Anna Talvi

Designer and Researcher

Microgravity wear. Antagonist Exo.Muscle suit. Courtsey of Anna Talvi

Lee Anderson (LA) *One of the things you said about your work was that you're "developing an optimal set of garments for prolonged stay in microgravity environments. This set is engineered to help keep the astronauts' and future space travelers' bodies fit and healthy when living in space stations and habitats." Can you speak to your background, in the context of this work, how you arrived here and how did you get to this question of designing for weightlessness?*

Anna Talvi (AT) This project you just described was the final project of my MA work. My PhD research is an extension of that, a smaller and more specific part. How I arrived at the MA project? - I was studying at the RCA and looking for a challenging project where I could utilize a rather strange combination of skills I've developed over the years. And, I got quite excited when I found this topic for two reasons: a) I was very surprised how little has been done for it through human-centered design and utilizing methods from advanced performance-wear. And b) I found that through the kinds of experiences I've had and my previous studies until that point, I could really benefit this research.

I come from a science background. I studied mathematics and physics before, my parents are biologists and my brother is a medical doctor. So, I grew up in quite an academic mindset. But also I did equestrian sports for all my youth. So, when I competed I was always thinking in terms of bodies pushed to their limits, both human body as well as the body of the horse. And what you wear and how much the small details aid the performance makes a big difference. So that definitely had a strong influence.

I was working together with sports doctors and physios and really trying to understand the anatomy on a very practical level, in a logical way. So that's one side of it. And then the other side of it is, I've always had a very creative, questioning mind. And I've always loved prototyping and making things.

And, I think because of equestrian sports, I've been fascinated by what you wear and the huge influence it has on people on so many levels. On the levels that you consciously realize, as well as some that you don't think about. But, if you think of

very technical wear, or even of your favorite t-shirt, you only realize how much it supports you once you don't have it.

I think for me it was a combination of those very opposite views on one thing. A bit like, I don't know if you read, Nicholas de Monchaux's Fashioning Apollo? There, it's very evident how the human side and craft-based approach, in the beginning, clashed with the highly technical systems engineering culture of NASA. The women who made the Apollo A7L spacesuits, were originally making women's bras and underwear.

I think this was just so fascinating and complex how this very scientific, evidence-based research, whether it's material science, human physiology et cetera, was suddenly next to the very practical, tactile aspects, which often times root from tacit knowledge, which comes from the experiences

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what we wear, design, fashion, these kind of things. What made it work was finding the common link, the interwoven part of it.

LA *I wonder if your background in math and physics helps you speak the language that you needed when you were approaching the prototyping and design? It seems like that's a whole other set of skills, but that it might have given you a leg up or helped you approach it in some way.*

AT Oh, totally. Because, especially in the beginning of the research, I approached many research teams in the field and when you say that you come from RCA, which is an art and design school, it's not taken seriously. I won't name any names but one of the first things someone in the field told me was: "Hi. I never talk to art people." So, all you can do is say, okay, let's sit down, I'll explain and show you what I do.

"The thinking and ideas might be very similar, but it's often very difficult for people from different fields to communicate those ideas."

The language you use is definitely very different whether I speak to biomedical engineers or materials scientists, or when I speak to someone who helps me to develop the design or manufacturing side. It's very, very helpful that I can meddle in between those two. It's also quite frustrating and rather tricky at times. Language and the kinds words you use make a huge difference.

Especially in the recent, maybe 5-10 years, there is more interest and will to combine design thinking with these very technical specialities. But I think often what makes it difficult is how you communicate things. The thinking and ideas might be very similar, but it's often very difficult for people from different fields to communicate those ideas. The scientific norms are very narrow and the creative norms are very, wide and intuitive. Without the experience in both in my previous education, I definitely couldn't do it.

LA *Yeah, it makes me picture this kind of spectrum where, depending on the conversation you're having, you switch like your artist's brain and your science brain and you sort of gage where to meet them.*

AT Yeah, exactly. But then I still think it's a lot to do with language, because mathematics and biomedical engineering, they are actually—they can be—highly creative things. And, you know, Einstein was highly creative.

And, if you think about Max Tegmark, and the people in AI, they are very imaginative and creative people. It's just down to language and your training, the methods of how you express yourself, what makes the difference and what labels you a computer scientist or a fashion designer and what labels if you have an artist´s or a science brain. But essentially it is the same brain.

LA *I was thinking about the outcome as well. And that maybe when someone says "I don't talk to artists,"*

they're thinking of the intention of the artist's work versus the intention of a scientist's work, and about that end application. Something that I've read from your work is about human-centered design and design thinking, and trying to bring that in at the beginning of the process.

AT Well, I think often times, it's horrible to say, but mostly things come down to funding. How science works, everything comes down to funding. There is a rigid structure and funding means you have to make things step-by-step, clearly and efficiently. If you think about a rocket, you can divide it into parts, and then there is a specialist in every part who can estimate how much developing it costs. Of course, there's a lot of unknowns and difficulties, but you must map those things out. And the funding bodies and institutional hierarchies oversee things.

