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Lee Anderson (LA) *Regarding your book 'Spacewear: Weightlessness and the Final Frontier of Fashion,' I would love to know, as a starting point, how you came to this research?*

Barbara Brownie (BB) More broadly, my research is about the relationship between clothes and the body. And I think this very much is in that same sphere. The reason this came about in particular is when I started research for my next book, on science fiction fashion, I realized fairly quickly this isn't science fiction anymore.

There is scope to look at space fashion, not in the realm of science fiction, but as reality, or at least as speculative design. So it turned from science fiction into a book about space fashion, or clothes for space.

LA *I love the historical context that you give in the book, including some of the differences between the more emotive or evocative designs versus things that are much more practical and functional. Could you speak to that in relation to the spacewear book or clothes and the body in general?*

BB Again, this relates to the transition from sci-fi to reality. During the last Space Age, space travel was becoming a reality but not for most people. Commercial space travel was still science fiction, and people were anticipating it sooner than it actually happened. But it meant that people

aspired to space travel in a more distant way than now.

What was achievable for most people was the space age aesthetic rather than actual space travel. Whereas now we're getting to a point where people can actually purchase a trip to space. Even though it is out of reach for most people, there's still a possibility of doing things like going on a zero gravity flight, which is a lot more affordable.

More people are able to experience the reality of the weightless environment. And it means that there has to be a shift away from just thinking about the aesthetics and the style and signifying space travel, towards the reality of designing for space. And that's true not just for fashion, but also for all sorts of other design as well.

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Once you think about having to relocate all of the objects that we interact with on an everyday basis into the zero-gravity environment, everything has to be redesigned not to look sleek and space-agey,

but actually to function in that microgravity environment.

LA *Sci-fi is a compelling "in" for talking about some of these things because people get excited by the visuals and the movies that have come out, and it's a genre in and of itself. For fashion, however, sci-fi isn't an industry, but what you're describing is an industry that will become.*

BB I think that spacewear will necessarily become equivalent to leisurewear or activewear. And it has to be located apart from all those other fields and fashion because it has distinct concerns that aren't applicable everywhere else. Having to design for the weightless environment means that those fashion designers are going to have to think about things that other

people don't; they will have to be trained differently, will have to be aware of different things. A different set of baseline ideals and approaches will need to characterize that field of fashion.



LA *You write about current fashion design for specific groups of people maybe or for specific purposes that might take on new meaning, or find new applications in spacewear and give some great examples of whether you could speak to this and what you uncovered in the research.*

BB Interestingly, some of the learning that has taken place in other areas is transferable. For example, dress-making for people in wheelchairs or for snowboarders, or anybody whose body is in that seated position. Tailoring for that seated position, as opposed to an upright, anatomical position, is something that exists in other fields that we can learn from and transfer into this new environment.

I've looked at underwater photography in the book as well. Thinking not just about the manufacture and the design of clothes, but also how we depict clothes and how we understand the way that they drape over the body. That's again, something we can learn about from elsewhere.

LA *You describe the dress form as almost a constraint right now because it means you're, by design, creating something for gravity.*

BB Constraint is sometimes a good thing, sometimes a bad thing. You talk about how gravity has constrained us and we can be liberated from that space. But if you're too liberated, it's really difficult to keep control of things. Sewing on the space station is a really good example of that.

You then have to start introducing artificial constraints in order to take some of that control back. Where you've got an environment in which

drapes just doesn't happen and fabric can billow out everywhere, you do need to start adding those constraints in the form of elasticity,

things like that. But then, those rules are going to be probably relaxed, the more we get used to space travel. I also think if you're going to have, say,



Reduced Gravity Walking Simulator, Langley Research Center. NASA, December 11, 1963

bits of tethering, or close fitting parts of the garment, just to take some of that control back.

LA *Thinking about design for work on the space station versus someone who might be going for leisure and wanting to make a statement like that, there might still be some rules around an appropriate amount of expansive fashion choices.*

BB And there are rules at the moment. If you look at any of the companies who do zero-gravity flights, they have strict rules about not having clothes that float up in front of your eyes and

a music video shot in space, it's likely that they'll throw some of those constraints out the window.

Initially, it's not just going to be about fashion for space tourists, but also how the creative industries have opportunities to engage with space.

Costume is something that we need to think about: how the creative industries will begin to exploit the weightless environment, either for practical purposes to film something that authentically looks like it is in space, science fiction and so on, or for more ethereal

purposes to make something look a little bit otherworldly, and use that weightlessness to make things look floaty and beautiful.

