[MUSIC PLAYING]

DARIEN CARR: Hey, everybody.

TARA OLUWAFEMI: I'm Tara Oluwafemi.

DARIEN CARR: And I'm Darien Carr. And we are master of architecture students at the GSD*The Nexus* is produced in conjunction with a commitment by the Frances Loeb Library to acquire and create an open access bibliography of various media suggested by the community on the intersection between race and design.

TARA OLUWAFEMI: Hello. Welcome to today's episode of*The Nexus* podcast. Today we'll be speaking with Dmitri Julius, who was the Chief People Officer of ICON. ICON is a construction technologies company leading the way into the future of human shelter and home-building using 3D printing and other scientific and technological breakthroughs.

In his role, Dmitri is building and cultivating an elite, adaptive, and diverse team to support ICON's mission and strategic vision. Prior to joining ICON, Dmitri was the sales manager and store director for TreeHouse-- The Home Upgrade Company. He also served in the United States Marine Corps for eight years as an operations and logistics troop staff non-commissioned officer. Thank you so much for joining us today, Dmitri.

DMITRI JULIUS: I'm super excited to be here, thank you so much for your time.

TARA OLUWAFEMI: Well we've been really looking forward to this conversation. Darien and I recently have gotten very into space, and I guess it's what everybody's talking about. It's been all over the news. We have Jeff Bezos going up, we have Elon Musk with all his ideas. And we know ICON does some of that work, but we want to actually get a little bit more to the root of some of ICON's origins and some of the other work that they do.

So ICON describes its mission as using 3D printing robotics, software, and advanced materials to advance humanity. This work encompasses collaborating with nonprofit organizations like News Story and Mobile Loaves & Fishes to create houses for the housing-insecure, all the way to developing prototypes for lunar architecture with NASA. So can you tell us a little bit about what is the origin story of ICON and how does it end up doing this kind of work that's mixing nonprofit work with work something like a government agency like NASA?

DMITRI JULIUS: That's a fantastic question, and honestly, if you look at it on paper, it seems a little disparate and maybe a little disjointed. But I think once you kind of hear the background, it'll make a little bit more sense. So you mentioned earlier that I had worked for an organization called TreeHouse which effectively was a Home Depot meets Whole Foods.

And so you take all of the built environment materials that we're used to, sheet rock and off-gassing paint and asphalt shingles and all of these things that of go into the homes that we know and have accepted as a part of the built environment for the last 250 some-odd years, and we basically tried to take that model of the master plan community and turn that paradigm on its head a bit and say, what if we could take those same materials and choose the highest quality? So paints that are safe for children to be around that don't have any long-lasting effects on health?

And what if you could encourage people to collect all the rainwater that collects on their houses and in their gutter systems? What if you could add solar panels to kind of everyone's home? And basically it was bit by bit ways to improve the dignity and living conditions of those homes that we all live in, these master planned communities. And from that idea was born a bigger idea, which was, what if we stopped making houses 5%, 10%, 15% more efficient and safer and more dignified and what if we fundamentally reimagined the housing envelope from the ground up, what would it take to create more resilient, more adaptable, more accessible, and more affordable housing for everyone?

And that's where the idea of ICON was born. We took a round of research and development and found Alex Le Roux, our chief technical officer who had kind of been working on this problem siloed on his own as an undergraduate at Baylor University. Took the fundraising know-how from TreeHouse and our other two co-founders, Evan Loomis and Jason Ballard, went out and hit the road with the prototype, and we were able to win the South-by-Southwest pitch competition in 2018 that really kind of gave us the opportunity to get the funding necessary to go build these large-scale robotic systems to actually attempt to go build these houses in real life.

And as you might imagine, just like anything novel, there were some questions about the viability or could it compete with what already exists? Or how do you really go toe-to-toe with the $1.2 trillion annual industry that is the construction industry? And so we knew that the responsibility for building these houses at a high level with high quality was going to be 100% on us.

So we kind of became the technologist and the construction team, and we partnered with some fantastic folks that you had mentioned earlier in Mobile Loaves & Fishes and at New Story who gave us an opportunity in their nonprofit models to go create these houses for individuals who otherwise wouldn't have had access, and the story kind of goes from there.

And so it's been a tremendous journey thus far, and we're really excited to have an opportunity to do what we set out to do, which is to make a meaningful difference in the global housing crisis. And it just so happens that the complex coordination and the novel problem-solving that goes into solving for terrestrial environments applies directly to extraterrestrial environments as well.

DARIEN CARR: Can you speak a little bit more about how the development of Earth construction technologies relates to outer space? So exciting to think about that and how the core mission of ICON's project is to center that idea of technology as a tool to create equity.

DMITRI JULIUS: Absolutely, yeah. And so the interesting thing about being a part of the built environment or if you've ever purchased a home or had the opportunity to be involved in the building of a home or even the purchasing of just like the architectural plans and all the pieces that go into that, it's a multifaceted, multipronged system. It's actually quite disjointed by design.

