

## **The Yoga Pant Problem**

The Rise of Synthetic Fibers and the War on Cotton.

### **Chapter 1: Introduction**

**Alexis:** Hi, I'm Alexis Pedrick.

**Lisa:** And I'm Lisa Berry Drago.

**Alexis:** You're listening to *Distillations*, and we're your new hosts! And that's not all that's new around here. We're now officially coming to you from the Science History Institute.

**Lisa:** That's right, the non-profit organization formerly known as the Chemical Heritage Foundation is now the Science History Institute. You can read all about the change at science history-dot-org. and don't worry, you can still find *Distillations* wherever you find podcasts.

**Alexis:** If you've been outside lately you've probably noticed that yoga pants and leggings are no longer just for exercising. Or practicing yoga.

**Sage Rountree** >> It's all about getting the cute yoga butt out walking around. Once I wore them I never wore jeans again if I could help it. I'm disappointed if I have to wear pants that button because yoga pants are so cozy.

**Lisa:** That's Sage Rountree, a yoga instructor in Carrboro, North Carolina. Sage isn't alone. Yoga pants are so popular so schools, and even airlines are struggling a little with how to react.

**News clips** >> Schools in Massachusetts, North Dakota, and Illinois are some of the states where in some schools where wearing tight pants is considered against school policy.

>>Girls have been pulled out of class for wearing leggings.

>>What do you think? Are her pants too tight? Her parents say no way, the school say yes.

>>I think girls should not be allowed to wear leggings as pants.

>>You should only wear leggings at home.

>>They should not be labeled as a distraction to boys.

>>They're leggings, that's what everyone wears nowadays. It is really not a big deal. To me it's not.

>>They made it through security only to be stopped by the so-called fashion police. Two girls were kicked off a United Airlines flight from Denver to Minneapolis because they were wearing leggings.

>>One Montana lawmaker went as far as calling yoga pants provocative, and wanted to make wearing them illegal in his state.

**Alexis:** This is reporter James Morrison.

**James:** This trend has spawned a whole new hybrid clothing style called the athleisure wear. It's exactly what it sounds like. Companies like Lululemon and Athleta, are now designing athletic apparel for people who have no intention of ever working out. There's a funny video on YouTube by the Van Vuuren brothers with nearly six million views that's making fun of this phenomenon.

**YouTube video** >> Active wear, active wear. Never exercising in my active wear. Active wear, active wear. Doing literally nothing in my active wear.

**Alexis:** Apparently this is not a passing trend. According to University of Nevada fashion historian, Deirdre Clemente, this is just the beginning.

**Deirdre Clemente** >> We are seeing athleisure infiltrate the American wardrobe and I think that infiltration has only just begun.

**Lisa:** Now before we go any further, let's address the leggings elephant in the room. I'm wearing stretchy business casual clothes, which you might mistake for yoga pants. And the world hasn't ended.

**Alexis:** No, that's true. I'm really comfortable in business casual stretchy clothes. I think it's all right, we are all okay. Work is all still getting done. No crises have happened, and, you know I'm a lot more comfortable for it, and I don't have to iron, which makes me super happy.

**Lisa:** Super happy. Not everyone is as happy as we are about the comfort athleisure wear trend. In fact the entire cotton industry is extremely upset about it.

**James:** That's because performance athletic wear isn't made out of cotton. It's made of synthetic fibers like polyester, nylon, and spandex that can stretch and wick away moisture. John Robinson is an agricultural economist at the University of Texas. He says the rise and popularity of yoga pants and leggings has coincided with a decline of the demand of cotton over the past five years.

**John Robinson >>** When these fashion things happen, then all of the sudden there will be a big shift—in this case inwards—in the demand for cotton because it seems like everyone is wearing those tight clingy yoga pants, whether they should be or not they are. They're very popular. And those kinds of fashion trends can influence, obviously they influence, ultimately the demand for cotton fabric.

**Lisa:** While synthetic yoga pants may be the latest economic threat to the cotton industry, this battle between manmade and natural fibers has been raging for decades. Cotton might be the current victim of this war, but silk was its first casualty.

## **Chapter 2: The Rise of Rayon & Nylon**

**Lisa:** Before the 1800s there were no manmade fibers. There was cotton, wool, linen, and silk: all natural. Cotton accounted for 85 percent of the world's fibers consumption at this point. Silk on the other hand was a coveted niche fiber because it was the softest, most luxurious, and expensive of them all.

