

Fashion, Digital Technologies, and AI. Is the 2020 Pandemic Really Driving a Paradigm Shift?

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Abstract

Is the Covid-19 pandemic going to force the fashion industry to rethink herself and push it to embrace digital technologies more and more? The answer is most likely “yes”, but the question is somewhat ill-posed. In fact, the fashion world, especially haute couture, has always been very keen to innovation and experiment with technology. Even before the current situation there have been experiments that encompass every part of the fashion ecosystem, with AI applications for smarter supply chain and manufacturing, new materials and design processes, new ways of presenting fashion in digitally augmented fashion shows. While other businesses are slowly learning that human and AI interaction is the way to go, the fashion world seems to have found this insight a long time ago and has been a fertile field for interactive applications for a long time now. The commercial model has slowly shifted from being centered around retailers to being heavily reliant on online shopping. So much so that we are seeing an increasing number of so-called digital native fashion brands, brands designed from the ground up to be entities of the digital world. This new way of selling fashion has been leveraging big data for some years now. Nonetheless the abrupt change in everyday life dictated by the quarantine is most certainly having an effect on the industry at all levels, from haute couture to fast fashion, from big brands to small ones. Big fashion shows with dazzling set pieces and parties are no longer possible and thus their function, to establish a certain image of those brands into people’s mind, is now carried by internet live streams designed by contemporary digital artists (Valentino 2020). Big fairs are now hosted as online events (Pitti Immagine) and many brands are launching applications that allow them to “try” clothes using augmented reality (YOOX), with physical retail stores becoming mere warehouses or even disappearing in the foreseeable future. But has this phenomenon started or accelerated with the onset of the Covid-19 pandemic? In this paper we will try to answer this question by using data science to investigate the correlation between the spread of the virus and the shift in the fashion industry practices and priorities.

Keywords: Covid-19; Fashion; Digital Technologies; Social Media; Artificial Intelligence.

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Introduction

The Covid-19 pandemic has completely shook up every aspect of our lives by forcing us to renounce such a basic part of our lives like the possibility of moving and meeting other people. Quarantine has transformed how people work, if they are able to work at all, and has made impossible every kind of social leisurely activity. Obviously, fashion has been impacted heavily by the situation because it is both an industry, with millions of workers that rely on it, and an expression of human life deeply connected to the social experience.

This consideration begs the question: How has the Covid-19 influenced the world of fashion? The objective of this article is to try to answer this question from the perspective of a data scientist. We will look at the data regarding the industry during the pandemic, looking for some insight on the economic side of things as well as investigating how people are considering fashion in a time where their lives are focused on more pressing necessities and their day is spent inside the four walls of their house.

The other focus of this paper is on the technological possibilities that the pandemic seems to point towards. Many are asking themselves if the virus would force fashion brands and retailers to seek a new strategy to sell their products. That is both in the abstract sense of conceptualizing and advertising their products in an unprecedented manner, as well as in a more practical sense of finding new ways of dealing with their customers that will no longer be able to go to a physical store or will be severely hindered in their freedom to do so. We find that this question, albeit legitimate, is kind of ill-posed in the context of the fashion world. This industry, in fact, has always been much more prone to innovation than one might think, and technology has been steadily integrated and explored in the last two decades. For this reason we think that the fashion world already has the instruments and solutions to surpass the pandemic, even if the transition will be far from easy and painless, as many of the technologies necessary to work in the quarantine world have been available for quite some time now.

One area of particular interest, that we think it is worth illustrating, is Artificial Intelligence (AI) and its incredible potential for application to numerous aspects of the fashion industry using Big Data from online platforms. The interest is strong as literature reviews show a steady increase in publications.¹ A more intelligent way of managing production and sales is invaluable for any brand, as well as a way for intercepting the ever-changing taste of the public. But AI models have also demonstrated their ability to assist in creative tasks, like music, and fashion design is one of them. This kind of creative tasks especially foster an interaction between the human and the machine, recognizing the importance and potential of both, a thing that oftentimes is forgotten in other fields of application.²

The paper is organized as follows: In Section 2 we will discuss the impact of Covid-19 on the fashion industry, drawing our considerations from the available data and distinguishing between “fast” and “high” fashion brands. Then, in Section 3, we will talk about innovation and technology in the fashion world, with a special consideration for artificial intelligence applications. Finally, Section 4 concludes the paper.

