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## Proceedings of IASDR 2023: Life-changing Design

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THE 2023

# IASDR Congress

Life-  
changing  
design

Milan 9<sup>th</sup>–13<sup>th</sup> October

PROCEEDINGS OF IASDR 2023

EDITORS:

Daniela De Sainz Molestina

Laura Galluzzo

Francesca Rizzo

Davide Spallazzo



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# Life-Changing Design

Proceedings of the 10th Congress of the  
International Association of Societies of  
Design Research (IASDR 2023)

**EDITORS:**

Daniela de Sainz Molestina

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# Life-Changing Design.

## Introduction to the Tenth IASDR congress

The International Association of Societies of Design Research (IASDR) has long been at the forefront of advancing design research, providing an international platform for researchers, scholars, and practitioners to engage in robust discussions, share insights, and explore the ever-evolving landscape of design research. IASDR 2023, the association's 10th Congress, stands as a pivotal juncture in the trajectory of design research, offering a comprehensive perspective on its current state while charting its future directions.

Over the past decade, design research has witnessed a remarkable transformation. From its roots in aesthetic considerations and form-centric approaches, design research has evolved into a multifaceted discipline, extending its influence beyond traditional boundaries. Contemporary design literature now encompasses a wide array of facets, each addressing critical aspects of design's impact on diverse domains, including organisational culture, public policies, product development, and the creation of immersive spaces, services and systems. This transformation underscores the dynamic nature of design research, as it continuously adapts to our society's changing demands and challenges.

The central theme of IASDR 2023, "Life-Changing Design", resonates profoundly in the wake of global events, particularly the unprecedented disruptions caused by the COVID-19 pandemic. This theme invites us to reflect on the profound transformations that have unfolded and continue to reshape our world. The pandemic has brought to the forefront questions about the role of design in navigating these changes, challenging us to explore how design can facilitate adaptation, resilience, and innovation in a rapidly changing world.

IASDR 2023 has been organised and host by Politecnico di Milano, where design keeps strong roots in the made in Italy tradition and where at the same time design opens up to the new territories of design research and to the new trajectories of innovation.

IASDR 2023 encompasses an array of thematic tracks, each dedicated to exploring critical dimensions of design research. These tracks serve as focal points for discussions and investigations, providing a framework for researchers to delve into specific areas of interest.

The following thematic tracks guide our exploration:

### **[Changing] Organizations and Policies**

This track examines the transformative potential of design in the realm of public sector organisations and policies. It aims to foster social justice and sustainability by challenging traditional notions of prosperity. Researchers investigate how design equips itself with tools, methods, and frameworks to support systemic transformation, thereby promoting well-being and addressing complex societal challenges.

### **[Changing] Products and Production**

This track focuses on the transformation of manufacturing processes and their impact on products and

systems. It explores the proliferation of digital fabrication and digital craft, analysing their potential to revolutionise product development, sustainability, and business models. Researchers delve into how design can envision emerging materials, artefacts, and future scenarios from a sustainable perspective.

### **Identities and [Changing] Identities**

Cultural identities and their evolution in an increasingly multicultural world take center stage in this track. Researchers delve into the roots of design's influence on identity, considering factors such as authorial identities, identity hegemony, and the implications of design on gender, class, and religion. Additionally, this track explores the role of design in translation processes, which involve revising systems, tools, and programs for communicating and preserving identity.

### **[Changing] Ecosystems**

Addressing the imperative transition toward sustainability, this track examines how design contributes to the socio-ethical and economic dimensions of sustainability. It explores design for sustainable materials, energy, business models, and transitions, focusing on fostering positive environmental and social change.

### **[Changing] Communities**

Community empowerment and sustainable behavioural change through design interventions are central to this track. Researchers investigate how design can enhance collaborative processes, co-design knowledge, and tools while addressing urgent public interest issues. The track emphasises shared decision-making, democratic participation, and the evolving roles of individuals, communities, and entities in supporting systemic transitions.

### **[Changing] Education**

This track reflects on the evolving landscape of design education, recognising the complexities and challenges inherent in this domain. Researchers explore the inspirations for change in design education, the transformations it engenders, and the existing gaps and issues. This track seeks to foster clarity, identity, and adaptability in designing educational goals while embracing diversity and differentiation.

### **[Changing] Spaces and Services**

Integrating spatial and service design to create innovative living environments and services is the central concern of this track. It explores how design interventions across various scales, from micro to macro, can drive transformative actions, enhance public participation, and guarantee inclusivity and diversity in service offerings.

### **[Changing] Interactions**

The dynamic interplay between technology, social changes, and design forms the core of this track. Researchers investigate how digital technologies, augmented reality, virtual reality, and mixed environments impact interactions, communities, processes, and professions. This track emphasises the role of Interaction Design in shaping technology-based innovations responsive to social and contextual changes.

### **[Changing] Heritage**

Preserving and reinterpreting cultural heritage in the face of global change is the central focus of this track. Researchers explore how design research can offer novel approaches to knowledge preservation and cultural experiences related to tangible and intangible heritage. This track seeks to activate participation dynamics that reintegrate relevant portions of cultural heritage excluded from current development paradigms.

IASDR 2023, with its overarching theme of "Life-Changing Design" and its diverse thematic tracks, presents an exceptional opportunity for researchers, scholars, and practitioners to engage with the dynamic landscape of design research. The conference serves as a platform for robust discussions, knowledge sharing, and the exploration of innovative solutions to society's complex challenges.

By examining these thematic tracks and their intersection with the central theme, “Life-Changing Design,” we aim to contribute to the ongoing dialogue surrounding design research and its transformative potential, fostering a deeper understanding of design’s role in shaping our world.

Luisa Collina  
Alessandro Deserti  
Francesco Zurlo

**Shifting identities: new materialities of power and control**

Joaquin Santuber, Hasso Plattner Institute, University of Potsdam, Germany  
Pablo Hermansen, School of Design, Pontificia Universidad Católica de Chile, Chile  
<https://doi.org/10.21606/iasdr.2023.501>

**Speculating gender in conversational interfaces**

Patrizia Marti, University of Siena, Italy  
Stefano Varlaro, University of Siena, Italy  
<https://doi.org/10.21606/iasdr.2023.394>

**Textile Autobiographies: Crafting shifting identities with refugee communities**

Francesco Mazarella, Centre for Sustainable Fashion, University of the Arts London, UK  
Seher Mirza, Centre for Sustainable Fashion, University of the Arts London, UK  
<https://doi.org/10.21606/iasdr.2023.414>

**The Brand as a Place. For a Model Interpreting Identity in the Digital Age**

Francesco E. Guida, Politecnico di Milano, Italy  
Elisa Finesso, Politecnico di Milano, Italy  
<https://doi.org/10.21606/iasdr.2023.288>

**The impact of identity construction and diversification of Chinese craftspeople on the design innovation of traditional handicrafts – a case study of Dong Brocade in Tongdao, Hunan**

Yihan Jiang, Hunan University, China  
Claire Yuting Xie, The University of Sydney, Australia  
Jinge Mao, Hunan University, China  
<https://doi.org/10.21606/iasdr.2023.420>

**Wearing Black when feeling Blue: An exploration of the relationship between clothing and mood**

Rins Lindeman, Delft University of Technology, The Netherlands  
Pieter M. A. Desmet, Delft University of Technology, The Netherlands  
Maurizio Filippi, Delft University of Technology, The Netherlands  
<https://doi.org/10.21606/iasdr.2023.502>

**[Changing] Ecosystems****Front Matter**

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Cindy Kohtala, Umeå Institute of Design, Umeå University, Sweden  
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Camilo Ayala Garcia, Faculty of Design and Art, Free University of Bozen-Bolzano, Italy  
<https://doi.org/10.21606/iasdr.2023.886>

**An explorative multiple case study of smart-circular PSS – status quo in industry**

Thomas Kruschke, Fraunhofer IPK, Germany  
Theresa Riedelsheimer, Fraunhofer IPK, Germany  
<https://doi.org/10.21606/iasdr.2023.191>

**An investigation into the product attachment between single-person household and their home appliances**

Ga-eul Han, Department of Design, UNIST, Ulsan, South Korea  
James Andrew Self, Department of Design, UNIST, South Korea  
Chajoong Kim, Department of Design, UNIST, Ulsan, South Korea  
<https://doi.org/10.21606/iasdr.2023.549>

