THE MIXED REALITY OF FASHION: EVOLVING FOR THE FIFTH INDUSTRIAL REVOLUTION

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ABSTRACT

The Earth's resources have been stretched beyond its limits specifically by the homo-sapiens, who are now living with the reality of an ecological collapse. Industrial revolution can be held responsible for accelerating this momentum towards man-made catastrophe that has already changed the face of the earth irreversibly. The Industrial Revolution that began at the end of the 18th Century is now believed to have been succeeded by the four stages and the Fifth Industrial Revolution (5IR) is being hailed as the next stage that will usher in an age of human and machine cooperation for better living on the earth.

The brief existence of mankind on earth has been studied through anthropological evidence of archaeology and DNA studies, while our understanding of human civilisations relies heavily on literature, art and design and especially fashion which has been the zeitgeist of human socio-cultural developments. Therefore, it stands to logic that in the face of catastrophic consequences on the ecological and geological forces on the planet, business and design of fashion will have to evolve incorporating technological advancements in cognisance with human adaptations of the Fifth Industrial Revolution (5IR).

This paper aims to outline that the possibilities and ramifications of the advancements of the 5IR on the Fashion Industry and generate discussions on how the fraternity to should prepare to be future-ready. The research utilises a review of literature from papers defining the evolutionary trends for Industry 5.0, as well as the hopes for the fifth industrial revolution. Qualitative analysis of information is combined with primary research data from industry partners working on or with Artificial Intelligence, Multi-Sensory, Super-sensory and Mixed Reality.

The research seeks to generate discussion on the scope of applications ranging from Trend predictions and corrections, AI-dependent design, Sourcing alternatives, altered anthropologies, Virtual show and store experiences and many other subsidiary resultants of 5IR. The paper shares visions of a sustainable future and cautions of the past that would pave pathways that divert us from a dead-end we seem to be hurtling towards.

INTRODUCTION

"अति सर्वत्र वर्जयेत्"

"Ati Sarvatra Varjayet"
-Ancient Sanskrit proverb meaning, - "Excess of anything is bad".

The earliest Homo Sapiens (humans) are known to tread on Earth about 300,000 years ago which has been but a

blip in the 4.6 billion year history of the congenial blue planet. Yet, the “most intelligent animal” known to have lived on this planet, has orchestrated Anthropogenic conditions and created much ambiguities around the feasibility of post humanist society. The ingenuity of mankind, combined with its insatiable greed has orchestrated this impeding Armageddon especially as a result of the phenomenon of advancement referred as the Industrial Revolution.

The 19th-century economic historian, Arnold Toynbee coined the term “Industrial Revolution” to characterise the growth of Britain’s economy between 1760 and 1840. It was then extended to further classification as the First Industrial Revolution which harnessed the power of steam and made seemingly superhuman tasks possible, the Second Industrial Revolution for Mass-production through electricity, the Third for Automation with computers and the Fourth for Globalisation and Digitisation. Cumulatively, all the stages of Industrial Revolution have successively degraded social equality and wreaked havoc on earth’s eco-system. The communal action with the synergy of human and artificial intelligence will characterise the Fifth Industrial Revolution (5IR). This would ideally aim to evolve the exclusive concentration on profit-driven businesses of Industry 4.0 that is responsible for driving humanity to the brink of extinction. 5IR will be guided by decisions made in the present with regards to our approach, investment, and deployment of these potent new technologies, which will determine our existence and the nature of the planet in the years to come. This revolution will have a tremendous impact on people, industries, and institutions, just like the previous ones did.

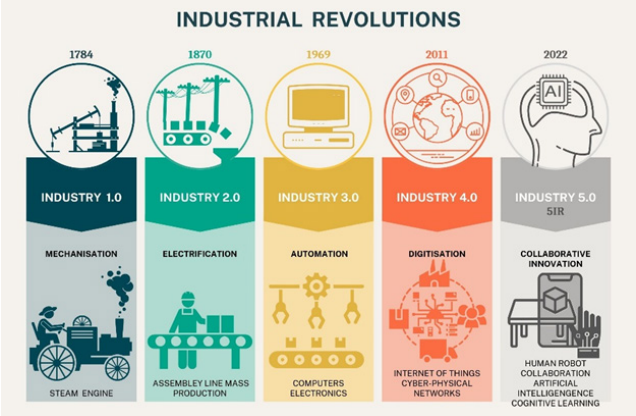

Fig. 1 Phases of Industrial Revolution

Fashion industry is infamously a large and immediate stake holder in the entire transition of Industrial Revolution, and socio-economic changes linked to it. The United Nations Environment Programme (UNEP) claims that despite the viability of Sustainable fashion and circularity in the textiles value chain, the fast fashion industry is feeding a century-old wasteful global consumer behaviour. As an answer to this unsustainable lifestyle, a new era of 5IR is being heralded by tech-giants, visionaries and researchers that uses cognitive systems relying on collaborative human-machine learning and circular economies with ethical business practices equated to profit through technological breakthroughs. This will also entail a change in perspective to one of for-benefit, meaning that the more good you do, the more money you will make. Digital, biological, and physical innovations will lead us through avenues of sustainable and rejuvenating living conditions on earth.

