Fundação para a Ciência e a Tecnologia

ID+ RESEARCH INSTITUTE FOR DESIGN, MEDIA AND CULTURE

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RITA ASSOREIRA ALMENDRA

DESIGN COMMIT
1ST INTERNATIONAL CONFERENCE ON DESIGN & INDUSTRY 2024
BOOK OF PROCEEDINGS

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DESIGN COMMIT

1ST INTERNATIONAL CONFERENCE
ON DESIGN & INDUSTRY • 2024

BOOK OF PROCEEDINGS

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DESIGN COMMIT
1ST INTERNATIONAL CONFERENCE ON DESIGN & INDUSTRY 2024

SCIENTIFIC EDITORIAL

LIST OF SCIENTIFIC EDITORIAL COMMITTEE / AFFILIATIONS AND CREDITS OF EDITORS

BOOK OF PROCEEDINGS FOR THE DESIGN COMMIT 2024 CONFERENCE

INTRODUCTION

This Book of Proceedings is a collective endeavor and an academic commitment from the participants of the Design Commit 2024 Conference. All papers have undergone a meticulous peer-review process, orchestrated by our Scientific Committee and executed under strict guidelines of anonymity and impartiality. Our goal is to present a compilation of research that not only reflects innovation and diversity in the field of design and industry but also fosters constructive dialogue on sustainable futures and social responsibility within these realms.

SUBMISSION AND REVIEW PROCESS

Each submitted manuscript underwent an initial review to ensure relevance to the conference theme and adherence to established guidelines. The subsequent double-blind peer review was employed to safeguard the integrity of both reviewers and authors, supporting fair and unbiased judgment. We recognize the importance of authentic academic discourse and as such, are dedicated to a zero-tolerance policy on plagiarism and a commitment to originality.

EDITORIAL ETHICS AND CONTENT USAGE

 We underscore the importance of ethics in academic information usage and encourage practices that promote scientific integrity and collaboration.

CONTRIBUTIONS AND AUTHORSHIP

We clearly outline the responsibilities of authors, from initial submission to the presentation process. Contributions should reflect the work of no more than five collaborators, with the designation of the corresponding author established to facilitate communication and ensure accountability. We emphasize the value of transparency and the proactive declaration of any potential conflicts of interest.

COMMITMENT OF REVIEWERS AND COMMITTEES

Both the members of the Scientific Committee and reviewers are integral parts of this process, committed to maintaining the academic rigor and excellence that are the hallmark of Design Commit. They are dedicated to thoughtful evaluations, enhancements of submissions, and the efficacy of academic communication.

CONCLUSION

The DESIGN COMMIT 2024 Secretariat wishes to express gratitude to all contributors, whose works comprise this volume. May the papers presented here serve as catalysts for ongoing innovation and inspiration for all those committed to the advancement of design and industry.

DESIGN COMMIT
1ST INTERNATIONAL CONFERENCE
ON DESIGN & INDUSTRY 2024

DESIGN COMMIT conference is an event organized by the **Lisbon School of Architecture** (FA ULisboa), in partnership with the **School of Design** (ESD) of the **Polytechnic Institute of Cávado and Ave** (IPCA), the **Department of Communication and Art of the University of Aveiro** and the **OIKOS research group** of the **Research Institute for Design, Media and Culture** (ID+), the **School of Applied Arts** (ESART) of the **Polytechnic University of Castelo Branco** (IPCB), and **Rethink – Research Group on Design for the Territory** (CIAUD); and **School of Architecture, Art and Design of the University of Minho** (EAAD) and the **Design and Technology Group** (DeTech) of the **Laboratory of Landscape, Heritage and Territory** (Lab2PT).

The conference operates under the scope of the **Research & Education in Design research group** (REDES) from the **Research Centre for Architecture, Urbanism and Design** (CIAUD).

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ABOUT US

The first edition will be an in-person international event, consisting of a wide variety of plenary sessions, and bringing together researchers, academics, designers, rapidly expanding technology companies, emerging companies, business associations and policy makers, with the objective of fostering and actively developing a joint reflection, in a transdisciplinary scientific exchange, which enhances innovation through Design and Industry for a better future with a strategic vision.

Fields that will stimulate responses to the challenges of climate change and environmental degradation will be proposed, paving the way to achieve the goals of the 2030 agendas.

The DESIGN COMMIT 2024 will take place during the 7th Braga Economics Week, an initiative promoted by InvestBraga, aimed at addressing economic issues, involving various types of events, and promoting the exchange of ideas among economic agents, institutions, and citizens.

PURPOSE

This international conference aims to explore models that prioritize a post-growth economy, with **modern**, **resource efficient**, **smart**, **sustainable** and **inclusive** principles, focused on enhancing human health and education, promoting knowledge and inter-sector collaboration, and a digital society for all. And, in this way, contribute to the transition towards a more sustainable, equitable, and resilient future that considers the well-being of both people and the planet.

Amid pandemics, wars and environmental disasters, designers and industries have been forced to imagine a world in which the only way to move forward is to look back. Design and Industry need to understand the role they can play in removing obstacles to social progress and work together to create healthier societies.

PREFACE TO THE DESIGN COMMIT 2024 CONFERENCE

A Word from the Conference Chairs

Dear participants and collaborators,

It is with immense pleasure and honor that, on behalf of all the chairs of Design Commit 2024, we welcome you to this unique event, dedicated to the fusion of design and industry and their vital role in shaping a resilient and sustainable future.

In a world of constant transformation, where sustainability and innovation have become imperatives, Design Commit emerges as a beacon of knowledge and collaboration. Our mission is to unite thinkers, creators, educators, and industry leaders to discuss, share, and promote practices that lead to excellence and responsible innovation.

This year's conference presents an exceptional program, filled with inspiring keynotes and discussion panels that promise to stimulate critical thinking and the exchange of ideas. Each session has been carefully planned to reflect the challenges and opportunities presented to our global community.

Through this Book of Proceedings, we offer a glimpse of the innovative research and studies that will be showcased. The papers reflect the depth and diversity of the participants' contributions and serve as a window into the future directions of design and industry.

We wish to express our profound thanks to the members of the Scientific Committee, the organizing team, and everyone who contributed to making Design Commit 2024 possible. Your tireless commitment to excellence and the exchange of knowledge is the driving force behind the success of this event.

We invite you to delve into the following pages and join us on the journey of learning and discovery that we promote. May the discussions and insights generated here inspire actions and innovations that transcend the boundaries of this meeting.

With high expectations and a sense of enthusiastic anticipation, we move forward together to explore the boundless potential of design and industry in creating a more promising future for all.

Warm regards,

The Chairs of Design Commit 2024

MARIA JOÃO FÉLIX, FÁTIMA POMBO, FERNANDO MOREIRA DA SILVA, PAULO CRUZ, RITA ASSOREIRA ALMENDRA

OVERVIEW AND OBJECTIVES OF THE DESIGN COMMIT CONFERENCE

OVERVIEW

Design Commit stands at the forefront of interdisciplinary dialogue, bringing together innovators, visionaries, and thought leaders from the realms of design and industry. As we gather in the bustling heart of creativity, our agenda is driven by the challenges and possibilities of integrating sustainable practices within these dynamic fields.

At the core of Design Commit is the dedication to fostering a community where collaboration transcends traditional boundaries, encouraging a synergy that fuels transformation and growth. We convene under the shared belief that design is not just an aesthetic choice but a pivotal tool for societal and industrial evolution.

OBJECTIVES

- **To Inspire Innovation:** By showcasing cutting-edge research and case studies, we aim to spark new ideas that participants can take back to their own work, driving the frontiers of design and industry forward.

- **To Facilitate Networking:** Providing a platform for professionals from various sectors to connect, share insights, and forge partnerships that have the power to reshape the market landscape.

- **To Educate:** Through keynotes and panel discussions, we offer learning opportunities that enhance skills, expand knowledge, and offer new perspectives on tackling the design and industry challenges of today and tomorrow.

- **To Promote Sustainability:** Emphasizing the importance of eco-friendly and socially responsible design, we encourage discussions and solutions that contribute to a sustainable future.

- **To Advance Research:** Encouraging the exchange of academic findings and engaging with the latest in scholarly work, thus nurturing a space where theory meets practical application.

- **To Advocate for Change:** Pushing the boundaries of what's possible, and advocating for a proactive stance on global issues through the lens of design and industrial development.

As we embark on this journey of discovery and innovation, the Design Commit Conference is more than just an event, it is a catalyst for change, driving a future where design and industry not only coexist but thrive together, fostering an ecosystem of sustainable development and progressive thought.

ACKNOWLEDGMENTS TO SPONSORS, COLLABORATORS, AND SUPPORTING INSTITUTIONS

The realization of the Design Commit 2024 Conference was made possible through the generous support and commitment of our sponsors, collaborators, and supporting institutions. At this moment of gratitude, we would like to express our recognition to everyone who contributed to the success of this event.

To our sponsors, whose financial and in-kind support has strengthened the structure and quality of the conference, we offer our heartfelt thanks. Your vision and understanding of the value of innovation in design and industry are fundamental to our collective progress.

We are immensely grateful to the organizing team, who shared their expertise and passion, enriching the program with insightful talks and discussion panels. Your dedication to excellence and professional development has not gone unnoticed.

A special thank you goes to the supporting institutions, whose partnership and support were essential to expanding the reach and depth of our meeting. Your collaboration allows the ideas discussed here to resonate beyond the conference walls.

We also acknowledge the assistance of various entities and volunteers, whose help behind the scenes was vital for the logistics and organization of the event. Your hard work and attention to detail ensured a smooth and memorable experience for all attendees.

Last but not least, we thank the academic and research institutions that, by supporting their representatives and researchers to participate in Design Commit, underscore the importance of an ongoing commitment to learning and innovation.

