Symbolizing Red Copper as Sustainability: Encouraging Sustainable Awareness in Contemporary China through Textile Design for Everyday Homeware

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Abstract: This project explores how copper corrosion, colour transformation and recastability translate into textile-based homeware design, aiming to address copper's limitations in textile applications while elevating contemporary Chinese consumers' sustainability awareness. By merging traditional copperplate engraving with digital translation and electronic knitting, the research transforms time-based corrosion traces into durable, replicable textile patterns, balancing material uniqueness with scalability. This research redefines sustainability not merely as recycling, but as a design methodology grounded in material longevity, cultural memory, and user engagement within everyday domestic environments.

Keywords: Red copper; Sustainability awareness; Material culture; Textile-based homeware; Cultural memory

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1. Introduction

Amid contemporary China's urbanisation and neoliberalism, consumers' rapid consumerism and waste have emerged as big problems, and the public is lacking awareness in conserving resources and has a low understanding of sustainability (Zou, 2010). Simultaneously, the older generation holds onto frugal habits cultivated in the 1960s–1990s when material was scarce, such as re-using household items repeatedly. One of the representative artworks demonstrating this habit is Chinese artist Song Dong's installation *Waste Not* (MoMA, 2009): for several decades, his mother collected an astounding variety of objects ranging from metal pots and plastic bowls to blankets, bottle caps, toothpaste tubes, and toys. This habit of being thrifty and re-using is related to the traditional Chinese saying "Waste not." (see Fig. 1). The general meaning of this proverb is: If you don't waste things, you won't lack anything.

Figure 1. *Song Dong: Waste Not* (MoMA, 2009).

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There are similar examples of frugality in my own family. During the early stages of China's industrialization, my father used discarded copper wires to make and repeatedly repair cooking pots to extend their service life (see Fig. 2). This preference for pre-industrial consumerist living and working conditions not only reflects the importance of resource conservation but also illustrates how the Chinese "waste not" tradition influences his understanding of sustainability and global sustainability advocacy (Allwood et al., 2006; Yu, 2014).