**James:** Silk is so soft because it's a delicate thread created by silk worms when they're spinning a cocoon. It's durable because the individual threads are very fine and strong, like a spider's web. When you weave silks threads together you get clothing that is both extremely soft and strong. These qualities made it popular among the wealthy and it became the basis for much of their attire in the forms of satin and velvet. It was also expensive because almost all silk production was happening in Asia, which means it had to travel great distances.

**Lisa:** But in 1884 the French engineer Count Hilaire de Chardonnet discovered how to make artificial silk in a lab by mimicking the silkworm process with chemicals. This process still used natural materials, but it was the first manmade fiber. It later become known as rayon.

**DuPont educational video >>** When we make this rayon fiber we are imitating a spider spinning a web. When it spins the thread from its web, it forces this liquid up through tiny holes called spinnerets. We use this tube as a spinneret. We draw and sell the liquid forces it up through the tiny hole to the end of the tube. And here is our rayon fiber.

**James:** Clothing companies were ecstatic about this new fiber. They rushed it to market as artificial silk stockings, but early rayon was riddled with problems. It couldn't handle heat or water. But consumers didn't know that, so they were surprised when they fried it with their irons or watch it fall apart in the wash.

**Clemente** >> So it annoyed women. They started to think, we don't want to buy this stuff. So you sort of see the rayon market struggle in through the 20s.

**Lisa:** But in 1925 something happened that would forever alter the course of synthetic fibers.

**James:** The American chemical company DuPont was flush with cash from selling smokeless gunpowder to the American and allied forces during WWI. And it was looking to diversify its business by acquiring new chemical technology companies. Among its early purchases were cellophane and rayon. And a company with deep pockets like DuPont was able to take rayon and make it more durable and less susceptible to heat.

**Lisa:** And this happened at a pivotal moment in America. The country was in the middle of the roaring 20s and women's fashion was changing. Ankles, calves, and even knees were finally seeing the light of day. Women had just gotten right to vote. They were going to college in record numbers. They were moving into new spaces and their clothes had to move with them. Dresses were getting shorter, but modesty still required their legs to be covered with something.

**James:** Demand for rayon stockings skyrocketed. DuPont's success with rayon set it on course to experiment more with manmade fibers. It wasn't sure exactly what it was looking for, but it knew there was potential for an even stronger, more durable fiber than rayon. So it spent the next decade developing a thread that would be as strong as a spider's silk.

**Lisa:** Bob Kenworthy is our in-house chemist. He tells us that chemists knew about the chemical reaction that creates Nylon, but it wasn't put into practice until 1938. It involved 11 years of research and more than 230 DuPont scientists and technicians, lead by Wallace Carothers.

**Bob Kenworthy:** Polymerization: difunctional acids, difunctional amines that produce long-chain molecules hadn't really been reduced to practice in an engineering sense so that it was a useful material that came out of it, okay? I mean you can run that reaction and get a piece of glassware full of black goop, okay? It doesn't exactly do anything but what Wallace Carothers and his group did—he found a way to run that reaction that could then be reduced to useful practice. And

therefore we now have nylon. First as silk substitute but now much more broadly used in a lot of different applications.

**Lisa:** On October 27<sup>th</sup>, 1938 the company announced the world's first fully synthetic fiber, which required no natural ingredients. And it was called Nylon 66. The company previewed the new fiber at the 1939 World's Fair that spring, which had the fitting theme of "The World of Tomorrow." Later that fall, nylon stockings hit the consumer market for the first time. Debra Hughes is the curator of collections at the Hagley Museum in Wilmington, Delaware, which preserves DuPont's archives.

**Debra Hughes >>** They were first put on sale in Wilmington in six local department stores and within the first few hours they were sold out. Later, they were offered across the country and four to five million pair were sold out in a few hours.

**James:** Within two years, nylon stockings captured 30 percent of the hosiery market. But their run was short lived. In 1942, America entered WWII and all consumer nylon production stopped.

### **Chapter 3: WWII and the Post War Era**

**Alexis:** At this point nylon mostly just threatened the silk market. Cotton still made up about three quarters of the world's consumption. The cotton industry just couldn't fathom how these synthetic fibers would ever compete with their product.