Together, we have built a conference that reflects the intersection between creativity, technology, and business, paving the way for the future of design and industry. Our sincere thanks to all of you for being part of this journey.

CONFERENCE PROGRAM

PROGRAM

MONDAY, MAY 20TH

08:30 — **WELCOME DESK | REGISTRATION**

09:15 — **TECHNICAL SUPPORT SESSION**
Small Auditorium

CONFERENCE OPENING CEREMONY

09:30 — **MUSIC DEPARTMENT OF THE UNIVERSITY OF MINHO**

György Ligeti [1923-2006]
Bagatelles [1953], for wind quintet [c. 13']".

09:50 — **DESIGN COMMIT GENERAL CHAIR**
Maria João Félix

10:00 — **MAYOR OF BRAGA CITY COUNCIL**
Ricardo Bruno Antunes Machado Rio

10:15 — **STUART WALKER**
Keynote Speaker

11:00 — **COFFEE BREAK**
Foyer Floor 1

11:30 — **TRANSDISCIPLINARY PATHS: RESEARCH LEADERS IN ADVANCING DESIGN AND INDUSTRY FOR A RESILIENT FUTURE**

MODERATION: RITA ALMENDRA
Lisbon School of Architecture (FA Ulisboa) and Research & Education in Design Research Group (Redes) from the Research Centre for Architecture, Urbanism and Design (CIAUD).

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Director of the Research Institute for Design, Media and Culture (ID+)

JOÃO CABELEIRA
Assistant Director of the Laboratory of Landscape, Heritage and Territory (LAB2PT)

JOÃO VILAÇA
Pro-President for Research and Innovation (IPCA)

12:30

SYNERGY AND STRATEGY, PIONEERING INNOVATION THROUGH DESIGN AND INDUSTRY FOR FUTURE GROWTH

MODERATION: FERNANDO MOREIRA DA SILVA

Lisbon School of Architecture (FA ULisboa) and Research & Education in Design research group (REDES) from the Research Centre for Architecture, Urbanism and Design (CIAUD).

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CRISTINA GÓIS AMORIM

Manager of the Cultural and Creative Industries Sector of Portuguese Trade & Investment Agency (AICEP)

13:30

LUNCH BREAK
Foyer Floor 1

2:30 PM - 4:00 PM
SESSION 1A | THEMATIC SMART
meeting room 1

2:30 PM - 4:00 PM
SESSION 1B | THEMATIC SOCIAL
meeting room 2

2:30 PM - 4:00 PM
SESSION 1C | THEMATIC GREEN
meeting room 3

2:30 PM - 4:00 PM
SESSION 1D | THEMATIC SPECULATIVE
meeting room 4

16:00

COFFEE BREAK
Foyer Floor -1

4:30 PM - 6:00 PM
SESSION 2A | THEMATIC SMART
meeting room 1

4:30 PM - 6:00 PM
SESSION 2B | THEMATIC SOCIAL
meeting room 2

4:30 PM - 6:00 PM
SESSION 2C | THEMATIC GREEN
meeting room 3

4:30 PM - 6:00 PM
SESSION 2D | THEMATIC CONVERT
meeting room 4

18:00

WELCOME COCKTAIL
Foyer Floor 0

PROGRAM

TUESDAY, MAY 21ST

08:30	**WELCOME DESK | REGISTRATION**
09:15	**TECHNICAL SUPPORT SESSION** Small Auditorium
09:30	**TERENCE LOVE** Keynote Speaker
10:15	**DESIGN AND INDUSTRY IN THE NEXT ERA** LUÍS ABRANTES **Movecho** **LARUSDESIGN. URBAN FURNITURE ADAPTED TO CULTURE AND PLACES** PEDRO MARTINS PEREIRA **Larus**
11:00	**COFFEE BREAK** Foyer Floor 1
11:30	**THE MATRIX WHERE DREAMS, DESIRES AND DESIGNS CAN MESH TOGETHER, POWERED BY ARTNETIC** ANDRÉ FONSECA FERREIRA **PERFORMER** RUI BARREIRA
12:00	**IMPACT OF ROBOTICS AND AI IN THE FUTURE OF DESIGN AND INDUSTRY** **MODERATION: PAULO CRUZ** School of Architecture, Art and Design of the University of Minho and Research & Education in Design and Technology Group (DeTech) from the Laboratory of Landscape, Heritage and Territory (Lab2PT) NUNO VILHENA LOURENÇO **CEIIA- Centre of Engineering and Product Development** GERMANO VEIGA **Senior Researcher at INESC TEC** JOSÉ MANUEL MACHADO **Director of the Algoritmi Centre**

13:00	**ADVANCING ADDITIVE MANUFACTURING: FUTURE-READY DESIGN SOLUTIONS POWERED BY CODI** MOISÉS DOMINGUES	
13:30	**LUNCH BREAK** Foyer Floor 1	
	2:30 PM - 4:00 PM **SESSION 3A | THEMATIC SMART** meeting room 1	2:30 PM - 4:00 PM **SESSION 3B | THEMATIC SOCIAL** meeting room 2
	2:30 PM - 4:00 PM **SESSION 3C | THEMATIC GREEN** meeting room 3	2:30 PM - 4:00 PM **SESSION 3D | THEMATIC SMART** meeting room 4
16:00	**COFFEE BREAK** Foyer Floor -1	
	4:30 PM - 6:00 PM **SESSION 4A | THEMATIC GREEN** meeting room 1	4:30 PM - 6:00 PM **SESSION 4B | THEMATIC SOCIAL** meeting room 2
	4:30 PM - 6:00 PM **SESSION 4C | THEMATIC SOCIAL** meeting room 3	4:30 PM - 6:00 PM **SESSION 4D | THEMATIC SOCIAL** meeting room 4
19:30	**DESIGN COMMIT DINNER** Pousada Mosteiro de Amares	

PROGRAM

WEDNESDAY, MAY 22ND

08:30	WELCOME DESK | REGISTRATION	
09:30	THEMATIC SESSIONS | MEETING ROOMS Floor -1	
	9:30 AM - 11:00 AM **SESSION 5A | THEMATIC SMART** meeting room 1	9:30 AM - 11:00 AM **SESSION 5B | THEMATIC SOCIAL** meeting room 2
	9:30 AM - 11:00 AM **SESSION 5C | THEMATIC GREEN** meeting room 3	9:30 AM - 11:00 AM **SESSION 5D | THEMATIC SOCIAL** meeting room 4
11:00	**COFFEE BREAK** Foyer Floor -1	
	11:30 AM - 1:30 PM **SESSION 6A | THEMATIC SPECULATIVE** meeting room 1	11:30 AM - 1:30 PM **SESSION 6B | THEMATIC CONVERT** meeting room 2
	11:30 AM - 1:30 PM **SESSION 6C | THEMATIC SOCIAL** meeting room 3	11:30 AM - 1:30 AM **SESSION 6D | THEMATIC GREEN** meeting room 4
13:30	**LUNCH BREAK** Foyer Floor 0	
14:30	**ORCHESTRAL WELCOME FOR AUDITORIUM SESSION.** MUSIC DEPARTMENT OF THE UNIVERSITY OF MINHO Antonín Dvorák [1841-1904] Serenade para Sopros em Ré menor, Op. 44 (1878) [c. 20']	

15:00	**FOUNDATIONS AND FUTURE: A JOURNEY THROUGH DESIGN** FERNANDO MOREIRA DA SILVA **Full Professor Emeritus of Design at the Lisbon School of Architecture of the University of Lisbon.**
15:15	**GUTO REQUENA** Keynote Speaker
16:00	**JOSÉ RUI MARCELINO** Keynote Speaker
16:45	**IN SEARCH OF THE LOST BALANCE POWERED BY LOVING THE PLANET** EDUARDO RÊGO
17:30	**CONFERENCE CLOSING SESSION** DESIGN COMMIT AWARD CEREMONY

DETAILED PROGRAM

PROVISIONAL DETAILED PROGRAM
20-22 MAY 2024

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ALL THE TIME IS BASED ON LISBON, PORTUGAL TIME (GMT+00:00)

PROVISIONAL DETAILED PROGRAM
20-22 MAY 2024

Please note that the following is a provisional program subject to changes.
We will keep you informed of any adjustments as we finalize the details.
All the time is based on Lisbon, Portugal Time (GMT+00:00)

MONDAY, MAY 20TH

	2:30 PM - 4:00 PM **SESSION 1A | THEMATIC SMART** meeting room 1 https://zoom.us/j/93366132899	2:30 PM - 4:00 PM **SESSION 1B | THEMATIC SOCIAL** meeting room 2 https://zoom.us/j/96385995188
	Moderator: Paulo Cruz	**Moderator:** Kelli Smythe
14:30	**PAPER ID [46]** Design of braided fibrous structure (scaffold) for treatment of spinal injury using Rhinoceros 3D software and Grasshopper plugin. Ivis Aguiar Souza, Lais Kohan, Maurício José da Silva Filho, Raul M. E. S. Fangueiro, Diana S. P. Ferreira.	**PAPER ID [48]** Qualitative research to improve usability in housing for old adults users: methodologies compared in research in Portugal and the Netherlands. Maristela Silva, Rita Filipe, Masi Mohammadi
14:45	**PAPER ID [61]** The Integration of Artificial Intelligence in Jewellery Design Processes Livia Tenuta, Susanna Testa, Francesca Antinarelli Freitas, Beatrice Rossato, Alba Cappellieri.	**PAPER ID [5]** Brand Design: Project-Based Learning Case Study Raquel Antunes, António Brandão.
15:00	**PAPER ID [96]** Drawing and Manual Sketching in the Context of Industrial Design, in the Era of Artificial Intelligence Verónica Duarte, Maria João Félix, Miguel de Aboim Borges	**PAPER ID [54]** Ecomusealia: the cultural landscape as a museum object. The designer's perspective through communication. Ana Moreno, Nelson Zagalo, Heitor Alvelos
15:15	**PAPER ID [112]** Perspectives of Students on AI Use in Interior Architecture and Design Jinoh Park	**PAPER ID [14]** Synesthetic Design Practice: The Smell of Music Yang Li, Yiyuan Ding, Nankai Cheng, Giuseppe Lotti
15:30	**PAPER ID [158]** Sustainable design to support the creation of rural and mountain communities in inland Portugal Daniel Raposo, Teresa Paiva, João Neves, Maria Fátima Veríssimo, Hugo Mendesi	**PAPER ID [18]** Sports bra design for well-being: focus on mobility, fabric moisture management and air permeability Ines Katić Križmančić, Ivana Salopek Čubrić, Vesna Marija Potočić Matković
15:45	**PAPER ID [165]** EUROACE Bauhaus Villages Strategic Plan João Neves, Daniel Raposo, Domingos Santos	