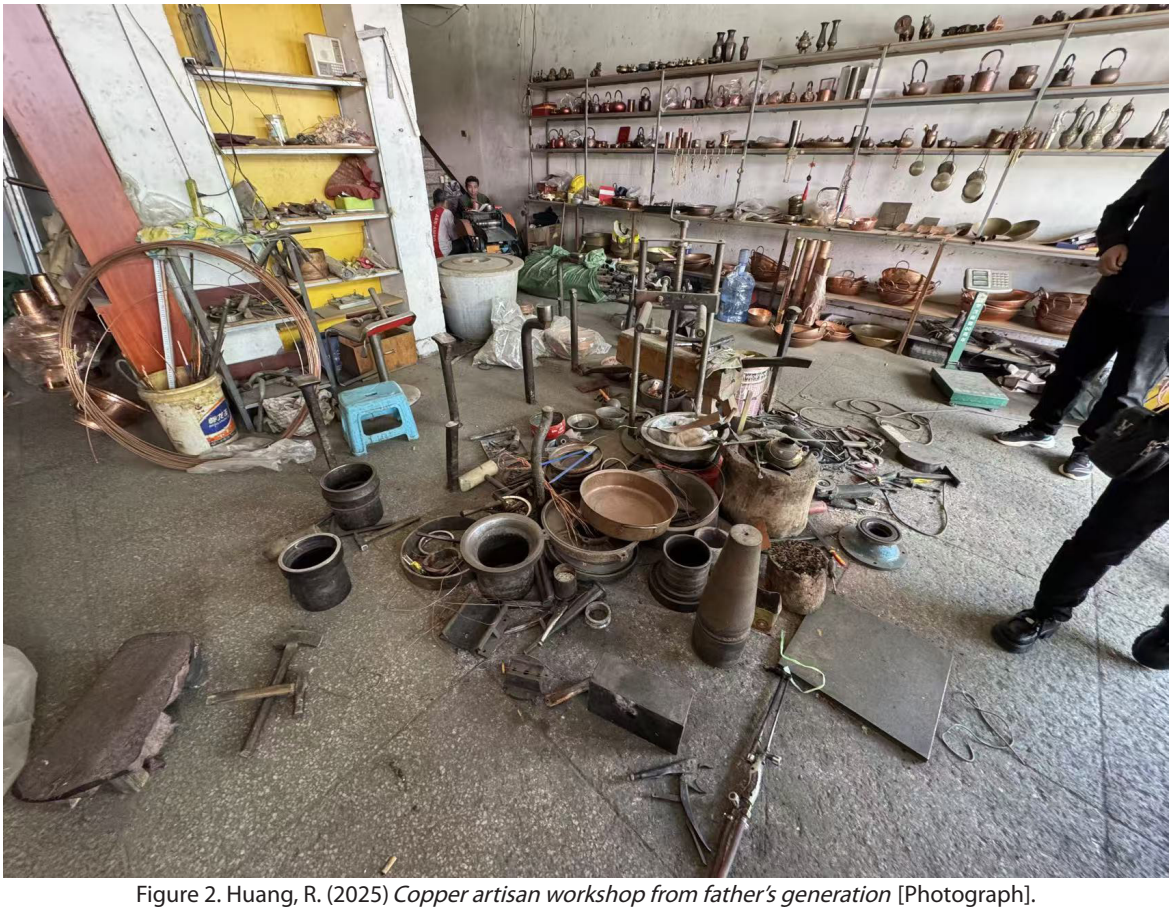

Figure 2. Huang, R. (2025) *Copper artisan workshop from father's generation* [Photograph].

By contrast, contemporary Chinese consumers prefer buying cheap, light, and visually uniform household products made of plastic or metal-coated materials (Anonymous, 2023; Ling and Laksitamas, 2024). This functionality- and cost-driven choice reflects the fast consumption value, where material durability and environmental friendliness are often neglected and ignored (Zhang, Liu and Chen, 2024).

This project aim to use copper in textile-based homeware design. The focus is to investigate how copper's corrosion, colour transformation, and recastability can be reinterpreted in sustainable design to increase public understanding of sustainability in daily life.

Functionally, copper has many attributes that are sustainable. The natural patina that builds up on copper not only gives it a unique aesthetic quality but also confers a degree of durability (Sinha and Sinha, 2010). Copper's wide colour range and malleability have made it adaptable across design disciplines, unlocking a huge potential for aesthetic sustainability (Smith, 2020). Lastly, copper is 100% recyclable, and its recastability confers the ability to be repeatedly reused without loss of physical integrity (Li and Wang, 2020). However, academic and practical studies into the visual language and symbolic meanings of this material in textile applications are still limited. Based on copper's inherent properties and the research gap mentioned above, this project uses copper as the core material in Chinese homeware design.

Copper has long been valued for its strength, durability, and lustrous quality and has been extensively used in buildings, sculpture, and decorative arts (Copper Development Association, 1985). These characteristics, to some extent, have also restricted its use with flexible materials. In textiles, metallic fibres, including copper, lack the necessary flexibility and continuity for weaving or knitting, and their high density presents challenges for processing and shaping (Erdumlu et al., 2015). Second, although metal has its own "patina" (Scott, 2002), its corrosion process releases toxic substances, making it unsuitable for direct skin contact and restricting its use in textiles (InChem, n.d.). Third, the patterns and colours generated by the metal's corrosion process take time to settle and are difficult to permanently preserve or consistently display (Scott, 2002).

Notably, some artists have used copper wire or sheets in textile techniques such as weaving and sewing to explore the tension and relationship between metal and fabric (October Gallery, 2023; Robson, n.d.). However, these works rarely consider the recyclability and reuse of the metal material from a sustainability perspective.

Copper in textile design faces challenges such as material instability and limited recyclability (see Figs. 3 and 4). Even when partially incorporated into fabric structures, its recyclability and reuse after use or consumption remain unresolved. This research reinterprets the visual traces left by copper's corrosion process using experimental printmaking techniques and sustainable textile surface techniques and materials and converts its visual traces into reproducible and eco-friendly surface patterns to address the challenge of its recyclability.

