in your studies you're looking at individuals?

Romy: Yes, I'm looking at individuals.

James: How do you then look at groups? How would you use this and extrapolate out to groups of like-minded people, maybe?

Romy: Yes, that's a really good question.

James: Because if I'm in the making a product, if I'm Mercedes Benz, I can't make it for one person. How could you use this technique to expand and look at groups?

Romy: So, there are different ways to go about it. One way in brain imaging would be to just look at the individual results we get and then basically collect them in a group result. But here we might actually miss out on important intra-individual differences. So it's also something we're interested in, as you said, maybe there's a group that is particularly good in performing this and this task. Maybe there's a group that is a particularly good in using this network to solve this task or so.

James: Right, but some people are gifted with language, other people are gifted with analytic, you know, everyone has their own gifts. You have to have determined what their baseline performances is. Is that what you mean? Group them like that?

Romy: Yes, or it could be that they also, they might be behaviorally the same, but they might use different strategies in the brain to solve. So that could be something quite interesting to look at because it then could be used for rehabilitation purposes or training purposes.

James: This a fascinating field because you can get faster in research and the less bias, so where you can go is significantly quicker.

Romy: Yes. That's the hope that we can just be more efficient for certain questions. It's not applicable to everything.

James: Where would you see your next challenge? Okay, you've got this now, you're making some progress. What's the next big challenge you're trying to solve with this?

Romy: Yes, so I think the next challenge is basically built around this whole framework. Basically, because I want to look at many different cognitive tests, I also basically want to understand what is all the research that has been done and shown what engages this brain network. So what I'm actually currently doing is that I'm trying to gather full text publications and then really use natural language processing tools to understand what has been associated with these brain networks in the

past. Look over the last 10 years, what experiments have we done, what cognitive tests have we used to trigger or probe this network? So this is very much like also another artificial intelligence problem, but it's completely outside of brain experiments. But this is going to inform my experiments later on.

James: Right. So it's just getting you smarter quicker before you do your background research, before you conduct a particular study, is what you were just saying?

Romy: Yes, so I basically want to look at big data and want to be as holistic in the way I'm looking at these networks beforehand and really gather all the prior knowledge we have about this brain network, and then I want to test us within an individual.

James: That's amazing. What's in your way?

Romy: I can tell you: publishers.

James: Really?

Romy: Yes, paywalls and that makes it really hard to get permissions to download automatically full texts. I mean this is something academics are quite frustrated with, how the whole publishing model works actually.

James: Because you can't get to their unstructured data is what you're saying?

Romy: Yes. I mean we, we as universities have contracts with different publishers and we have separate contracts with them, and some of them allow us to do text mining and data mining on full text publications, but others don't have any agreements on this. So I'm right now in the process of talking to them, trying to get special agreements.

James: To go and do that.

Romy: Yes. I mean, that's the idea. I know that others in the field also do this on more back roots. But the problem is that I think this is the way going forward, I do think we need to... the brain is utterly complex, so we do need to take everything we have, and we already have understood about the brain and put it to use. And it's really difficult as a single researcher to also just keep up with the sheer amount of publications in the field.

James: Right, which is why artificial intelligence, machine learning, is proving out in so many other industries to create an advantage. Because you can just do the just brute force kind of research work that would just take thousands of hours to do.

Romy: Exactly. Exactly. It's like impossible for a human to do in their lifetime what you could do with text mining or so, yes.

James: That is remarkable. So, you know, the basis of this podcast is really around human creativity and how it's being affected or enhanced or changed or made better. Whatever that context is. And with this automatic neuroscience that the scientists that you built kind of working as this assistant that you made, understanding this deductive reasoning and the spatial working of the memory function in the brain, do you think we're at a stage where we'd be able to understand the process of creativity and get deeper into what that might mean?

Romy: Yes. I think creativity itself is something I'm personally also really interested in. I'm a big fan of meditation for example, and I do think that often this kind of pulling yourself out of the current framework you have been in, or your current patterns of the brain, that can sometimes bring about these insights or these 'a-ha' moments. Like, oh, okay, I got like this perspective shift, suddenly. Everything looks, looks different in a way.

James: Because you calm the brain down.

Romy: Exactly. You basically go out of these routine habitual thinkings. You calm it, and then you gain this kind of bigger perspective on your work or so, or also in your life even. That in itself I would call, in a way, creativity, because it brings about these perspective shifts, these changes of thinking. So I do think actually that yes, looking at mindfulness training and neuroscience...

James: Using this AI neuroscientist to help you?