**Aqueous logics: Towards a hydro feminism approach to sustainability**

Beatrice Maggipinto, Interactive Technologies Institute - ITI/LARSyS, IST University of Lisbon, Portugal

Valentina Nisi, Interactive Technologies Institute - ITI/LARSyS, IST University of Lisbon, Portugal

Sarah Fox, HCII - Carnegie Mellon University, Pittsburgh, USA

Nuno Nunes, ITI/LARSyS - U. Lisbon, Lisbon, Portugal

Tom Ainsworth, School of Architecture Technology and Engineering, University of Brighton, UK

<https://doi.org/10.21606/iasdr.2023.437>

**Arousing “Arts of Making” in design: cultivating growing material societal meanings for sustainable transitions**

Ye Yang, College of Design and Innovation, Tongji University, China

Valentina Rognoli, Department of Design, Politecnico di Milano, Italy

<https://doi.org/10.21606/iasdr.2023.558>

**Bio-Brutalism; five case studies framing the emergence of new raw aesthetics at the intersection of material regeneration, environmental design, and craft**

Fernando Galdon, Royal College of Art, UK

Harry Hosker, Royal College of Art, UK

Hugo Garcia, Royal College of Art, UK

William Eliot, Royal College of Art, UK

Anna Tsiganchuk, Royal College of Art, UK

Shaoyu Wang, Royal College of Art, UK

Delfina Fantini, Royal College of Art, UK

Robert Phillips, Royal College of Art, UK

<https://doi.org/10.21606/iasdr.2023.202>

**Circular Futures: how can design nurture more sustainable production and delivery systems for social micro enterprises?**

Valentina Demarchi, Politecnico di Milano, Italy

Daniela De Sainz Molestina, Politecnico di Milano, Italy

<https://doi.org/10.21606/iasdr.2023.551>

**Collaborating with an Amazonian tree: a bio-product design experiment with ancestral references**

Andrea Bandoni, Faculdade de Belas Artes da Universidade de Lisboa, Portugal

Raul Cunca, Faculdade de Belas Artes da Universidade de Lisboa, Portugal

Carla Paoliello, Faculdade de Belas Artes da Universidade de Lisboa, Portugal

Gabriela Forman, Faculdade de Arquitetura da Universidade de Lisboa, Portugal

<https://doi.org/10.21606/iasdr.2023.156>

**Creating national strategy for circular design through co-design: An Australian perspective**

Simon Lockrey, RMIT University, Australia

Allister Hill, RMIT University, Australia

Liam Fennessy, RMIT University, Australia

Helen Millicer, One Planet Consulting

Richard Collins, Arcadis

Juliette Anich, RMIT University, Australia

Karli Verghese, RMIT University, Australia

<https://doi.org/10.21606/iasdr.2023.167>

**Digital transition, Sustainable Product-Service System (S.PSS), and environmental sustainability - A systematic review**

Hang Su, Politecnico di Milano, Italy

Carlo Arnaldo Vezzoli, Politecnico di Milano, Italy

Nan Xia, Tianjin University of Science & Technology, China

<https://doi.org/10.21606/iasdr.2023.494>

**Exploring a framework in designing smart circular ecosystems in the waterborne passenger mobility**

Laura Pirrone, Politecnico di Milano, Italy  
Andrea Ratti, Politecnico di Milano, Italy  
Arianna Bionda, Politecnico di Milano, Italy  
<https://doi.org/10.21606/iasdr.2023.462>

**Exploring and facilitating Daoism's contributions to design prototype, a case study from a "More-than-Human" social innovation project: Hokkhi**

Jixiang Jiang, Department of Design, Politecnico di Milano, Italy  
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Yizao Wu, College of Design and Innovation, Tongji University, China  
<https://doi.org/10.21606/iasdr.2023.100>

**Global goals, local future stories: unpacking contrasts and visions of circular economy activities in neighbourhood makerspaces**

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Damla Çay, Innovation Center of Moholy-Nagy University of Art and Design, Hungary  
Aykut Coşkun, Koç University-Arçelik Research Center for Creative Industries, Türkiye  
<https://doi.org/10.21606/iasdr.2023.332>

**Material connaissance as a tacit knowledge co-creation method**

Spyros Bofylatos, Royal College of Art, UK  
Niki Boukouvala, University of the Aegean, Greece  
<https://doi.org/10.21606/iasdr.2023.427>

**More than human empathy: a caring approach to ecosystemic design**

Mariana Pestana, Interactive Technologies Institute - ITI/LARSyS, IST University of Lisbon, Portugal  
<https://doi.org/10.21606/iasdr.2023.407>

**Navigating circularity in practice: proposing a decision-making tool for guiding circular product development**

Danika Van Kaathoven, Kyoto Institute of Technology, Japan  
Daijiro Mizuno, Centre for the Possible Futures, Kyoto Institute of Technology, Japan  
<https://doi.org/10.21606/iasdr.2023.324>

**Out with the new, in with the old: Future directions for Design for Sustainability**

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Louise Mullagh, Lancaster University, UK  
Naomi Jacobs, Lancaster University, UK  
<https://doi.org/10.21606/iasdr.2023.378>

**Planet-Oriented Design: a proposal for new ethical transitions in Design Education**

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<https://doi.org/10.21606/iasdr.2023.506>

**Small fish in a big pond: Product Longevity Design Strategies for Smart Speakers**

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Markus Löchtefeld, Aalborg University, Denmark  
<https://doi.org/10.21606/iasdr.2023.290>

**Sustainable design strategy of Chinese old Town community based on landscape ontology:  
A case study of Daojiao Community in Chongqing**

Xingyu Chen, College of Design and Innovation, Tongji University, China  
Hongtao Zhou, College of Design and Innovation, Tongji University, China  
Xiang Liu, Sichuan Fine Arts Institute, China  
<https://doi.org/10.21606/iasdr.2023.260>

**The social influences of digital technologies in the Design of S.PSS and DE: A literature review**

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Carlo Arnaldo Vezzoli, Politecnico di Milano, Italy  
<https://doi.org/10.21606/iasdr.2023.415>

**The use of life cycle assessment for lightweight product design based on functional unit**

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Jorge Sierra-Pérez, Department of Design and Manufacturing Engineering, EINA, University of Zaragoza, Spain  
<https://doi.org/10.21606/iasdr.2023.496>

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Sine Celik, Delft University of Technology, The Netherlands  
Jan Carel Diehl, Delft University of Technology, The Netherlands  
<https://doi.org/10.21606/iasdr.2023.511>

**User decision making for end of use product: Exploring the reasons for keeping and care  
motivations for responsible sharing**

Yoon Jung Choi, Virginia Polytechnic Institute and State University, USA  
<https://doi.org/10.21606/iasdr.2023.362>

## **[Changing] Communities**

### **Front Matter**

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Daniela Selloni, Department of Design, Politecnico di Milano, Italy  
<https://doi.org/10.21606/iasdr.2023.888>

**A design-driven approach to distributed ledger technologies for small farmers communities:  
A case study in Portugal**

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**Against the norms: designing violence prevention through engaging men**

Rute Fiadeiro, Royal College of Art, UK  
Jo-Anne Bichard, Royal College of Art, UK  
John Stevens, Royal College of Art, UK  
<https://doi.org/10.21606/iasdr.2023.359>

**Approach or Avoid Away from Kiosks for the Elderly? A Study on Acceptance and Behavioral  
Intention of Self-Service in Hospitals**

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Tseng-Ping Chiu, National Cheng Kung University, Taiwan  
<https://doi.org/10.21606/iasdr.2023.253>

# Arousing “Arts of Making” in design: cultivating growing material societal meanings for sustainable transitions

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Under the industrial mass production of the 20th century, “making” is controllable and directed by “thinking” in artifact design activities, which formalizes the dominant pattern of “reactive making”, meaning “making following thinking”. The initiative of “making” has been continually weakened and overlooked. Meanwhile, properties of the physical material are defined by the disciplines of Science and Engineering, acting as the “tags” or “surface textures” in CAD for designers to select after the conceptualizing process in design practices. We found tons of nameless and meaningless materials have been surged forth in an uncontrolled way, which has grown a cultural and societal sharp disconnection with human beings, consequently instigating a cascade of environmental crises. In response to this challenge, we delved deeply and unearthed the underlying “making” paradigm that drives the current predominant approach to designing artifacts. By conducting thorough historical research, we retraced the origins of the concept of “making” and its evolution, as discussed by five prominent thinkers: Aristotle, Herbert Simon, John Dewey, Paul Carter, and Tim Ingold. These scholars' ideas converge within the domains of both “making” and “design.” Following a further and in-depth comparative analysis, we identified two separate yet interconnected paradigms of “making”—namely, the “Science of Making (SoM)” and the “Arts of Making (AoM).” As a result, we formulated four essential principles of the “becoming-with” concept within the framework of “AoM.” We further exemplified the practical implementations of these principles through grounded research and case studies.