Figure 3. Anatsui, E. (2023) *Clouds gathering over the city* [Artwork].

Figure 4. Robson, H. (2020–21) *Depending* [Textile installation].

In total, this research uses high-purity copper (≥ 99.9%) as its starting material. By recording changes in its colour over time and imprinting these light signals onto textiles as prints, this project has transcended a visual technical limitation in metal printing, extended copper's use into flexible textiles and homeware applications, conferred new cultural and contemporary significance onto copper, and therefore added a further dimension to its sustainability.

2. Research Questions and Aims

This project will address the Research Question: How can red copper be used as a sustainable element in contemporary Chinese everyday homeware practices through the exploitation of its corrosion, colour transformation, and recastability in textile design to increase public sustainability awareness?

The aims of this research are threefold: firstly, to understand Chinese consumers' expectations towards sustainable design in copper homeware; secondly, to understand how these sustainable material designs for homeware can be developed through copper's inherent properties, corrosion, colour transformation, and recastability; finally, to understand whether these characteristics can be incorporated into textile design to increase consumer acceptance and use of copper homeware, as well as public environmental awareness.

Finally, can copper be developed as a viable material in contemporary sustainable home textiles and homeware through the exploitation of its corrosion, colour transformation, and recastability? The material retains the natural copper corrosion process and re-edits the ageing and renewal process of copper through sustainable textile techniques. It reflects a cultural value in the process of regeneration and communicates functional significance through sustainability and material durability.

3. Social Background and Research History

(1) Homeware textile waste disposal in China

With the current speeding-up urbanization and industrialization in China, consumerism has spread through the established cities (Yu, 2014). The market has been saturated with low-value, off-puttable products, developing a

trend of the so-called disposable consumption (Fletcher, 2013; Zhao and Sun, 2019). Such products use cheap but not sustainable resources, engage in major dyeing and finishing contamination, are hard to repair or recycle, and reduce their life cycle.

The fast fashion model dynamics are seen in furniture textiles and daily household items in China. High-speed replacement as a trend of small furniture and soft furnishings has been driven by the search for updated residential style and the growth of low-end online markets of homewares (Xiong et al., 2022; 52bjy, 2020) (see Fig. 5). In the meantime, lack of development of recycling and reuse systems implies that huge quantities of discarded homeware are simply sent to landfills or to incinerators (Xiong et al., 2022). To make this problem worse, composite fibers, polyester fabrics, synthetic colors, and coatings, which are popular in furniture fabrics, only make the problem of material waste even more severe (Fu, 2021; Zhang, Zhu and Qi, 2023; Yang et al., 2021).

Figure 5. 52bjy (2020) *Serious waste of used textiles and how to achieve environmental recycling* [Photograph].

China has, within recent years, also unveiled a policy process called trade-in, which involves recycling homeware within its economy (NDRC, 2025). Nonetheless, the existing model is centered on the means of collection of the old items and replacement with new ones, with not many investigations concerning the possibility of redesigning materials and traces of old usage objects into new everyday objects. At the same time, plastic finishes and metal cladding are extensively used due to their low price. But their vulnerability to wear and tear and repair also supports an argument in which a disposable home goods consumption culture is wreaked, making it difficult to build emotional and temporal value.

It is on this background that this study makes an intervention in the homeware textile domain. Combining the time qualities of copper with textile materials, it aims at turning homeware fabrics no longer into replaceable ornamental surfaces, but instead, into objects of everyday life, which could be tangible, mendable, and even recyclable. The natural qualities of copper, such as its ability to resist corrosion, change color when exposed to air (i.e. patina), and its high recyclability, provide one possible way out of the culture of disposable consumption (Schlesinger, 2011). This paper, therefore, examines how copper-based furniture textiles can extend product lives and achieve more aware consumption habits.

(2) Copper as a sustainable design material

The corrosion , colour transformation, and recastability make copper unique in its use in sustainable textile

design.

