



Circular Design

A virtual event takes a deep dive into the principles of sustainability

By Robert Grace

Brand owners, designers, and product developers keen to curb waste and advance sustainability need to stop focusing solely on individual products. Instead, they should take a step back and consider the entire ecosystem surrounding such products including raw material sourcing, energy use during manufacturing, product transportation, reuse and recycling capability, and end-of-life scenarios for those items.

That was one of the key takeaways from some of the experts who shared their views as part of a recent virtual conference on design and sustainability. No less than 36 presenters participated in the inaugural Sustainability Deep Dive organized by the Industrial Designers Society of America (IDSA), June 3 to 5.

Other compelling stories emerging from the sessions included:

- » How Nike developed its latest line of sneakers—called Space Hippy—from trash;
- » How there are no inherently sustainable materials, since their eco-friendliness depends largely on how developers choose to use them; and
- » How a small U.S. injection molder has been reinvigorated by embracing design and sustainability.

The event, originally scheduled to take place in Denver but moved online due to the COVID-19 pandemic, attracted nearly 600 participants. Circular design took center stage, and included a presentation by Anna Queralt Fuentes, an engagement manager of the U.K.-based Ellen MacArthur Foundation, one of the concept's

leading global proponents.

She stressed the importance of designers in this process, noting that everything has been designed by someone, important decisions are made during the design stage, and once a product is designed, one can't "unscramble the omelet." Key principles, she added, include designing out waste and pollution, striving to keep products and materials in use for as long as possible, and working to regenerate natural systems.

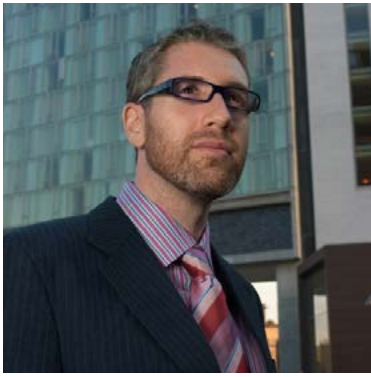


Anna Queralt Fuentes of the Ellen MacArthur Foundation.

The Promise of Going Circular

Tim Brown, chairman of global design firm IDEO, has stated: "If you adopt a holistic view of production, take advantage of idle capacity, reuse materials, and increase the lifespan of products, you will save both money and the planet. That's the promise of circular design."

In addressing the challenge of sustainability, one of the Deep Dive's organizers and co-emcees, New York designer Stephan Clambaneva, likened climate change to a "slow-moving pandemic." But even in the midst of



Deep Dive organizer and co-emcee **Stephan Clambaneva**. Courtesy of iD8trs

a crisis, he remarked, one can find silver linings.

Clambaneva cited a January 2009 *New York Times* essay by Michael Cannell, who wrote it during that year's economic meltdown. Titled "Design Loves a Depression," Cannell's article chronicled how the worst period of the U.S. depression of the 1930s became a golden age for design.

He suggested that perhaps our current difficult circumstances will again foster innovation and creativity. That sense of hope and inspiration permeated the talks that made up the Deep Dive event. Following is a sampling of the stories shared and messages delivered by a few of the presenters.

Designing the Organization



Rebecca Chesney of IDEO.

Four IDEO members hosted an online workshop as part of the IDSA event and expanded upon their approach. Rebecca Chesney, senior portfolio lead for IDEO's Circular Economy of Food CoLab, stated: "IDEO activates ecosystems of stakeholders to pool risk and resources and collaboratively explore challenges that are too large for any one organization

to tackle alone. We see a bigger role for designers to play in this."

Her first key point was "design collaboratively," while keeping the system in mind, creating the right conditions, and building to think (referring to the value of creating physical prototypes).

Her colleague Christopher Krohn, portfolio lead for OpenIDEO (the firm's open innovation program), mused on how designers should shift from objects to systems. "Prototype the system, do eco-system mapping, identify value throughout the system." Listen and learn, get feedback from the user community, and develop a shared set of metrics to define what success looks like, he said.

His colleague Rhys Thom, an IDEO portfolio director, urged designers to also work to "design the organization." Designing for the circular economy requires designers to design organizations and business models as well as products and services, he noted. Start with purpose, and ask, "Why does this organization exist, beyond profit?"

Increasingly try to shift your company's focus from products to service. Thom used the Dutch firm Philips as an example, noting how it moved from a transactional approach (of selling light bulbs) to more of a relationship-based, subscription-based model (of providing a lighting service, and all that that entails). This can help a company to identify new types of value.