Impact of Covid-19 on the industry

Fast Fashion

Fast fashion is one of the sectors that suffered more heavily from the impact of the pandemic. Characterized by the extreme velocity at which new products are created, distributed, and sold, with low

1. C. Giri et al., “A Detailed Review of Artificial Intelligence Applied in the Fashion and Apparel Industry,” *IEEE Access* 7 (2019): 95376–96, <https://doi.org/10.1109/ACCESS.2019.2928979>.
2. Marco Roccetti et al., “A Cautionary Tale for Machine Learning Design: Why We Still Need Human-Assisted Big Data Analysis,” *Mobile Networks and Applications*, 2020, <https://doi.org/10.1007/s11036-020-01530-6>; Luca Casini and Marco Roccetti, “The Impact of AI on the Musical World: Will Musicians Be Obsolete?,” *Studi Di Estetica* 0, no. 12 (2018), <http://mimesisedizioni.it/journals/index.php/studi-di-estetica/article/view/630>.

margins on the single items and high volumes of sales to generate revenue, fast fashion brands were already walking on a thin line. With the Covid-19 outbreak this frail system toppled, and all its flaws have been undeniably exposed. An example is the global nature of these companies whose production infrastructure is scattered all over the world, in the pursuit of lowering costs, and that for the global nature of the contagion are impacted on every level and will continue to be as long as the whole world is not safe from the emergency. Fast fashion as an industry is losing money for the first time in 20 years, but the highest price is being paid by the countries that are more heavily dependent on textile production, like Bangladesh where 80% of the GDP is produced by the fashion industry. This particular business model in the fashion industry is quite unsustainable and the pandemic has only made evident what the insiders have known for quite some time.

Inditex, the company that owns, among others, the brands Zara, Pull&Bear, Bershka and Oysho, announced that because of the pandemic they will “permanently closing as many as 1,200 stores — 16% of its global outlets — and will pivot more aggressively toward selling online, as the fast-fashion giant maps out its post-pandemic future.”³ Similarly, H&M announced the closure of roughly 70% of its stores worldwide as the company took a major hit because of the global lockdown.⁴

In Figure 1, we can see how some popular fast fashion companies fared in the stock market in 2020 (data was obtained from the “Yahoo!Finance” platform). Inditex (ITX) and H&M (HM-B) are the two major players in the fast fashion world. Like most brands they dropped significantly in March with the pandemic ramping up, but in the coming months they failed to recover. This is probably due to the heavy focus they put on retail sales, with online stores being a small part of their annual revenue. A similar situation can be seen for the Italian brand OVS (OVS.MI) that has suffered considerable losses and failed to recover. American brand The Gap (GPS) and Fast Retailing (9983.T), the parent company of Japanese fast fashion brand Uniqlo, also show the same dip in March but were also able to pick themselves up and come back to the same level by September, presumably thanks to the better online sales.⁵ The differences in intensity for those companies are to be considered a result of different containment measures taken in different countries as well as the different scale of those companies).

Haute Couture and Luxury Brands

Luxury brands and haute couture fashion are very peculiar as they are high revenue businesses that however concern a somewhat restricted niche of people able to afford their products.

On the economic side of things this meant that the effect of the pandemic was felt but in a smaller measure compared to the mass-producing fast fashion brands. Figure 2, below, shows financial data for LVMH (MC.PA), a group that controls many luxury brands among which is Louis Vuitton, Kering (KER.PA), owner of Gucci, YSL and Balenciaga and Hermès (RMS.PA). After the common dip in March the companies slowly regained their footing, with losses not greater than 10% in September. Arguably, the typical client of such brands is someone who enjoys luxury in and of itself, so is not conditioned by the “status symbol” effect and fact that social gatherings are now impossible, and is presumably wealthy so the economic hurdles derived by the lockdown are not a factor.