PROVISIONAL DETAILED PROGRAM
20-22 MAY 2024

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ALL THE TIME IS BASED ON LISBON, PORTUGAL TIME (GMT+00:00)

	2:30 PM - 4:00 PM **SESSION 1C | THEMATIC GREEN** meeting room 3 https://zoom.us/j/94140615243	2:30 PM - 4:00 PM **SESSION 1D | THEMATIC SPECULATIVE** meeting room 4 https://zoom.us/j/95436964714
	Moderator: Francesco Galli	**Moderator:** Heitor Alvelos
14:30	**PAPER ID [72]** Visualising Science: Crafting Memes in Design Pedagogy Susana Barreto, Heitor Alvelos, Cláudia Lima, José Carneiro, Pedro Alves da Veiga, Eliana Penedos-Santiago, Marta Fernandes, Nuno Martins, Júlio Dolbeth	**PAPER ID [115]** A Participatory Speculation toolkit for co-designing with Rural Communities Hernani Alves, Eduardo Gonçalves, Ana Margarida Ferreira
14:45	**PAPER ID [70]** EcoDesign futures. A wastewater recycling system for zero-mile vegetable production Giorgio Buratti, Fiammetta Costa, Attilio Nebuloni, Luciana Migliore, Annamaria Alabiso, Matteo Meraviglia	**PAPER ID [123]** Making Meaning: Discussing Futures of Measurement, Value and Impact in Design Higher Education Suzanne E. Martin
15:00	**PAPER ID [92]** The Intersection of Design Methodologies and Circular Economy Principles: A Focus on Waste Reduction, Sustainable Materials Management, and Educational Toys Raquel Salomé	**PAPER ID [34]** Enhancing User Experience in the Metaverse: Exploring Abstract User Design Semiotics and its Impact on Communication Culture Anton Storey
15:15	**PAPER ID [128]** Ceramic waste and opportunities: Design as a mediator in the conservation of biodiversity Joana Pinto, Lígia Lopes, Jorge Lino	**PAPER ID [116]** How do audiences perceive practice cases? Investigating typological differences in Design Futures through perceptual mapping techniques Tiantian Li, Zhiyong Fu
15:30	**PAPER ID [126]** Sustainable Crafts Design Research-A Scoping Study About Craft Development Problems in the UK Li Zhang, Cees de Bont, Avsar Gurpinar	**PAPER ID [4]** The Architectural Present - Hypertopia In Singapore João Rosmaninho, Margarida Lopes
15:45	**PAPER ID [160]** The importance of technology and design for the success of nations. Gilberto Santos	**PAPER ID [159]** A game-based framework to design and analyze games to augment creativity in their players José Raimundo
16:00	**COFFEE BREAK** foyer floor -1	
	4:30 PM - 6:00 PM **SESSION 2A | THEMATIC SMART** meeting room 1 https://zoom.us/j/93366132899	4:30 PM - 6:00 PM **SESSION 2B | THEMATIC SOCIAL** meeting room 2 https://zoom.us/j/96385995188
	Moderator: Chiara Frencia	**Moderator:** Susana Barreto
16:30	**PAPER ID [143]** Uncompilable: an interplay between Design and AI in the real world Daniel Risi	**PAPER ID [49]** Reflections on Inclusive Clothing: contributions to development Leticia Nardoni Marteli, Luis Carlos Paschoarelli, Fernando Moreira da Silva, Paula Trigueiros
16:45	**PAPER ID [55]** Virtual Production: A Closer Look at Digital Innovation And Health Guilherme Cruz, José Raimundo, Marta Madureira.	**PAPER ID [39]** Empower Creative Education with Awareness and Critical Thinking. Narratives of 'change and power' in fostering future creative leaders. Francesco Galli, Irina Suteu

PROVISIONAL DETAILED PROGRAM
20-22 MAY 2024

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ALL THE TIME IS BASED ON LISBON, PORTUGAL TIME (GMT+00:00)

17:00	**PAPER ID [31]** Designers for/and/with manufacturing: design-driven solutions for an updated dialogue between young creative talents and the textile-knitwear industry Giovanni Maria Conti, Martina Motta, Mariana Ciancia, Katia Goldoni, Francesca Piredda, Beatrice Zagatto	**PAPER ID [125]** Food literacy for Public Health: an Information Design exploratory study Suzana Parreira, Pedro Duarte de Almeida, Duarte Vital Brito
17:15	**PAPER ID [117]** Inclusive Knowledge System: A Cyber Physical System for Education and Research in the Made in Italy Ph.D. program Arrigo Bertacchini, Salvatore Carleo	**PAPER ID [135]** Multicultural Interface Design: Collecting and Designing Information for the access of Migrant and Refugee Women and Children to the Brazilian Healthcare System. Diovana Mazur Damacena, Kelli Cas Smythe
17:30	**PAPER ID [93]** Emerging approaches in yacht design and manufacturing: State of the art and future perspectives of generative design and additive manufacturing Massimo Piccioni, Arianna Bionda, Andrea Ratti	**PAPER ID [21]** Participatory Design in ceramics craft: A case study in the Poty Velho district Rebecca Nunes, Raquel Antunes
17:45	**PAPER ID [134]** Using the workshop technique as an evaluation tool: the case of the wayfinding information behavior method. Kelli Cas Smythe, Érica Santos Vargas	**PAPER ID [164]** Development, implementation and management of visual identities. Definition of a model for SMEs in the agri-food sector. Rogério Ribeiro, Daniel Raposo, Rita Almendra, João Neves
	4:30 PM - 6:00 PM **SESSION 2C | THEMATIC GREEN** meeting room 3 https://zoom.us/j/94140615243	4:30 PM - 6:00 PM **SESSION 2D | THEMATIC CONVERT** meeting room 4 https://zoom.us/j/95436964714
	Moderator: Suzanne E. Martin	**Moderator:** João Neves
16:30	**PAPER ID [13]** Innovative and Sustainable: Design of a Home-Based Device for Reusing and Recycling Face Masks Nankai Cheng, Yiyuan Ding, Li Yang, Paulo Noriega, Giuseppe Lotti	**PAPER ID [131]** IKEA hacking: customization and democratization of objects Domenico Di Fuccia
16:45	**PAPER ID [150]** Design of Water Sustainability: Trees in Arid and Semi-Arid Climates Terence Love	**PAPER ID [91]** Sustainable Product Development Strategies: an alternative for the Micro and Small Furniture Industry in emerging economies Juliana Cardoso Braga, Juliano Aparecido Pereira, Fernando Moreira da Silva, Luis Carlos Paschoarelli
17:00	**PAPER ID [41]** Parameters for a Degrowth Architecture: Subverting the Socio-Ecological Spatial Conditions of the Capitalist-Growth Regime Anna Deeg	**PAPER ID [38]** Pulse Approach workshop: one way of testing the proposal of integral design project management tool Luciana Lopes, Heitor Alvelos, Cristina Parente, Gonçalo Gomes
17:15	**PAPER ID [107]** Design of Tools in Fire Management Pierpaolo Antonio Fusaro, Arrigo Bertacchini, Giulia Teverini	**PAPER ID [32]** A new model for STEAM approach guided by DESIGN Wilson Kindlein Júnior, Brendon Willian Guedes Barbosa, Flávia Ribeiro Vieira, Ivan de Lima e Silva Penz
17:30	**PAPER ID [113]** Bio-based materials in cosmetics: territorial synergies and design-oriented product experimentations. Rosanna Veneziano, Michela Carlomagno, Stefano Salzillo	**PAPER ID [27]** Capulana: searching for the future in tradition Sofia Vilarinho, Henri Christiaans
17:45	**PAPER ID [163]** A precious territorial network: Alkimiya mag jewelry design maps Maria Dolores Morelli, Carmela Barbato	**PAPER ID [162]** Genie of the magic lamp or collaborative genius? Reflection on the use of generative Artificial Intelligence in the teaching-learning process in communication design Vitor Tavares, Suzana Dias, Manuel Granja, Mónica Santos, Estela Vilhena

PROVISIONAL DETAILED PROGRAM
20-22 MAY 2024

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ALL THE TIME IS BASED ON LISBON, PORTUGAL TIME (GMT+00:00)