**James:** The war completely disrupted everything. Much of cotton cropland was converted to grow food for the war effort, but it was still used as the source of all soldiers clothing. Meanwhile nearly all nylon went into making things like parachutes, ropes, blood plasma filters, and tents. At the same time, America was also at war with its main silk supplier: Japan. So women were left without silk, rayon, or nylon stockings.

**Alexis:** But it was still improper to go without them, so some women drew lines up the backs of their legs with chalk, to mimic the seam from stockings. There was also a significant black market.

**James:** All of this signaled to DuPont that the demand for nylon stockings never ceased during the war. And when the company was released from its war duty in 1945, it immediately returned to producing nylon stockings. But they didn't anticipate how much demand had built up during the war. When the first pairs of nylon stockings hit stores in September 1945, so-called "nylon riots" broke out. And things got nasty.

**Hughes** >> There were so many people that people would be pushing and shoving and pushing people down to grab a pair of nylons. It was like this major sale with not that many nylons and too many people who really wanted it. So everybody wanted it.

**Alexis:** The biggest of these nylon riots was in Pittsburgh in June of 1946. 40,000 people lined up for over a mile to compete for just 13,000 pairs of nylon stockings. After years of rationing and sacrifice women were starving for a return to normalcy, and they wanted to re-embrace fashion.

**James:** DuPont eventually opened another nylon production plant and the riots subsided. Over the next decade they released a family of synthetic fibers to compete with natural fibers like wool and cotton. Polyester, acrylic, and spandex all debuted under the brand names like Dacron, Orlon, and Lycra. They even had their own catchy ad jingles.

**Archival advertisement** >> *To look neat in the fall look for Dacron on the label. Because Dacron is a man's best friend.*

**Alexis:** Postwar America embraced synthetic clothing as the next evolution beyond natural fibers. They wrinkled less and could be worn without ironing. Manmade fibers were the clothing of the future.

**Hughes** >> Everything was looking ahead. In our terminology it'd be the new iPhone or it'd be this and then everybody had to have the new. I think that was the type of atmosphere for some of these new fibers when they came out.

**James:** By the 1950s manmade fibers could be found in underwear, socks, and even men's suits. But early synthetics were scratchy and uncomfortable. Many people still preferred the feel of cotton on their skin. And for all its success, DuPont still hadn't convinced fashion designers that synthetic fibers could be stylish. Here's Deirdre Clemente again.

**Clemente** >> They had a difficult time being able to convince fashion designers to use, you know, dacron instead of silk. Because snobby designers would say "Oh, we're not using that stuff."

**Alexis:** So DuPont came up with an ingenious solution. It shoveled piles of cash at fashion designers and it plied them with thousands of free samples.

**Clemente** >> Designers such as Hubert Givenchy openly embraced this. They took the check and made some dresses out of synthetic fibers. And that's really when the natural fibers industry said "We've got a problem"

**James:** Because designers dictate fashion trends, once Givenchy made a line of polyester dresses, Sears wasn't far behind. But this expansion would not go unchecked.

#### **Chapter 4: Cotton Strikes Back**

**Lisa:** In 1966, panicked U.S. cotton farmers successfully lobbied Congress to pass the Cotton Research and Promotion Act. It allowed cotton growers to unite and formed the company, Cotton Incorporated, which is still to this day focused on promoting and researching new technologies to make cotton more competitive. Mary Ankeny is the group's vice president of product development and innovation.

**Ankeny:** The first effort of this program was to advertise cotton directly to the consumers. So we weren't trying to sell cotton to the mills. But we were trying to make the consumer aware of the great fiber that's out there that we call cotton. And we did through the development of the seal of cotton.

**James:** This was an actual seal. You've probably seen the logo of a fluffy cotton ball growing out of the word cotton a thousand times on packages of undershirts or socks.

**Archival advertisement:** So when you're looking for comfort, look for the sign of cotton. The more cotton, the better you feel.

**James:** Cotton had never been advertised before this time. It was seen as a commodity like milk, eggs, or bread. But it was quickly losing market share. In the 1960s cotton share of the retail and home furnishing industry was 66%. By 1975 that share was wiped in half to just 34%. That's because the synthetic industry had finally perfected ways to make fabrics like polyester more durable and comfortable and DuPont had released millions of pamphlets educating consumers about how to wash and iron synthetic without ruining them.

**Clemente:** And that's really where all of the decades of working out the kinks and all of the decades of 'oh, these aren't as nice as natural fibers.' All of that fades in the 1970s. The American consumer comes to not only accept synthetic fibers, but celebrate them.