Krohn advised that as a product-focused company, first look end-to-end at the process of sourcing, materials use, manufacturing, end-of-life factors, and the like.

Waste With a Sole

Footwear and sports apparel giant Nike is a high-profile leader in sustainability, an activity that includes converting more than 1 billion used plastic bottles a year into recycled fabric. But the Beaverton, Ore.-based firm wants to continue to raise the bar when it comes to reducing its carbon footprint and striving for zero waste.

Noah Murphy-Reinhertz is the sustainable design lead within Nike's NXT Innovation Space Kitchen and head of the team that created the firm's recently released Space Hippie line of sneakers made mostly from trash. In his presentation, the former director of industrial design at Fuseproject explained the approach that led to these latest shoes.



Noah Murphy-Reinhertz of Nike.

NASA refers to its mission to reuse and repurpose materials as "in-situ utilization," because crew members in deep space for extended periods of time have no other option. Similarly, Nike notes, "There's no resupply mission coming to Earth" to replenish our limited natural resources. "What if waste becomes our future feedstock?" the company muses.

Murphy-Reinhertz said: "Our trash is incredibly technical. It leads us to repurposing both our own high-performance materials and the most high-performance materials that we can find out there and do it in a way that consumes very little energy throughout that process."

Over the past couple of years, Murphy-Reinhertz and his team committed to creating Nike's lowest carbon footprint shoe, and realized that to do so, they would



Nike has rolled out the Space Hippiie line of sneakers, derived mostly from trash. Model #04 of the Space Hippiie line is Nike's lowest carbon footprint shoe yet. Courtesy of Nike

need to find a way to work with waste. Over the course of a year, they traveled the world and collected various forms of trash, much of it from factories making Nike products. A group of designers, engineers, and developers in Oregon then worked together to figure out how best to turn those materials into a shoe.

Each shoe consists of an upper (which holds the wearer on the platform), a midsole (that provides cushioning and a foot bed on which to stand), and an outsole (traction and durability).

For the textile waste, the group collected post-consumer T-shirts, factory textile scraps, and plastic bottles, and from that created what it calls Space Waste Yarn. They did not want to use chemical recycling, since they wanted to limit the amount of energy used throughout the production process.

"We shred those T-shirts, wash them, and they get spun back together. This creates a staple fiber yarn that is like the most ancient form of yarn," Murphy-Reinhertz explained. "In and of itself, it's not a technical innovation, but it's a supply-chain innovation to get all these things together, and then to twist them together in such a way that we can put them through the same Flyknit process that we use for all our top-end running shoes."

Embrace the Limitations

This exercise reduces the carbon footprint of the yarn by about 70 percent relative to even typical recycled polyester. "When you take that melting and extruding step out, you just use so much less energy. So, learning how to work with that 'lint yarn' is really the key part," he said. "You just have to embrace the limitation, the constraints, of that material and work with them in that way."

The next step involved using essentially a composite filler. "We've got rubber flashing, the little trimmings that come out from the edge of the waffle press when you make the outsole of shoes. Let's take those and mix them into our typical foam. You just place virgin material with reclaimed material without any additional processing. But of course, it creates a very weird look; you don't get the same old foam." Nike calls that midsole compound Crater Foam.

Known for creating shoes for elite athletes like Michael Jordan and LeBron James, Nike gained further attention in October 2019 in Vienna, when Eliud Kipchoge of Kenya ran 26.2 miles in a once-inconceivable time of 1 hour, 59 minutes, 40 seconds—becoming the first person to cover the marathon distance in less than two hours. For that race, he wore a bespoke version of Nike Vaporfly running shoes, incorporating its highly

engineered ZoomX foam cushion.

Nike spent years developing ZoomX foam, and the team realized it had pattern waste left over from die-cutting that high-tech foam. “It became really clear,” said Murphy-Reinhertz, “that this was a high-performance, high-value material that we didn’t want to throw away. So how do we recycle that?”

“We took 100 percent of that foam and pressed it into a mold. There’s still some carbon impact there from heating the mold, but the material itself is 100 percent recycled content. That really is a first for a performance cushion underfoot.”

They then added a layer of this reclaimed ZoomX foam on top of the Space Hippy’s midsole. “What’s cool,” Murphy-Reinhertz said, “is that it gives people wearing everyday shoes access to the same kind of foam that’s in the really elite product.”