There is however the cultural side of haute couture, with the big fashion shows where the brands can express all their creativity, not just on the clothes that appear on the runway, but on the whole experience that the audience is subjected too. The goal is to impress, to be controversial and make people discuss and generate hype as shown by the success of designers like Rick Owens or Alexander McQueen.

3. Saabira Chaudhuri, “Zara Owner to Close 1, 200 Stores as It Outlines Post-Coronavirus Future,” *Wall Street Journal*, June 10, 2020, sec. Business, <https://www.wsj.com/articles/zara-to-close-1-200-stores-as-it-outlines-post-coronavirus-future-11591794618>.

4. Alice Ierace, “Covid and The Ugly Side of Fast-Fashion,” *NOWFASHION*, April 6, 2020, <https://nowfashion.com/covid-and-the-ugly-side-of-fast-fashion-29731>.

5. Nivedita Balu, “Gap Reports Lower-Than-Expected Quarterly Loss on Surprise Rise in Same-Store Sales,” *Equities News*, August 27, 2020, <https://www.equities.com/news/gap-reports-lower-than-expected-quarterly-loss-on-surprise-rise-in-same-store-sales>.

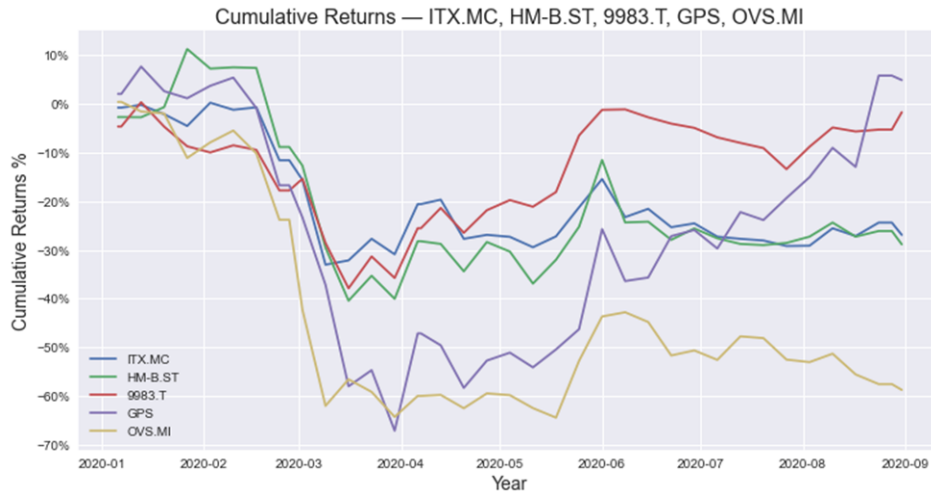


Figure 1: Stock market data for Fast Fashion Brands. Inditex (ITX), H&M (HM-B), Gap (GPS), Fast Retailing (9983.T) and OVS. Data sourced from Yahoo Finance.

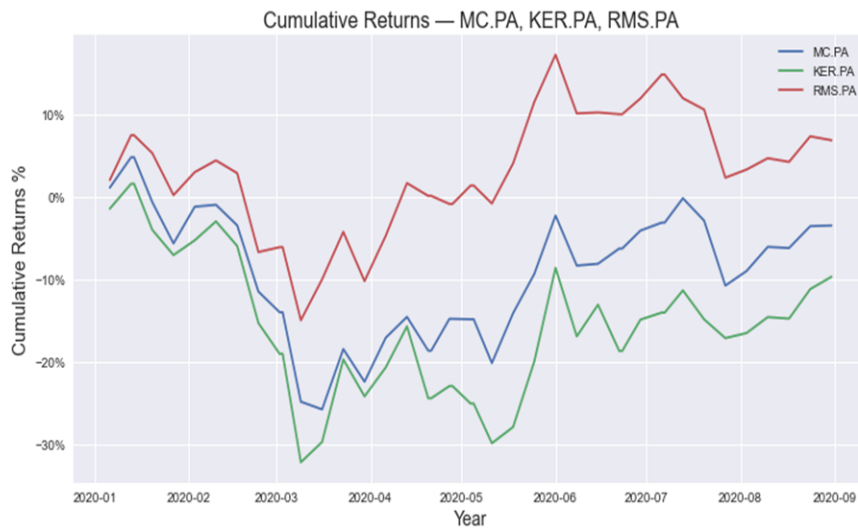


Figure2: Stock market data for Luxury Brands. LVMH (MC.PA), Kering (KER.PA), Hermès (RMS.PA). Data sourced from Yahoo Finance.