You've got the architect and the builder and potentially the master planner. You've got the developer. You've got the city code individuals that are responsible for making sure that what you're building is safe. You zoom out on that thing and there's like 30 or 40 different entities involved. And everyone has a profit margin and everyone has a timeline, and everyone has sometimes competing interests.

And so we wanted to take that entire process and try to figure out ways to streamline it in ways that are most advantageous to the end user or the customer, the homeowner in this case. And so if you can find ways to kind of shrink that process-- digital design, for example, no longer requires that you go seek out an architect and a builder that has that very specific skill set, whether that be a stonemason or a woodworker, you really have an opportunity to kind of do these very difficult and complex things in a digital environment, therefore kind of cutting down on some of the cross-talk and the noise in this process and really streamline it down.

I think right now currently-- and we can look this up, I don't want to be inaccurate, I know it's changed since we've been functioning in a COVID environment, but I think from stem to stern, kind of creation of plans all the way to execution of homes on average in the United States is something like 11 and 1/2 months to delivery.

So if you were to purchase a home on January 1, typically you don't have the opportunity to move into that home until sometime in November, December, and then all the costs that are associated with that potential weather delays, obviously the increase in cost of materials as supply chains are squeezed in this new world that we're functioning in. And so really taking a look at the points of pain for all of the folks involved, but especially for our end user, the homeowner, and really try to gain some efficiencies in that process.

And that's not too dissimilar from the process that goes into space travel, space flight, all the pre-planning, and ultimately the construction and post-construction phase. And so there's a lot of similarities there. And when you're taking a look at it and say, hey, I think we can redesign this and really starting to pull out some of the extra pieces that don't necessarily lend themselves to the end product, one, the process becomes much faster. You can really limit some of the cost.

And then you have an opportunity to really create something that's one of a kind without adding any extravagant cost because it's a digital design file by nature. It can be changed with the click of a mouse that doesn't necessarily require somebody to go into the draft room or to send a change order or to charge you to move that bathroom wall from A to B. And so all of those things become much more accessible without adding any additional time or cost, and that's a really novel thing and a fantastic opportunity.

TARA OLUWAFEMI: Thank you so we were just curious about what some of your thoughts were about the recent trip to space by Jeff Bezos and whatever his friend over in Europe--

DMITRI JULIUS: Sir Richard Branson?

TARA OLUWAFEMI: Yes, thank you. And the recent announcement by Elon Musk that he wants to go ahead and start putting ads in space, basically. How do you see these issues of-- we see the very public realities of the privatization of space travel being really reserved for the wealthy, and then the work that you're doing that's very on the ground but not getting as much attention. And it's a very attainable goal that is democratizing space travel.

I mean, you're working with NASA, which is a government agency. So they technically should be working for the good of all the people. So how do you see your company fitting into this whole privatization of space travel and what are your ideas on all of that?

DMITRI JULIUS: Personally I'm watching with awe and wonder and a bit of confusion about what's taking place with the individuals that have taken individual flights to space on their own accord. Their own company agendas, personal agendas. While I can't speak to that because I don't know those individuals personally, I'm kind of staring at that the same way everyone is, kind of wondering, what is the use case? What the end goal there? And ultimately, how does this set the tone and create the conversation around democratizing space flight?

As interested in the outcomes there as the group here on the podcast, and ultimately we're in a wait-and-see mode just like everyone else. But that doesn't prevent us from doing the real and tangible work that we're doing on the ground and in conjunction with some of the existing agencies to go ahead and figure out ways to create sustainable shelters not only for astronauts at the International Space Station, but obviously as we look forward to traveling further and further away from previously explored areas, really diving into the opportunities that exist potentially for creating areas for safety and for travel and for dwelling for individuals that are currently residing on Earth.

And so it is kind of a twofold thing, because we're in partnership with a government agency. If you take a step back for a moment and you take a look at a lot of the novel technologies that have had an opportunity to really thrive and become commonplace, things like the internet that we're communicating on right now, the personal cellular device, the laptop computer all came by way of public-private partnership with some of the largest federal entities in the world that comes along with some of the largest budgets in the world.

And so it really creates an opportunity for us to get the work accelerated in a way that wouldn't have otherwise been possible had we just been this small startup with nine people a couple of years ago in Austin, Texas. Now there's a real opportunity for us to achieve these goals on scale to create technology that's going to be useful hopefully for all of humanity here in the next 15 years or so, which is an incredibly exciting and daunting opportunity, and it has to kind of happen in the same universe that Elon Musks and the Richard Bransons of the world are doing their thing.

And so we can't let that distract us from all of the very real and visceral problems that are going to go into trying to solve this very difficult scientific challenge, but those are the reasons we get out of bed in the morning. So we're really looking forward to the opportunity to try to correct the space flight and space travel conundrum with a group of people that we've assembled together here in Texas.

DARIEN CARR: Wow. It's so funny how like it's a conundrum now, but it stems back so far in the past. Like I'm speaking from-- I saw-- I don't know if you have seen it, the recent Questlove documentary. It's called *Summer of Soul.* It's about the Harlem cultural festival in 1969, Harlem, New York.