OTHER RELEVANT RESEARCH REFERENCE

The following research papers have informed the current research about the ramifications of new technologies reshaping the fashion industry and their impact on human existence on earth.

Julian Müller’s (2020) independent expert report titled “Enabling Technologies for Industry 5.0” is a manuscript documenting the results of a workshop with Europe’s technology leaders European Commission, Directorate-General for Research and Innovation Industry 5.0 was discussed among participants from research and technology organisa-

tions (RTOs) and funding agencies across Europe in two virtual workshops on 2 and 9 July 2020. The goal was to get feedback on the general concept, and to discuss the enabling technologies and possible challenges.

Micah Carroll, et al, (2023) raises concerns on growing capabilities of AI system towards potential manipulation and coercion. These systems can learn manipulative behaviours, even without their designers' knowledge, by imitating human data which threatens human autonomy.

Thomas Olsson and Kaisa Väänänene (2021) published paper titled "How Does AI Challenge Design Practice?" that outlines various considerations regarding how human-centred and cross-disciplinary AI might both challenge and support design work in light of the new computational building blocks, conditions, and societal requirements. It presents instances that should spark thought and discussion, whilst encouraging technique development in AI ethics, societal responsibility, and design practise through the prism of four viewpoints to design dynamics: people, product, principles, and process.

Han Yan, et al (2022) study "Toward Intelligent Design: An AI-based Fashion Designer Using Generative Adversarial Networks Aided by Sketch and Rendering Generators" is conducted through a vast network of collaborative effort to develop a novel GAN-based AI-driven framework aimed to facilitate the design process-based framework for fashion design. It maps the phenomenon of how the input latent code is uncontrollable at the first step and the semantic-aware textures on sketches, multi-conditional feature interaction module developed in the rendering-generation model sketch sampled from a latent vector incapable yet of capturing fine design constraints from the learned distribution.

In "FashionQ: An AI-Driven Creativity Support Tool for Facilitating Ideation in Fashion Design" Youngseung Jeon, et al (2021) articulates the role of AI in supporting creativity with a case study of an AI-based Creative Support Tools (CST) in fashion design based on theoretical groundings conducted a user study with 10 fashion design professionals (7 females and 3 males). It is a statistical analysis of levels of advantages and limitations in divergent and convergent thinking capacities of CST- AI tech whilst performing various stages design process both new and adapted parameters. It supports finding design solutions to the above limitations and highlights the areas and importance of human intervention in AI-assisted design process.

Brandon Ginsberg (2023) report titled "Artificial Intelligence In Fashion" in Forbes outlines the impacts of AI in fashion and the industry consisting of design, logistics, marketing and sales.

Jinder Kang's (2023) blog essay titled "Top Examples of Augmented Reality in Fashion Retail" in Netguru.com informs on Augmented Reality application in the fashion industry through case study of brands and e-commerce trends.

Yong-Chin Tan et al, (2022) report titled "Augmented Reality in Retail and Its Impact on Sales" studies the tangible impact in real-world sales contexts. The comparative research was conducted in collaboration with cosmetics and beauty retailer, records customer engagement and behaviour, and sales through AR usage in online settings showing dramatically improved engagement and profitability.

Balyer, A., & Öz, Ö. (2018). "Academicians' utilises qualitative approach to uncover the views of a focus group of 20 faculty members, on digital transformation in education. Revelations indicated the responsibility of training/ education mangers to create vision for an effective learning environment. Recommendations suggest the need for readiness for tech transformation in pedagogy.

Zhang, et al, (2020) "Genome editing with the CRISPR-Cas system: an art, ethics and global regulatory perspective" informs about application of gene editing in horticulture, agriculture, animal husbandry, genetic cures to diseases as well as gene omission for predisposition to diseases and the legal standpoint on this in different countries.

Vera Raposo, (2019) gives bio-ethical commentary in "Gene editing, the mystic threat to human dignity" and argues to the cause of continuing experimentation on Human Gene modifications so that people are spared the pain and

suffering caused by the many diseases.

The PwC report titled “The effectiveness of virtual reality soft skills training in the enterprise: a study”, D Eckert, et al - 2020, researchers recorded the engagement and retention of new knowledge in three separate focus groups of new managers across 12 US locations to train each group through classroom, e-learning and V-learning (VR-based). It goes on to demonstrate how V-learning benefits that far outperform the previous conventional methods of learning. The situation where cognitive functions are delegated to a digital artefact is described in Christopher P. Rieple’s doctoral dissertation from 2021, “Personality, Demographics, and Use as Predictors of the Degree to Which Smartphones Extend the Mind in Digital Natives.” The findings provide credence to the theory that smartphones might be complementing rather than replacing biological cognition. Future studies should focus more intently on determining when and how smartphones enhance cognitive processes.