TUESDAY, MAY 21ST

	2:30 PM - 4:00 PM **SESSION 3A | THEMATIC SMART** meeting room 1 https://zoom.us/j/93366132899	2:30 PM - 4:00 PM **SESSION 3B | THEMATIC SOCIAL** meeting room 2 https://zoom.us/j/96385995188
	Moderator: Carla Cadete	**Moderator:** Paula Trigueiros
14:30	**PAPER ID [74]** Postpartum Posture Correction in Baby Carriers: Biomechanical Insights and Structural Determinants Maria Moga	**PAPER ID [146]** Designing for meaningful Heritage: Affect, Embodiment and Emotional Gaelle Pillault, Tenna Doktor Olsen Tvedebrink, Fátima Pombo
14:45	**PAPER ID [106]** VAI – A collaborative Project to Immunize People Through Mass Vaccination Ana Brum, Gláucia Ferro, Aguinaldo Santos	**PAPER ID [147]** Customizing Wearable Prosthetics: A preliminary review of the current State of the Art in upper limb prostheses Andreia Caldas, Demétrio Matos, Adam de Eyto, Nuno Martins
15:00	**PAPER ID [111]** Industry 5.0 and Sustainable Fashion: future prospects for Designers in the era of Smart Factory and Artificial Intelligence Fernando Moreira da Silva, Roberto Liberti, Silvestro Di Sarno, Valentina Alfieri	**PAPER ID [145]** The contribution of Interface Design in the fight against COVID-19: analysis of the DGS and SNS24 websites, Portugal Inês Costa, Nuno Martins, Francisco Garcia, Rita Espanha, Daniel Brandão, Ana Barros, Branco Di Fátima
15:15	**PAPER ID [10]** Mapping a Network Culture: From an empirical study on university–industry collaboration Hugo Palmares, Miguel Terroso, Emília Costa	**PAPER ID [120]** Action strategies for the definition of a neighbourhood community: the discipline of design meets condominiums for the development of "block" Giuseppe Sorvillo
15:30	**PAPER ID [83]** Design thinking in the development of sustainable furniture Sofia Soares, Liliana Soares, Ermanno Aparo	**PAPER ID [59]** Transpedagogy as an activist design practice: other modes of knowledge production and action through a School Ship. Raúl Goñi, Manuela Valtchanova
	2:30 PM - 4:00 PM **SESSION 3C | THEMATIC GREEN** meeting room 3 https://zoom.us/j/94140615243	2:30 PM - 4:00 PM **SESSION 3D | THEMATIC SMART** meeting room 4 https://zoom.us/j/95436964714
	Moderator: Graça Guedes	**Moderator:** José Machado
14:30	**PAPER ID [67]** Reimagining Fabrics: The Role of Additive Manufacturing in Evolving Textile Design and Production Susana Marques, Carina Lopes, Rui Miguel, Álvaro M. Sampaio	**PAPER ID [89]** FLY-PT Project: Collaborative Approaches in E-VTOL Passenger Cabin Design José Rui Marcelino, André Castro, Catarina Ferreira
14:45	**PAPER ID [8]** Designing Awareness: A Collaborative Initiative for Climate Change Engagement in Porto Susana Barreto, Juliana Pires	**PAPER ID [23]** Design of an electronic mechanism to control the removal of bags in a public dispenser: contributions of 3D printing to the creative process Diogo Santo, Alice Araújo, Raquel Souto, Rui Silva, Cláudia Lima, Rui Mendonça
15:00	**PAPER ID [50]** Hybridizing Construction: The Transformative Influence of Ceramic AM João Carvalho, Paulo J. S. Cruz, Bruno Figueiredo	**PAPER ID [51]** Innovative design solutions in manufacturing industries by adopting art-driven experimentation Chiara Frencia, Bettina Maisch, Fatima Pombo

PROVISIONAL DETAILED PROGRAM
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ALL THE TIME IS BASED ON LISBON, PORTUGAL TIME (GMT+00:00)

15:15	**PAPER ID [104]** Appl(e)ause. A Food Design experiment to create new processed foods from apple by-products Raffaele Passaro, Cristian Campagnaro	**PAPER ID [66]** A Grasshopper-Based Computational Framework for Geometry Analyses based on the Jollying Process Diogo Carvalho, João Oliveira, Violeta Clemente
15:30	**PAPER ID [52]** The life and death of growth cities: Investigating the transition to degrowth spatial planning Anna Deeg	**PAPER ID [98]** The Role of Design in Fostering Circular Strategies through Digitalization in Waterborne Passenger Urban Mobility Ecosystems. Laura Pirrone, Arianna Bionda, Andrea Ratti
16:00	**COFFEE BREAK** foyer floor -1	
	4:30 PM - 6:00 PM **SESSION 4A | THEMATIC GREEN** meeting room 1 https://zoom.us/j/93366132899	4:30 PM - 6:00 PM **SESSION 4B | THEMATIC SOCIAL** meeting room 2 https://zoom.us/j/96385995188
	Moderator: Fernando Moreira da Silva	**Moderator:** Violeta Clemente
16:30	**PAPER ID [95]** Natural Material Innovations in Sustainable Building Systems Tatiana Campos, Paulo Cruz, Bruno Figueiredo	**PAPER ID [87]** The Neighborhood is IN(clusive). The Synergy of Participatory Design, Art Practices, and Social Design in Community Empowerment and Societal Transformation. Ana Cardoso, Maria Milano, Cláudia Pinhão
16:45	**PAPER ID [99]** Synergies between biomimicry and design Workshop Biomimicry 101 - "How can nature guide us into a sustainable future." Jeremy Aston, Ana Duque, Luciana Barbosa	**PAPER ID [137]** Revolutionizing Bell's Palsy Recovery: The Innovations of Reactivate in Design for Health and Well-being Valentina Sorvillo
17:00	**PAPER ID [102]** Aesthetics and meaning within the circular design discourse: an analysis based on design projects Nina Costa , Adriano Pinho, Francisco Providência	**PAPER ID [58]** Devices for curb-climbing wheelchairs Ana Rita Silva, Benedita Camacho, António Nicolau Costa
17:15	**PAPER ID [78]** Neo-rural Bioconstruction: A Cultural Analysis. Transformations and Connections Between the Past and the Present Llara Fuente Corripio	**PAPER ID [141]** Redesigning the learning environment of an online fashion design course: A step towards heutagogy Graça Guedes, Patrícia Gomes
17:30	**PAPER ID [20]** The Impact of Technology in Design Learning: A Study with Digital Natives Catarina Ferreira, Sara Lamúrias, Rita Martelo	**PAPER ID [42]** Emotional Design affecting Consumers' Preferences for China-chic Style Character Design Kaiqing Chen, Dominique Falla, Dale Patterson
17:45	**PAPER ID [151]** Sustainability in Business Plans: a Portuguese Linen Textile Company case Isabel Duarte de Almeida, Maria João Delgado	**PAPER ID [161]** Beyond-verbal communication: challenges of codesigning with persons with moderate to late-stage dementia Cláudia Lima, Susana Barreto

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	4:30 PM - 6:00 PM **SESSION 4C | THEMATIC SOCIAL** meeting room 3 https://zoom.us/j/94140615243	4:30 PM - 6:00 PM **SESSION 4D | THEMATIC SOCIAL** meeting room 4 https://zoom.us/j/95436964714
	Moderator: André Castro	**Moderator:** Rita Almendra
16:30	**PAPER ID [15]** Producer to Consumer vehicle (P2Cv) Product Design of a Smart Mobility Solutions for Minimising Loss and Waste in Micro Food Supply Chains. Guilherme Matos, Jeremy Aston	**PAPER ID [57]** Art Thinking and the transformation of the anachronistic object "Making the strange familiar and making the familiar strange". Rehearsal at Recoleta and Bajos de Mena, Santiago de Chile. Gaston Uriel Lisak Zabotinsky
16:45	**PAPER ID [19]** The temporary and sustainable music festival as a proscenium for new cultural acts. Glastonbury Festival: anatomy of a sustainable event Marco Manfra, Alessandro Damiani	**PAPER ID [68]** Citizen Participation in Strategic Conversations about Future Uncertainties Jennifer Schubert
17:00	**PAPER ID [119]** Sustainable Social Innovation Practices Supporting Communities in Place-Based Innovations. The Case of an Intergenerational Community Care Center Silvia Maria Gramegna, Alessandro Biamonti	**PAPER ID [86]** Designing for Tomorrow: Inspiring Students to Shape a Better World Carla Cadete
17:15	**PAPER ID [71]** Inclusive Design: Consumer Diversity in Hotel Service Maristela Silva, Rita Filipe, Paola Rebollar	**PAPER ID [82]** Innovation in Coastal Safety: Designing and Deploying a Mobile Compact Lifeguard Tower for Matosinhos Beaches Jose Luis Ferreira, Rui Pedro Freire, Rafael Coelho
17:30	**PAPER ID [73]** Designing Sustainable Tourism Experiences for Acquatic Ecosystems The Development of a Regenerative Floating Resort Elena Elgani, Elisa Schembri, Giulia Ettori, Rosanna Caldarella, Davide Grasso	**PAPER ID [153]** The abstraction effect: how abstract language can combat aversion to imperfection and influence consumer behavior Manuel Sousa Pereira, António Cardoso , Giulia D'Auria, Marianna Aruta, Mattia Adinolfi, José Carlos de Sá

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ALL THE TIME IS BASED ON LISBON, PORTUGAL TIME (GMT+00:00)