Anyway, there's this beautiful montage where-- it's actually becomes clear that the festival is actually the same day that we landed on the moon the first time. And then they're kind of walking around and like the news reporter is like how everyone here like at the Harlem Cultural Festival feel about space travel. And everyone's like, oh, well, actually, we're starving. We don't have houses, so I don't know where we're going to space. There's so much work to be done on this planet.

But I think like as I'm listening, there's so much opportunity at the intersection of space travel and space exploration and life here on Earth, and I think so much of that is around education. And education, and then also the technological applications you've been talking about thus far. So I was wondering if you could speak a bit to that, if education at all plays a role in how you're thinking about it.

How could we like educate people, one about the technology of space, use technology as an opportunity to educate people. But then also kind of change the narrative in a way such that there's like this historical dissonance between like space travel and like sometimes what it feels like in daily life and try to create more of a harmony between those two polar extremes sometimes to kind of like craft out a better world on this planet, which could lead to a better world in future iterations of what that means.

DMITRI JULIUS: Absolutely. You can't begrudge anyone for dealing with real on-ground problems and the idea of imagining a future that has absolutely nothing to do with those day-to-day struggles. It becomes something that seems grandiose and absolutely not applicable to real life right. I'm a kid from South Central LA. We grew up with nothing.

And the idea that someone would go spend a trillion dollars trying to get to the moon while the individuals in my community are starving with inadequate housing doesn't necessarily make sense. And so I totally understand that. I'm coming to this conversation with that in my background and fully aware that there are people really experiencing day-to-day struggles that are so far removed from the high ideation of potentially traveling to Mars, so that's great, but how does that help the people in my community?

So first and foremost, I fully understand that, and that is going to be an ongoing challenge in this conversation, and most conversations that technologists are working on, because ultimately, the work that you're doing is in the future. Like the work that you're attempting to achieve is about the idyllic best landing spot for us as humanity.

And so you have to be of dual mind, because there are the real and tangible problems that we're dealing with every day, i.e. the IPCC climate report that recently came out that talks about all of the challenges that we're experiencing right now with climate on Earth right now today. Real things that can be improved upon if we focus up as a nation, as a world, as an economic leader in the space.

But then there's also the imagined future of-- regardless of whether or not we're able to solve all of those problems, we're still going to have to continue to chase down a sustainable future and other opportunities outside of the one that we're currently looking at. And so the future has to be intersectional. There has to be ways to both solve the problems that we're dealing with right now today that are very real and visceral, and we also have to be able to imagine the future where we're solving some of these problems and looking towards the next major innovations and breakthroughs.

And so I think, when you talk about addressing it from an education standpoint, that remains our largest opportunity. Not only the traditional spaces of STEM education, which are incredibly important to the task at hand, but also just making sure that the youth in our communities understand that space flight and travel is not an exclusively white space, and that there is an opportunity for them to make inroads and make sure that they know that careers like the one that I currently have are readily accessible to them if they meet the baseline criteria.

And so there is something to be said about educating our uncles, our brothers, our sisters, our cousins, that STEM environments, ones like NASA, for example, aren't exclusively there to limit their opportunity. We have to continue beating at that door and breaking away at that glass ceiling for sure.

TARA OLUWAFEMI: Yeah. It's interesting that you're talking about this, because I know NASA's Artemis program, part of it is to have the first woman on the moon and the first Black man on the moon by 2024. And it's interesting, though, that long before this goal is achieved, we already have the billionaires going to space. And it's been how many years since we landed on the moon? I think we landed on there 1969? 50 years later or so, we still have not had a woman on the moon and a Black man there. But I think at this point we have like, what, four or five American flags on the moon? Things like that.

So it's interesting that public ideas about how there still is a disparity in wealth and all of those people who have access to space, but now we're all really trying to work to shift a lot of this. And it kind of goes hand-in-hand, I think, with a lot of the resurgence of Afrofuturism. It's coming up in my thesis project-- I know Darien's been doing research on it as well. Like we're both very interested in Sun Ra again, and like everybody is starting to look at these references again. And I know Solange Knowles tends to have some like Afrofuturistic elements to it and all of that.

And we're wondering-- so how do you begin to envision these futures that are diverse? And as you're developing all these projects for space, what are some of the inspirations and references that you look to to kind of help you picture a world where there are Black women and just Black men-- just non-white men in space and actually living there and thriving and not just the wealthy?

It's a vision that you have to kind of pass on to others and get them to buy into it, because we're also familiar with space, but we haven't been there. So you kind of have to sell us this vision. So I'm wondering how you-- have even sold yourself this vision? Like what do you look at to keep you going?

DMITRI JULIUS: Yeah. I'm looking at the same influences that you are. Obviously as a curious kid of the '80s, someone like Sun Ra has been in the lexicon for me and my family since as far back as I can remember. Obviously the influence of music, Black philosophers, and space exploration has kind of gone hand-in-hand since probably that first moon landing in June of '69.

I look to works like Kid Cudi's project,*The Man on the Moon,* which is probably one of my favorite records of all time that kind of deals with isolation of space travel and just that feeling of achievement paralleled by the constraints of finally being free but alone in classic musings of just someone that's like out there in space like finally did it, but like alone with their own thoughts and kind of quite isolated. And so those things kind of resonate with me.