INTERVIEWS WITH INDUSTRY EXPERTS

Semi-structured interviews were conducted with technology and fashion industry specialists and their experiential insights, opinions and estimation have been used in collation with secondary research to generate all discussions that follow.

	Name	Designation	Company	Date	Discussion Topics
1.	Mr. Vinay Bhardwaj	VM Head	Nexon Omniverse, Style Union	26/11/2023	Predictive and generative AI, eco-friendly logistical solutions, customer engagement through new tech.
2.	Mr. Rishi Desai	Head of Growth	AjnaLens	29/11/2023	AI –efficient 3D designers, VR Learning, Digital fashion, emerging roles of fashion designers in the virtual world.
3.	Mr. Jubi Ramachandran	Business Consultant	AjnaLens	29/11/2023	New age VM, Marketing and future physical-virtual retail bridges.
4.	Ms. Ishleen Kaur	Extended Reality Designer	Interality	28/11/2023	Extended reality, crypto economy, energy efficient NFTs, Web 3, digital and virtual artist collaborations with physical brands.

Table 1 Primary data collection Record

FIFTH INDUSTRIAL REVOLUTION (5IR)

The idea of 5IR can be conceptualised as the restoration of a “human/value-centred Industry 4.0”. The concept of Industry 5.0 can be seen as an exceptional challenge that draws attention to the necessity of re-evaluating ethical and ecological aspects of business, manufacture and retail by inspiring ideas of sovereign capability in contrast to profit and productivity centric functioning. (Müller, 2020) It’s critical to recognise that the Fifth Industrial Revolution (5IR) is bringing about a systemic shift in a variety of industries and facets of human existence.

5IR TECH ADVANCEMENTS

The technologies supporting the concept of the 5IR include (Müller, 2020):

1. Human Machine Interactive (HMI) and Human-centered design and technologies merge human and robot capabilities for physical and cognitive activities.

2. Bio-inspired technologies and smart materials with sensors and better features, including improved recyclable characteristics.

3. Digital twins and simulations based on real-time data-based digital twins and simulations to optimise manufacturing, test items and processes, and discover detrimental consequences.

4. Cybersafe Technologies for data and system interoperability handling, storage, and analysis.

5. Artificial Intelligence that can detect causalities in complex systems to generate actionable intelligence.

6. Reliable and Energy-efficient autonomous technologies to power all the aforementioned technologies with massive amounts of energy required to operate them.

A systemic approach needs to take into consideration a number of difficulties around Social, Governmental, Economical and Ecological aspects that allows for Interdisciplinary and Trans-disciplinary applications with scope of scalability. The ramifications of developing technologies extend far beyond the exciting new possibilities they promise. The salient point is that, the 5IR empowers us with unprecedented knowledge and technology and requires us make ammends in our priorities to aid sustainable living of mankind on a healthy planet.

FASHION INNOVATIONS

"Be the change you want to see in the world"
-Mohandas Karamchand (Mahatma) Gandhi

As with any revolution, new ideas are met with distrust and resestence until they find a way to become a new normal. Change, however, is inevitable and fashion industry thrives on the concept of change. A creative business model that has thusfar been largely ridden with wasteful methods and socio-economic malpractices, may now be getting the tools and momentum thrust towards ethical and sustainable industry.

New Technology and its applications are currently causing confusion and anxiety amongst the skilled labour and other professionals. There has been great concern within the fashion industry that new tech would eventually replace human labour and a chance that certain professions could disappear as AI algorithms replace designers, marketers, and other fashion industry workers. It is critical that fashion industry and pedagogy synergetically embrace all new technology and resources of 5IR responsibly and ethically. Fashion professionals cannot afford to passively experience the revolution but must proactively take on the responsibilty to give it direction and structure. Fashion fraternity needs focus on evolution of their workforce and professionals into new constructive and creative roles. Embrace, evolve and be future ready!

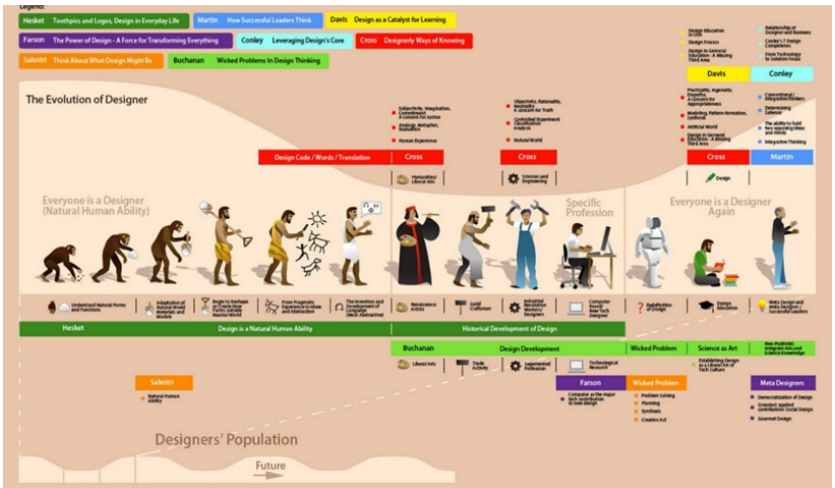

Fig. 2 A model for projected Evolutionary role of designers Courtesy: Jo Lam

5IR PREDICTIVE PATHWAYS IN FASHION INDUSTRY

To be future ready begins with understanding of how the 5IR tech and knowledge is likely to impact the fashion industry.