These shows often include performances of visual artists and musicians, specifically designed for the occasion, that enhance the experience and can be considered works of arts themselves. The physical aspect is obviously central and with the restriction necessary to prevent the spread of the virus fashion brands had to reinvent what a fashion show could be, leveraging digital technologies and experimenting with what could be done without the physical presence of the audience. Using Anna Wintour words from a New York Times article: “There will definitely be something, but nothing resembling fashion week as we knew it.”⁶

Online Shops

As a further confirmation of the crucial role of a solid online platform during this pandemic, we can take a look at those companies that specialize in reselling fashion products online. German Zalando and British ASOS are arguably the two biggest players in this sector, along with Italian YOOX. As the latter is not a public company, let us observe the stock market results for the first two alongside ETSY, an American company that focuses on e-commerce of homemade objects by the users (mostly clothes and accessories).

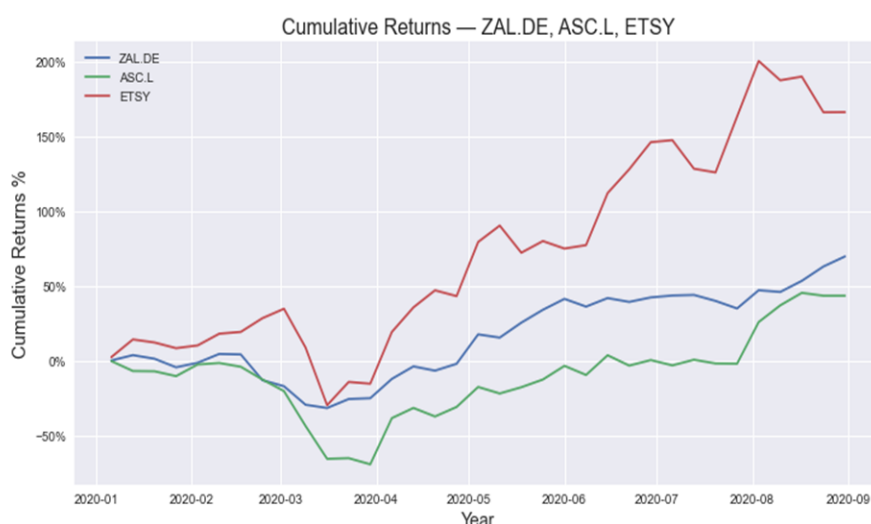


Figure 3: Stock market data for Online Shops. Zalando (ZAL.DE), ASOS (ASC.L), ETSY. Data sourced from Yaboo Finance.

We still observe the dip in the first weeks of March, but this time rebound is much quicker and, even more interestingly, these companies started growing and did really well by September. What is decisive here is their superior online presence and a streamlined infrastructure that dealt way better with the impact of the pandemic across the world. Since these companies' core business is sales, as the production of their own line of clothing is secondary, most of their focus is on managing logistics and marketing, and the absence of physical stores translates to far less losses and expenses. Etsy is particularly interesting, as it saw the rise of a business occasion in the production of customized face masks as they became the primary measure to contain the spread of the virus all across the globe. This practice was soon picked-up by the major fashion brands across the spectrum from casual to luxury, as it often happens with things that suddenly become everyday objects.

6. Irina Aleksander, “Sweatpants Forever: How the Fashion Industry Collapsed,” *New York Times*, June 8, 2020, <https://www.nytimes.com/interactive/2020/08/06/magazine/fashion-sweatpants.html>.

Innovation in the fashion world

As we anticipated in the introduction, although Covid-19 put the fashion world in shambles and highlighted the unsustainability of certain mechanisms within it we find that the drive to innovation that could catalyze the changes necessary is already present. In this section we will provide a number of examples of innovative practices in the fashion world that involve smart digital technologies, big data and AI, augmented and virtual reality.