You've got the influence of stuff like the queen, Octavia Butler, who's been imagining an Afrofuture for as long as I can remember. I soak all of that up. And so it's not even about having to sell that dream for me. That's omnipresent if where to look. These are ideas that we as a people have had for a long time.

I looked at influences like the individuals that were serving at the same time my father served. My father was a career United States Marine and served for 30 years, and overlapped the careers of astronauts like Ronald McNair who served up until '86. Robert Lawrence Jr. Who served until '67. Mae Jemison-- there are so many African-American influential individuals that have worked to create opportunity for individuals like me, which is humbling. I stand on the shoulders of giants who have had an opportunity to not only do this work, but do it at a time where it was wholly unacceptable for them to receive the praise and adulation for making that moon landing even possible.

I think most people listening to this podcast have had an opportunity to see the film *Hidden Figures,* and I hope they have an opportunity to read the book because there's some really interesting disparities between the two that we can get into on another podcast at a later date. But effectively, without the calculations of those folks, like we never make it. We get beat by Russia like hands down. It's not even a question.

And so when we talk about the imagination that it requires in order to create an opportunity for us to even get to space, that work has been done, those foundations have been laid, and I'm really just trying to carve out a path for this organization that includes everyone. This is our next best opportunity to create a future that is not only intersectional, but highly inclusive and creates spaces for everyone, and it remains to be seen whether or not we can achieve that.

TARA OLUWAFEMI: So another question Darien and I had about that, then, it's like we all have these images of space and the future, but we're curious of, is it possible to develop a Black identity in a context that decontextualized from planet Earth? How would we even begin to do that? Is there a Black space identity? Where would we go to for that? How do we begin to develop that identity? Or I know that it's something that already exists, but how do we bring that with us off of planet Earth or is it possible to almost start from scratch?

Like the way that Sunra was talking about a lot of things was, you know, another planet that we could go to that doesn't have these ideas of oppression and racism and sexism and violence and all sorts of the negative things that are associated with life on Earth that make things harder for some than for others. So how do we begin to develop new identities on another planet? Or will every world we create in space always be attached to what we face on Earth? And this is like-- there's no definite answer. None of us live in the future. But I'm curious about what you think.

DMITRI JULIUS: Yo. No, I appreciate the question. I get asked this question a lot, actually, by mostly members of my community and family members. Like what's really going to be different once we get to Mars? It's a very real question. It's one that I feel a lot of pressure to be able to answer honestly.

And so what I will say is this. I do believe that there's an opportunity to reimagine what it means to be Black or African American in an entirely new context. We've created so many unique things. Our food, our cultural, our music, our confidence, the way we speak. Everything that we have done as a people is in the context of being a marginalized community.

Now there is this real opportunity for us to start from scratch, but I think starting from scratch with air quotes definitely in place, all the patriarchal systems that led to these moments are still going to be in place because those are the same fundamental systems that we're utilizing to get ourselves there in the first place.

So I don't think that there is an easy way to completely detach those things from one another, but I do think that there is an opportunity to create a mindset around the realm of the possible. Like there is a new opportunity for us to take advantage of the fact that there is no late infrastructure, there is no rich communities and poor communities on the moon-- like they don't exist yet.

And so I think we have an opportunity to be incredibly inquisitive. We've got to ask the tough questions. We've got to insert ourselves in the conversations when it comes to how infrastructure is going to be doled out. How we're going to approach the opportunity that we have to really build up a space in space that considers everyone's needs.

And so this is actually a really difficult kind of multifaceted problem that we're going to face, and I can't say with an honest tone and a straight face that I know the answers to how we're going to handle that in an uncharted future, but space exploration at this point provides us the best opportunity and a blue ocean scenario for us to really take advantage of the endless possibilities. And so I think we can take all of the learnings and the experiences that we've had thus far, both the triumphs and the failures, and really leverage those into the opportunities into our own written future. So that's what I'd say.

DARIEN CARR: How can we think about decolonisation as a way to move forward? Is there a way to start from scratch without centering on colonization?

DMITRI JULIUS: I think this is probably the most difficult question to answer, because when I think about decolonization, it's always different from the textbook relationship of the term. Traditionally, decolonization is referring to our ability to gain back parts of our culture-- the land, our lives, our religion, the things that were stripped from us as an indigenous population.

And in this context of space exploration, we're not necessarily going in and planting an existing culture. There's no infrastructure, there's no people there. There are effectively no one to colonize. And so in that spirit, it's the bastion of creativity and an opportunity for progressive steps that don't necessarily require any caveats for infractions or atrocities that we've committed against someone. We're actually just going to a place that happens to be empty.

And I think that does represent our best opportunity as humans to build something kind of devoid of human suffering. Space exploration for me is incredibly exciting because of that opportunity. But I think it would be ignorant and a bit silly for me to assume that all of the systems that have been in place magically just go away because we're traveling to another place. And so I think we have a responsibility to stay committed to the work and asking the questions that have been pervasive here on the ground and how that translates directly to space.