When it comes to the very human side of problems, predominantly what artists and designers work with, there is so much you don't know and cannot predict. It's a big mess. Even if you put methodology and theory behind design, it's still okay to have this cloud of thought and not a step by step plan ahead of time. And I think this is where those two approaches oftentimes clash. So, I try to kind of bring the little bits of acceptance to those unknowns.

Take space medicine, for example: there is so much we don't know about the human body, let alone the human mind, here on Earth. So, obviously, we know way less about what happens to us in zero gravity.

And there is even less, almost nothing we know for sure, about what happens in partial gravity—one sixth on the moon, one third on Mars. And I just try to bring in the acceptance of, "Okay, these are the unknowns of this problem," and we cannot plan everything out; but we have to test it. We have to prototype and test it on human bodies, see what works and what doesn't, and what comes out of it. So I cannot often design an experiment ahead of time. I do the experiment and then afterwards reflect and see what's worked and what we continue on with.

So I think, in some ways, I bring these unplanned unknowns into the scientific part. In design, oftentimes, we don't appreciate enough the value of prototyping and working with humans and their instincts and responses. The science side helps me analyze and understand the creative process more. And put a bit more structure, reason and methodology behind it. And on the other hand, I try to explain the science side a bit more like the creative and the prototyping side.

"I think it is very important to create systems which support psychology and incorporate human-centered design right from the start..."

I have to prototype in order to think. I have to see it, I have to feel it, I have to test it on the bodies. I have to see it on 2D and to see it in 3D models, I have to see it physically and virtually, all these kind of things. So yeah, I think this goes both ways.

LA *For your MA work that was in the Moving to Mars exhibit, you made this suit that was really meant to help support the physiology of the body. And then there was the thought, well, what about the mind and the fact that these two things really work together. How can we expect people to survive and thrive in a new environment if they don't have the mental security or sense of self that they did when they left Earth? Can you speak to how that came about? And I do see that as kind of an exploratory artistic expression, where you're just suggesting: we need to think about this, and here's one way that we could. Did I interpret that right?*

AT Oh, totally. I think this is very much related to the last question as well, how do we incorporate human-centered design. How do we do we incorporate it right from the start and not attach it somewhere in the end? So this has to do with a lot of the development process and prototyping, as I said.

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In engineering, you often start with theory and then you plan the experiment, and then you do the experiment and so on. And mostly you test the experiment so it can be repeated, in a controlled environment. But like this, you also cancel out a lot of the unknowns and possible outcomes. Whereas in design and creative practice, we embrace it.

The human mind is very hard to predict. And I think it is very important to create systems which support psychology and incorporate human-centered design right from the start of the development of everything around you. For example, how the space station is designed, it's important to incorporate architects, designers, lighting designers, anthropologists et cetera, and not only engineers, from the start. All the small details, even if it is the warmth of the light, has a big influence on the human psyche.

And, obviously, what you wear. This is why the suit that walked on the moon was made by a company that originally was making women's bras and girdles. There were other options, for example the hard-shell, very sci-fi looking Litton Industries suits and Hamilton Sundstrand suits, but they were made by engineers. They didn't perform as well with the astronaut's body and they couldn't really move well in them. And if it fights with the human body and is not layered, tailored and fashioned to work with the body, but is like a separate thing around you, history shows these things don't really work.

Many of the psychological things are unconscious. I always like to talk about the monkey brain, the limbic system. The cortex which is the analytical and logical part of the brain is like, "okay, I need to do this task. I'm going to go work out, that's good for me." But the limbic system, the primal monkey brain is the one that, for example, in the case of an accident, makes you behave in ways you would have never imagined. It's responsible for the very core of how you behave and for the things you don't know why you do. It controls memory and emotion, but it's also where your olfactory smell-center is located. So out of all human senses, smell is the one that's most related to long-term memory and emotion.

That's why I did a project called X-Earth. The idea is that you can take a few Earth memory smellscapes with you when you go to space. It can be the smell of your spouse or your child, or the seaside. I worked with IFF [International Flavors & Fragrances] for it.

Sometimes you remember things immediately just because you smelled something. It's very intuitive and you can't really control it. But in many cases, for big decisions and how we go about in life and in the world, our rationale is not fully in control of it. So I think we need to acknowledge it and use this to our advantage. And this is much what art and design is about.

You always hear astronauts say that they miss odd things like how running water feels and different smells. Remote science labs, like the International Space Station or the base in Antarctica, both which you go to for many months without the option to come back when you want, have a very sterile look. They basically live in lab settings.
The Antarctic researchers, for example, took apart the wooden fruit boxes from a supply shipment and

covered the blank walls. They said it felt so much more human. It's difficult to explain, but especially in these situations you want to be surrounded by things familiar and human.

LA *It makes me think of the things that we will learn once we get going to these places that you just can't anticipate. What ways do you think this research might benefit us on Earth as well?*

AT I get asked that a lot. "Anna, seriously, what are you doing? You have brains. We have so many problems here on Earth. Why are you not working on any of those? We don't really need to go to Mars. Calm down, woman." (laughing) But I don't think anything that's developed for space gets funding, unless it has direct Earthly applications.