WEDNESDAY, MAY 22ND

	9:30 AM - 11:00 AM **SESSION 5A | THEMATIC SMART** meeting room 1 https://zoom.us/j/93366132899	9:30 AM - 11:00 AM **SESSION 5B | THEMATIC SOCIAL** meeting room 2 https://zoom.us/j/96385995188
	Moderator: Fátima Pombo	**Moderator:** Rute Gomes
09:30	**PAPER ID [9]** Design Culture Toolkit: A university–industry co-creation approach to impact companies' corporate culture Hugo Palmares, Miguel Terroso, Emília Costa	**PAPER ID [75]** "Can I have more ideas?" - Developing soft skills in secondary education children using design thinking Sofia Nunes, João Ferreira
09:45	**PAPER ID [53]** Design of smart LED streetlight luminaire for the mitigation of light pollution David Figueiredo, Eduardo Noronha, João Dias-de-Oliveira	**PAPER ID [85]** Won't this be weird? Approaching the Design Fixation problem caused by social conformity as a new perspective Nikole Melo de Mendonça, Rita Assoreira Almendra
10:00	**PAPER ID [130]** Exploring Pseudo-Tactile Sensations: Virtual Reality Integration in the Textile Industry for Sustainable Transformation. Cláudia Legoinha, Silvina Félix	**PAPER ID [22]** Participatory Design and Food Literacy, Promoting Health and Well-Being as Integral Components of a Post-Growth Economy Verónica Duarte, Maria João Félix, Miguel de Aboim Borges, Claúdia Viegas
10:15	**PAPER ID [79]** Frugal innovation in transforming scarcity into opportunities Ismael Gonçalves Taborda, Cláudia Cirineo Ferreira Monteiro	**PAPER ID [148]** For a Deeper Encounter With Cultural Heritage: Analysis of "Leonardo: Experience a Masterpiece" Exhibition Through the Lens of Experience Design Aleksandra Kosztyła, Pedro Cardoso, Heitor Alvelos
10:30	**PAPER ID [1]** Operations optimization for the industrial faucet industry: test assembly and packaging in a one-piece flow line Miguel Terroso, Ivo Rodrigues, Adriana Amorim, Deividi Hartmann, Maria João Figueiredo	**PAPER ID [133]** Designing for Impact: Elevating Employee Experience and Service Delivery in Tandem Nidhi Singh Rathore, Sogand Seirafi
	9:30 AM - 11:00 AM **SESSION 5C | THEMATIC GREEN** meeting room 3 https://zoom.us/j/94140615243	9:30 AM - 11:00 AM **SESSION 5D | THEMATIC SOCIAL** meeting room 4 https://zoom.us/j/95436964714
	Moderator: Nuno Dias	**Moderator:** Luís Mota
09:30	**PAPER ID [7]** The Eco-design of TALLUM, a Multifunctional Kitchen Island for an Innovative Eco-user Carolina Polónio , J. Paulo Davim, Fátima Pombo	**PAPER ID [56]** Teacher-Generated Drawing Strategy. A Starry Night Scream Rui Costa, Susana Campos, Pedro Bandeira Maia
09:45	**PAPER ID [77]** Industrial waste from corn used in the development of tubes for planting eucalyptus seedlings Leticia Perciliano Sakurai, Ghiovani Zanzotti Raniero, Antonio Roberto Giriboni Monteiro, Cláudia Cirineo Ferreira Monteiro	**PAPER ID [88]** Mapping the Awareness of a Place Jose Silva, Fernando Moreira da Silva
10:00	**PAPER ID [110]** An Introductory and Exploratory study into the context of Portuguese Sustainable Fashion Micro-companies. Elsa Lima, Gianni Montagna, António Dinis	**PAPER ID [69]** Innovation in Design and Engineering: The Refill_H2o Ana Filomena Curralo, Sergio Ivan Lopes, João Mendes, Antonio Curado

PROVISIONAL DETAILED PROGRAM
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ALL THE TIME IS BASED ON LISBON, PORTUGAL TIME (GMT+00:00)

10:15	**PAPER ID [44]** Innovative Design Strategies for Sustainable Coral Reef Restoration in the Anthropocene. Pedro Dias, André Castro, Maria João Félix	**PAPER ID [97]** Sustainable Regional Development through Design Ana Moreira da Silva
10:30	**PAPER ID [84]** Design of a Yarn Analysis Mechatronic Prototype for Textile Industry Filipe Pereira, José Machado, Filomena Soares, Rosa Vasconcelos, Vitor Carvalho, Luís Motta Barbosa	**PAPER ID [90]** Design as Leverage - Mapping Solutions José Gago, Tiago Marques
10:45	**PAPER ID [12]** Incremental Innovation in Nanobiosensor for Monitoring Microplastic Particles in Fresh Water Marcio Ana, Luís Cesar Ferreira Motta Barbosa	
11:00	**COFFEE BREAK** FOYER FLOOR -1	
	11:30 AM - 1:30 PM **SESSION 6A | THEMATIC SPECULATIVE** meeting room 1 https://zoom.us/j/93366132899	11:30 AM - 1:30 PM **SESSION 6B | THEMATIC CONVERT** meeting room 2 https://zoom.us/j/96385995188
	Moderator: Pedro Bandeira Maia	**Moderator:** Paula Trigueiros
11:30	**PAPER ID [37]** Speculative Proposals: A Design Resource for Crafting Speculative Scenarios David Palma, Marco Neves	**PAPER ID [29]** Urban design solutions for dog waste: Design of a mechanical device for a dog waste station bag dispenser Maria João Megre, Francisco Pereira, Vasco Lameira, Cláudia Lima, Rui Mendonça
11:45	**PAPER ID [24]** Authorship in contemporary tattoo: A design perspective Bruno Cordeiro	**PAPER ID [152]** Proposing a Sustainability Compendium for the Portuguese Industry Sector Students Rute Gomes, Paulo Dinis, José Silveira Dias, Maria João Félix
12:00	**PAPER ID [109]** Fashion, Speculative Design and Fashion Films in Contemporary Fashion Brands: A Literature Review Mónica Lopes, Manuel José Damásio, Alexandra Cruchinho	**PAPER ID [118]** The professional practice of design: a qualitative study of design processes and their suitability for teaching academic design Luís Mota, João Martins, Liliana Soares, Maria João Félix
12:15	**PAPER ID [122]** Being-Centred Design – Notes on a Speculative Process Philosophy Nuno Dias, Abhishek Chatterjee, Vasco Branco	**PAPER ID [63]** Businesses in Bamboo and their Considerations for a Sustainable Venture Monikuntala Das, Amarendra Kumar Das
12:30	**PAPER ID [45]** The lives of metal: A speculative inquiry between art and industry through the molding of aluminum Antônio Frederico Lasalvia, Hugo Reis, Filipa Frois Almeida	**PAPER ID [16]** Lamp "SaboR a LuZ"©, 20 years of ecodesign Fernando Miguel Marques

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	11:30 AM - 1:30 PM **SESSION 6C | THEMATIC SOCIAL** meeting room 3 https://zoom.us/j/94140615243	11:30 AM - 1:30 AM **SESSION 6D | THEMATIC GREEN** meeting room 4 https://zoom.us/j/95436964714
	Moderator: Ana Moreira da Silva	**Moderator:** José Machado
11:30	**PAPER ID [35]** Colour in the food, colour on the ceramic plate – symbolic perception of the whole Maria João Mercês	**PAPER ID [94]** Ecodesign: Shaping a sustainable future with plastic products Ana Barroso
11:45	**PAPER ID [65]** Analysis of the Academic production using Systematic Literature Review: Brazil - Portugal (2017-2022) Lívia Brasil	**PAPER ID [60]** Sustainable Conversions for Covo: Co-creation between Design and Craftsmanship Amélia Ribeiro, Maria João Barbosa
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PAPER ID [61]

THE INTEGRATION OF ARTIFICIAL INTELLIGENCE IN JEWELLERY DESIGN PROCESSES

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In recent years, Artificial Intelligence (AI) has transformed the traditional design process worldwide. This technology enables designers across various sectors to rethink how to collect and analyse data and more sustainably express creativity in the design process. In the design field, Artificial Intelligence offers innovative alternatives to improve efficiency and sustainability, and it plays a crucial role in the jewellery design process. This paper intends to establish directions to help the design process become more efficient by integrating artificial intelligence-based programs and tools. Primarily, this paper focuses on using Artificial Intelligence throughout the design process, from the research to the communication phase. Each step involved in the design process is identified and analysed. Secondly, for each identified phase, this paper highlights strengths and weaknesses, opportunities and limitations that Artificial Intelligence offers in jewellery. In conclusion, the paper reflects on the role of designers in the new AI-driven design scenario, and it offers an overview of opportunities and challenges to be overcome for a more sustainable and innovative design process.

Keywords: design, jewellery design, artificial intelligence, sustainability, creativity

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1. Introduction

Significant developments in science, industry, urbanization, and secularization characterised human history from the mid-18th century to the contemporary. Alongside all the benefits this progress has brought, unsustainable ways of living have emerged (Walker, 2020, pp. 268-294). We have entered an age of polycrisis (United Nations, 2023, p.3), and awareness of the changes is crucial to offering concrete responses.

Among the significant developments, the advent of the digital age caused noteworthy social and cultural changes in short periods (Figoli, 2022, p.27). Nowadays, Artificial Intelligence (AI) is increasingly being used to solve global problems (Raper, 2022, p.1), such as reducing greenhouse carbon emissions by up to 10% (Das, 2022, p.2). Described as "the process of creating intelligent machines that can imitate or exceed human abilities in specific tasks" (Elfar, 2023, p.106), AI is transforming industries such as healthcare, aviation, online services, agriculture, education, gaming, marketing, finance, design, and it has emerged as a possible and fascinating solution to tackle the sustainable challenge. The fashion system is not exempt from the fascination of AI, which is increasingly adopted as a helpful tool within the value chain.

Fig. 1. A map showing the implementation of AI strategies worldwide.
Source: Artificial Intelligence Index Report 2021

In particular, digitalisation and optimization of tasks and resources, achieved through AI-driven processes, have been successfully implemented through the fashion design practice. Indeed, the design process in the fashion sector leads to sustainable challenges that could be solved by integrating AI-driven tools. The main challenges consist of the ideation and development of creative concepts in line with the target and customer preferences, which would not result in unsold products, the overall reduction of the production encouraging high-quality projects than fast designs, the use of sustainable materials which can be recycled and used for future projects, the identification of product's defects before the production stage and the reduction of the vast amount of energy and materials used for completing tasks.