And so I think if the recent news has taught us anything, there's a tremendous influence on the foundation of who gets to travel to space for years to come, and I think that we've got a chance to really be inquisitive about that and raise our hands and say, how are we going to use this for the good of all the people?

DARIEN CARR: Yeah. And I wanted to circle back, RE that identity point on the interactivity and the intersectionality as you've been talking about it between space travel and life on Earth. And just going back to Sun Ra. I'm working on a piece for the AADN right now. The tentative title is like the El Saturn's Invisible City. And El Saturn is essentially Sun Ra's label.

It came out of something he did in Washington Park called the Thmei Research Group. And him and his colleagues, they were just very invested in kind of reinventing Chicago through a lens of outer space. And they ended up becoming Afrofuturists, but if you look in the linear notes of some of the albums, like they're listing the specific venues that kind of were inspiring this kind of very spacelized-- and spatialized isn't like architecture spatialized-- outer spacelized ideas, I think it's exciting to think about Black identity and space can't be Black identity and space if not connected to the local identity of place.

But it's constantly intertwined. Like I feel like there's a constant feedback loop, which is very exciting to think about. I don't know, what do you think?

DMITRI JULIUS: Exciting is the term. It really does represent an opportunity for us to imagine the best version of ourselves not only as Black people, but as people. As residents of the Earth, as citizens of the United States, as people who have an opportunity to dream big and imagine the future that we've always wanted. This is our next best chance.

And so I agree with you wholeheartedly. And I think the tough part is going to be to answering some of those really difficult questions, when the ideas of race and class and socioeconomics ultimately make their way into the conversation. There's no separating that from what comes next. And so there has to be a willingness to challenge the status quo and to make sure that we're bringing those voices into the conversations as we talk about doling out potential resources to individuals that are going to have a chance to change the outcomes of the past.

And so we'll see how that works. I the work that we're going to be doing to ensure that that's possible. Like not only are we building a startup that showcases different ways of imagining housing, but we're also trying to build the company better and different. Building it back better, to borrow something from the president, there's really a way to think about resources. Typically individuals at the lowest end of the socioeconomic ladder are the ones that get access to technology last.

And we really wanted to challenge that. So we started out working with nonprofits to provide houses to individuals with 3D printing technology before anyone else in the world did. And so we built the world's first 3D printed neighborhood in Nacajuca, Mexico. Individuals living in abject poverty in a desolate area that experiences all sorts of natural disasters. They're right there in the middle of the Richter scale when it comes to earthquakes that they receive all the time. You can look up recent news about Nacajuca where they had to evacuate the entire city due to flooding by way of tropical storm.

And so we really wanted to showcase, hey, not only can you build novel technology and you can do it for-profit, but you can do it in a way that services the community better than we've done that in the past.

And so we also wanted to showcase that you can build an inclusive company that includes executives that are not only people of color and not only female, but like a unique striation throughout the organization that's not just top-down, but showcases the diversity in the community that we're serving, and ultimately I think that makes us a stronger organization and makes us a little bit more agile and avid in the way that we seek out opportunities and who we decide to partner with and the challenges that we're going to face as we look at this next chapter, which is spaceflight.

DARIEN CARR: Yeah. And kind of like rethinking about making a company around space travel, I think is really brilliant because that's something that hasn't been done before. And I immediately think of like the kid who's listening to this and is like, oh my gosh, like this sounds like a great conversation, this sounds like a great thing to be thinking about and to work towards, but how do I get there?

And it sounds like for you, getting there did require building a company and kind of creating an infrastructure in order to execute this idea. But RE that, what would be like your advice to somebody in like a younger generation who is listening to this and it's like, oh, I would love to get into this conversation or I would love to learn more about these things? What would you say to them? What would be like any references or advice or wisdom that you've picked up along the way?

DMITRI JULIUS: Well, I don't know if I would call it wisdom, but what I would say is the opportunity to be here right now was just by way of persistence. Never looking around. There have been numerous opportunities for me to quit on this journey. I walk into rooms where I'm the only person of color or the only Black face that I've seen for weeks or months or sometimes even years at a time. And so it can really feel like you're isolated along this journey, but just a dedication to staying relevant, staying educated on the things that are moving the needle in this space, a STEM education is going to be something that's incredibly necessary I think going forward.

Not just in 3D printing, and not just in the built environment, but you look at the challenges that we're facing as a world, and the answers are lying right there in science-- biology, chemistry, physics-- are likely going to be the things that are going to be driving all industry as we look towards a future where climate challenges are absolutely real, infrastructure challenges we're facing on every continent on this planet.

And so as we look towards the most high-impact areas of opportunity, I think a STEM education is going to be one of those things that really sets you apart gives you a chance to be a relevant voice at any table that you're at. Just more generally speaking, that persistence, asking the questions, nosing your way into the room, ensuring that you're taking every opportunity to be inquisitive.