With the ever-increasing importance of online shops and the way trends start and develop on social media, the fashion industry is sitting on a goldmine of big data. The manufacturing pipeline, the logistics of warehouses and the sales can all benefit from the insight hidden in those data. In this context artificial intelligence can help by providing models that can ingest all of them and output prediction on upcoming trends and sales that can be used for guaranteeing stocks and designing effective marketing campaigns.⁷ AI can also be leveraged for enhancing the manufacturing process by performing accurate quality control in the production chain. Automatically spotting a defect in a garment in a reliable way helps save costs by avoiding those damaged goods that will eventually be returned, reach the store's shelves.⁸

A problem when creating smart models to exploit information in big data is working with unstructured data like images. It is easy to imagine how in fashion those can be quite common. Alibaba is using AI to quickly build a knowledge base of attributes describing their fashion products starting from photos. The recent advancement in AI methods make so that the process of collecting the data and building a system that can recognize the specific features in the products is now quicker and more automatable. Through the use of a technique called Few-Shots Learning, sophisticated algorithms are able to generate a model to describe a new attribute (e.g. a particular kind of neck or sleeve) in a matter of hours instead of months.⁹ A good model that is able to recognize style from photos results in an AI system able to learn "what is similar to what" and "which item goes with which" creating a sort of map of fashion inside of them. This conceptualization can be used for stunning visualizations like Google's Runway Palette experiment, developed for their Arts and Culture platform, which shows a cloud of fashion styles clustered together, for creating searching tools that are visual instead of textual in nature (useful in the context of shopping assistants and websites) and is at the base of AI-assisted fashion design, where man and machine collaborate together in a creative endeavor.¹⁰

A great application of this concepts is Stitch Fix Inc., an American company that operates an online service of personal styling.

7. Tsan-Ming Choi et al., "Fast Fashion Sales Forecasting with Limited Data and Time," *Decision Support Systems* 59 (2014): 84–92, <https://doi.org/10.1016/j.dss.2013.10.008>; Sbastien Thomassey and Xianyi Zeng, *Artificial Intelligence for Fashion Industry in the Big Data Era*, 1st ed. (Springer Publishing Company, Incorporated, 2018); Roberta Sirovich, Giuseppe Craparotta, and Elena Marocco, "An Intelligent Fashion Replenishment System Based on Data Analytics and Expert Judgment," in *Artificial Intelligence for Fashion Industry in the Big Data Era*, ed. Sébastien Thomassey and Xianyi Zeng, Springer Series in Fashion Business (Singapore: Springer, 2018), 173–95, https://doi.org/10.1007/978-981-13-0080-6_9; Matthias Wölbtsch et al., "Mind the Gap: Exploring Shopping Preferences Across Fashion Retail Channels," in *Proceedings of the 28th ACM Conference on User Modeling, Adaptation and Personalization*, UMAP '20 (New York, NY, USA: Association for Computing Machinery, 2020), 257–265, <https://doi.org/10.1145/3340631.3394866>.
8. Junfeng Jing et al., "Yarn-Dyed Fabric Defect Classification Based on Convolutional Neural Network," *Optical Engineering* 56, no. 9 (2017): 093104, <https://doi.org/10.1117/1.OE.56.9.093104>; Henry Y. T. Ngan, Grantham K. H. Pang, and Nelson H. C. Yung, "Automated Fabric Defect Detection — A Review," *Image and Vision Computing* 29, no. 7 (2011): 442–58, <https://doi.org/10.1016/j.imavis.2011.02.002>.
9. Lei Yin, "FashionAI: Revamping the Fashion and E-Commerce Industry through Artificial Intelligence," *Alibaba Cloud Community*, September 30, 2019, https://www.alibabacloud.com/blog/fashionai-revamping-the-fashion-and-e-commerce-industry-through-artificial-intelligence_595413.
10. Maria Th Kotouza et al., "Towards Fashion Recommendation: An AI System for Clothing Data Retrieval and Analysis," *Artificial Intelligence Applications and Innovations* 584 (2020): 433, https://doi.org/10.1007/978-3-030-49186-4_36; Li Fengzi et al., "Neural Networks for Fashion Image Classification and Visual Search," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, April 24, 2020), <https://doi.org/10.2139/ssrn.3602664>; Hee-Su Kim and Sung-Bae Cho, "Application of Interactive Genetic Algorithm to Fashion Design," *Engineering Applications of Artificial Intelligence* 13, no. 6 (2000): 635–44, [https://doi.org/10.1016/S0952-1976\(00\)00045-2](https://doi.org/10.1016/S0952-1976(00)00045-2); Cyril Digne, "Runway Palette — Google Arts & Culture Lab, The Business of Fashion," Experiments with Google, November 2019, <https://experiments.withgoogle.com/business-of-fashion>.