**Keywords:** *Arts of Making; making paradigm; becoming-with; knowing through making*

## 1 Introduction

Throughout history, Craftsmanship can be seen as a precursor to the emergence of Design, demonstrating a deep understanding and integration of materials, techniques, and aesthetics to produce pleasing objects (Buchanan, 2007). In this way, Design can be traced back to the Greek word “techne”, which means “an art of making,” indicating the initiative and creativity of the “making” process. However, with the shift from handicraft to machine production, the Industrial Revolution brought about significant changes in production methods. Mass production gradually shaped the new





roles of modern designers, who took on more conceptual roles and separated themselves from physical hand-making (or handcrafting) and production, thus closing the initiative of “Making with materials” in design practices. In 1967, *Materials* is the first formal publication for designers that symbolizes the method of materials selection in artifact design activities (*Materials*, 1967). After that, A number of books on material selection methods have been developed from engineering-based methods (Patton, 1968; Cornish, 1987; Ashby, 1992; Lindbeck, 1995; Budinski, 1996; Chatterjee, Athawale and Chakraborty, 2010; Wongsriruksa et al., 2012), to sensory criteria-based methods (Ashby and Johnson, 2002), as well as the construction of Material Experiences for users (Karana, Pedgley and Rognoli, 2013, 2021). In the 1990s, Computer-aided Design (CAD) and additive manufacturing further devalued handcrafting and accelerated the dematerialisation of the design process. Against the backdrop of the modern design pattern, there has been a huge gap between the experiential, cultural and social qualities of the materials and the designers, resulting in a broken connection and meaning between the societal meanings of the materials and the users.

In order to mend and rebuild the fractured designer-material-user bond, we need to rethink and re-engage the “Arts” qualities of “making”, which means moving from a reactive approach to a proactive stance of “making with materials” in design practices. This requires a deep understanding and elucidation of the essential onto-epistemological aspects of “Arts of making,” encompassing its unique qualities and principles.

This paper is organized as follows:

In Section 2, we delve into the origins of the current “making” method and analyse Aristotle’s progression from “Poiesis” to “Poetics,” which laid the initial philosophical foundations for the empirical and rational dimensions of “making.” Moving on to Section 3, we explore the influential and conflicting viewpoints presented by John Dewey and Herbert Simon in the 20th-century design history. In Section 4, we further examine the evolution and elaboration of Dewey’s arguments on the artistic aspects of “making” from the perspectives of craftsmen and artists, as expounded by Paul Carter and Tim Ingold. Subsequently, in Section 5, we carefully compare and summarize the two distinct “making” paradigms discussed earlier from the onto-epistemological perspective—namely, the “Science of Making (SoM)” and the “Arts of Making (AoM).” Building upon this, we extract the core principles of the “AoM” for design practices. We then demonstrate the effectiveness of the “AoM” in a workshop through grounded theory, accompanied by two typical case studies. These examples highlight the irreplaceable power and essential contributions of the “AoM” in the process of reconstructing “growing” meanings between humans and materials through a dynamic “becoming-with” process.

## **2 Origin: Aristotle’s proposition from “Poiesis” to “Poetics”**

When we trace back the term “making” and its etymological roots from Ancient Greek, it derives from the original term “poiesis,” which denotes “the activity in which a person brings something into being that did not exist before<sup>1</sup>.” Its original meaning highlights an act of invention or creation. Design, as the art of making, is rooted in the term “techne” (Lee & Kim, 2021), which is commonly interpreted as

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<sup>1</sup> See from [https://encyclopedia.thefreedictionary.com/Poiesis#cite\\_note-1](https://encyclopedia.thefreedictionary.com/Poiesis#cite_note-1)

"craft" by broader proponents (Parry, 2021). However, in the work "Ethics" (1955), Aristotle offers a clear explanation that "techne" is a form of "poiesis (making)," encompassing the idea of "producing something by way of true reasoning." According to Aristotle, he defines "poiesis (making)" as a rational activity that relies on "mental nature" rather than "physical nature" and "emotional nature."<sup>2</sup>

More essentially, Aristotle introduces the theory of *Hylomorphism*, which unveils the interplay between form and matter as the two meta-causes of "making (Manning, 2013)." According to Aristotle, form and matter stand as independent entities, with form assuming a dominant role, acting as the objective for matter (Aristotle [Terence Irwin], 1999). *Hylomorphism* posits matter-making as an extension of form-thinking, wherein the thinking process takes precedence and influences the act of making (Kelsey, 2010).

"Poetics" developed by Aristotle can be regarded as the significant approach to the study of poetry (poiesis), known as "analytical-synthetical-Poetics (Aristotle [S. H. Butcher], 2008)."<sup>3</sup> He defines poetry as a comprehensive category encompassing all literary creations and performances, reflecting the actions of human beings while shaping their experiences. In his analysis, Aristotle examines tragedy, which he views as shorter yet imbued with intense emotions, surpassing epic poetry. He identifies six fundamental components that fall into three categories within a tragedy: Object (Plot, Character, Thought), Media (Diction, Song), and Mode (Spectacle).

Meanwhile, the "synthesis" strategy assumes a critical role in Aristotle's approach. He emphasizes the significance of "unity," denoting the coherence of plots achieved by selecting and assembling a sequence of events into a consistent and harmonious whole. According to Aristotle, the plot serves as the soul of tragedy, and its entirety comprises a beginning, which naturally follows something rather than arising from a causal necessity; a middle, which logically proceeds from the beginning in a sequential manner; and an end, which follows the middle due to a rule or necessity without any further actions ensuing (Ibid., pp. 10). In light of this, Aristotle's "analytical-synthetical" inquiry strategy is evidently a reasoning process oriented towards thoughtful contemplation. It becomes apparent that 1) Thought, occurring in the realm of the mind, is analysed separately as a rational process to arrive at decisions or conclusively prove general truths; 2) Action is a product of thought; and 3) The analytical process entails breaking down the entire plot into functional elements (Buchanan, 2009), while the synthesizing process involves connecting a beginning, middle, and end of the plot into a unified whole. In the subsequent section, we depict the trajectory of Poetics by juxtaposing it with the other two paths of "making" proposed by Simon and Dewey, as illustrated in Figure 1.

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<sup>2</sup> Aristotle asserted that *in Ethics*: the soul of man had three natures: body (physical/metabolism), animal (emotional/appetite), and rational (mental/conceptual). Physical nature can be assuaged through exercise and care; emotional nature through indulgence of instinct and urges; and mental nature through human reason and developed potential. Rational development was considered critical, essential to philosophical self-awareness, and uniquely human.

<sup>3</sup> "Poetry" evolves from "Poiesis", and "Poetics" is the theory and methodology to study poetry. Aristotle is the main character to develop poetics, whose theories were composed around 330 BCE. He has had a profound impact on Western aesthetic philosophy and artistic production.

In summary, adhering to the tenets of *Hylomorphism*, Aristotle offers a defining characterization of "making" as an objective-oriented, actual reasoning activity. Within this framework, Aristotle develops the strategy of "making," known as analytical and synthetical Poetics. Simultaneously, Aristotle's Poetics places imitation as the central principle encompassing all forms of poetry. It stands as one of the earliest Sciences of artificial and Productive Science (Ibid., pp. 423). Aristotle's Poetics is also regarded as a science of Humanity, delving into the human elements within his theory (Buchanan, 1992). Aristotle argues that all works of Arts must be contextualized within society to shape human experiences while conveying ethics, virtue, and social value, which constitute the essence of Arts<sup>4</sup>.

### **3 Crossroads: two representative contrasting positions in 20th century**

#### **Design history**

##### **3.1 Rational extreme: a positivist evolution of Aristotle's Poetics**

Herbert Simon stands as a prominent figure in the Design Methods Movement (Buchanan, 2009), with profound implications for design history. Embracing and advancing Descartes' theory of mind-body dualism, Simon significantly developed the concept of "making" as a rational computational activity, dissociated from human experiences. In his seminal work, *Science of Artificial* (Simon, 1969), Simon presented a modern rendition of Aristotle's Poetics. He transformed Aristotle's notion of "imitation" into "simulation," aligning it with positivist ideas of the sciences and employing reductionist methods.