1. TREND FORECAST PREDICTIONS AND CORRECTIONS

Artificial Intelligence (AI) algorithms are already learning from and manipulating consumer behaviour, political opinions and other humanistic personal choices (Micah Carroll, et al, 2023). Discussions with Ajna Creator team reflect that intrusive AI will turn more predictive and creative. Collection of data will be facilitated by more data collection points in future devices that will track even human emotions through pheromone detectors, pupil dilation, heart rate anomalies etc. embedded in daily our devices will outstretch the limitations of today's tech of smartphones, laptop devices, CCTV cameras etc. Collation of through surveillance and home or personal devices will lead to round the clock trend spotting and incredibly accurate trend forecast with real-time correction.

Besides concerns regarding privacy, AI based forecast may also make fashion more homogenised that can make design and marketing decisions less unique and creative to avoid business risk and save time. (Brandon Ginsberg, 2023) Without human intervention and diligence, the fashion industry would lack new exploration and fresh ideas.

2. FASHION PEDAGOGY AND AI-EFFICIENT DESIGNERS

AI Creativity will continue to require AI-efficient designers. The future designers will need better training in comprehending and utilising machine learning to provide the human element in design sensibilities to the AI- generated designs. This would define the employability of designers across the fashion industry.

Ajna Creator group members believe that the future designers will learn and practice their skills on virtual platforms in a 3D format using traditional tools e.g. Virtual draping or sketching on 3D virtual or physical dress forms with simulated fabric weight and fall and response to alterations or simulated detailing of seams and closures. Hands and tools held by them could be mapped through gloves/ pens/ mixed reality hand-tracking lens. Haptic feedback based gloves could simulate authentic experiences of working with realistic materials in a virtual space.

This method would allow designers to experiment with greater confidence, an option to undo and redo each step of construction and record all of them for better production planning. It eradicates material wastage aspects of training or experimentation and becomes more cost-effective and sustainable solution for learning design and construction practices.

The encouraging idea is that up-skilling current and future design professionals will be eased with accessibility to distance learning, VR based simulated learning and gamification of pedagogy. In a study conducted by the US Learning and Development Innovation team at PwC, (D Eckert, et al, 2020) surveys and records a comprehensive data demonstrating v-learning was more effective than e-learning and classroom-based learning. V-learning focus group was found to study with four times more focus and speed of learning and were 275% more confident to apply their learnings, when compared to the ones engaging with the same curriculum through e-learning and physical classroom.

Immense possibilities may open with "Brain-machine interfaces" that will only need the human designer to have imaginative and strong design processes and the responsibility of depiction and actualisation of the thoughts will rest with the brainwave receptive AI design and robotic creators.

3. GLOBAL SOURCING FROM ETHICAL AND CYCLIC RESOURCES

5IR, like all other revolutions, could potentially increase national wealth and its technologies have the power to lift entire societies out of poverty but the AI will have to train with additional algorithms designed for equal wealth distribution and anticipation of externalities to avoid global challenges.

Transport and manufacturing paradigms are shifting with regional trends of increased social interaction and trade between countries, Globalised Economic trends in IOT, Technological trends and Meta flows concerning the environment, safety and depleting resources. Woke consumerism will be fed with real as well as superficial transparency around ethical sourcing.

Brandon Ginsberg (2023) report in Forbes informs that AI could impact the supply chain management in fashion industry with cognisant models capable of using past inventory and sales data to recommend stock sourcing, timelines and location-wise quantity allocations to fashion businesses. This would result in increased profits as well as customer satisfaction while reducing waste and generation and carbon footprint of logistic management.

Customers will be able to preview products through Augmented and mixed reality and make informed and stable decisions about their purchase and hence lowering the rate of product returns. This will reduce dead stock inventory as well.

4. SLOW FASHION BOOSTERS

Traditional practices for manufacture may get a new boost with Collaborative robots (‘cobots’), which work together with humans and assist humans (Müller, 2020) in “handmade” process by real-time mimicking and replication of artisan’s techniques. The scope of aiding an artisan’s output or simultaneous production of hand-crafted products across the globe by a remotely located artisan open exciting prospects. More importantly, the cobots could learn and preserve the experiential learnings of dying crafts while artisans face a paucity of apprentices who would have done the same.