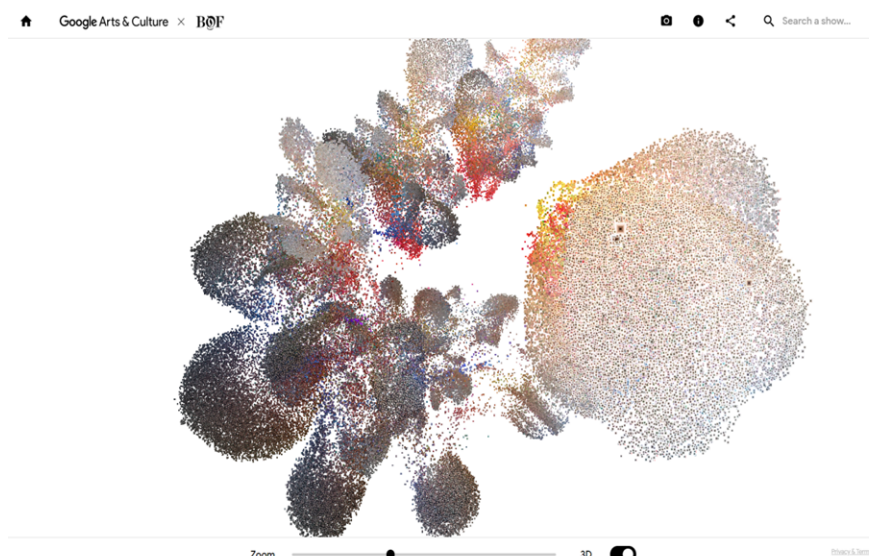


Figure 4: *Runway Palette* by Cyril Diagne, created for Google Arts & Culture.

Another solution that could help in reducing costs for online shops is the implementation of some kind of Try-on feature using Augmented Reality, as this possibility can help reduce the risk of clients returning items that do not fit as expected.¹¹ For example, going to Ray Ban's website right now one can try any pair of sunglasses and see how they look. But a pioneer in this sense was YOOX. In 2018 they launched *YooxMirror*, "the first AI-powered virtual styling suite."¹² This unprecedented application employs Augmented Reality technology and allows the user to create their custom digital avatar by uploading a selfie and use it to try on clothes and outfits, deciding what suits them and eventually share their stylized looks with friends. While the customers are experimenting with their combinations of products an AI system will analyze these choices and suggest appropriate items to match the style. The face of this AI is the virtual model Daisy, a digital avatar that is also used as an Instagram influencer taking over the YOOX profile on the social network. Hype Auditor shows they have higher engagement rate compared to human influencer although their cost is higher, and their popularity is probably due to the novelty.¹³ Virtual models have been around on Instagram before. Lil Miquela emerged on the platform in 2016 and has since amassed 2.7 million subscribers. She appeared on *Vogue* and collaborated with Prada. Similarly, Shudu, created by the digital artist Cameron-James Wilson, is a virtual supermodel with the semblance of a beautiful black woman that came to fame in 2018 and has "worked" among others with Fenty.¹⁴

This brings us the innovative side of catwalks shows.¹⁵ In a world where gathering a large number of people is no longer a possibility those events have no space to be. One would think that this will force fashion brands to renounce all together to runways or to painfully adapt by embracing a new, all-digital, form of shows. The truth however is that the seeds of this change were already there, and the transition

11. Elena Mazareanu, "Reverse Logistics Costs in United States," Statista, May 26, 2020, <https://www.statista.com/statistics/871365/reverse-logistics-cost-united-states/>.