Microgravity wear, X-Earth gloves. Courtsey of Anna Talvi

Think about satellites and communications, or biomedical research and space medicine, including what I work on. The bone and muscle loss is very similar to what happens to elderly people, or people in bed rest, on Earth. A lot of medical data is gathered and science experiments, such as 3D printing human organs, is done in zero-gravity. The benefits of having the ISS, and all the science we get from it, is just invaluable.

Also, the human body and mind is so adaptable. If you think about physiology in microgravity, you get substantial bone and muscle loss. But, if you stay in zero-gravity, that's probably not such a big problem. Your body just adapts to it. The problem is that you want to come back to Earth, which has gravity. And that's where your bones would break. So I think, through stretching our mind to think what we need and how we design things for space, it really forces us to understand ourselves here on Earth.

Designing for space is also a very good exercise of sustainable design for Earth. Because if you think about space travel, you have a very limited amount of things you can take with you. And these few things need to support everything you need. The supply is so limited, it's the ultimate sustainability challenge. And, probably one of the biggest issues we have here on Earth right now. It's so beneficial in so many ways.

I think one of the biggest advantages of going to space is that it helps us to understand ourselves on Earth. You have to force yourself to understand the changes that will happen and what you have to prepare for, and think ahead. And it really gives you a very good perspective of our lives on Earth. And I think that's a very valuable thing.

LA *You mentioned a little bit about commercialization. And I wondered if you think about the prospect of marketing in space, or the merchandising of products? And since you make products that would end up there, eventually, Is that at all in your mind? Or are you purely thinking of this as a way to serve the scientific community?*

AT Well, firstly, I really lack the artist gene, wanting to show my work to people. I'm pretty bad at it, just check out my Instagram (laughing). I know I want my work to be used and I want them to make astronauts' lives better. I want them to make life on Earth better. But my motivation has never been driven by commercial interests.

Done in the right way, however, I think it's important. Whether people like or not, things like space tourism and suborbital flights are important. Is it really going to space? No, but there are people who have the possibility to pay a lot of money for it, and that money hopefully circles back into other developments for space. If that results in more public

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interest and funding, and enables us to develop better reusable rockets to get us to Mars quicker and back to the Moon, I guess commercialization is necessary at times.

I support it, because it supports the longer term aim. Commercial spaceflight is already happening. Going back to the Moon is happening in a few years. I think that looks pretty good. And Mars is a bit of a leap, but I'm still very positive about that, too.

LA *For the timeline of your own work, within all of that, what do you think is possible? If we return in 2024 to the moon, are we testing your semi-gravity suit?*

AT My PhD focus is on musculoskeletal conditioning: how to keep your body in good physiological condition when spending longer durations in microgravity. And that's for long-term flight, like living at the ISS or going to Mars.

My goal is to have the suit prototype fully developed and tested in three and a half years. It's a long, complex process and you never know the problems or obstacles that come up. But right now it's going well! So I'm positive, and I think about the final outcome perhaps less than I should. Because the more valuable outcome is the research and the process, rather than this final suit.

LA *I wanted to talk to you about your process, actually. And you have said, we've been released from gravity, so why shouldn't we also release ourselves from static block patterns? And I wanted to know, from putting on your designer hat, how you approach that three-dimensional design around the body, thinking more of it as what we can't see beneath the layers of skin?*

AT Well, I think that comes from two things. When competing as an equestrian athlete, you wear a tailored riding jacket. It's a very interesting thing. When you buy clothes from the high street they are rather 2D. So you can put the garment flat and you see the block pattern right there.

I got my training in how garments are made from a men's tailor in London. In bespoke tailoring, it´s all about what goes in between the layers: how you mold it, how you mold it to the body. But, I am always on the move. I studied physics and did sports. So you are never still; you're always moving. There is no "right" 3D form. You can tailor the most gorgeous tailored suit for a standing body, but then when you move the clothes don't really fully adapt to it. So in my mind garments shouldn't only be just 3D, but actually 4D.

It bothered me so much but I didn't know how and what to do with it. So, at first, I started draping on moving bodies and ended up with these weird, swirling patterns and swirling seams. But every time someone tried the things on, they were like, "Oh, this feels different." They don't just rest on your shoulders when you're still, but it really kind of wraps your entire body. And now, from that, I'm trying to develop a 4D approach to garments, so instead of grain lines you have vectors, so you see the body as a map of strains.

I guess it developed naturally. My tailor was very surprised of how I knew, without ever being taught, to make the lining bigger than the shell of the garment. But I just remembered the riding jacket always being restrictive and the lining ripping at the armholes. So it's just probably my frustration with restrictive things: always being active, and always having a bad posture (laughing) and always having clothes that are pulling. Developing computational 3D and 4D methods to solve these issues is one of the things I'm most excited about.

LA *It's awesome. And that's for sure another thing that would benefit people everywhere, on Earth, on Mars. It's like, it's really a direction you can see fashion moving in a more permanent way.*

AT In so many ways. Even if you think about waste - how wasteful it is to cut out things from flat sheets. And I've never seen a flat person in my life. And I don't think I will (laughing).

LINKS
Anna Talvi