Preservation of traditional models for recycling will find new avenues through 3D VR based connections with their target market. True respect for slow fashion and artisan skill is generated through sharing stories of making (Suruchi Dhasmana, 2018) and authentication of transparency in the interactions with the artisans working painstakingly in the premise of slow fashion. Rishi Desai speaks of AR based Immersive story- telling experiences in mixed reality that would enable customers to get a first-hand experiences of the Artisan processes and even allow them to interact or virtually partake in the making of artisan products in real time. Simple scanning of QR codes or other coding embedded in design could allow user to establish a direct connection with artisans. This will give artisans autonomy over their work and better awareness of global fashion trends.

5. MATERIAL INNOVATIONS:

Smart materials are redefining and blurring the boundary between the digital and physical worlds. (Müller, 2020). Space race to escape a dying planet earth could actually be facilitating the research and development of some of the most innovative materials. These would easily find application in performance wear and make futuristic fashion statements. Recyclable and recycled, lightweight materials with intrinsic traceability would be in vogue. Self-healing or self-repairing materials and living materials will be regenerative in nature. Adaptive or responsive ergonomics and surface design with embedded sensor technologies and biosensors may become the need of the hour. 3D Printed materials resembling fabrics could change the way we make and purchase fashion.

6. CUSTOMISATION FOR REDUCED DEAD STOCK INVENTORY

Luxury retail market is pioneering the use of 360 cameras and body mapping through various personal and studio devices to provide accurately customised manufacturing use customer data to provide tailored, on-demand items. Apps like MTailor, take less than 30 seconds to calculate clothing measurements using the camera on a smartphone. Unspun, an American denim brand, reduces global carbon emissions by 1% through a zero-inventory, low-waste process by producing custom jeans made-to-order, with 3D body scans for unique, perfect fit.

Unmade, a London-based manufacturing platform works with Fartech to offers custom-fit, bespoke knitwear creation within hours using industrial knitting machines at the same cost as mass produced. It has partnered with brands like Opening Ceremony and Christopher Raeburn to enable their customers to digitally customise their purchases. Augmented reality, specifically Virtual Try-On (VTO), enhances shopping experiences by offering personalized recommendations based on customer preferences and past purchases. This fosters brand loyalty and emotional bonding, with studies showing fewer returns on customised purchases. (Yong-Chin Tan et al,2022)

Combined with possibilities of 3D printers, printing out downloaded specifications of exclusive garments in consumer homes or collection centres could mean irradiation of excess production and minimal dead stock in warehouses.

7. DESIGNER BABIES AND ALTERED ANTHROPOLOGY

Recently, low-cost gene sequencing has greatly increased our ability to modify the basic blocks of life using techniques such as CRISPR can alter a live cell's genome sequencing (Zhang et al., 2020). Scientists are studying the potential use of the CRISPR-Cas9 method for human embryo germ-line editing and the feasibility of an embryo reaching "personhood" is still questionable (Miklavcic and Flaman, 2017). Despite the ethical ramifications and global regulatory policies, the possibilities of the applications on human embryos already opening up.

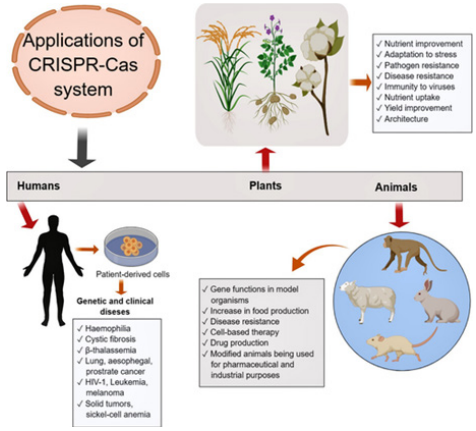

Fig. 3 Applications of CRSPR-Cas9 system in clinical and genetic diseases and trait improvements in plants and animals. Courtesy: Plant Biotechnology Journal, Volume: 18.

Chinese scientists used of the CRISPR-Cas9 technique in one-cell-stage monkey embryos in February 2018 and by November 2018 media reported that He Jiankui had succeeded in his experiment of facilitating the birth of two twin girls had been born with disable the CCR5 gene that enables the HIV infection hence making them HIV immune (Nie & Cheung, 2019)

Given the above data, it seems no science fiction that "human enhancement" could see the anthropology of humans artificially altered or possibly even new human forms could emerge, legal and ethical opposition notwithstanding. Fashion for these newer forms could become another unexplored territory.

8. MONETISING FASHION NFTS IN METAVERSE

A Non-Fungible Tokens (NFT) are blockchain-based smart contracts that can include code that pays crypto currency, as royalty, to the creator every time it's sold. Digital metaverse (multiple alternate to universe) have been evolving and gaining popularity through gaming but thanks to the pandemic, the Metaverse has expanded to providing a safe haven for internet users to fill their social gaps and explore a simulated world that mimics the real thing. (#AJ Marketing, 2023).