To begin with, copper forms a stable oxide film (i.e. patina) on its surface when it is exposed to air and moisture. This coating also prevents additional corrosion that increases the service life of the material considerably and reduces the amount of resources used due to frequent replacement (Scott, 2002; Del Governatore, 2007; Leygraf et al., 2011; International Copper Association, 2015). (See Appendix A.1).

Second, in natural oxidation, copper undergoes a colour change with time, changing such that it becomes blue-green gradually as it changes from reddish-brown in colour. Such development not only demonstrates the visible ageing of the material over time but also gives textile design narrative and aesthetic significance, as copper can be used to represent an art of permanent restoration (Scott, 2002; Leygraf et al., 2011; Chawla and Sharma, 2021) (See Appendix A.2).

Lastly, red copper (i.e. high-purity copper) is particularly recastable as its composition is simple and highly purified. It does not lose its high performance after numerous remelting processes and, as an example, red copper preserves over 98% of its electric conductivity after being remelted many times, whereas the energy used to recycle it is a small fraction of that used in primary production (Schlesinger et al., 2011; International Copper Association, n.d.) (See Appendix A.3).

When applied artistically and in design practice, it is also possible to constantly rework the surface of copper by using chemical processes and etching, which attribute the matter with ever-changing visual life. According to Richards, what is interesting about copper is that it can be regenerated a great number of times on its surface (Richards, 2019, p.114).

According to the cost factor, although silver is also ductile, its cost is some seventy times more than copper (World Bank, 2023), as compared to metals like iron and lead that are not as viable by virtue of corrosion and toxicity (Nriagu, 1990). Specifically, red copper (high-purity copper) can be seen as the most recyclable type of the material due to the ease of its composition and constant characteristics. These benefits allow red copper to achieve a special balance in terms of durability, ease of work, and expressiveness in terms of visual qualities, thus becoming one of the most sustainable materials in the metal printing process (Zhang et al., 2022).

However, the sustainability of red copper does not come easily, especially considering the environmental effects of mining and smelting and the carbon emissions emitted during recycling (Schlesinger et al., 2011). The given research thus aims at lengthening the life cycle of the material and creating new methods to reduce the possibility of wasting resources, as Cooper (2010) emphasizes. In addition to showing material regeneration in the physical processes, red copper is also a cultural icon since its surface color and shape keep changing continuously, making it a functional and expressive material in sustainable design.

4. Reviewing the Application of Copper in Textile Design

(1) The application of copper's corrosion in textile design

The practice of Dana Draper talks of the possibilities of copper as an expressive medium of art. In the last ten years he has switched to copper plates, which are painted with as much painterly authority as on canvas and paper, a technique of generation of imagery which is accomplished by acid etching, patination and by the use of the hand-polishing. According to him, he does not consider copper as a metal, but rather as a painter would consider a surface, replacing acid with paint in some way (Copper Development Association, 2010).

As copper is considered warm and poetic by Draper, it becomes a part of its natural corrosion. Patina has been used in his collage and abrasion methods and tonal shadows have been created by grounding back selectively with a resemblance to the application of drawing and painting (Copper Development Association, 2010). This unveils

the experimental expressiveness of copper and makes each plate a material of only one use: a corroded plate is one image which cannot be reproduced (see Fig. 6).

Figure 6. Copper Development Association (2010) *Co-design framework* [Copper relief artwork].

The idea of single-use copper has given the present project the motivation to make copper visual language last longer. Similar to Draper, this study is made directly upon copper sheets; but it replicates and translates patterns of corrosion onto the textiles via printmaking and computer translation. This strategy is opposite both to the practice of Draper which minimizes a single consumption of materials by making plates reproducible and sustainable, and to turning contingent signs of abrasiveness into repeatable communicable visual signs. Employing digital printing and knitting to transport these symbols also reduces waste of material and the process becomes more appropriate to large-scale production (see Fig. 7).