Given the use of various waste materials, the resulting look of the finished shoes is imperfect, a bit rough, and no two are the same. But that, Nike believes, is part of their charm.

The Space Hippy line—which currently comprises four models (dubbed #01 to #04)—are, by weight, made from

25 to 50 percent recycled materials. The new Flyknit upper is made from about 75 to 90 percent recycled content, by weight. About 12 percent, by weight, of Nike grind rubber is in the Crater Foam midsole. And in shoes #03 and #04, the outsole contains about 13 percent of regrind rubber, by weight.

“The lesson here, for ourselves,” said Murphy-Reinhertz, “is how can we take an abundant resource—trash—and transform that into a high-performance product? Something that we can make today, with the tools available, that represents a really significant carbon impact.”

The Space Hippy #04 model, which clocks in at 3.7 kg of carbon per pair, is by far the lowest carbon footprint shoe that the company has produced.

“For Nike, that 3.7 kg of carbon [per pair] is just a mark along the way to zero, and eventually to beyond zero,” he said. “If we’re going to take ourselves down to carbon neutrality—not just in terms of making shoes today, but carbon neutrality in terms of our total impact on the planet—there is no finish line. So, this represents that starting point, and point of inspiration. Embrace ‘start where you are, use what you’ve got, and let’s go further.’”



EcoGlobal is turning “dirty plastics” into durable products called EkoMats. Courtesy of Material ConneXion



About Sustainable Materials

Another conference speaker, Andrew Dent, PhD, took a deep dive into the topic of materials.



Dr. Andrew Dent of Material ConneXion.

Dent, who earned his PhD in materials science from the University of Cambridge in his native England, is executive vice president of research at New York City-based Material ConneXion and chief material scientist for its parent company, Sandow. Material ConneXion operates eight subscription-based materials libraries around the world, featuring more than 10,000 ma-

terials and processes across all disciplines of design.

“When you design,” Dent advised attendees, “we want you to think about the material first. It helps you design differently, design better, and it makes the potential for sustainability more inherent.”

Still, he stressed, “There is no such thing as a sustainable material. By itself, no material is inherently sustainable. You can choose the most green-looking, most amazingly recycled material, but if you use it in the wrong way, you’re doing it a disservice. You are ruining any chance it had to reduce environmental impact. Sometimes the most obvious choices aren’t the best choices, and sometimes the choices that you think will be terrible are actually pretty good.”

He gave the example of a large tail section of a Boeing Dreamliner. It used to be made out of highly recyclable aluminum. Then Boeing explored making the component out of carbon fiber composites, which are energy-intensive to make, and currently impossible to recycle, meaning they tend to get landfilled. You would have thought, Dent said, that the carbon fiber composite was a completely unsustainable material.

However, the strong, very lightweight composite reduces the weight so much compared to the previous metal material that the airplane’s fuel savings alone make this an improvement over aluminum. “Don’t always assume that because something looks bad, that it necessarily is bad.” The key, he notes, is in how you use the materials.

Additionally, Dent explained that the circular economy is not the same as sustainability. Expanded polystyrene (EPS) egg cartons and coffee cups, for example, actually have a lower overall carbon footprint than comparable products made out of recycled paper, meaning they technically are more “sustainable.”

However, the current poor recyclability of EPS means the recycled paper products have a much better chance of having a productive second or third life. So, Dent suggests, even though the paper cartons and cups consume more energy to produce, and have a bigger carbon footprint, they are the better choice for a circular economy.

He went on to highlight a few recent developments in the reuse of waste that appear to hold promise.

- » A social enterprise company called EcoGlobal in Chelsea, Vt., says a process it has developed can turn single-use and “dirty” plastics into a durable, recycled material it calls Ekopolimer, which it then molds into durable, multipurpose mats called EkoMats (www.ekomats.com).
- » A Swiss company called RePlan Global Sagl (www.replanglobal.com) has granted a license to Turin, Italy-based Ecoplasteam SpA (www.ecoplasteam.com) to use its patented process to produce its new EcoAllene material, made from recycled TetraPak multilayer, poly laminate food and drink cartons that consist of paper, polyethylene, and aluminum foil.
- » UBQ Materials Ltd. (www.ubqmaterials.com) of Tel Aviv has developed a patented, proprietary process that can make a new thermoplastic raw material out of mixed household waste destined for landfills, including food waste, soiled cardboard, paper, and mixed plastics. The company claims the resulting biobased, fully recyclable, composite material—called simply UBQ—is “the greenest thermoplastic material on the planet.”