We like to say it around our offices, we take pride in being incredibly nerdy, and that means asking all of the questions that you possibly can of individuals that have the answers that you don't. Maniacally focused on making sure that you're capturing information every day. One of the things I think I'm most proud of this organization that we've amassed is, I don't believe I've been the smartest individual in any room or any meeting that we've had for the last three and a half years, which is incredible because it provides the opportunity for me to learn from all of my peers on a day-to-day basis.

And so I think there's a lot to be said about surrounding yourself with individuals that have amassed a skill set and a knowledge base that you're interested in, and I think that that's something that Darien and Tara, you all personify in your pursuit of excellence in education. But also ensuring that you chart out what it is that you want. And then be relentless about it. Don't give up just because you don't hear other people that sound like you or see other people that look like you. Had I quit that, I would quit this journey three and a half years ago and I wouldn't be here today talking to you all.

Our website is a fantastic wealth of knowledge. It's www.iconbuild.com. And I will say that we're hiring, so that's www.iconbuild.com/careers. There's a whole host of different career opportunities, everything from engineering to support services, things like accounting and architecture, and we were loving the opportunity to speak to diverse candidates from all over.

So if it sounds like something that you're interested in, you want to get involved, please feel free to visit our website, submit your CV and your application, we'd love to hear from you. That's some of the advice I'd give.

TARA OLUWAFEMI: My follow-up question is more about the process of how you design these buildings and these spaces that you make. What is the research that goes into the communities that you enter into? I know that one of the things that can always be a little tricky when you're doing digital work is that you can almost tend to lose a sense of the reality of a place, the things that make something very local.

So as you were designing like in Mexico for a small community, how were you ensuring that the designs that you made were speaking to the pre-existing designs and using materials that are familiar or are still giving the appearance of regional? Something that I understand with the digital that we can often lose a sense of place, and we don't want to do that.

So how are you able to do that and then how will you also do that with the moon in a sense, we don't want to be colonizers, but we will be leaving Earth, and in a sense, colonizing the moon and Mars. So how can we use what's there to live there without kind of depleting what is there?

DMITRI JULIUS: Two fantastic questions. I think I'm going to take them one by one. And so I think your first was, how do we go about designing something that is both locally useful that speaks directly to the challenges that the people on the ground without necessarily alienating anyone or just building something that looks awesome on a computer screen but doesn't necessarily speak to the challenges of the folks that are there, right?

TARA OLUWAFEMI: Yes.

DMITRI JULIUS: I love this question, actually, because I think it's one of the more important things about the way that we've gone about creating design that is incredibly useful for multiple communities and multiple different regional challenges. And so there are so many examples of the do-gooder company that kind of shows up to a community, doesn't ask the right questions, builds something that might have looked fantastic in the Gutenberg or back in New York City or in California where they came from.

Built the thing, and then a year later it's collecting dust and nobody's utilizing it because it's an incredibly worthless piece of architecture that doesn't necessarily solve for any of the problems on the ground. And we were incredibly sensitive to that when we showed up in South Central Mexico. So one of the things that permeated throughout the entire design process was we invited all of the community members that were going to be living in this space-- and I'm not just talking about elders, I'm not just talking about heads of household. I literally mean everyone that was going to live in this community had an opportunity to be a part of the design process.

We rented out the largest venue in the area and had one-on-one design conversations with each of these families from the kiddos that were old enough to speak to us and provide their design ideas about how they wanted to interact with their neighbors and their brothers and sisters and family members, all the way up to the community elders that had input on how they wanted the infrastructure to be laid out and the grid and the water system, so on and so forth.

In fact, there were so many fantastic ideas that came out of that design sprint, we decided that was the only way that we wanted to design in the future. And so if you've got an opportunity to build with ICON, we've created a digital platform for our customers that allows you to interact with the software so your ideas are captured and then can be manipulated into the digital design file. And so you can literally drag and drop rooms in a certain place, create different elevations in these spaces, move rooms from A to B, open and close and orient in such a way that creates spaces that are useful for everyone.

And I think that by capturing those voices, what we did was instill not only confidence in our ability to design something that was going to live on well beyond just this iteration of end users. So this community is going to have longevity for generations, and we thought that incredibly important, but we wouldn't have gotten there without the input of the individuals on the ground.

I'll give you an example. We were designing these lots in such a way to allow for green space in between each one. That's the platonic ideal here in America. Like everybody wants a backyard, you want to be able to have space for the dogs to run around, maybe some space for a clothesline, whatnot.

And the community came to us and said, this design is it doesn't work, and we were kind of perplexed by that. We meticulously captured all that information, that data that we had received and we didn't understand. And one of the community elders came to us and said, no, this isn't going to work. We can get five more families in this community if you cut down these backyard spaces by like a third of a yard.

And she calculated the math on the grid and was like, we would rather have five more families join us in this community than have five larger backyards. And for me, I was floored by that because it was something we would have absolutely missed had we just been listening to ourselves. And it also spoke directly to the type of people that we were serving. It mattered more that there was more folks being sheltered by the community than having their own individual spaces, and that's a lesson that I'll take with me forever. So I greatly appreciated that, and you don't come to that without soliciting the voices of the individuals that you're ultimately trying to serve. So that was tremendous.