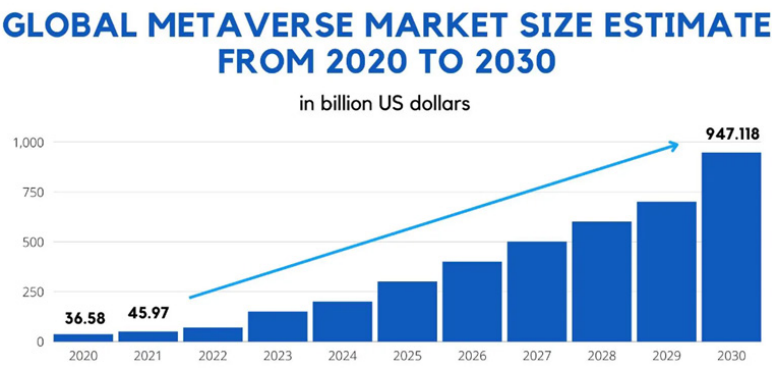

Fig. 4 Online Survey Report and Expert Projections Courtesy: #AJ Marketting

Extended Reality designer, Ishleen Kaur pointed out how these virtual living spaces offer a plethora of experiences, including gaming, extending to Crypto- economy that thrives on virtually engaging activities like exploring new surreal destinations, making alter-ego avatars, shopping, trying on clothes, and buying NFTs.

From Prada to McDonald's, brands have entered the metaverse and made an impact online. Crypto-artist like Beeple, Amrit Pal Singh, KAWS, Grimes, Trevor Jones creating waves with their digital art and Fashion giants want to capture the virtual market by riding this wave. Louis Vuitton and Beeple collaborated in both worlds. LV designer, Nicolas Ghesquiere printed Beeple's futuristic designs on the Spring-Summer 2019 collection and continued into window display. Beeple went on to design LV NFT's and created a metaverse for the fashion label.

Fig. 5 Louis Vuitton SS19 collection with Beeple prints

Fig. 6 Beeple NFT for Louis Vuitton and poster of “Louis” gaming platform

Prada, Balenciaga alongside fresh designers like Hillary Taymour of Collina Strada, Casey Cadwallader at Mugler, and Marine Serre have collaborated with digital artists to push the limits of emerging technologies.

Fig. 7 Real model’s virtual Avatar in Balenciaga AW21 Courtesy of Dimension

Ishleen commented that this trend feeds netizens who are brand aware in the real world, to fulfil aspirations or seek the status of owning designer labels even as NFT’s which sell at a premium in the metaverse.

New age fashion designers will thus diversify into using their real-world knowledge of product to design virtual fashion for digital avatars in the metaverse just as architects are employed to plan and meticulously plan and create believable surreal metaverse. New York-based multidisciplinary artist Freeka Tet said in May 2021, Vogue India interview, that he would like to see fashion designers sell the design alone on 3D models or patterns so that garments can be custom-made to limit production as per actual consumption.

9. RETAIL EXPERIENCES AND MIXED REALITY SHOWS

As Multi-Sensory, Supersensory and Mixed Reality gain more popularity, physical stores are likely to shift to experience driven customer engagement in an Omni-Channel sales model. VM head of a fashion business of Nexon Omniverse, Vinay, Bhardwaj, predicts the consumers will visit stores for an immersive and engaging experience of brand and product while purchase could be completed with customised deliveries.

Virtual try-ons are a sustainable solution for inventory management, allowing stores to stock fewer options while providing consumers with an immersive experience of products in their size and color. AR technologies, such as virtual try-ons, allow fashion retailers to provide a fun and engaging experience for shoppers, pushing them out

of their comfort zones and experimenting with new fashion trends. The personalized and interactive nature of AR fosters a stronger emotional connection between customers and brands, leading to increased loyalty. Consumers who use AR apps are 19.8% more likely to make a purchase than those who don't. Employed strategically within sales funnels, augmented reality can increase store sales by shepherding customers from curiosity to actual purchase. (Sandeep Chandukala, 2022) AR also makes shopping more efficient by allowing customers to preview products before making a purchase, reducing purchase uncertainty and helping customers make more informed decisions.

Fig. 8 Zara's 2018 instore augmented reality experienced through smartphones with the Zara AR app to watch holographic models fashioned in latest collection, come to life. Shoppers could directly buy the look through the app.

Farfetch, in partnership with Nicholas Kirkwood, launched its first customisation initiative in April 2017, allowing customers to create and visualize their own products online.

AR-based virtual and interactive shows are becoming common at Chanel, Dior, and Louis Vuitton, albeit none have gone totally digital. Physical fashion shows have conventional format of a catwalk with series of looks, which was exciting to diehard fashionistas but not for the general audience. Experiential fantastical shows with storylines and interactive choices provided to multiple online viewers broadens the outreach of fashion labels. (Feldner-Busztin, 2022) Christian Dior uses AI to create virtual audiences for fashion shows live streamed interactive spectators to engage with models and making fashion more participatory.