Creating a Business Model

Another company that’s keen on design has built its own modest library of sustainable materials, but it’s nothing like Material ConneXion. Matrix4 is a small injection molder in Woodstock, Ill., 60 miles northwest of Chicago, that had been a shuttered shell of a factory seven years ago. Then five years ago Patricia Miller bought the plant from her grandfather and restarted it.

“I wanted a new business model,” Miller told Deep Dive attendees. “I bought a dead factory, and much needed to be renovated. I wanted energy-efficient machinery, zero waste, efficient materials handling, and more.” The company today makes no single-use products but rather focuses on durable and reusable applications.

Miller presented a breakout session to the conference

along with her partner, Kyle Swen, a high-profile designer she recruited from the West Coast to join Matrix4 as its first chief design officer. Prior to joining Matrix4, Swen was a founding partner and executive vice president of Astro Studios, a San Francisco-based design consultancy, and had worked at Lunar Design, also in the city.

In January 2019, Miller and Swen said they married design and manufacturing to create the M4 Design Studio + Manufacturing Factory House. Miller also preaches the need for manufacturers to “think holistically,” and uses software from Sustainable Minds LLC (www.sustainableminds.com) to examine all aspects of materials procurement and production.

Sustainable Minds of Cambridge, Mass., is a cloud software and services company, whose mission is to operationalize environmental performance into mainstream product development and manufacturing in an accessible, empowering, and credible way.

Matrix4 went so far as to establish an “artist in residence” post in the company, whose job is to help create objects of art from “unusable” waste. They have found a way, for example, to reuse purging materials from the injection molding process either as art or to repurpose in regrind.

Miller noted that the company also built a materials library with such items as coconut fiber, corn cobs, rice



Patricia Miller and Kyle Swen blend design and manufacturing at Illinois molder Matrix4. Shown is artwork created from injection machine purgings. Courtesy of Matrix4

hulls, flax fiber, and the like to test and explore for use as natural fillers and reinforcing agents in its plastic compounds. As they search for suitable applications, they test the actual drying times and mechanical properties for these biomaterials and aim to determine their true carbon footprint.

Still Time to Deep Dive

There were too many presentations at the Deep Dive event to do anything but hit a few highlights. Other presenters included Wyoming-based Seth GaleWyrick, who oversees engineering and design at Biomimicry 3.8. The company—whose name refers to the 3.8 billion years of life on Earth—describes itself as “the world’s leading bio-inspired consultancy offering biological intelligence consulting, professional training, and inspiration.”

GaleWyrick explained how biomimicry is design innovation inspired by the way nature works. The concept of a circular economy is a great example of biomimicry since there is no such thing as waste in nature. In ecosystems, he noted, resources flow through endless closed loops. He offered several examples of biomimicry inspiring design, such as how the shape of the kingfisher bird’s large head and long narrow beak motivated Japanese engineers to redesign the nose of that country’s bullet train.

Julianne Trummer and Blake McEldowney, senior officials from Spanish design consultancy Mormedi, teamed on a two-part presentation. In the first part, they took the audience on a journey, looking at how design has assumed an ethical responsibility in the past. In the second part, they shared their thoughts on how design can and should contribute to shaping a better future.

And Grant Goldner, the founder of a New York-based sustainability consultancy that operates at the intersection of material science, industrial design, and the circular economy, revealed his work with a fledgling, Brooklyn, N.Y., maker of electric motorcycles that opted for natural fiber-reinforced bioplastics for some external parts. (More on this project in the September issue.)

If you find some of these messages educational or inspiring, the best part is that videos of all the presentations from IDSA’s first Sustainability Deep Dive are available for free viewing at www.idsa.org/SDD2020.

ABOUT THE AUTHOR

Robert Grace is a writer, editor, and marketing communications professional who has been active in B2B journalism since 1980. He was founding editor of and worked for 25 years at *Plastics News*, serving as editorial director, associate publisher and conference director. He is now both editor of SPE’s *Journal of Blow Molding* and a regular contributor to various outlets. A long-time member of the Industrial Designers Society of America, he runs his own firm, RC Grace LLC, in Daytona Beach, Fla., and can be contacted at bob@rcgrace.com.