Romy: Yes. I mean, these are things that I'm still thinking about how I actually can bridge these two interests together. And I have ideas about this, but they're really vague. But I do think that it could help us to get a better understanding of what is actually creativity, and how can we... is creativity actually a concept that exists in itself and the brain? Or is it just maybe a more abstract concept that actually relates to many different other tasks? It could be also just something as mental flexibility. Maybe it's just about how fast you can switch between certain patterns in the brain are so.

James: Because creativity isn't necessarily just because I could paint.

Romy: No, no, not at all.

James: That's artistic, but doesn't even mean I created it. Maybe I looked at a bottle and painted it. Creativity is taking things that... pieces that may be exist and making something that didn't exist before?

Romy: Exactly. Yes.

James: So what parts of the brain... that's got to be an incredible challenge to see how every brain comes up with either creative people that seem to develop things all the time without any effort, and the others get roadblocked.

Romy: Yes, exactly. And we noted that certain networks in the brain are networks that talk the most to other networks, and they are really good in switching between them. And this is actually a network I'm personally also investigating now in my postdoctoral research, because it's a very important network, very much involved in high level cognition. So you could think that this is probably... and also network that often shows up in combination with the mindfulness training.

James: Right. It's very true. You know, that theory, I'm sure you're familiar with it, of the two different systems in the brain, right, based on that book *Thinking Fast*, *Thinking Slow* where you have this intuitive system and then you have these others second system where you have to think through your answer. That's got to play a part in creativity too, when you're trying to free your mind.

Romy: Yes, certainly. The whole concept of intuition is quite interesting, I would say. It's not that I would have a good grasp on it yet. It's a term we often use but don't really have a good understanding, to my knowledge, of how this is also represented in the brain or how... but there's more and more research coming out about how the brain also communicates with the stomach and with other organs, and how this kind of perception of your own bodily signals changes your perception or your cognition in general. So I think intuition probably taps into these kinds of things that there's a feeling associated with something, like some kind of maybe implicit knowledge. You can't verbalize it, yet it's there.

James: It must be an incredible thing to try to study. If you're just studying the second system where you have to reason on something, you could watch the brain activity and you could incite that by which you ask them to solve. But when you're trying to use this AI neuroscientists to analyze intuition, it's almost instantaneous. And how do you even begin to monitor and look at the brain activity when it comes to intuition?

Romy: From really using the approach I have been proposing, or I have been developing, you really need to define how does the pattern of intuition looks in the brain.

James: Yes, where in the parts of the brain is it excited.

Romy: And I think that's something we, for example, don't even really know yet. Because I think the whole concept of intuition isn't really broken down into pieces you can really study and probe yet.

James: But it sounds like the loop style opens up the door to do that. If you had to study intuition and then go and look at your research, the person's already gone. The subject's gone. But if you have this loop capability, you can probe this intuition probably quicker and with a great deal more penetrating accuracy.

Romy: Yes. And also I feel like intuition is something very interesting in terms of another kind of method that is emerging in the field... it's actually quite old, but I feel like now also neuroscientists are picking up on femininology, so they're trying to have a subject.

James: What is that?

Romy: So basically it's just like subjective reports about your own feelings. It's a subject describing, "I felt this and this, or I'm feeling this and this," and they give a verbal report, often. We say a first-hand experience. Bridging this gap between basically our third person perspective on brain activity and a first person perspective of a subject, explaining in detail what they just have experienced, so imagine somebody explains, "I'm having this intuition, and my intuition grows right now, and now I had this breakthrough or so," that you had reports of this, then you can see what actually happened in the moment when they were describing this.

James: While they're describing it?

Romy: Yes. That's something that I'm also personally fascinated with. Again, you can then use all kinds of machine learning algorithms or artificial intelligence technology to analyze these qualitative reports and try to map them to brain data.

James: Yes. That would go right along with creativity.

Romy: Yes.

James: Because many times, the artist can try to tell you what he was thinking, or other times he's like, No, it just came to me."

Romy: Exactly.

James: "I don't even know why. It's just I was in the shower and this is what I thought of." Then they go and they make this and research, so yes, it's a fascinating field, and the quicker you could get it, the more research you can do, the higher the odds you'll discover something.

Romy: Yes, yes. Cognitive neurons are a fascinating field, for sure.

James: Now, how do you see cognitive neuroscience where the individual focus... and then you've got fields like anthropology where you have a more broader look at a group. How do you see these two fields being related or is the research you're doing able to help one of the other fields like anthropology? Where do you see the sharing with this AI neuroscientist?

Romy: I'm super surprised you're bringing up anthropology, because it's a topic to my heart, I would say.

James: Really? Yes, mine too.

Romy: Yes. Okay.

James: Yes.

Romy: It's just like I met this really interesting neuroscientist. He was the director of the Maxx Planck Institute in Leipzig, and I met him again...