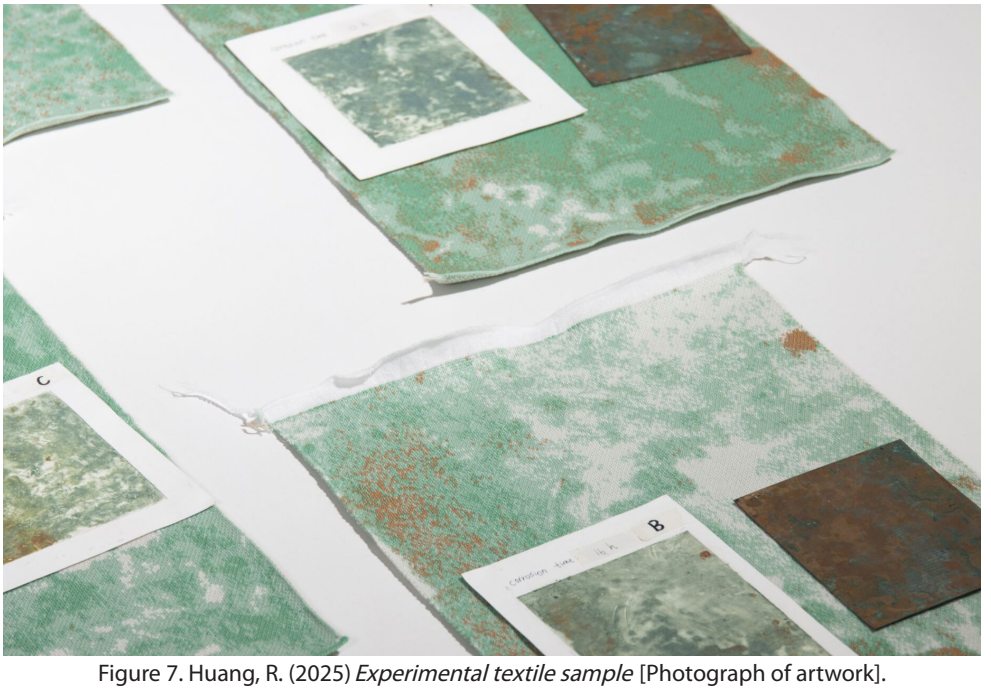

Figure 7. Huang, R. (2025) *Experimental textile sample* [Photograph of artwork].

Draper, however, is less sustainable in his approach given that his methods of solving patina are normally industrial and non-biodegradable. Comparatively, this study uses the ordinary acids like vinegar and lemon juice to come up with eco-corrosion processes.

Overall, the physical poetics that the work of Draper pursues is based on the uniqueness of each copper plate, and this project re-contextualizes the disposability of copper by converting its visual expression into sustainable and repeatable forms. By such means, it is addressing the problem of the short-lived materials and promoting the so-called environmentally-friendly stories in the culture of fast consumption.

(2) The chromatic transformations of copper in textile design

The article by Neha Lad (MaterialDriven, 2017) addresses the subject of chromatic changes of copper throughout the corrosion process. She weaves discarded copper wire with paper yarn that has been recycled and permits that natural oxidation and patination can steadily change the surface of the textile, ranging it through a range of bright copper to dark browns and blue-green patinas. The patina and cracks form a unique type of visual language. Through welcoming decay and oldness, Lad transforms material degradation to design value under the concept of a circular economy. Due to the nature of her practice, through which she uses the process of natural corrosion of real copper wire, her results are contingent and non-reproducible, which places her practice in the realms of an experiment and art (see Fig. 8).

Figure 8. MaterialDriven (2017) *Patinated woven copper and paper yarn textile by Neha Lad* [Textile sample].

The present study, however, does not involve continuous consumption of copper. It instead employs environmental-friendly acidic materials to form corrosion, fixes the resulting prints in printmaking as well as digital translation, and turns these traces into reusable visual materials (see Fig. 9). Large-scale textiles can also be applied with the help of digital printing and knitting. This research, in contrast to the aging aesthetic of Lad, investigates the reproducibility and communicability of the changes in the chromatic appearance of copper in eco-friendly design to compromise the artistic experimentation and practicality.