TARA OLUWAFEMI: That's great. And I'm happy to hear that you guys are so open to feedback. My second question was, how do you use local materials in this 3D printing process? I mean, also once we go to the moon and once we go to Mars, we have to kind of work with what's there. How are you already establishing that model here on Earth in the local communities you work with?

DMITRI JULIUS: Yeah. So thank you so much for the question. We ultimately decided to build our construction robotic set around the idea of utilizing cementitious material because it's the most readily available worldwide. Do you think about the combination of things that go into concrete, and the number one ingredient is ultimately sand. And that can be aggregate sand or that can be beach sand. There's a real opportunity for us to continue to gather that without necessarily having to go cultivate it or dig for it or are all of these things, it's readily available on most of the continents on this planet.

So that was a calculated decision. We didn't want to utilize polymers, we didn't want to utilize wood. There was a real opportunity there for us to leverage. And also, it creates an opportunity to build monolithic structures that can last for generations. So we're not talking about a sheet rock and stick frame house that's rated for life around 35 years. You're talking about building effectively a stone structure as a monolith that has the opportunity to be rated for 250 years of life.

So now you're talking about generational design that creates an opportunity for you and your family to live in it and the next generation of your family to live in it. And hopefully, all things go well, the next iteration of your family to live in it. So that is something that not only drives down costs, but all leads to sustainability, because every 30 years you're not in a rebuild-remodel cycle, there's an opportunity for you to leverage that building for generations to come.

And I think that ideology lends itself quite nicely to what we're going to have to do on the moon. And so it is no secret that rocket travel to the moon is incredibly expensive. And one of the things that really leads to the cost there is the weight. So the more you pack on to a rocket, the more thrust you need, therefore creating like a larger and larger launch. And so all of the force that needs to be generated increases tenfold as you continue to bring more and more materials with you.

And so one of the things that we had to do in this design iteration was think wholeheartedly about where these materials were going to come from. And the only way to solve this problem to date is to use localized materials. So we're talking about lunar regolith-- basically moon dust. And capturing moon dust, while it sounds quite simple, is actually one of the most challenging things you could possibly imagine. The lack of gravity, the razor sharp nature of the dust, the fact that when you land you send a ejecta all over. And in a limited gravity situation, it kind of stays in that elevated state for years to come.

And so thinking through the design challenges for not only sourcing that material, gathering that material, and then utilizing it in a build become kind of a leading design challenge here. And so we're going to utilize a form called laser sintering, which effectively means you-- and I'm going to oversimplify this. And so for your scientists listening, don't cringe at this too hard, but this is basically-- this is the Barney version of this, but basically you use a large-scale vacuum to capture that material, you force it to settle in a low-gravity situation, and then you heat it up to the tune of melting it, and you basically burn that material into place creating like a lava-like state.

Once it dries, that becomes your base layer, and then you effectively build on top of that layer by layer. And so you have this monolithic structure that you've created out of local material. And if you do that effectively, you don't have to bring a whole lot of additional materials into space, therefore limiting the cost, limiting the weight, and then utilizing those localized materials kind of allows for additional builds in other locations on the moon.

TARA OLUWAFEMI: Thank you. But when you're designing these spaces on the moon or like in other areas, what are the essentials that we have come to for home construction or the spaces needed for humans to live? Like what is the minimum space size that we have come to and decided is what will make a good quality of life in space and here on Earth? What are the amenities that are required for these spaces? I'm just curious about what you have come across in your personal work and in these projects that you all have been taking on.

DMITRI JULIUS: Great question. I'm going to try to answer to the best of my ability. But what we do know is that there are some very baseline essentials to life right. If you take a look at that Maslow's hierarchy of needs, there are some things that people absolutely require in order to thrive and be successful, and there are some really interesting conversations around this. I really appreciate the tremendous amount of thought that goes into the pack out for each and every one of our astronauts kind of utilizes in those extraterrestrial travel environments.

As we think about not only what do you need to travel to space, but what you need in order to be successful, there's a lot that goes into that. And I'll be honest, we haven't answered those questions fully. And so we're actually in the process of working on answering those questions right now. In partnership with NASA, we're working on basically an analog for what these trips will look like.

And so at Johnson Space Center right now, we're working on a simulated surface habitat where basically we're going to build a one-to-one model of what we expect to be able to build on Mars, and then effectively have candidates volunteer to live in that environment as if they were living on Mars so we can learn more about what those needs are going to be and how we will effectively design for those very harsh conditions that we're going to be asking people to live in at the outset.

And so I can tell you, I've spent a hundred hours on the phone with NASA engineers thinking through things like human waste and space toilets, which sounds laughable, but those are real problems that you're going to have to solve. And if you aren't incredibly maniacal about useful solutions to this problem, then what we're really talking about is space litter. And we don't want to be party to creating a whole lot of space junk.

And so we're trying to be incredibly maniacal about thinking through each stage in this process to allow for, one, people to have as much comfortability as you possibly can when you think about just the absolute isolation that someone's going to be facing, we want them to be as comfortable as possible.