James: Where you're a fellow?

Romy: Yes, where I'm right now. He was a former president and invited to one of our meetings. Then I met him last week in Cambridge again. He's a neuroscientist, physicist and anthropologist.

James: Oh, my. That's incredible, because it's completely different sides of the brain, so to speak.

Romy: Yes. It's amazing. I talked with him about my research, how I'm interested in also understanding how really basically cognitive concepts are represented in the mind and I used the term 'cognitive taxonomy' for this. He's like, "Yes, I'm very interested in cognitive taxonomy in ontology as well, but coming from an anthropology point of view."

James: Correct.

Romy: So he says basically a concept such as the mind is very... it's a very western concept. For example, in Japan, they have five different words for mind. The same goes for words like intuition and creativity.

James: Right, or the Greek have four words for love. In English, we've got one. Right?

Romy: Yes. Exactly. So he says we need to understand... if we really want to get to the substrate of the brain and how processes are really computed in the brain, we really need to understand also that we are not just

completely biased in the way we term these processes and how they relate to each other.

James: Yes, I'm fascinated because when you look at the digital realm, the internet and these villages, these digital villages that are being created, it's really fascinating.

Romy: Yes, this is also... I had another friend studying digital anthropology, which I also think is fascinating.

James: Tell me more about that.

Romy: Honestly, I don't know much about it, but she's a fascinating person to talk to, so... but I think there's a whole new other culture emerging with the digital use and how data is being used, and that this creates a whole new culture in itself that can be studied using methods of anthropology. I think that's the direction it goes.

James: Yes, I think so. I think so. Then you see... because you wouldn't have expected, right, that cognitive science would be using an algorithm to help it, right? You wouldn't necessarily think of it that way. But then as you explain this, it's so logical. It really makes sense how you could group this research in real time and use this advantages of this computing power to run scenarios that just wouldn't be practical for a human to do.

Romy: Yes, exactly. Yes. But this is just something of course that comes with many, many different strings coming together. Again, it was I don't know... it was just the right context. We asked the right questions, we met the right people at the right time, and then suddenly something... this emerged, which is fascinating.

James: Now, when you're bringing your research or your results to your classic leaders, your classically trained in the sense... not that you're not classically trained, but I mean the classical thinkers in neuroscience, cognitive science. Do they rebuff you and they think this really isn't going work and they doubt it? Or are they quick to accept it? How are you finding the feedback for this?

Romy: It has been super positive. I was really afraid of this.

James: Yes?

Romy: It's always once you have... you propose something new. Of course, then I sometimes wonder if artists feel this. They expose something to the world which came out of them or out of a teamwork, in our case, but then I feel a lot of them, they were really positive. Once they got it, they were like, "That's the thing you have to do. That's the right

approach." So that's why I think I also got this post-doc fellowship, and I also connected with leaders in the field in Cambridge and Stanford. These are very much professors that are very known in our field. Then backing me shows that they also think it's a good way to go forward.

James: There's a new frontier here?

Romy: Yes. Yes.

James: That is... and you're getting good support where you're currently working or doing your research? Is it in a commercial environment? Is it an academic environment?

Romy: No, it's a purely academic environment. So right now I'm based in Leipzig at the Maxx Plank Institute. It's a purely academic environment.

James: Like a think tank type of thing? They sponsor the research?

Romy: Yes. My research is sponsored via my fellowship, which is going through Cambridge University, but the nice thing with this fellowship is they really want you to go out, explore different labs, expose yourself to different mindsets. So in Leipzig, this is just a purely research-focused lab, basically. Or an institute. We have no teaching obligations there, so it's just purely research focused.

James: Now, what I wonder when you're talking about this... it's coming to my mind, so I'm just going to throw this out there. So do you tell the candidate that's being researched that there's going to be an algorithm monitoring it, or do you tell them it's just a typical research?

Romy: Often I try not to bias them. So sometimes yes, I think I say out of ethical reasons, I say we are looking at your brain activity in real time. But I don't say that it influences the kind of cognitive tests they get. So that's something I only tell them after.

James: Yes. How do you think it would change their behavior? Why do you choose to... you said not bias them? How would it bias them?

Romy: I think some people just would start overthinking once they see, "Oh, I have to do again this test? Am I not good enough?"

James: Ah, okay. Right.

Romy: I had some people, because at some point, maybe you understand that it's not a random set of tasks you're getting. Especially towards the end when the algorithm identified which is the best one for engaging this network, it starts showing it over and over again. So people come out. "Do you think I wasn't good enough? Why did I get always this task?"

James: Right. So in the cognitive studies that you're doing, or anyone might be doing, then how you prep the people who are participating is enormously important?

Romy: Yes. Yes.