In those cases, you have a range of different criteria for the costumes, but one of the key criteria is going to be that those clothes visibly evidence weightlessness. Otherwise, what's the point in spending all that money going up to space to film the film or the music video. If you're paying all that money to be in a weightless environment, you need clothes that are going to showcase that fact.

To respond to weightlessness in some way means that they're going to be a little bit baggy, or have a little bit of drape. It can't be too form fitting because, otherwise, you have almost no point in going up to film in space in the first place.

LA *Now I'm thinking back at all of these films, even across the worlds of Star Wars, for example, there's nowhere gravity is manipulated or questioned at all. Everyone is walking as we do.*

BB Because it's too difficult. It is so difficult to replicate, and so expensive, that we've ignored it. We haven't engaged with it until recently. I watched an interesting interview with Anne Hathaway who said, in *Interstellar* they were taught to look like they were floating by just standing on one leg and raising their arms out to the side. It was part of the choreography. They were trained to always move like that (laughing), while they're talking and delivering their lines.

So they're beginning to think about it but in a really low-tech way. And with Tom Cruise's film, we're going

to start to see more of a shift towards footage that actually is filmed up there. The more we see footage from the International Space Station Online for example, the more we will be able to recognize the difference between the authentic and the artificial.

In the same way we can spot bad CGI that we didn't notice 10 years ago, the general population of cinema goers and TV watchers will have a better sense of how things react to weightlessness just through exposure to more footage that's actually filmed in space. And then we'll get to a point where we can really tell when something isn't actually filmed in space.

To achieve that level of authenticity, they'll have to actually start sending people up there and filming in either zero-g flights or up on the space station.

LA *Makes me wonder if this is why Sandra Bullock's hair in Gravity was cut so short (laughing).*

BB A lot of the women in these Films and TV shows have the hair cut short. And I think it's just a way of avoiding that problem (laughing).

LA *The idea of tech came up, and you write about some ways that really low-tech elements of fashion design are going to have an impact and a place here. It's not all about technology.*

BB Yes, I think that's one of the key things that we need to realize—the fashion industry, and all design

industries—when they are looking at a possible future in space.

There has been a tendency to think about all of space as high-tech, and that design for space is going to be about wearable technology, textile technology and these big developments in engineering. And actually, gravity is basic physics.

Engaging with lack of gravity with weightlessness doesn't require anything high-tech if you're looking at something that is quite fundamental to the difference between Earth and Space. All of the history of design has been informed by the fact that we live

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in this Earth-gravity environment. It is one of those key baseline features that we take for granted.

And that's not because we didn't have technology in the past. Whenever we move forward into the future, we tend to think of it as high-tech. We need to be careful about falling into the trap of assuming that future equals high-tech.

LA *Keeping an open mind to almost accidental discoveries could also be a part of that.*

BB There will have to be accidental discoveries. A lot of it is going to be experimentation and trial and error; send something up into space to see what happens.

Our technology, 3D animations and simulation software are not



accurate enough to predict the consequences of microgravity on things like different kinds of cloth. There is software that has physics engines in it that you can adjust to zero gravity. And there's other software that works to simulate drape where you can put in different features or different fabrics and it will change the drape a little bit. But none of those have been combined together in a successful way, yet.

I think we're still at the stage of not yet having had enough experiences—or enough measurement—of the effects of weightlessness on cloth. And so one of the things that I'm working on now is this very low-tech way of measuring the effects and quantifying the effects of weightlessness on fabric.

I've been developing a registration grid that you can just print on fabric, and then you can send it up into a zero gravity environment and map what happens to all the different coordinates, so you can then use that to compare it to a simulation that you've done on the computer and see how accurate that computer simulation is, and feed the data back into it again.

So I think that is a key question: how do we quantify and measure the effects of weightlessness in order to be able to more accurately simulate it. Otherwise, there is always going to be a certain amount of the unknown. And designers who are working for space without being in space will only be able to guess at what's going to happen to the clothes without those effective means of predicting.

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LA What impact do you think it could have, if we could start to pre-explore, or understand fabrics better.

BB It'll make everything much more accessible. So it could potentially help the industry to expand. As soon as you've got tools to do this kind of thing without actually physically going up in space, the whole thing just becomes that much more accessible. And it allows people to experiment and tweak without having yet another trip to space.