Diverging from Aristotle's approach of analysing and synthesizing functional elements of artificial, as shown in Figure 1, Simon adopted a hierarchical method where "analysis" involved mechanically decomposing entities into progressively smaller parts, while "synthesis" entailed aggregating these parts into larger constructs (Buchanan, 2009, pp. 424-426). Simon's standpoint entirely diminishes the capacity of "making." As a result, "making" becomes a mechanized operation entirely governed by "thinking," and the design activity turns into an intellectual pursuit. Richard Buchanan later developed this approach into the Design Science strategy (Buchanan, 2007)."

During the 1960s, the Information Processing Cognition, introduced by Simon and embraced by other scholars, gained widespread popularity and emerged as the dominant theory followed by cognitive scientists. Over time, it evolved into the foundational framework for Artificial Intelligence (AI). Nonetheless, Design encounters a different set of challenges compared to AI's focus on well-structured and ill-structured problems (Simon, 1973). Design is confronted with wicked problems (Rittel, 1973), which defy conventional solutions. Employing the reductive method to address wicked problems fails to fully grasp the inherent complexities involved.

##### **3.2 Aesthetic quality: the crucial prerequisite for both "making" and "thinking" complete experiences**

In contrast to Simon's perspective, John Dewey, a prominent representative of Pragmatism, critically extended beyond Aristotle's Poetics to emphasize the inherently connection between practice and human experience. In his work *Art as Experience* (Dewey, 1934), Dewey's ideas challenged the

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<sup>4</sup> See <https://english.hawaii.edu/criticalink/aristotle/index.html>

traditional understanding of art and aesthetics, which are not just isolated or elitist pursuits but play a vital role in shaping human experiences.

Dewey argued the distinctions between “have an experience” and “have experiences” to respectively explain a whole and integral experience or an inchoate experience with extraneous interruptions or of inner lethargy (Ibid., pp.35).

Essentially, Dewey introduced a crucial concept -- “aesthetic quality.” He argued no matter the artistic and creative “making” experiences, or the strict reasoning “thinking” experiences<sup>5</sup>, “aesthetic quality” is the decisive criteria to determine the experience is complete or not. Dewey highlights that the experience of “making” is inherently connected with “aesthetic quality” (Ibid., pp.54), while the experience of “thinking” would remain inconclusive and lacking in depth without aesthetic element. “Aesthetic quality” here contains three core meanings within Dewey’s arguments. Firstly, it refers to the emotional unity of the whole process of practices. As Dewey argued that an integral experience comprises Intellectual Experience, Practical Experience, and Emotional Experience, significantly, with Emotional Experience serving as the unifying force that brings these constituent elements together (Ibid., pp.61).

Secondly, it signifies the consummation of a continuous movement that flows seamlessly, without gaps, from one successive part to the next. In this way, Dewey criticizes Simon’s arguments on the separate and ready-made entities of thinking process that are combined to produce a third entity (conclusion) (Ibid., pp.38), instead, thinking is more akin to a continuous movement of subject-matters. Meanwhile, contrary to Aristotle, who decomposed Poetics into three static periods, namely “a beginning,” “a middle,” and “an end,” Dewey described these periods in terms of dynamic and progressive meanings: “inception,” “development,” and “fulfillment.” Notably, the “end” is not a distinct and separate entity; rather, it represents a movement of anticipation and culmination, eventually arriving at completion (Ibid., pp.62). In this way, both “making” and “thinking” experiences with “aesthetic quality” assume a dynamic organization running a sense of growing meanings (Ibid., pp.40). Essentially, contrasting to Aristotle’s *Hylomorphism*, Dewey provided a fresh perspective. Form, in Dewey’s view, exists within dynamic relations, growing and evolving along with matter. Through intricate interweaving and mutual influence, form and matter adapt to each other and ultimately coalesce into a sense of qualitative unity.

Thirdly, Dewey uses the Greek concept of “kalon-agathon” to underscore the significance of aesthetic qualities in moral actions. He highlights “aesthetic quality” can signify a practice is honest or not. Dewey criticizes the contemporary morality’s deficiency, which lacks aesthetic attributes and often involves grudging compliance with duty (Ibid., pp.40-41). In addition, Dewey contends that elements like “the humdrum,” “slackness of loose ends,” and “submission to convention in practice and intellectual procedure” act as obstacles to achieving the “aesthetic quality” of an experience (Ibid., pp.

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<sup>5</sup> In Dewey’s context, “making” experiences refer to the “thinking through making” process of all the artistic work like a painting, a sculpture, a piece of music, or any form of creative expression, they are likely to undergo an aesthetic experience themselves, while “thinking” experiences mean the “making through thinking” process, which is an intellectual theoretical formulation process in organized reasoning structure (Ibid., pp.39).

43). In Figure 1, we present a visual representation of the fundamental concepts underlying the diverse trajectories of "making" put forth by the three aforementioned thinkers.

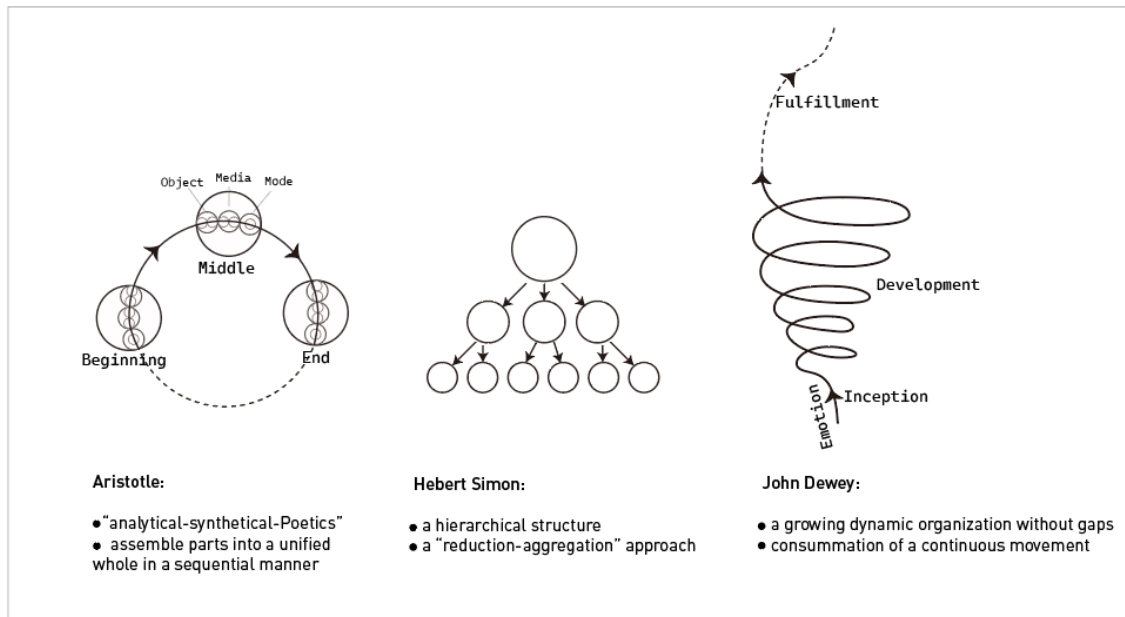


Figure 1. A visual representation of the fundamental concepts underlying the diverse trajectories of "making" put forth by Aristotle, Hebert Simon and John Dewey.

Furthermore, talking about the significant differences between "making" and "thinking" experiences, as Dewey argued, only lie on their materials. The materials of making experiences in the fine arts consist of intrinsic qualities like colours, sounds, or forms, while in an experience of thinking, materials are signs or symbols with no intrinsic sensory qualities of their own (Ibid., pp.39).

To finalize, Dewey's arguments break down the rigid separation between "form" and "matter" under the material selection mode, shifting towards the *Morphogenetics* position (Simondon, 1964, 1989, 2005); that is, form is ever emergent rather than given in advance<sup>6</sup>. More importantly, Dewey suggests that the boundaries between "making" and "thinking" experiences are not rigidly defined. Instead, they overlap, and an integral intellectual experience inherently bears an aesthetic stamp to reach its full potential and fulfillment. He proposed "aesthetic quality" can be regarded as the transitional key to transform the separate and independent form-matter relationship of *Hylomorphism* to the co-evolving form-matter relationship of *Morphogenetics*.