James: Now, have you tried with the algorithm to say okay, these people have been told, and these people haven't been told, to see if it does something different?

Romy: No, I haven't done that yet. I think that would be interesting.

James: It would be interesting, right? If you warn it. Say be careful about doing it two times in a row, or something to educate it for that type of situation. I'm curious to see the result because sometimes people, when they know they're being observed... I guess that's definitely a tenet in anthropology, right, is blending in? Because that scientist has to blend in to that community, otherwise they behave differently. Like Foucault's theory, how people behave differently when they're being monitored. So I guess that's similar in your field. You have to really understand how you're going to set their mind?

Romy: Oh, certainly. I think also this is just in general for every experiment, I guess. That's something we need to be really careful about. Are these settings actually valid? Are we going to really observe the same brain activity if we would just study them outside of the lab, doing just natural things and not being in this super artificial environment?

James: Yes. That's going to really be interesting.

Romy: Yes. Even just lying in a dark scanner with a buzzing sound in the background doesn't seem like very natural.

James: It must affect us. It must affect us, for sure. Wow. So obviously, one of your wishes would be better access to data?

Romy: Yes.

James: So you can prep? That's definitely a wish?

Romy: That's definitely a wish.

James: What's another you wish you had so you could further your research?

Romy: I really am super happy with, for example, these massive online courses out there. I have to say, even as a post-doc, I'm still doing... I just teach myself new methods. I'm really trying to learn more about deep learning algorithms, so it's super cool that these courses are out there.

James: Right, that you can learn.

Romy: That you can learn, and that they are sometimes even for free, which is even better.

James: Yes, that's incredible.

Romy: Yes. I think one thing is just always funding. These human brain imaging studies are so expensive, so you need... and often in academia, one problem is that you have maybe a few years for your research, but then... for example, I probably after three years, I need to think again where am I going to apply next? How do I further my research? I need to apply for big grants to get my own research programs together to start building a group.

James: Because once you've published, then you have to start again on something else, I guess? Or further that nuance that published?

Romy: Yes, and you really need to show that you are thinking long term, which I love to do. It just takes away so much time to keep applying for grants.

James: Wow.

Romy: So I think easier and more trustful access to money, in a way, would be...

James: Yes, that's always true. Definitely. So then this is really fascinating. I could keep going. It's really interesting. I want to congratulate you on hearing how you see something and you're young and you went out there and you pushed and you didn't even let a setback stop you. You figured it out and you kept going. You must feel really good about that?

Romy: Yes. I often think when you're in it, you're just in it. But then after, of course, when I had my PhD defense and talking to my supervisor, I was like, "Wow, this turned out really well, didn't it?" It was just such a lucky coincidence because I didn't even know my supervisor before. I did quite a courageous thing in a way, but I was naïve. I never met him before, and we just...

James: It was probably better you were naïve. You went ahead and did it. You're less intimidated.

Romy: Yes, exactly. Yes. But all my students, I would tell now, meet your supervisor. It's so important that you get along and that the personal relationship is right. But I was just really, really lucky on many levels.

James: That's great.

Romy: I think luck always is also one of the factors also in academia.

James: That's so true. I'll tell you, we're going to pay close attention to your work. I really am eager to see it move into creativity, and understand creativity and how the different aspects of creativity... you already see some algorithms being used to write novels, to paint paintings, sculpture... so that you see these things happening. Really fascinating to see the parity in how it's thinking versus how humans think and improving the creative algorithms that are getting thought of.

Romy: Yes. That would be fascinating, and it's definitely probably something that is... yes. People and also including me are going to work on over the next few years. Yes.

James: Yes. That's great. Well, if you had one thing to tell the audience about your work or what's really passion about, what do you think you might send out there to everybody?

Romy: Really keep broadening your horizon and read other disciplines' work. I feel that's something that just how certain concepts in physics and anthropology, how all this can actually fuel your own creativity, I think, is enormous. That keeps me so excited. Also trying to find how everything is connected somehow.

James: That's great. Staying intellectually curious?

Romy: Yes. Staying intellectually curious, for me at least, keeps me going.

James: I love that. I say that all the time.

Romy: Yes.

James: I really... enriching yourself. That's fantastic.

Romy: Exactly, yes.

James: That is great. Well, we again... we thank you for being here. To find out more about this podcast, please visit our website at CreativeIntelligence.fm and follow us on Twitter at the CQ podcast. To find out more about Romy, please visit her website at romylorenz.com and follow her on Twitter at @Romy_Lorenz. You've been listening to the Creative Intelligence podcast, and thank you for joining me, James Ingram, and my guest, Romy Lorenz, for what's been a stimulating and informative session. Thank you very much.