A specific area of the design field, represented by the generative design method, is helping designers solve some of those challenges and generate ideas faster and more efficiently. Generative design is a computer-aided design technique and software category that uses AI to optimize the design process. Therefore, the symbiotic human- computer relationship behind generative design can become necessary to solve complex sustainable problems related to the amount of energy used or unsold productions. Consequently, in the design process, AI Generated Content (AGC) has received tremendous attention within the past few years (Chen, 2023, p.1). Thanks to the emergence and advancement of large foundation models, which enable the rapid development of domain- specific models, AGCs are having great success in the creative industry and can produce high-quality content quickly. They are commonly employed to produce various types of content, including images, texts, audio, and video, that can be efficiently integrated in the design process. These models are trained to generate digital images from text descriptions using a dataset of text–images and to create more complex and realistic images to support the creative design process.

In particular, in the jewellery world, designers have started to speculate on how these technologies can extend their capabilities in their design process, enhancing the creative process through a more sustainable approach. AI allows jewellery designers to generate innovative designs faster, propose customised solutions to clients that fit better with the target, and make the design process more efficient and digitised. Therefore, this reshaping of the industry by integrating AI-driven parametric tools and AGC strategies in the design process allows jewellery designers to explore new possibilities, create innovative designs, and push the boundaries of creativity more sustainably. The industry is also showing much interest in integrating this technology. For instance, a team of researchers at Microsoft is trying to revolutionize the jewellery design process and striving to reshape conventional approaches in the jewellery industry. They employed machine learning to craft an artificial intelligence system capable of automating the design process. In pursuit of this goal, they instructed the AI to generate various designs (Bubeck, 2023, p.13).

Despite its popularity, AI and the advent of AIGC have raised many concerns regarding the environmental impacts caused by more efficient and, consequently, faster production. Also, from a social perspective, issues that arise would be privacy, bias, toxicity, misinformation, intellectual property (IP), and potential misuse of technology (Chen, 2023, p.2). This paper aims to highlight opportunities and limitations of using AI in the jewellery design process and to explore directions and strategies that prioritize a post-growth economy with modern, resource-efficient, smart, and inclusive principles. It focuses on enhancing creativity, sustainability, and education, promoting a new digital scenario that presents a new role for the designer.

2. Materials and methods

In jewellery design, AI supports, innovates, and revolutionizes the design process in various ways. This paper focuses on its three main stages, research, development, and communication, to establish opportunities and challenges for using AI in the jewellery design process.

We have decided to start from the initial stage of the design practice because AI's impact on the process outputs exponentially increases if applied in the early phases, considering that the most polarizing design decisions are made here (Figoli, 2022, p.9). To gain a competitive business advantage, companies and designers gather and store consumer information that helps to analyze, model, personalize, predict, and influence their potential customers' behavior (Gkikas, 2022, p.148) at the early phase of their research process. By researching customer preferences or future customer trends at the beginning of the process, AI algorithms enable designers to collect data more efficiently and tailor their design concepts to specific target audiences.

The importance of the research phase and the collection of data before the ideation of specific concepts in the design process has been demonstrated in a study conducted by Salesforce that surveyed 14,300 consumers and business buyers globally; personalised experiences are considered a critical factor in the purchasing decisions of 84% of shoppers. The research found that 80% of customers now think the experience a company provides to be as important as its products and services (Salesforce, 2023). By utilizing a fusion of Design AI and Computer-Aided Design (CAD) software, the jewellery industry seeks to meet consumers' expectations, offering personalised experiences. Companies and designers use AI technology to gather customer data, empowering them to participate actively in design development and eventually co-create their jewellery pieces.

Figure 2 shows that by 2024, the total amount of data created, captured, copied, and consumed worldwide is forecast to increase rapidly (Gkikas, 2022, p.149). In the jewellery industry, AI is used for target audience analysis, customer preferences analysis (Tenuta, 2023, p.2), and trend analysis.

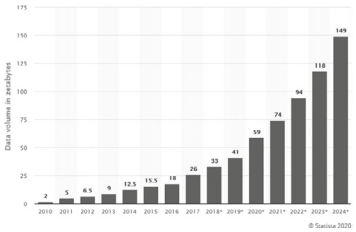

Fig. 2. Worldwide data created from 2010 to 2024.
Source: https://www.statista.com/statistics/871513/worldwide-data-created

For the jewellery design process's research phase, we gathered information from websites, jewellery studies, scientific papers, international journals, and books. The research phase in the jewellery design process consists of three different main actions:

- the collection of data on the target audience (primarily relied on demographic data such as age group, gender, and location)
- the collection of data on customer preferences (using historical data, artistic influence, social media, and economic indicators)
- the collection of data on global trends

Today, companies are approaching AI data-driven methods for the research process because AI can support and improve the analysis of a vast amount of data. For instance, Gucci uses AI to examine consumer trends and identify potential product prospects. Their AI-integrated mobile application furnishes sales personnel with insights into product specifics and customer buying patterns.

Predicting new global trends is crucial for designers. AI can identify real-time impactful and emerging trends, including relevant business events or use cases that accelerate the research process and provide detailed

insights. AI can process vast amounts of data from various sources, such as historical data, artistic influences, social media, economic indicators, scientific research, and articles. Therefore, AI can recognize emerging changes, potential developments, and scenarios. For instance, leveraging AI predictive capabilities can allow the earth-mined and lab-grown diamond jewellery industries to anticipate evolving trends so that their offerings align with ever-changing purchasing preferences. Nevertheless, despite AI's advantages to designers, it poses challenges. Ensuring the quality and reliability of data, mitigating biases in AI algorithms, and addressing ethical concerns stand out as critical considerations for the effective and responsible utilization of AI in strategic planning.

The research phase also includes the concept creation, starting with defining a mood board that combines evocative images and keywords. Designers must collect ideas, fonts, images, materials, inspirations, and additional creative design elements to create an inspirational board. Typically, creating a mood board is still largely conventional and can be defined as time-consuming since producing colour and style variations requires a long time. Generative design and AI can quickly generate a wide range of design concepts, allowing designers to select and proceed with the AGC they consider more feasible, as in the case of "Human vs Midjourney: What happened when we used AI to create mood boards" by Big Human team (Big Human, 2023), including designers, engineers, writers, and strategists. Their work involves designing products to help technology and humanity evolve responsibly. To understand if AI can positively affect the creation of creative concepts in their design process, they experimented with Midjourney, an AI image generator. As shown in Figure 3 and Figure 4, the process consisted of four steps: creating mood boards following their traditional visual research methodology – the keywords chosen were Efficient, Techno Magical, Infinite Boundless, and Augmented; using the research process to define a new perspective and creating three distinct territories in line with the brand values – the territories were Ethereal Science, Prism Glitch and Executable; replicating the visual directions entering prompts on Midjourney and Dall-E related to their fundamental brand values; and compiling the various images they received back from the software into the same three visual territories (Big Human, 2023).

Fig. 3. First and second step of the 'Human vs Midjourney' case study.
Source: https://www.bighuman.com/blog/midjourney-ai-generated-mood-boards

Fig. 4. Third and fourth step of the 'Human vs Midjourney' case study.
Source: https://www.bighuman.com/blog/midjourney-ai-generated-mood-boards

From this investigation, the Big Human team realised that, when using Midjourney to create mood boards, they spent more time finessing the prompt than looking at the visuals. The prompt engineering took their design features out of the creative process, giving a more mechanical appearance. Also, they realised that originality is not part of AI's nature. Midjourney can only show things that already exist. Instead, humans can develop and generate new visions. In conclusion, they felt limited and uninspired. They chose to turn to Are.na to develop their mood boards, an online social networking community and creative research platform. It led them to

unexplored territories and new scenarios that they had never experienced before. Finding connections through other people's creative thinking brings more innovative designs (Big Human, 2023).

For the development phase of the jewellery design process, the following steps were taken into consideration: sketching and prototyping the jewellery pieces, which can be created digitally or physically. In the following sections, we have analysed how AI-driven digital sketches and prototypes can benefit the design process.

The possible applications of AI in sketching and prototyping include using text-to-image synthetic models that have been widely explored in recent years and can render texting codes into images. Some AI Jewellery generators primarily used in this sector are Fotor, StarryAI, BLNG, and Neural.love. For instance, the AI image- creation platform StarryAI supports designers in jewellery creation with generative AI and presents a five-step guide from the concept to the creation phase. The guide starts with suggesting to designers to choose the correct design software between generative design software, AI-powered design tools such as Adobe Illustrator or AI art generators, to set the design parameters, to let AI work, review and refine the range of design concepts generated and create a prototype (Starryai, 2023). This process allows the designer to refine concepts, visualize the designs better, and make any modifications before the final production. From a design perspective, it is interesting to notice that here, the designer's need consists in setting the parameters, which opens the discussion about the AI still requiring relevant human input.

Fig. 5. Example of Starryai AI-generated jewellery designs.
Source: https://starryai.com/blog/designing-jewelry-with-ai-from-concept-to-creation-in-five-steps

In addition, the French jewellery company Boucheron used AI for the first time to create its Contemplation collection, crafting an algorithm with mathematicians to generate a cloudlike diamond-and-bead necklace.
The prototype stage includes the physical prototype, which consists of the tangible representation of the jewellery design and 3D printing or other AI-driven prototyping technologies. Starting from the sustainability aspect, we have considered the experimentation with recycled metals in the AI-driven process of 3D printing for physical prototypes. For instance, companies from the jewellery sector, such as Tiffany & Co. and Boucheron, are using AI to design personalised jewellery through 3D metal printing, creating distinctive designs and prototypes. In particular, Nick Koss, the founder of Volund Jewelry, stated that computers have a unique ability to re-create natural patterns and that humans play a critical role in how machines generate those patterns. Here again, the need of the designer to support the technology is reiterated.
Figure 6 shows the example of the company Imaginarium, a leader in 3D printing and advanced manufacturing technology, housing the most extensive setup of 3D printers (Imaginarium, 2023). It offers over 140 materials, including recycled metals for 3D printing, and 1600 designs brought to life daily. The company works in the jewellery and healthcare industries; some of its jewellery works are shown in the figure below.