**Alexis:** By the 1970s, manmade fibers reigned supreme.

**James:** This celebration took place mostly in the discos. The glam crowd wanted to distance themselves from the free-loving, anti-war hippies who wore loose and colorful clothing. So the disco crowd opted for skin-tight tight, shiny and sparkly clothes which were mainly polyester. And then in 1974, the 100% polyester leisure suit had arrived. The idea was that this was this was a casual suit that could we worn a aboard a yacht, or out in the country. Its popularity spiked in 1977 when a young John Travolta donned a white leisure suit in the film, “Saturday Night Fever.”

**Clip from 1979 Saturday Night Fever:** Can you guys do layaway?

As long as it doesn't turn into a 20-year mortgage.

All right, look, put me down for five dollars for that blue shirt by the window. Hold it for me.

Hey wait for your receipt. Please, please don't trust me.

**Lisa:** The cotton industry knew it couldn't beat synthetic fibers in a head-on competition. Natural fibers couldn't stretch like spandex, or take fancy dye patterns like polyester. But cotton was comfortable and it lasted. So the industry focused on drumming up demand in its core market of work clothes, and blue jeans, which were highly popular in the 70s.

**James:** Cotton grew bold in its offensive. It was the only natural fiber with the market share and the deep pockets to push back on manmade fibers. And then in the late 1970s it moved into synthetic territory. It coated cotton yarn with synthetic acrylic to make cotton clothes wrinkle free just like polyester.

**James:** In this 1979 commercial a young Bryan Cranston promotes the no-iron “Cotton Ease” shirt.

**Archival Advertisement:** This new 100% cotton shirt is fantastic. 100% cotton, but with a special process so I can just wash and wear. It's new. The Cotton Ease Shirt by Arrow. All the comfort of 100% cotton and easy care. Because she promised to honor. But not to iron.

**Lisa:** Cotton Inc.'s investment in advertisement started to pay off in the 80s, and it played out in a few ways. One was that people started mixing natural and synthetic fabrics in their outfits.

**Clemente:** In your mind picture one of these 1980's aerobicized backup dancers for James Fonda, the legendary Jane Fonda workout aerobics video. What do they have on? They have on nylon tights, some sort of a spandex or lycra jumpsuit - leotard- and a cotton sweatshirt.

**James:** This is also the decade where you see cotton elbow its way into the corporate world. Wool and synthetic suits had reigned supreme in the office place in the 70s, but in the 80s this new thing called casual Friday started to catch on. Here's Cotton Inc.'s Mary Ankeny again.

**Ankeny:** People started wearing Dockers and more cotton pants. Cotton polo shirts and cotton dress shirts paired up with khaki pants and leaving the three-piece suit at home.

**Lisa:** The 80s offered a comeback for cotton. By the end of the decade it was nearly back up at nearly 50% of the fibers market. By comparison, polyester and nylon together were at about 30%.

**Lisa:** Then it capped off the decade with a drop-the-mic moment during the TV broadcast of the Macy's Thanksgiving Day Parade in 1989.

**Ankeny:** That's where we had the jingle: the look, the feel, the fabric of our lives.

**Cotton Ad Jingle:** "The Touch, the Feel, the Fabric of our Lives."

**Ankeny:** That commercial, series of commercials, really struck the hearts of Americans. Even to this day, years and years later, when I tell people I work for Cotton Inc. I say the fabric of our lives and immediately the light goes off. And they are like 'Oh, yeah.'

## **Chapter 5: Synthetics Rise Again**

**James:** But cotton's comeback was about to come to an end. The synthetic industry had set its eyes on cotton's most valued market: blue jeans.

**Alexis:** That was a tough pill to swallow for the cotton industry since blue jeans have long been their bread and butter. Traditionally denim is 100% cotton, but by the mid 1990s clothing manufacturers began making women's jeans with as much as 35% spandex in them --to provide a stretch quality. This lead into the skinny jean era of the late 90s, early 2000.

**James:** In 2002, demand for polyester surpassed cotton for the first time ever. By 2005, the cotton industry became fully aware that consumers wanted more stretch from their everyday attire. Skinny jeans gave away to jeggings, leggings and yoga pants, which were made almost entirely of manmade fibers. Cotton has never really been able to break into this market because it doesn't stretch.

**Alexis:** Can I just stop us here for a moment to say that stretchy jeans are the absolute best. And I think they are a necessity. I need stretch in my jeans or otherwise I won't be able to wear them.