Virtual or extended reality fashion shows would be able to use celebrity models Avatars with or without morphing, in as many looks and ensembles as they choose. After drawing fair contracts with models based on royalty per show, their bodies would be scanned using body-mapping cameras and the eternal virtual body form may thereafter be used across simultaneous multiple locations of Mixed Reality shows without the need for travel.

Fig. 5 Bella Hadid's avatar for Mugler SS21Courtesy of Andrei Warren, Misato Studio

10. NEW-AGE FASHION MARKETING

Rishi envisages a fashion business model that will form a bridge between physical designer garments and virtual designer NFTs. "NFTs are expanding the fashion market, not killing it. The Labels may choose to set eligibility crite-

ria of physical world purchases for qualifying to buy the same designer's NFT in the metaverse." says the Ajna Lens professional. Promotional coupons for NFT purchases along with real ones etc. could drive omni-channel purchase with brand conscious and loyal customers.

Marketing gets more aggressive but better tuned to individual customers. Geotagging on mobile phones is helping registered customers to receive relevant information on brand offerings when they are in physical proximity to the store, thus increasing foot fall and purchase. AI-based personalised recommendations that could track consumer moods through inputs ranging from OTT viewer choices to biometric mood mapping, would entice consumers for store experiences attuned to their preferences at that specific moment.

Gamification and prizes: Retailers can add virtual scavenger hunts, quizzes, and digital rewards to AR experiences. AR-based gamification boosts engagement, loyalty, and repeat visits with fun and incentives. Regular customers as well as influencers that have excellent AR experiences are more likely to share them on social media, boosting word-of-mouth promotion and recruiting new and loyal customers.

AR experiences can be visually appealing and shared on social media. Customers that prefer AR in retail are likely to tell friends and followers, increasing brand visibility and possibly recruiting new customers.

LIMITATION

Endless possibilities that are constantly evolving as technology grows, make it hard to encompass all their cumulative socio-economic, techno-ecological effects on the fashion industry. This research has been able to collate primary data with the sea of information on the 5IR Tech to find probable trajectories in which the fashion business will transform. While it is by no means an exhaustive list, or complete analysis, the research surely generates conversations on the new face of fashion business and evolved role of designers. As researchers, we must endeavour to keep mapping changes and find pathways with new tools to benefit the industry and the planet it thrives in.

CONCLUSION

Fashion learning, business and consumption should be geared to benefit from and contribute to the 5IR and this paper highlights the benefits of technologies that can be used for creating a more sustainable business model but cautions against greed of mankind and anomalies of technology that can have devastating outcomes despite well-intended ventures.

The 5IR is not a mere prediction of an inevitable future but a call to action towards an evolution to avoid extinction. Fashion industry has far reaching impact in manufacturing, design, supply chain, self-worth, and social acceptance. Hence, the fraternity has a great responsibility towards empowering, sustainable fashion for social and global economic development while upholding shared values of human dignity, and intergenerational stewardship.

REFERENCES

Arthur, R. (2017, December 28). Fashion brands are tooling up to create custom clothing in minutes. WIRED UK. https://www.wired.co.uk/article/custom-made-luxury-clothing-fashion-design

Ball, P. (2018, October 9). Designer babies: an ethical horror waiting to happen? The Guardian. https://www.theguardian.com/science/2017/jan/08/designer-babies-ethical-horror-waiting-to-happen

Balyer, A., & Öz, Ö. (2018). Academicians' Views on Digital Transformation in Education. International Online Journal of Education and Teaching, 5(4), 809-830.

Behance. (2023). Evolution of the Relationship of Designers and Users on Behance. [ONLINE] Available at: https://www.behance.net/gallery/51582117/Evolution-of-the-Relationship-of-Designers-and-Users. [Accessed 12 July 2023]

Carroll, M., Chan, A., Ashton, H. and Krueger, D., (2023). Characterizing Manipulation from AI Systems. arXiv preprint arXiv:2303.09387.

Chandukala, S. R. (2022, March 31). How Augmented Reality Can — and Can't — Help Your Brand. Harvard Business Review. https://hbr.org/2022/03/how-augmented-reality-can-and-cant-help-your-brand

Cyranoski, D., Reardon, S. Chinese scientists genetically modify human embryos. Nature (2015). https://doi.org/10.1038/nature.2015.17378

Dhasmana, S., (2018). 'Creating New Patronage: Revival of Asian Indigenous Crafts by Evoking Interest amongst the Nouveau Riche.', 20th IFFTI Annual Conference, Fashion Futures. Donghua University, Shanghai, China, 12 April. China: IFFTI, pp.340-352.

Eckert, D. and Mower, A., (2020). The effectiveness of virtual reality soft skills training in the enterprise: a study.

Feldner-Busztin, E. (2022, December 15). Where digital and physical collide: The new era of digital fashion shows. The Interline. https://www.theinterline.com/2022/06/30/where-digital-and-physical-collide-the-new-era-of-digital-fashion-shows/

Gauri, Pratik,. and Eerden, J., (2019). A 5th industrial revolution?(What it is, and why it matters). In World Economic Forum. Available at: https://5thelement. group/wp-content/uploads/2019/05/A-5th-Industrial-Revolution_-What-It-Is-And-Why-It-Matters_05 (Vol. 3).