In the subsequent Table 1, we summarized and compared the key propositions from Dewey about "An Aesthetic Experience (the experience with aesthetic quality)" and "Non-aesthetic Experience (the experience without aesthetic quality)."

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<sup>6</sup> For example, "In the moulding of a brick, form is not united with the material. Rather, there is a bringing together or unification of two 'transformational half-chains'— respectively building the mould and preparing the clay – to a point at which they reach a certain compatibility: the clay can be taken to the mould, and the mould can take the clay (Simondon 2005, pp.41–42)."

Table 1. Comparisons between “An Aesthetic Experience” and “Non-aesthetic Experience” based on Dewey’s arguments

	<b>An Aesthetic Experience</b>	<b>Non-aesthetic Experience</b>
<b>Nature</b>	emotional unity	less or unemotional
<b>Parts</b>	Intellectual Experience, Practical Experience and Emotional Experience	Intellectual Experience or Practical Experience
<b>Structure</b>	a growing dynamic organization	extraneous interruptions or of inner lethargy
<b>The beginning</b>	emotion or value driven	controlled by interest and purpose
<b>Process</b>	inception-development-fulfilment	beginning-middle-end
<b>The end</b>	the integration of the parts (consummation of a movement)	slackness of loose ends
<b>Material</b>	intrinsic qualities/ signs or symbols	ready-made entities
<b>Form</b>	unifying qualities/ conceptions symbolized in terms	combine to produce a third entity
<b>Character</b>	flows seamlessly, without gaps, from one successive part to the next	the humdrum, submission to convention
<b>Relation with material</b>	ingesting & digesting	mechanically combined

#### **4 Advancing: unveiling further specific developments based on Morphogenetics**

In the context of the philosophical basis of *Morphogenetics* discussed earlier, social activist Paul Carter criticized the standardized, dogmatized, and homogenized inquiry pattern of "Making through Thinking," and he introduced Material Thinking (Carter, 2004), which primarily focuses on exploring artists' unique ways of making. Meanwhile, anthropologist Tim Ingold challenged the conventional procedure of archaeologists analysing matters standing by from the outer environment. His approach mainly focuses on studying craftsmen’s ways of making to facilitate a deeper exchange with matters from the inner environment (Hallam & Ingold, 2014; Ingold, 2013).

##### **4.1 Inverse the “Lateral” into the “Longitudinal”: making as a line of correspondence**

The inquiry pattern of “making through thinking” was vividly described by Tim Ingold as a “Lateral” transformation process (Ingold, 2013, pp. 20), which presupposes hypotheses to direct the lateral transformation from mental images to physical manifestations. This process also vividly maps the current mainstream artifact design pattern based on *Hylomorphism* that will be discussed in Section 5. On the contrary, Ingold's research on craftsmen's making behaviour led him to propose the inverse process named as “Longitudinal” transformation (Ibid., pp.20). He established a profound and sentimental connection with the matters (Ibid., pp. 6), which was further developed into the concept of "correspondence." As Ingold argued, "correspondence" is the essence of “making” highlighting on “a sentient movement in real time (Ibid., pp. 118).” More significantly, Ingold clearly explained the distinctions between “correspondence” and “interaction” shown in Figure.2(Ibid., pp. 107-108).

In essence, "correspondence" means constantly "perceiving and responding to the world," where the flowing sensorial awareness and material processes ultimately converge in meaningful engagement. Align with Dewey, sentient lies at the heart throughout the entire "correspondence" process. Ingold refers to this kind of inquiry pattern as "an art of inquiry."

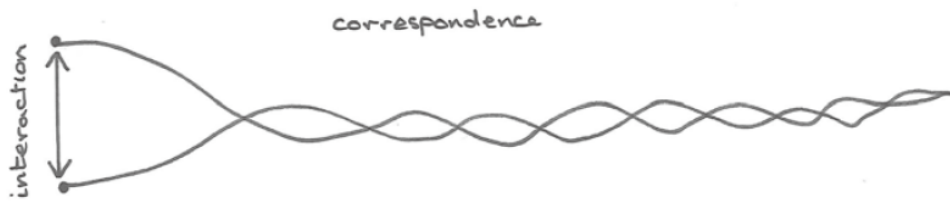


Figure 2. Visualization for the difference between "interaction" and "correspondence," ©Tim Ingold, 2013.

In short, as Ingold highly concluded, "Making, then, is a process of correspondence: not the imposition of preconceived form on raw material substance, but the drawing out or bringing forth of potentials immanent in a world of becoming (Ibid., pp. 44)." Aligned with the philosophical underpinnings of Morphogenetics, Ingold's propositions elaborated and clarified the concept of "making" from the standpoint of craftsmen. This perspective fundamentally challenged the prevailing ontology of "making" as a static state of "being," which had held sway for more than a century. Instead, Ingold introduced a paradigm of "becoming," emphasizing "growth" as the central essence and inherent quality of the "making" process (Ibid., pp. 20).

#### 4.2 Material Thinking: a theory and practice for creative research

Being an engaged social activist, Paul Carter astutely observed that the present prevailing reflective and interpretative disciplines in the sciences (or humanities) are transforming into profit-driven structures to "discipline invention" rather than nurturing and encouraging truly creativity (Carter, 2004, pp.33). To counteract this trend, the concept of "Material Thinking" was introduced as a crucial creative research theory through conducting six in-depth case studies, closely tracking representative artists from diverse fields by Carter. His purpose is to unveil the intricate process of generating creative tacit knowledge among artists as they work with physical materials. Carter primarily distilled the three core aspects that define "Material Thinking."

To begin with, the essence of "Material Thinking" can be described as "humid," encompassing two key aspects. On one hand, "humid" encapsulates the genius of water, which binds without imposing restrictions and collaborates without subjugating (Ibid., pp. 310). This emphasizes that "Material Thinking" involves the capacity for integration and collaboration. Carter further elucidates that successful collaboration hinges on maintaining a delicate balance of "give" and "take (Ibid., pp. 38)<sup>7</sup>," drawing parallels to a harmonious ball game where receiver and thrower work in perfect synchrony. The prerequisite for collaboration is a mutual inclination process (Ibid., pp. 298). In another respect, it invokes a process of secret transformations based on the principle of "like to like" (Ibid., pp. 312). This perspective underscores that "humid" thinking embraces ambiguity and probes into diverse possibilities with an experimental spirit.

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<sup>7</sup> Carter explained it from the original etymological roots: For the Greek verb has both a passive and an active sense. Passively, it means to receive; actively, it means to grasp, to possess. The double meaning is reproduced in the English verb to take, meaning both to receive and to grasp. That is, the place of the collaborative process is one of give and take.

Secondly, a defining trait of "Material Thinking" is its poised nature, demanding the creator's ability to seize the opportune moment with a heightened focus on the predisposition of materials towards movement, change, inter-penetration, and transformation (Ibid., pp. 308).

Thirdly, Carter deeply elaborates "material" here with physical qualities and social discourses simultaneously. In terms of physical qualities, in the process of creative making, material is regarded as "colloidal"<sup>8</sup> with the essence of "formlessness" and "intermediation," playing the role of constantly varying while rejecting fixed status and substances. Meanwhile, the material is treated as "discursive material," artists will "dis-member"<sup>9</sup> it along with its stories, ideas and locations around, and then "re-position" them in a new way to create a new social discourse with doubtful or critical perspective (Ibid., pp. 33). For example, in the instance of the study on "designing hair" (Saúl Baeza, et.al, 2022), designers "dis-member" the essential components that imbued hair with meanings, such as genetics, culture, identities, and fetishes, and "re-positioning" them within unconventional contexts. This process sought to challenge established hair stereotypes, sparking contemplation and speculation about its significances.

## 5 Core findings and discussions

### 5.1 Contrasting and condensing the fundamental propositions presented earlier

We proceed to systematically arrange and refine the insights of the five thinkers in Table 2, with the clear intention of facilitating a more seamless analysis and enabling crucial and precise comparisons for the two "making" paradigms in Section 5.2.