Fig. 6. Examples of 3D printed metal jewellery design.
Source: https://imaginarium.io/case-study/

Some benefits of using AI in the development phase of the jewellery design process are cost-effectiveness, material optimization, and quality enhancement, but they also come with challenges. AI can predict the cost of a specific design based on the materials involved and the type of manufacturing required for the production. It helps designers create more economically efficient designs without compromising quality. Thus, AI can also help designers optimize the use of materials, especially precious materials, including precious metals such as gold and platinum, and precious gemstones such as diamonds, emeralds, sapphires, and rubies. Therefore, through the analysis of specific designs, AI tools can propose methods to reduce the usage of gold or diamonds without influencing the aesthetics or quality of the piece of jewellery. Unfortunately, AI lacks when it comes to gemstone selection. AI algorithms cannot select gemstones depending on their quality, colour tone, or dimensions. AI would show the designer the available material list of stones, considering any stone in any size to fulfil the design requests. However, there could not be any availability, and they could not exist in nature. This means that designers or gemmologists still need to source available stones in the colour and shape needed. Then, AI offers a superior alternative in terms of quality enhancement for the jewellery pieces, analysing and detecting potential structural weaknesses, and suggesting intelligent improvements.
On the other hand, designing jewels requires precision and technical knowledge, and the supervision of a master designer or goldsmith is necessary during the process. AI can serve as a support but cannot technically replace human contribution. For instance, AI cannot recognize a jewel's practical wearability. It cannot predict the correct dimension or thickness of a jewel. Lastly, AI cannot select the appropriate materials and techniques to produce the jewel. For instance, while AI algorithms can generate sophisticated and intricate pattern designs that were previously unimaginable, those designs may not effectively translate into jewellery pieces due to the limitations posed by specific manufacturing methods. The last phase of the jewellery design process consists of the communication phase. It involves designers' strategies and digital AI techniques to promote and communicate their products to the final clients.
The first case study we have analysed is the Italian jewellery brand Pannalù by Susanna Testa. The designer uses AI for the brand's advertising campaigns to enhance creativity and inclusivity, as shown in Figure 7. In the discussion on the role of artificial intelligence in creative fields, the author expresses a belief in the significant potential of AI as a creative tool. AI is seen as an opportunity to experiment and push the boundaries of creativity. One aspect the author finds particularly fascinating about artificial intelligence is its unpredictability and the element of surprise that emerges in interaction. This unpredictability, she suggests, spontaneously stimulates creativity, sometimes in entirely novel ways. "AI enables the construction of worlds and the shaping of imaginative visions in previously unimaginable ways, all through language and words." (Tancorre, 2023) However, the author also emphasizes the importance of using artificial intelligence ethically and responsibly. The challenge lies in integrating this technology into the creative process without losing the human essence at the core of art and creativity. She refers to the experiences at Pannalù Paprika Farm, where AI was used not to replace human creativity but to amplify it, to experiment and explore new possibilities. "This," she argues, "demonstrates how technological innovation can enrich and renew the creative landscape."

Fig. 7. AI-driven advertisement campaign by Pannalù.
Source: https://www.brilliantearth.com/news/virtual-try-on/#CYOEngagementRing

Secondly, we have analysed the case study that involves the American jewellery company Brilliant Earth, which allows customers to try on jewellery pieces virtually, create personalised engagement rings, and find matching wedding rings online. In fact, for the first of these features, they can find their favourite ring directly from their

phone and select the option "Virtual Try On." After uploading a picture of their hand and customizing every ring element, they can save and share the design. Figure 8 shows the three AI-driven features Brilliant Earth offers.

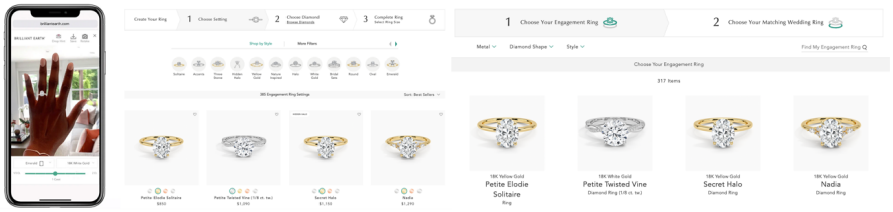

Fig. 8. Virtual try on, Create your own engagement ring and Find my matching wedding ring By Brilliant Earth.
Source: https://www.brilliantearth.com/news/virtual-try-on/#CYOEngagementRing

Another case study is represented by Maria Tash, who is known for revolutionizing the fine jewellery and luxury piercing industries. After more than five years of experimentation, she launched the Tash Studio software. This online platform allows consumers to try different piercing patterns from home. They can virtually simulate their ears with different skin tones, try different compositions, combine different outfits, and be creatively inspired. With the technological advancements of AI, its use expands not only to the sales and retail experience but also to the creative design process (Tenuta, 2023, p.2).

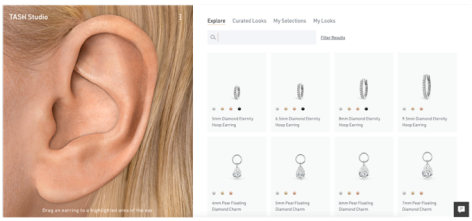

Fig. 9. Maria Tash Virtual Try-on.
Source: https://www.mariatash.com/TASH-Studio

The previous case studies show how integrating AI into the communication phase can benefit designers and companies. AI technology can help designers save time, improve content quality, and boost campaign performances based on data and user preferences. AI can help identify good strategies to improve the user experience and increase customer satisfaction, resulting in a more engaging relationship between the designer and the client.

3. Results

From the data analysis of the jewellery design process's research, development, and communication phases, it has emerged that employing AI and AI-driven tools leads to opportunities and several challenges. For this study, we have organised and elaborated the results following three main approaches: sustainable, creative, and educative.

From a social and environmentally sustainable perspective, the design process presents some opportunities and limitations. From an environmental point of view, AI integration into the jewellery design process leads to a reduction of waste but also to an increase in the amount of energy required for specific processes, such as generating complex designs. The prototyping phase especially shows the positive impact of reducing waste

through the digitalization of tasks. AI-driven tools can efficiently minimize the materials required for a specific prototype and select the suitable materials. For the same reason, in the communication phase, AI-driven tools can help to reduce waste by analysing and establishing the best selection of materials that will be involved in the process of the advertisement campaign. However, using AI in the design process can also have negative impacts. Generally, it involves significant computing power and substantial energy required, often sourced from fossil fuels, resulting in a detrimental environmental impact. Some scholars assessing the energy needed to "train" AI, meaning to operate advanced models of Artificial Intelligence that are beneficial for natural language understanding and processing, have observed that it can lead to the emission of 284 metric tons of carbon dioxide equivalent. These emissions are nearly five times the average lifetime emissions of an American car, including its production (CISV, 2021, p.56). In summary, the discussion between the potential of AI in reducing waste and the consequential increase of energy used is still open. At a global scale, we have to consider that, even if AI has demonstrated to be able to reduce waste for each design product process, improving the efficiency, it is more critical to try to reduce the overall number of pieces produced instead of accelerating the process making the production faster and more efficient which is not in line with the concept of sustainability. This touches on a crucial debate in artificial intelligence, sustainability, and production ethics. It raises a fundamental question about the direction in which technology, particularly AI, should be steering industrial and economic practices. AI's role in increasing production efficiency is undeniable. It can optimize every stage of the manufacturing process, from design to logistics, significantly reducing waste and resource consumption per product unit. These improvements are often celebrated for their potential to make industries more environmentally friendly by lowering their carbon footprint and reducing the waste generated during production. However, this technological efficiency may paradoxically contribute to a cycle of increased consumption and production. This phenomenon is sometimes referred to as the "rebound effect" or "Jevons Paradox," where increases in efficiency lower the per-unit cost of production and can lead to an overall increase in resource consumption. In this case, the efficiency gained through AI could produce and consume more products, which might negate the sustainability benefits through increased total production and consumption. Focusing on responsible production emphasizes the need for a shift towards sustainability that is not solely efficiency-oriented but also considers the volume of production and consumption. It suggests a model emphasizing producing fewer, higher-quality items that meet needs without encouraging overconsumption. This approach aligns with the circular economy principles, emphasizing minimizing waste and maximizing resources. Reflecting on this, it becomes clear that technology alone cannot solve the complex problems of environmental degradation and resource depletion. There is a need for a holistic approach that combines technological innovation with changes in consumption patterns, business models, and regulatory frameworks to ensure sustainable outcomes. This involves improving things and rethinking what is made and how much, aiming for a balance between meeting human needs, preserving environmental integrity, and ensuring economic viability. This reflection opens up broader questions about the role of AI in society and the economy: How can AI be leveraged for efficiency and holistically promoting sustainability? What regulatory or economic incentives could encourage businesses to prioritize quality over quantity and sustainability over short-term efficiency gains? How can consumers be encouraged or educated to value sustainability and quality in their consumption choices? Addressing these questions requires interdisciplinary collaboration involving technologists, environmental scientists, economists, policymakers, and the public to redefine progress and success in an age of technological abundance.

On the other hand, considering the social aspect of sustainability, the use of AI raises ethical issues, including data privacy, intellectual property, and bias. For the data privacy issue, in the data collection for the research phase, it has been demonstrated that large foundation models are known to be vulnerable to privacy risks and attacks. The AIGC can also be subject to privacy leakage. Studies have attributed these privacy attacks' success to duplicated data in commonly used web-scraped training sets. A sequence that appears multiple times in the training data is more likely to be generated than a sequence that occurred only once. This suggests that deduplication could be used as a countermeasure in privacy-sensitive applications (Chen, 2023, p.2). A complete resolution to the privacy issues has yet to be achieved. However, companies and researchers have taken proactive steps to address these issues, such as introducing warning messages and detecting replicated content. AI in the jewellery industry raises broader questions about intellectual property, including concerns about data memorization, ownership of images, and plagiarism. For instance, Stable Diffusion memorizes duplicate images in the training data.