But then there's like the real tangible like, how do I go about getting water? Like can I grow plants in this environment? What's the lighting situation need to look like? Am I going to be OK staring at red walls for 120 months in a row? Like what are the real challenges that people are going to face not only physically, but mentally in these spaces? And so we're trying to create that and learn those lessons here on the ground so we have empowered our teams to create useful spaces once we move into the extraterrestrial environments.

TARA OLUWAFEMI: Mm-hmm. So how is that, looking back on Earth, how have you incorporated those into some of the houses that you've made here? Like you're talking about bathrooms, and I'm curious about, what are the dimensions that when you're designing houses here on Earth, that you're like, bathrooms should have this, this, and this and be this dimension. Or you were talking about how you made those backyard spaces in the community was like, what? We don't need that much backyard space.

When we're thinking about future space travel, we really are starting to make these analogs that are so similar to what we already have on Earth, but if there's some way that you guys have started to almost break down the human essentials and started to redesign-- because I know every architect and every designer comes up with what they think everybody needs to live. And from that they're like-- and I think a bedroom should be this big, know because it encompasses xyz activity.

So I'm just curious about how you guys works to develop some of those models as well with the communities here on Earth and how you've seen those analogs between space and Earth.

DMITRI JULIUS: This has actually been one of the most fun things about this particular design challenge, both architecturally and intellectually. There are some things to kind of imagine that we haven't necessarily dealt with before. So we had the opportunity to partner with Bjarke Ingels' Build Group or the BIG Build Group. He's, I think, ostensibly the number one architect in the world and has spent a lot of time thinking about these kind of multi-spaces that are not only useful for one particular use case, but kind of lend themselves quite nicely to being utilized in other ways.

And so you think about something like a bathroom space where it's like, what is the idyllic bathroom space? That answer differs wildly if you were in Italy versus if you were in Central Texas versus if you were in Southern California just based on the needs of the community, the weather, how original the plumbing grid was designed, so on and so forth. And so we've really had to make some inferences.

But what we did, instead of making those inferences on our own, we actually had an opportunity to call in individuals that have been a part of space travel in the past and really create design ideas around their needs and what they told us was lacking in the first few iterations of this process from the '60s, '70s, and '80s.

And so we were able to incorporate all of those ideas and then utilize that in the design aesthetic to create a building that not only lended itself to the very baseline needs of like how big does about there need to be if I'm in all my gear and I need to be able to traverse a corner without necessarily disturbing an air lock, for example, is a conversation we have had.

There's also the very real intangible questions of like, I would like to be able to grow my own food and I need x amount of light in order to create that. And how is my circadian rhythm going to be thrown off by if I've only got access to fluorescent light x amount of days in a row? Like am I accidentally going to create a space that makes people insomniacs?

And so there's really a lot of nuance here. I'd love to answer your question with very raw dimensions, like a bathroom must be x yards by x yards. But what I will tell you is that the analog that we've built comes by way of a tremendous amount of partnership with astronauts that have been in space before, and with architects and builders that have synthesized those ideas into this building that we've been able to create.

And so we're really looking forward to learning whether or not we got it right this time. And the fantastic thing about analogs is that they're designed specifically to be experimental. So if we learn that a space that we've created doesn't exactly solve for the problems that these individuals are going to have, we get a chance to redesign it and build it back better, so I'm really excited about this.

TARA OLUWAFEMI: Yeah, that's very exciting, thank you. And I understand that the situations will be different. So you probably wouldn't have specific dimensions. I'm just always curious hearing about people being like, communal living! Communal living is what people need and five families need to share one kitchen. And it's always so interesting just to hear each group of designers' ideas of the essentials for life.

And I know with space travel, they've had a lot of time to kind of think about literally, if we go out into space bare, we could die. So like, what are the bare essentials for survival in space? And it goes beyond just having a protective suit and some water and some air to breathe, but like, what's going to keep us being human in a sense? So like sleep, we need sleep. And how do we remain human in space? It's a very interesting conversation. Thank you so much, Dmitri.

DMITRI JULIUS: I'm super happy to kind of pontificate on these things with you as well. There's massive learnings that are going to come out of this and I feel like we're just scratching the surface, but I'm incredibly appreciative to y'all for being willing to kind of ask these questions and really kind of shed light on something that I think could be transformative for us.

But we've got to be quite careful about our application of this thing and not just have it turn into *Lifestyles of the Rich* and *Famous* Mars version. So I'm really excited to be doing this work with y'all.

TARA OLUWAFEMI: Thank you, we appreciate it. That's so kind.

DARIEN CARR: Thank you so much for taking the time, Dmitri.

TARA OLUWAFEMI: I'm Tara Oluwafemi.

DARIEN CARR: And I'm Darien Carr.

TARA OLUWAFEMI: And you've been listening to *The Nexus,* a product of the African American Design Nexus at the Harvard Graduate School of Design. Today's episode was produced and edited by Maggie Janik. And we would like to thank DJ Eway for our theme music. To learn more about the African American Design Nexus, visit us online at aadn.gsd.harvard.edu.

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