12. Yoox, "Be Your Own Avatar — YOOXMIRROR Reloaded," *YOOX NET-A-PORTER Newsroom* (blog), November 5, 2019, <https://www.yoop.com/news/be-your-own-avatar-yooxmirror-reloaded/>.

13. Nick Baklanov, "The Top Instagram Virtual Influencers in 2019," *HypeAuditor Blog* (blog), November 14, 2019, <https://hypeauditor.com/blog/the-top-instagram-virtual-influencers-in-2019/>.

14. Alice Newbold, "The Numerous Questions Around The Rise Of CGI Models And Influencers," *British Vogue*, August 18, 2018, <https://www.vogue.co.uk/article/cgi-virtual-reality-model-debate>.

15. Brooke Roberts-Islam, "Virtual Catwalks And Digital Fashion: How Covid-19 Is Changing The Fashion Industry," *Forbes*, April 6, 2020, <https://www.forbes.com/sites/brookeroberstislam/2020/04/06/virtual-catwalks-and-digital-fashion-how-covid-19-is-changing-the-fashion-industry/>.

will not be as painful as one would think but it is rather an occasion to further express the creativity of the designers. While it is true that not every fashion company was ready to embark in this new paradigm before the pandemic, the future of the catwalk is something that builds on a recent past of experiments and it is not so difficult to envision.

There have been instances of experiments, before the pandemic, with the concept of a fashion show that is built on the use of computer graphics, augmented or virtual reality, and robotics elements. For example, in 2017 FTLModa allowed attendees at the New York Fashion Week to be transported to Milan through a SamsungVR headset and experience an exclusive red carpet with a collection shot in the Italian city a week earlier, in 2018 Dolce and Gabbana presented their handbags line using drones in place of models.¹⁶ During the pandemic Valentino has presented his collection for Fall/Winter with an online virtual show¹⁷ and Gucci set up a 12 hours streaming on its website that united video-art and fashion, curated by Alessandro Michele.¹⁸ Pitti has transformed the experience of the fashion fair in the age of the pandemic with PittiConnect, a platform that digitally brings together the exhibitors, buyers, and journalists in a virtual space.¹⁹

Conclusions

We have tried to understand the effects of Covid-19 on the fashion industry focusing on the different parts of it and gauged the impact it had on the economics of fashion at different levels, from fast fashion to haute couture. It clearly emerged how online presence and a smart management of the supply chain is crucial for companies dealing with high volume productions if they want to survive the pandemic, as the lockdown has shown that people are still interested in fashion even if their freedom of movement is limited but that the way they interact with the fashion ecosystem is drastically changing. While the world of high fashion is an exception when it comes to the way business is handled because of the nature of its customers, the way it experimented with digital technologies pushed the envelope of what is possible and we argue that all the instrument and ideas needed to power through this health crisis are there and have emerged in the last few years, before the spread of the virus. These last few months have certainly strained the business of fashion in an unprecedented way and probably things are not going to go back to the way they were completely, but picturing how the future of fashion is going to look like is not difficult, we had plenty of examples in the recent past to fuel our imagination.

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16. Phil Britt, "New VR Platform Wows Attendees at New York Fashion Week," *Samsung News Insight*, February 17, 2017, <https://insights.samsung.com/2017/02/17/new-vr-platform-wows-attendees-at-new-york-fashion-week/>; Alexandra Ma, "Dolce & Gabbana Is Using Drones to Model Its Handbags at Milan Fashion Week," *Business Insider*, February 26, 2018, <https://www.businessinsider.com/dolce-and-gabbana-uses-drones-to-model-handbags-at-milan-fashion-week-2018-2>.
 17. "Collezione Haute Couture Autunno/Inverno 2020-21 Donna," Valentino, 2020, <https://www.valentino.com/it-it/collections/donna/haute-couture-fall-winter>.
 18. "Gucci Epilogue," Gucci, 2020, <https://www.gucci.com/it/it/stories/runway/article/epilogue-video>.
 19. "Pitti Connect," Pitti Immagine, accessed December 2, 2020, <https://www.pittimmagine.com/it/focuson/pitticonnect>.

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