If you are too reliant on actually testing in zero gravity, you can't afford to look at the consequences of one minor adjustment. Whereas, if you could accurately simulate it, you could just tweak a little seam here and there and you could perfect things at a very detailed level. You can't afford to have that attention to detail if you can only afford one or two trips up in zero gravity flights.

So, it will open it up to wider audiences, but also potentially change the design process and allow people to look more closely at individual features of the garments that they're designing.

LA You write about some other scientific fields that are involved, outside of technology. For example, you touched on ergonomics and physiology. Could you speak to that a little bit and the other ways that

science and fashion come together?

BB One of the interesting things that I've discovered is that there are a lot of relationships between the sciences and fashion or textiles, other than physics. For example, there's a lot of experiments

with chemistry, with engineers and getting batteries in fabric and things like that. And then there's a field of research that brings biologists and textile designers together making fabrics from living materials and things that are reabsorbed in the atmosphere et cetera.

There are many experiments going on, and yet, the relationship between physics and fashion seems to have been neglected.

LA Since reading your book I've been thinking a lot about choreography in space.

BB If you look at interviews with anybody who is trained to think not scientifically but more poetically—the philosophers the authors, choreographers—who have experienced weightlessness, they have all said that it does change the way that they think about their relationship with Earth and their own bodies in their space, not only on our planet, but in relation to everything.

I think that's one significant thing we will see as people start to experience weightlessness and space travel more. You will see people revisiting the fundamental assumptions or feelings that they have about themselves and their relationship to their environment. That will have a



Candid view of Mission Specialist Ellen Ochoa, in the aft flight deck, playing a flute. NASA, April 17, 1993

knock-on effect, and it won't be as obvious as people painting pictures of moons. It'll be much more diverse than that because, if you take a choreographer as an example, it might change the way that they think about the relationship between the foot and the ground that the foot is pushing off on.

Those little things that don't necessarily remind us of space, but just open our eyes to new possibilities and new ways of looking at things.

LA *In dance, with the floor and the foot, there is a force that goes into that movement. But then with garments, there's tension and drape in certain places here that would not be even an issue or relevant in microgravity.*

BB In a weightless environment, it's more about tensegrity than about gravity pulling things towards surfaces. So you have to think about the tension between one part and another part of the same object, not the relationship of that object to

the ground or to a surface. It forces us to think of objects as contained things rather than things that have a relationship with the surface.

LA *Like my shirt on my shoulders, my shoulders being the surface that it sits on, that relationship goes away in zero gravity.*

BB It's a separate entity, or a separate object to your body. Your body happens to be inside it, but the shirt has its own behavior that is dictated by its own structure, not by the structure of your body within it.

LA *So how could this change the way fashion designers think about designing products for people on earth or any environment?*

BB One of the key things is thinking about garments from different angles. We are so used to the silhouette, and looking at things from the front in silhouette form. And as soon as you have a body that's floating around and not standing upright, you start to encounter these other parts of the garment, like shoulder seams, that we just don't think about except as a novelty.

Every so often you might think about having a fun design on the bottom of your shoe, knowing that not many people are going to see it. But if we start to think a bit more about what garments look like from other angles, that might transform the way that we approach fashion. And that's a necessity if you're designing for weightlessness, because you won't see a person in garments from the front.

LA *Now I'm thinking of images from the space station of astronauts moving around. And you very rarely*



"If we're designing for space, it's not about technology all the time, but it is about weightlessness as a principal concern."

have that front view, except during their press conferences.

BB And that's actually interesting in itself, because, if you look at posed photos, or as you say press conferences, they try really hard to imitate the Earth environment. And that makes sense, because we've established this culture of presenting yourself to the camera in an upright way.

And so you can see them trying to control their bodies, to minimize the effects of weightlessness, while they're doing the press conference. There's an artificiality about the pose that dissolves as soon as the camera goes, and you see candid videos of every day activities in the space station.

LA *That's a really interesting transition to wait for, is when we stop trying to mold things, experiences, representations, and objects for space based on our understanding of how things are on Earth, and how that might impact the way we think about things here, because by nature, you have to unlearn to a certain degree.*

BB And the culture of interaction with those objects as well. Putting yourself in front of the camera in an upright position is one example of that. But we interact with objects in a way that is not only a result of the shape of the object, but also because of various other cultural reasons.

And maybe some of that culture around objects and their use needs

to change as well in a weightless environment, because those things will suddenly take more effort.