**Lisa:** Yeah absolutely. But for the right fit, the right range of motion, I think stretchy jeans are a godsend.

**Alexis:** And you wash them and they don't shrink right away. 100% cotton, that's always a problem.

**Lisa:** Keep their shape.

**Alexis:** Exactly. Alright back to business.

**Alexis:** In 2011 the cotton industry hit another setback that was years in the making. The ethanol boom of 2006 cause the price of grade and oil seed to skyrocket. So a lot of the cotton growers switched to these crops instead. A steady decline in cotton ultimately came to a head in 2010 when two of the worlds largest cotton producing countries -China and Pakistan- saw their crops ruined by bad weather. The resulting shortage lead to the price of cotton nearly tripling from 70 cents a pound to more than \$2 a pound.

**James:** To save money, clothing manufacturers started blending more synthetic materials into traditionally cotton garments, like basic white t-shirt. Check the label on your undershirt the next time you get a chance and see how much polyester is in there, you might be surprised.

**James:** This shift made clothing manufacturers realize that Americans weren't as adverse to synthetic blends as they once thought. So when cotton prices finally dropped back down, these manufacturers continued blending synthetics to cut cost and the demand for cotton has pretty much being stagnant since then.

**Lisa:** Right now, cotton accounts for 27% of the textile market. That's right, 27%. It was at 85% 100 years ago. Meanwhile, Nylon and polyester combined make up 60% of the market. Analysts expect this share will only grow larger as the textile market grows by billions of pounds annually and athleisure wear becomes even more prevalent. But that's not to say cotton and other natural

fibers will fade away. In fact, all fibers are expected to benefit from the growing apparel market because people will always need clothes. And some people will always want comfortable cotton t-shirts, heavy wool coats or silk pajamas.

**James:** But 100% cotton, wool, or silk garments may be more of a luxury in the future, now that companies know they can get away with blending in synthetics to cut costs. And that might make you think manmade fibers are the clear winner in this decades-long competition. And you might be right. But Deirdre Clemente thinks there's another winner: us, the consumer.

**Clemente:** The past century has redefined the way that human beings dress. The rise of casual dress is part and parcel of the changing American society. One where class and wearing distinctions of your class aren't as important as they were in the French Court. They aren't as important as they were in the Roman society. Really what we are looking at today is a culture where society doesn't tell us what to do. We tell society what we are going to do.

**Alexis:** Okay Lisa, so let's reflect.

**Lisa:** We spent a lot of time talking about the economics story. But I think there is an important social angle we shouldn't miss.

**Alexis:** Okay, do tell.

**Lisa:** I think a lot of the anxiety is over who can wear leggings in public. Can we wear leggings in public? Where is it okay to wear leggings? Is it okay to wear leggings to a meeting, but not to a presentation? I think so much of that is about controlling what women wear. Or social anxieties over what women wear. And it doesn't matter whether its formal wear or leggings. It doesn't matter whether it's comfortable or uncomfortable clothes. I think it's always going to make someone anxious. Are women comfortable are they too comfortable?

**Alexis:** Exactly, exactly and I think that's why when we say the athletic leisure wear, that's what we are talking about. We are talking about women. Women are the ones who wear yoga pants. We are the ones who get thrown off the planes because we are wearing leggings. We get sent home from school. All those things, I think we have a long history in this country of being anxious, being concerned about women's fashion, you know. And change happens and people panic. People freak out. But I also think that's part of the process. I think all the trends that we have right now in athleisure -- they are just trends. Someone in fashion is making those decisions and they are filtering down to us. It just so happens that yoga pants are really comfortable and that's great, but I also don't think we should pretend that this is also not a fashion decision.

**James:** oh, and one final word about cotton. Cotton Inc. is already plotting its next comeback, branding cotton as the sustainable, natural alternative to synthetics. In an ironic twist, cotton is now selling itself as the fabric of tomorrow. For *Distillations*, I'm James Morrison.

**Alexis:** *Distillations* is more than just a podcast. We are also a multimedia magazine.

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**Alexis:** you can find the science history institute on Facebook and Instagram. You can also follow us on twitter at [scihistory.org](http://scihistory.org).

**Alexis:** for *Distillations*, I'm Alexis.

**Lisa:** And I'm Lisa.

**Alexis and Lisa:** Thanks for listening.