The generated images are simple combinations of the foreground and background objects of the training dataset. The system occasionally displays the ability to reconstruct memories, producing objects that are

semantically equivalent to the original without being identical in pixel form. A relevant example of violation of intellectual property in design involves the American artist Mason Rothschild and the French luxury house Hermès. In 2021, Rothschild released a collection of 100 MetaBirkins NFTs depicting fur-covered, patterned 3D handbags, and it was accused of unauthorised use of its revered Birkin trademark. For the same reason, in the jewellery design field, it is essential to reflect on whether an AI model should be trained on images of another designer's work and used to generate new designs without crediting or remunerating the original designer. It is also fundamental to consider whether AIGC models produce unique creative works or replicate content from their training sets. Ideally, AIGC should produce original and distinct outputs. However, the source and intellectual property rights of the training data are often unknown due to uncurated web-scale data (Somepalli, 2023, p.1). The powerful memorization of large AIGC models poses a risk of reproducing data directly from the training data, potentially raising legal concerns around copyright infringement and ownership.

Another social concern and problematic dataset arise when collecting data through AI-driven tools is the AI algorithm bias. Most AIGC models rely on text encoders that are trained using large amounts of data from the internet, which may contain social biases and toxicity (Chen, 2023, p.5). Since the training data used in AI models are collected in the real world, they can unintentionally reinforce harmful stereotypes, exclude, or marginalize certain groups, and contain toxic data sources, which can incite hate or violence and offend individuals (Weidinger, 2021, p.15). For instance, images generated with the prompt "Three engineers running on the grassland" using Stable Diffusion v2.1 resulted in all male people, and none of them would belong to the neglected racial minorities, indicating a lack of diversity in the generated images (Chen, 2023, p.4)

Fig. 9. Images generated with the text "Three engineers running on the grassland" by Stable Diffusion v2.1.
Source: A Pathway Towards Responsible AI Generated Content by Chen Chen, Jie Fu and Lingjuan Lyu

This shows a massive bias in using AIGC models in the research phase of any creative process. Another example is Google's Images, which encodes several social biases and stereotypes, such as generating images of people with lighter skin tones and aligning with Western gender stereotypes. These biases can lead to unfair discrimination and harm certain social groups (Chen, 2023, p.3). This demonstrates that designers should ensure the quality and reliability of data, mitigate biases in AI algorithms, and address ethical concerns that stand out as critical considerations for the effective and responsible utilization of AI in strategic planning.

As regards creativity, AI can expand the designers' horizons and help identify possible areas for their further research, development, and communication phase. Although AI enhances productivity, allowing designers to focus on the creative aspect of the project rather than focusing too long on the early stage of the ideation process, on the other hand, the integration of AI into the jewellery design process shows

a lack of creativity. Primarily, AI lacks human qualities like creativity and empathy, often limiting its ability to understand emotions or produce original ideas. Midjourney, one of the generative AI programs primarily used in the design sector, can only show existing ideas and products. Instead, humans can come up with new visions. Also, using AI in the design process shows a potential misuse of this technology, making designers dependent on it and reducing their critical and creative thinking skills. These AI tools often need more spatial understanding capabilities and the inability to follow complex instructions (Gokhale, 2022, p.1). Even though many of the designs generated are usually aesthetically appealing, some designs are not as admirable due to factors like disproportionate placements, lack of harmonic orientations, etc. (Gupta, 2018, p.2), which could lead to an unsold production of jewellery pieces. While AI can be a valuable tool in jewellery design, the designer ultimately must refine and curate the concepts generated by the AI and create a design that meets their specific aesthetics, functionality, and commercial viability. Jewellery design is a profoundly creative human process that cannot be entirely set aside in favour of this emerging technology.

Suppose it is true that in jewellery design, AI offers material optimization and reduction of waste. In that case, it is also true that today, a product is determined by its material worth and the design value inherent within it. If we are going toward eliminating the design value in favour of the technology, what happens to the design value when a machine accomplishes it? How is it perceived? These open questions must be posed when discussing values and creativity.

Talking about education, AI systems are attracting more and more attention as possible tools to enhance creativity in the design process (Figoli, 2022, p.11), but Integrating AI into traditional design processes may be difficult. It requires designers to adapt to a new technological scenario, and education and training in the design sector have become one of the main priorities. This new AI technological approach to the design process can be expensive and require specialised knowledge and resources that designers generally do not possess. Designers need to build experience prompting AI tools to be able to extract beneficial results from the AI's outputs. They need training programs and workshops to learn these new skills. From a positive perspective, using AI in the jewellery industry can potentially create new job opportunities for designers and artisans. For instance, new design roles may be needed to program and train AI systems to generate specific concepts or work with new materials. Similarly, suppose the AI revolution spurs an increase in customization or a trend toward uniqueness. More artisans may be needed to bring the broader range of designs to life, using their expertise in traditional techniques such as casting, soldering, and setting. Integrating AI in the design system remains challenging, especially in jewellery, where traditional techniques and craftsmanship are highly valued. In order to better understand AI potential and its applications, at University Name, we are integrating these new AI technologies into our jewellery design teaching methodologies.

4. Discussion

Designing for the new future implies considering the environmental and social sustainability aspects, creativity, and education included in the 2030 agendas and translating them into the industry. Artificial Intelligence applied to the jewellery design field can contribute to the transition towards a more sustainable and resilient future that considers the well-being of people and the planet. The jewellery industry's path is intricately connected to the limitless potential of AI-powered tools, and it is reshaping the way designers imagine and create new products. Designers are imagining a future world in which the only efficient way to move forward is to look back, keeping an eye on the present.

This paper encourages designers to responsibly integrate AI into their design processes, better exploring this technology and taking advantage of its capabilities. Designers need to understand their potential role in contributing to a positive and meaningful change in the design process, seeking to remove obstacles to sustainable progress. They must consider exploring new ways to utilize this technology to enhance their work, creativity, personalization, efficiency, and sustainability. The designer's role is to navigate existing elements rather than create something entirely new. This is what AI is accused of, which only automates a process already utilised in design practices: generating innovation by observing the existing.

The writer Jonathan Lethem has said that when people call something 'original,' nine out of ten times, they just do not know the references or the sources involved (Kleon, 2012, p.7). Lethem suggests that what we perceive as "original" is often the result of our ignorance about the sources and influences that inspired that work. This viewpoint applies to both human creativity and artificial Intelligence (AI). In the

case of humans, our creativity is deeply rooted in our experiences, culture, acquired knowledge, and external influences. Like machine learning models, AI also "learns" from vast data sets that are essentially a compendium of human expressions and knowledge. In both cases, creation is more a process of synthesis and reworking than invention ex nihilo. Speaking of originality, Voltaire (Voltaire, 1756, p.224) already stressed the creative interdependence of great authors and used the terms "imitation" and "borrowing": "Thus almost all is imitation. The idea of the Persian Letters was taken from that of the Turkish Spy. Boyardo imitated Pulci; Ariosto, Boyardo; the most original wits borrow from one another."

If we are shaped by the things we love, as Goethe wrote (Kleon, 2012, p.11), we can say that AI is shaped by the data, algorithms, and human interactions it receives and analyses. In this context, AI is indeed shaped by the information (data), the learning rules and methods (algorithms), and the interactions it has with human users. These elements influence how AI learns, adapts, and responds to requests.

The fact is that both human and artificial creativity do not operate in a vacuum but rather build on the foundation of what has already been done. This perspective invites a greater awareness of the influences and sources that inspire every creative act, regardless of its origin.
On the one hand, AI represents an exciting future for the design sector and provides innovative design scenarios that redefine and facilitate the design process. Optimization methods combined with machine learning techniques can take on a fundamental role in generating more efficient and sustainable designs. Combining the human approach and AI capabilities can lead to a more robust and effective sustainable design strategy. On the other hand, some criticalities regarding human-AI collaboration might emerge when introducing non-human agents in the design process and design teams (Figoli, 2022, p.64). AI raises critical concerns, and it is essential to understand its limitations. The primary concerns include the authenticity, privacy, bias, responsible use of sensitive data, and the vast amount of energy AI requires. Essential knowledge regarding the impact of AI systems in the design processes still needs to be included (Cautela, 2019, p.7).

In approaching the future, it is essential to continue experimenting with the capabilities of AI but also address the ethical implications that these new opportunities bring along. We must remember that AI will not replace the designer's role or human creativity. However, it will augment and amplify it, enhancing productivity and allowing them to focus on the more creative aspects of their work. This collaboration sees AI complementing human creativity through algorithmic insights, idea optimization, and innovative suggestions. The marriage of technological efficiency with the emotional depth of human imagination is at the core of this synergy. It is also crucial to balance human creativity and AI assistance. While AI can quickly generate ideas and concepts, it still requires human input and expertise to turn them into commercially practical and manufacturable pieces. Moreover, the most challenging part of being a successful designer is not sketching ideas but identifying those ideas that, when taken to market, together with a well-executed brand and customer experience, will lead to stunning, lasting, and saleable products.

Despite these social and environmental impacts, AI can still be a powerful tool for a more sustainable future scenario. This paper aims to actively develop a joint reflection in a transdisciplinary scientific exchange between art and science, which enhances innovation through Design and Industry for a better future with a strategic vision. Through the dynamic integration of AI, the convergence of sustainability innovation and ethical practices can become possible, leading the jewellery sector toward a more conscientious and responsible future.

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