There is a culture of drinking from a cup on earth that has informed the designs of cups for space. All sorts of people have been working on trying to replicate drinking from a cup, creating zero-gravity cocktail glasses and coffee cups. And the question I think that needs to be asking is, why? Why are we replicating that aspect of drinking?

The act of drinking itself works just as well through a straw and a bag as through a cup, so why do so many people have this fascination with redesigning the cup for space? And it's got to be something more than just practicality. There is a social or cultural aspect to it.

LA *I was thinking, during the crewed Dragon launch this summer, about the young family members of astronauts in particular, and that it must be comforting to see them on the ISS in a polo and shorts, because it looks like they're just next door. And if that were to change it might feel more alien, like they're further away.*

BB That balance is an interesting one. Because you're right, something that is too alien and unfamiliar is intimidating and potentially quite frightening. So we try to introduce

familiar things to that environment. But also, we are fascinated more by familiar things made strange than by things that are completely strange.

I think we are more interested in the coffee cup that works in space than we are in drinking from a straw in a bag, because it really exposes the strangeness of trying to drink in microgravity environments.

That is also one reason why it's interesting to see, say, a polo shirt in space: because it is familiar and yet, it's behaving slightly differently. It's familiar enough to recognize the strangeness of weightlessness. Whereas it would be difficult to identify the impact of weightlessness if it was applied to something that wasn't familiar in the first place.

LA *You mentioned design competitions and students who were challenged to think about designing for space and how very few of them think about weightlessness in their designs. Can you speak to this a little bit? Why is it hard for us to make that jump, even though we witness it?*

BB The fact that these students haven't thought about weightlessness probably has to do with the brief. It

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hasn't occurred to them yet because nobody has gone to them and said, "what about weightlessness?"

We did projects with our own students where I briefed them on

weightlessness. It influenced them enough that they started to think about things that hadn't come up with the student designs from other competitions.

For example, we had one student who, instead of skirts, did these puffballs that gathered and created a nice floral effect from underneath. And then we have lots of students thinking quite practically about how you could transform a garment so it's functional when it needs to be functional, but then transforms when somebody wants to visibly showcase their weightlessness.

We have students who designed a flight suit where the wearer can unzip a wing on their arm and it unfurls into a wing so they can look like they're flying weightlessly through space.

There were quite a lot of these fun, playful engagements with weightlessness. So I think once you put it in the brief and you say to students, "one of the things you need to think about is weightlessness," they do start to engage with that.

It's been really valuable for all of the students we're working with, not just because they might then think about planning for space, but because as a method and approach it forced them to reconsider some of the stuff that they take for granted.

There is so much that you have to throw out the window if you're designing for space: upwards orientation, designing for silhouettes, drape and all of that. And if you say, "start from scratch," that, as a method, encourages the students to be more creative, more questioning and more critical in their design. So I think it's a valuable project for them



OMEGA (One-Man Extravehicular Gimbal Arrangement). NASA, January 20 1967

to do, even if they're never going to design anything for space again.

LA *That stands up to the earlier point on the transferable design skills, where you can apply that experience to so many things that are relevant, and probably underserved here on Earth. It's just a way of thinking.*

BB They're much more inclined to critical questioning. Don't take anything for granted.

LA *Thinking about space and sci-fi in general, you're looking at possible*

futures through different ways of thinking.

BB Yes. Another project I've been involved in is called Fashion Fictions at Nottingham Trent University. It involves asking "What if?" and then designing clothes for that environment. You change one thing: What if you take away gravity? What if X? Then how would that change fashion? Or how would that change your field, whatever your field is?

It's a really interesting way of tricking you to think about what you take for



granted and also realizing how much would change if you alter just one thing; the consequences of that are often quite significant.

Sci-fi is the same, "what if?" What if there was a portal between London 1953 and now? What would we do to the rest of the story around that? So it is an approach from sci-fi.

LA *Given this interest, based on your research and the student work, what do you hope for the fashion industry from here?*

BB I hope, firstly, the industry will more broadly recognize that spacewear has its own concerns and needs to be thought of separately. It needs specialists in the field; not just specialist fashion designers, but also specialist tools. So for example, it needs contribution from other fields, like computer sciences, to develop the right kind of tools to simulate weightlessness more effectively.

I hope that the industry recognizes that there is the scope for this new field of study and practice. And I hope they recognize that if we're designing for space, it's not about technology all the time, but it is about weightlessness as a principal concern.

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LINKS

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