Gil-López, C., Guixeres, J., Moghaddasi, M. et al. Recognizing shopper demographics from behavioral responses in a virtual reality store. Virtual Reality 27, 1937–1966 (2023). https://doi.org/10.1007/s10055-023-00767-2

Ginsberg, B. (2023) Council post: Artificial Intelligence In Fashion, Forbes. [ONLINE] Available at: https://www.forbes.com/sites/theyec/2023/02/21/artificial-intelligence-in-fashion/?sh=20cecc5a7adb (Accessed: 03 July 2023).

Gogol, F. (2023, November 3). How to Make Money with NFTs: 19 Strategies. Stilt Blog. https://www.stilt.com/blog/2022/08/how-to-make-money-with-nfts/

Jeon, Y., Jin, S., Shih, P.C. and Han, K., (2021, May). FashionQ: an ai-driven creativity support tool for facilitating ideation in fashion design. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-18).

Kang, J. (2023) Top examples of augmented reality in fashion retail, Digital Acceleration Company. Available at: https://www.netguru.com/blog/augmented-reality-fashion-retail-examples (Accessed: 02 July 2023).

Knoepfler, P., (2015). GMO sapiens: the life-changing science of designer babies. World Scientific. pp.105-133.

Leng, J., Sha, W., Wang, B., Zheng, P., Zhuang, C., Liu, Q., Wuest, T., Mourtzis, D. and Wang, L., (2022). Industry 5.0: Prospect and retrospect. Journal of Manufacturing Systems, 65, pp.279-295.

Marketing, A J (2023) 'Top 11 metaverses you should know in 2023,' AJ Marketing, 20 September. https://www.ajmarketing.io/post/top-11-metaverses-you-should-know.

Miklavcic, J.J. and Flaman, P., (2017). Personhood status of the human zygote, embryo, fetus. The Linacre Quarterly, 84(2), pp.130-144.

Müller, J.J.E.C., (2020). Enabling technologies for Industry 5.0. European Commission, pp.8-10.

Nie, J.B. and Cheung, A., (2019). He Jiankui's Genetic Misadventure, Part 3: What Are the Major Ethical Issues. In The Hastings Center Forum.

Noble, S.M., Mende, M., Grewal, D. and Parasuraman, A., (2022). The Fifth Industrial Revolution: How harmonious human–machine collaboration is triggering a retail and service [r] evolution. Journal of Retailing, 98(2), pp.199-208. Available at: https://www.sciencedirect.com/science/article/pii/S0022435922000288 (Accessed: 03 July 2023).

Olson, S. (2016, January 1). International Summit on Human Gene Editing: A Global Discussion. International Summit on Human Gene Editing - NCBI Bookshelf. https://www.ncbi.nlm.nih.gov/books/NBK343651/

Olsson, T. and Väänänen, K., (2021). How does AI challenge design practice?. Interactions, 28(4), pp.62-64.

Pang, R.T. and Ho, P.C., (2016). Designer babies. Obstetrics, Gynaecology & Reproductive Medicine, 26(2), pp.59-60.

Raposo, V.L., (2019). Gene editing, the mystic threat to human dignity. Journal of bioethical inquiry, 16(2), pp.249-257.

Reddy, P. (2021, March 12)The crypto art market and NFTs - fleeting bubble or here to stay? (n.d.). Artisera. https://www.artisera.com/blogs/expressions/the-crypto-art-market-and-nfts-an-intriguing-bubble-or-here-to-stay

Rieple, C.P., (2021). Personality, Demographics, and Use as Predictors of the Degree to Which Smartphones Extend the Mind in Digital Natives (Doctoral dissertation, Capella University).

Schwab, K. (2023, May 31). The Fourth Industrial Revolution. Encyclopedia Britannica. https://www.britannica.com/topic/The-Fourth-Industrial-Revolution-2119734

Tan, Y.-C., Chandukala, S. R., & Reddy, S. K. (2022). Augmented Reality in Retail and Its Impact on Sales. Journal of Marketing, 86(1), 48-66. https://doi.org/10.1177/0022242921995449

Woo, K. (2021, May 21). 5 digital artists reimagining the fashion show. Vogue India. https://www.vogue.in/fashion/content/5-digital-artists-reimagining-the-fashion-show

Yan, H., Zhang, H., Liu, L., Zhou, D., Xu, X., Zhang, Z. and Yan, S., (2022). Toward intelligent design: An ai-based fashion designer using generative adversarial networks aided by sketch and rendering generators. IEEE Transactions on Multimedia.

Zhang, D., Hussain, A., Manghwar, H., Xie, K., Xie, S., Zhao, S., ... & Ding, F. (2020). Genome editing with the CRISPR-Cas system: an art, ethics and global regulatory perspective. Plant biotechnology journal, 18(8), 1651-1669.