Table 2. Summary and comparisons of the core propositions argued by Aristotle, Simon, Dewey, Ingold and Carter

	Aristotle	Simon	Dewey	Ingold	Carter
<b>Time</b>	330 BCE	1967	1938	2013	2004
<b>Proposal</b>	Poiesis & Poetics	Science of Artificial (a positivist Poetics)	Art as Experience (a new humanity-enhanced Poetics)	Making as a line of correspondence	Material Thinking
<b>Role of Making</b>	true reasoning	computation	organic interaction	correspondence	collaboration
<b>Nature of Making</b>	sequential	mechanical	aesthetic	growing	humid
<b>Metaphor of making course</b>	\	\	a rhythmic breathing course of "intakings" and "outgivings"	writing back and forth of "perceiving" and "responding to"	a ball game of harmonious "giving" and "taking"
<b>Making Approach</b>	analysis-synthesis	reduction-aggregation	Integrating three experiences into a unity	corresponding	dismember-repositioning

<sup>8</sup> See from Everett, Basic Principles of Colloid Science, p. 2.

<sup>9</sup> "Dis-member" and "Re-position" is one significant making strategy of artists highlighted by Carter. (2004, pp. 33-34).



<b>Component s of Making</b>	functional parts	progressively smaller parts	Intellectual, Practical & Emotional Experience	material flows, sense awareness	\
<b>Making Periods</b>	a beginning, a middle, and an end	\	inception, development, fulfilment	ongoing binding together of material flows and sense awareness	capture poised moments
<b>Making Structure</b>	assembling parts into a unified whole in a sequential manner	a hierarchical structure	a growing dynamic organization without gaps	a longitudinal process of growth	a "like to like" secret transformation
<b>The End of Making (objective)</b>	an end without any further actions	single self-sufficient deposit	consummation of a continuous movement; emotional unity	\	reinvent new social identities of material
<b>Materials in Making</b>	\	ready-made entities	intrinsic qualities	substances-in-becoming	formless colloidal with social identities

## 5.2 Defining the two making paradigms: “Science of Making (SoM)” vs. “Arts of Making (AoM)”

The ontological meta-cause theory *Hylomorphism* proposed by Aristotle reveals a separated and independent “form-matter” relation with form controlling matter and the objective to matter. In view of this, Aristotle’s propositions resonate with the majority of recent researches operating with a Being ontology in which the world is constituted by, or comprised of, ontologically distinct entities that interact or connect in order to produce organizational phenomena (Hultin, 2019). Moreover, Aristotle’s Poetics embodies the “thinking-dominated” approach that encompasses both rationality and compliance in the process of “making,” signifying the “making through thinking” epistemology emphasizing the “responsiveness” essence of “making.” It sharply delimits a view of cognition as an intramental process of knowing from the outside to the inside (Gedenryd, 1998; Ingold, 2022), and we are now standing outside of “beings” to research “about” them instead of “of” them<sup>10</sup> (Carter, 2004, pp. 32) in a univocal<sup>11</sup>, controlled and directed lateral transformation (Carter, 2004, pp.33; Ingold, 2013, pp.20). It embodies the pursuit for a clear true reasoning inquiry process where materials play the role of ready-made entities to be combined for new conceptions (Dewey, 1934, pp.39).

<sup>10</sup> Carter argued in his book(pp.32), “..... the reflective or interpretative sciences (or humanities) came into being, and, writing ‘about’ creativity, rather than ‘of’ it, they made it their business to discipline invention.”

<sup>11</sup> Carter uncovered in his book (Carter, 2004, pp.33), “No doubt ‘clear, unambiguous expression advances our capabilities for gaining cognitive [and operational] mastery of the world’. No doubt the ‘institutions of modern society and culture require an enormous increase in resources of univocal communication’. But it is these institutions that also prefer to use as evidence of a creative culture those ‘texts of regulation and legitimation.’”

When mapping this onto-epistemological “making” paradigm in design practices, we find it appropriately fit the current prevailing artifact design process. *Hylomorphism* served as the philosophical bedrock, which epitomizes the modern segregated relationship between form and physical material. Form of the final product originates from the designer's mind, and the form direct designer's selection for the physical material in the end before manufacturing. In this way, physical material is perceived as the CMF tag with the specific technical properties confined by the boundaries set by Science and Engineering. Consequently, the outcome of the “making” practices in design results in a "lifeless object," standing as an independent conclusion without living and growing meanings. This process is also explained as a “lateral transformation” process by Tim Ingold elaborated in Section 4.

To summarize, we term this onto-epistemological “making” paradigm the "Science of Making (SoM)," offering a comprehensive and condensed summary of the rational aspects of "making" and the “responsiveness” to “thinking” process. Comparing Aristotle with Simon, both of them stand on the “SoM” proposition, however, Aristotle's *Poetics* also highlights the “unifying” process of the parts to a whole to reach the ultimate goal of shaping human experiences, while Simon's perspective transforms “making” into a dehumanized and highly computational process, functioning merely as a mechanical aspect subordinate to "thinking." This approach falls short in addressing the intricate, irrational issues entwined with human experiences. We display visual representations based on the onto-epistemological perspectives in Table 3.

On the other hand, Dewey, Paul Carter, and Tim Ingold have significantly contributed to the advancement of the ontological theory of Morphogenetics in direct contrast to Hylomorphism. The Morphogenetics theory sheds light on the co-evolving and co-growing relationship between form and matter. This perspective suggests that materials are not pre-formed substances, and their relationship extends beyond the confines of a dualistic interaction as explained in Hylomorphism. Paul Carter's compelling metaphor of "colloidal" underscores that the form of material is consistently fluid, adapting to its physical and social environment. This paradigm shift emphasizes "making" as a matter of relationships, leading to a transformation from the earlier discussed ontology of becoming to an ontology of Becoming-with (Akama, 2015; Puig de la Bellacasa, 2012).

Each of their arguments illuminates the essential proactive nature of "making," revealing its initiative and creative artistic dimensions, which embody the epistemology of "knowing through making." In this process, cognition involves not only the mind but also action and the physical world, highlighting the interconnected roles of hands, heart, and head (Gedenryd, 1998). Dewey likened the making-knowing process to a rhythmic breathing course, with continuous intakings and outgivings (Dewey, 1934, pp.63). His perspective resonates with the harmonious "giving" - "taking" collaborative nature of a ball game described by Carter (2004, pp.298) and the "perceiving" - "responding to" interactive process when writing back and forth, as illustrated by Ingold (2013, pp.108). These three vivid metaphors harmoniously complement one another, embodying the idea that in the course of "making," knowing is a continuous process that generates and grows from within, engaging with the external environment (Ingold, 2013, 2022). With its "formless" character, physical material assumes an "intrinsic quality," acquiring identity and meaning endowed by the maker (Dewey, 1934, pp.39).

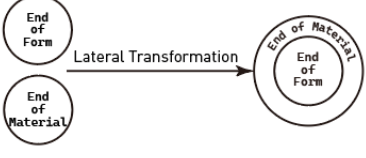
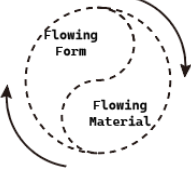
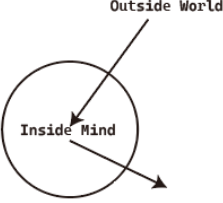
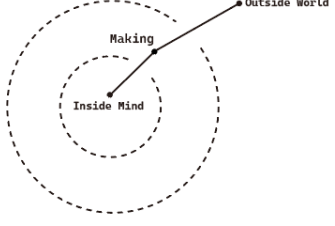

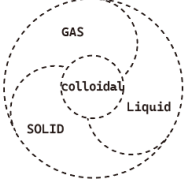
Incorporating the perspectives discussed above, while simultaneously complementing and contrasting with "SoM", we define this onto-epistemological "making" paradigm as the "Arts of Making (AoM)." “AoM” represents a "making-driven" inquiry process that places significant value on the proactive and

initiative-driven essence of "making." It takes the form of a dynamic, evolving inquiry structure, where the final result cannot be predetermined but rather emerges organically.

Remarkably, it's noteworthy that there can be overlaps between "SoM" and "AoM". Rather than seeing them as entirely separate, the "aesthetic quality" proposed by Dewey that we carefully discussed in section 3.2 is the transitional key to transform "SoM" into "AoM."

In the upcoming Table 3, we succinctly synthesize and visually represent the pivotal concepts of the two distinct "making" paradigms.

Table 3. Synthesizing and visualizing the pivotal concepts of the two distinct "making" paradigms

	Science of Making (SoM)	Arts of Making (AoM)
<b>Representative</b>	Aristotle, Simon	Dewey, Carter, Ingold
<b>Ontology</b>	Being	Becoming-with
<b>Meta-cause theory</b>	Hylomorphism	Morphogenetics
<b>Relationship of meta-causes (Form &amp; matter)</b>	separated, form determinates matter 	co-evolution & growing 
<b>Epistemology</b>	Making through Thinking (Reactive Making)	Thinking through Making (Proactive Making)
<b>Knowing path</b>	from outside (head-hand dualism) to inside 	growing from inside (interaction between hands, heart and head) exchanging with outside 
<b>Inquiry process</b>	a controlled and directed lateral transformation	a longitudinal process of growth
<b>Inquiry essence</b>	research "about"	research "of"
<b>"Making" context</b>	univocal communication	equivocation
<b>Role of material</b>	symbols or signs	intrinsic qualities
<b>Character of material</b>	ready-made entities 	formless colloidal 
<b>Relation between material and making</b>	Employing and employed	ingesting and digesting

### 5.3 The crucial principles condensed from “AoM” to apply to artifact design practices

In essence, the ontology of "AoM" redefines the fundamental basis of artifact design practices, shifting from a static state of "being" to an active state of "becoming-with." This indicates that "becoming-with" should serve as a foundational principle across the entire spectrum of "making" in design activities, prompting a transition from a "result-oriented" approach to a "process-oriented" artifact design process. Within this perspective, we seek to apply this foundational principle to two distinct aspects: one pertains to the physical material involved, while the other relates to the "making" process itself.

In terms of the former side, we are able to re-understand and re-start a new collaboration with physical materials in artifact design. “Becoming-with” inspires us, first, to adopt a dynamic perspective and re-understand “material” from a noun to a verb, which means breaking the fixed “tags” framed by Science and Technology, and perceive new possibilities from a continuous flowing and varying perspective like what Carter describes as “formless colloidal.” Within the domain of Materials R&D, the purpose of design intervention is to unlock the latent potentials of materials that remain unseen and stifled by the dominance of Science and Technology. In addition, we attend to re-understand “form” and “material” as emerging co-relations performed in designing.

Talking about the latter aspect, the concept of "becoming-with" extends across the entire "making" process, encompassing the stages of "inception," "development," and "fulfillment" as outlined by Dewey (1934). This inherent characteristic of "becoming-with" is intimately linked with the notion of "aesthetic quality," which plays a pivotal role in ensuring this attribute. We elaborate this concept as follows.

1. “Becoming-with” during the “inception” phase means starting in an ambiguous and equivocal environment (Carter, 2004), that is, emptying all the old known, stereotypes and experiences in the memory, starting the exploration without predefined objectives. Meanwhile, “aesthetic quality” requires a value or meaning-driven start with personal pure emotion instead of interests or benefits (Dewey, 1934).
2. “Becoming-with” during the “development” stage signifies a deliberate and patient “corresponding” process, that is, having a dialogue with materials, perceiving and responding to them, grasping not only the technical properties of materials but also placing them under the context of society or humanity.
3. “Becoming-with” of “fulfillment” phase denotes an emotionally enriched and expansive conclusion. This finale conceals limitless possibilities and offers a vast space for others to explore and create new meanings. It serves as a catalyst for ongoing growth, inviting continuous exploration and interpretation by others. This dynamic and evolving ending reflects the essence of "AoM," encouraging a process-driven approach that transcends predefined outcomes.

In summary, the key principles for designers in Material R&D, distilled from "AoM," can be outlined as follows:

1. Keep a fresh perspective on physical materials, considering them as formless colloids intertwined with diverse social identities.
2. Foster a reciprocal relationship with the experimental materials.

3. Maintain a continuous "becoming-with" making process with "aesthetic quality" throughout the entire course.
4. Produce a growing-meaning product with open possibilities for others to explore and create more new meanings.

#### **5.4 Essential contributions of "AoM" for sustainable transitions**

Subsequently, we organized a workshop to demonstrate the first three principles of "AoM" and complemented two typical cases study to explain the fourth principle. In the workshop, we applied Ground Theory research methodology to reveal the differences between "SoM" and "AoM," and further uncover the significances and values of "AoM" for sustainable transitions in artifact design.

The workshop was conducted during the summer vacation in 2021 with 30 students with arts and design backgrounds from 26 universities in China. All the students in the workshop were familiar with the prevailing making pattern of "SoM," and few of them have experience with "AoM." The workshop contains 7 weeks involving 4 different gradually in-depth stages to help students to perceive the "AoM" principles and reflect on them through the methods like reflection dairy, reflection meeting and presentation. After the workshop, we applied the research methods of Semi-structured Interview and Questionnaire to collect data, and the coding method of Constructing Grounded Theory to analyse data from 15 of these students.

Finally, this study demonstrates the effectiveness of "AoM" and uncovers the limitations and weak influence of "SoM" in artifact design process. We find the most significant potential of "AoM" is to transform three decisive elements of the "making" course in design from passiveness to activeness. The three pivotal elements are explained concisely as follows, and you can find more details in the research paper (Yang & Zhou, 2022). Firstly, the physical materials turn from passive to active states through "AoM," not only on physical forms but also on social identities. Secondly, the making process turns from passivity to initiative. Last but not least, the former two elements serve as the trigger for the third one. The relationship between designers and materials transforms from passive hierarchy to proactiveness. Intimate engagements with materials promote a deep dialogical rather than dominating relationship. In this view, they are able to create the "becoming-with" product in the end with social or cultural growing meanings for users to explore and create more new meanings.

Outside of the workshop, we'd like to share two compelling cases that vividly demonstrate the transformative power of the "AoM" paradigm. In one such case, we meet Tao Yang, a product designer with a visionary goal: to breathe new life into Huangjiu, a classic Chinese rice wine deeply rooted in traditional culture but now fading in appeal among the younger generation. Tao recognized the need for rejuvenation and embarked on a journey through the Material R&D stage, immersing himself in the intricate world of Huangjiu's microbe fermentation process. Through this process, Tao not only uncovered the precise 23 properties of the microorganisms for crafting the wine, but he also redefine their social and humanistic meanings as the unique connections with the human body, evoking emotions, sensations, and interpretations.

Guided by the "AoM" paradigm, Tao translated his vision into two "growing" products, both intrinsically aligned with the concept of "becoming-with." The first product reimagines Huangjiu as a dynamic commodity, transcending its traditional singular flavour to a personalized and harmonious blend tailored to individual preferences. The second product embodies a service provide users

opportunities to actively participate in the wine-brewing process. In this compelling case, Tao's innovative approach breathed new vitality into a fading cultural tradition, transforming it into a vibrant and modern existence, enriched by ever-growing meanings.

Another essential and illustrative case we'd like to share is the remarkable story of "Precious Plastic" founded by Dave Hakkens. The project was fundamentally driven by the "AoM" paradigm, which guided its evolution from a single concept to a global movement. The final product of his endeavour can be described as a worldwide "becoming-with" system. This system enables every individual on the planet to uncover their roles within it, working collectively to shift waste into valuable resources or products. Remarkably, the "Precious Plastic" movement has garnered the spontaneous support of 11,510 volunteers and has provided employment to 6,441 individuals from 107 countries. This collective effort has transformed approximately 595,400 tons of wasted plastic into new, purposeful products<sup>12</sup>. Throughout the journey of collection and remaking, unexpected and enriching meanings have emerged. These include reshaping the life values and instilling confidence by empowering refugees in the Tindouf camp in Algeria and the Sahara Desert, fostering social inclusivity and equality through a working network of unemployed women in disadvantaged countries, and revitalizing traditional local culture by seamlessly integrating plastics with age-old crafts, etc.

## 6 Conclusion and future work

In summary, our historical research has led us to propose two interconnected yet distinct "making" paradigms in the context of design activities: "SoM" and "AoM." We contend that harnessing the power of "AoM" in design necessitates a recalibration of the design ontology, shifting from a static "being" perspective to the dynamic realm of "becoming-with." We have introduced and exemplified four critical "becoming-with" principles by means of grounded research and case studies, bridging the philosophical foundations to real-world applications. Essentially, "AoM" acts as a transformational force, not only redefining design but reimagining our interface with the world of materials. By embracing the vibrant spirit of "becoming-with," it sets forth a trajectory towards profound, emotional, and sustainable interactions among designers, materials, and consumers, reshaping the human-material relationship from a conventional top-down hierarchy to a mutually beneficial, reciprocal, and symbiotic bond. This transformation paves the way for a future where design serves as a nurturing ground for cultivating societal growing meanings between humans and materials.

Our study equips future designers with a comprehensive perspective, bridging the gap from onto-epistemological foundations to practical applications, enabling a deep understanding of "AoM" principles and the pivotal transition from "SoM" to "AoM."

In our upcoming research, guided by the "becoming-with" ontology, "growth" emerges as the most distinctive feature of "AoM." This encompasses not only the process of "growth" but also the tangible outcomes it produces within the framework of "AoM." The two cases we've examined showcase these "growth" results across various scales and scopes, ranging from individual products to product services, organizations, and systems, echoing the expanding design horizons that harbor diverse "growth

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<sup>12</sup> See from <https://preciousplastic.com/impact/2023.html>

potentials." Presently, we are actively engaged in developing a research tool tailored for designers to craft results with heightened "growth" potential. We firmly believe that the concept of "growing potential" can serve as a critical criterion for evaluating diverse design practices during sustainable transitional phases and beyond.

## References

- Aristotle (1955). *Ethics*. Harmondsworth: Penguin.
- Aristotle, *Nicomachean Ethics*, second edition, translated by Terence Irwin (1999). Indianapolis: Hackett Publishing Co.
- Aristotle, *The Poetics of Aristotle*, translated by S. H. Butcher (2008). Gutenberg eBook. <https://www.amherst.edu/system/files/media/1812/Aristotle.pdf>
- Ashby, M. (1992). *Material selection in mechanical design*, Pergamon Press, Cambridge.
- Ashby, M. and Johnson, K. (2002). *Materials and design: the art and science of material selection in product design*, Butterworth-Heinemann, Oxford.
- Ayala-Garcia, C., Rognoli, V., & Karana, E. (2017). Five Kingdoms of DIY-materials for design. *Alive. Active. Adaptive: International Conference on Experiential Knowledge and Emerging Materials, EKSIG 2017*.
- Akama, Y. (2015). Being awake to 'Ma': Designing in between-ness as a way of becoming with. *CoDesign*, 11(3-4), 262-274.
- Barad, K. (2003). Posthumanist performativity: toward an understanding of how matter comes to matter. *Signs: Journal of Women in Culture and Society* 28: 801–831.
- Budinski, K. G. (1996). *Engineering Materials: Properties and Selection*, Prentice-H, New Jersey.
- Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, 8(2), 5.
- Buchanan, R. (2007). Strategies of Design Research: Productive Science and Rhetorical Inquiry. In R. Michel (Ed.), *Design Research Now* (pp. 55–66). DE GRUYTER. [https://doi.org/10.1007/978-3-7643-8472-2\\_4](https://doi.org/10.1007/978-3-7643-8472-2_4)
- Buchanan, R. (2009). Thinking about Design: An Historical Perspective. In *Philosophy of Technology and Engineering Sciences* (pp. 409–453). Elsevier. <https://doi.org/10.1016/B978-0-444-51667-1.50020-3>
- Baeza, S. (2022). *Designing hair*. DRS2022: Bilbao. <https://doi.org/10.21606/drs.2022.649>
- Blikstein, P. (2018). Maker Movement in Education: History and Prospects. In M. J. de Vries (Ed.), *Handbook of Technology Education* (pp. 419–437). Springer International Publishing. [https://doi.org/10.1007/978-3-319-44687-5\\_33](https://doi.org/10.1007/978-3-319-44687-5_33)
- Camere, S., & Karana, E. (2017). Growing materials for product design. *Alive. Active. Adaptive: International Conference on Experiential Knowledge and Emerging Materials, EKSIG 2017*. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85046020214&partnerID=40&md5=febd42366e27aca1f084eccb2a5145d>
- Carter, P. (2004). *Material thinking: The theory and practice of creative research*. Melbourne University Publishing.
- Cornish, E. H. (1987). *Materials and the Designer*, Cambridge University Press, New York.
- Chatterjee, P., Athawale, V. M. and Chakraborty, S. (2010). Selection of industrial robots using compromise ranking and outranking methods, *Robotics and Computer-Integrated*
- Dewey, John. (1934). *Art as Experience*. Perigee Books, New York
- Dewey, John. (1938). *Logic: The Theory of Inquiry*. Holt, Rinehart and Winston, New York
- Gedenryd, H. (1998). How designers work – Making sense of authentic cognitive activities [online]. PhD thesis. Lund University, Sweden.
- Giaccardi, E., Karana, E., Robbins, H., & D'olivo, P. (2014). Growing traces on objects of daily use: A product design perspective for HCI. *Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques, DIS*.
- Hallam, E., & Ingold, T. (2014). *Making and growing: Anthropological studies of organisms and artefacts*. Ashgate.
- Hultin, L. (2019). On becoming a sociomaterial researcher: Exploring epistemological practices grounded in a relational, performative ontology. *Information and Organization*, 29(2), 91–104. <https://doi.org/10.1016/j.infoandorg.2019.04.004>
- Ingold, T. (2013). *Making: Anthropology, archaeology, art and architecture*. Routledge.
- Ingold, T. (2022). *Knowing from the Inside: Cross-Disciplinary Experiments with Matters of Pedagogy*.

- Karana, E., Pedgley, O. and Rognoli, V. (2013). *Materials experience, fundamentals of materials and design*, Butterworth-Heinemann, Oxford.
- Kelsey, Sean. (2010). Hylomorphism in Aristotle's Physics. *Ancient Philosophy*, 30, 107-124
- Lee, Y., & Kim, M. (2021). The Poetics of Service: Making in the Age of Experience. *Design Issues*, 37(3), 44–58. [https://doi.org/10.1162/desi\\_a\\_00647](https://doi.org/10.1162/desi_a_00647)
- Lindbeck, J. R. (1995). *Product Design and Manufacture*, Simon & Schuster, New Jersey.
- Manning, Gideon. (2013). The History of "hylomorphism." *Journal of the History of Ideas*, 74, 173-187
- Materials. (1967). a scientific American book. San Francisco: W.H. Freeman and Company.
- Patton, W. J. (1968). Materials in industry, Prentice-H, Englewood Cliffs, N.J. *Manufacturing*, 26(5), 483-489.
- Puig de la Bellacasa, M. (2012). 'Nothing comes without its world': Thinking with care. *The Sociological Review*, 60(2), 197-216.
- Pedgley, O., Rognoli, V., & Karana, E. (Eds.) (2021). *Materials Experience 2: Expanding Territories of Materials and Design*. Elsevier. <https://doi.org/10.1016/B978-0-12-819244-3.00036-3>
- Ratto, M. (2011). Critical Making: Conceptual and Material Studies in Technology and Social Life. *The Information Society*, 27(4), 252–260. <https://doi.org/10.1080/01972243.2011.583819>
- Rittel, H. W. J. (n.d.). *Dilemmas in a general theory of planning*.
- Simon, H. A. (1973). The structure of ill structured problems. *Artificial Intelligence*, 4(3), 181–201. [https://doi.org/10.1016/0004-3702\(73\)90011-8](https://doi.org/10.1016/0004-3702(73)90011-8)
- Simon, H. A. (2008). *The sciences of the artificial* (3. ed., [Nachdr.]). MIT Press.
- Simondon, G. (1964). *L'individu et sa g n se physico-biologique*. Paris: Presses Universitaires de France.
- Simondon, G. (1992). The genesis of the individual (trans. M. Cohen and S. Kwinter). In *Incorporations*, eds. J. Crary and S. Kwinter. New York: Zone, pp. 297–319.
- Simondon, G. (1989). *L'individuation psychique et collective*. Paris: Aubier.
- Simondon, G. (2005). *L'individuation   la lumi re des notions de Forme et d'Information*. Grenoble: Editions. J r me Millon.
- Wongsriruksa, S., Howes, P., Conreen, M. and Miodownik, M. (2012). The use of physical property data to predict the touch perception of materials, *Materials and Design*, 42, 238-244.
- Yang, Y., Zhou, H. (2022). Material-Oriented Active Making: A Promising Approach for Sustainable Transitions. In: Rau, PL.P. (eds) *Cross-Cultural Design. Interaction Design Across Cultures. HCI 2022. Lecture Notes in Computer Science*, vol 13311. Springer, Cham. [https://doi.org/10.1007/978-3-031-06038-0\\_19](https://doi.org/10.1007/978-3-031-06038-0_19)

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