Figure 9. Huang, R. (2025) *Print experiment sample* [Photograph of printmaking experiment].

(3) Design practices of copper's recastability

In Draper's work process of creating engraves on copper plates, a process called corroding is done and polishing of the copper plates follows, which exposes the marks that are built over a period of time (Copper Development Association, 2010) (see Fig. 7). This technique focuses on the empirical intervention in the material, and the results are not reproducible. Although it is a tribute to the physical presence of copper and its archaeological record, it is confined to two-dimensional shapes, takes up a lot of material, and has little opportunities of being re-finished into its final shape.

Figure 10. ArtCloud (n.d.) *Wabi Sabi* (2014) [Photograph of copper artwork].

This study rather looks at the recastability of copper. It can be used to add to the traditional single-layer treatment of copper plates by connecting experimenters in multi-stage corrosion, forming more complex surface patterns. This re-coding logic is then converted into digital knitting. The resemblance of knitting to a straight-line structure allows interpretation of corrosion marks as patterns of textiles to dynamic surfaces (see Fig. 11). This is a media translation of the regenerative logic of copper, which is, via the reconfigurability of knitting, stretched out into a re-branding of copper and a multi-dimensional, sustainable cultural icon.

Fig. 11. Huang, R. (2025) *Print and Knit Recasting* [Photograph of textile experiment].

Collectively, these design practices show copper possibilities in three environmental-friendly aspects such as color-corrosion transformation, the ability to resist corrosion and even recastability, which proved to be useful not only in furniture textile uses. Coupled with its use as a material surface, copper can be used to express a language of sustainability, both in sight and in feel.

5. Methodology

(1) Collaborative participatory design research

This study will create awareness of the longevity of copper among the Chinese consumer. Towards this end, some 100 participants of diverse age groups, workplaces and residence issues were interviewed. The Collaborative Participatory Design Research (Sanders and Stappers, 2008) followed in the study focuses on collaboration between the researcher and the user to outline problems, generate ideas and reflect on the results. Three reasons were used to choose this method: (1) the corrosion, color change, and cultural reinterpretation of copper need to engage the users to determine sustainability prospects; (2) co-defining research questions would help in aligning the experiments together with the user expectations; and (3) displaying samples, gathering intuitive responses, prototyping, and conducting discussions would enable exploring how the participants would perceive sustainability.

(2) Survey and interview results on consumer expectations for copper-based textile design

Over 100 Chinese consumers of the age 18–46 and different occupations and cities took part and provided more

than 100 valid responses (see Appendix B.1). Second, four participants who showed a strong interest in the project were identified and invited to conduct in-depth interviews.These findings uphold the three purposes of the study.

Objective 1 – Copper sustainable design expectations by consumers: The majority of the respondents were in favor of sustainable issues, high-quality, long-lasting fabrics. Some of the younger participants who still chose to use single-use textiles to serve photographic/display purposes are very few. In spite of the fact that fast fashion is still common, there is a growing trend in favor of durability and longevity. Approximately 60 per cent said they were concerned about sustainability but, knowing how to gauge the eco-credential of homeware, they still had gaps of information (see Appendix B.2).

Objective 2 – Reactions to corrosion, color transformation and recastability: The copper print samples were linked with corrosion, transformability and recastability (around 65 percent) and this perception of copper was seen as long-lasting and recyclable. Majority of the respondents liked the aged beauty of patina, but there are some who found it to be too old and this is related to the cultural differences towards embracing corrosion (see Appendix B.3).

Objective 3 – The opportunity of copper in terms of refreshing sustainability awareness: More than three-quarters of the interviewees reported their readiness to buy textile patterns that evolve with time, and this is one of the manifestations of material lifecycle. Some thought that copper-laced fabrics in interior design could help increase life of products and increase emotional attachment (see Appendix B.4).

All in all, the results indicate that Chinese consumers are very aware of the durability, transform, and regenerative properties of copper. In addition to the physical qualities, copper has potential that tends to ensure cultural sustainability which not only makes the user recognize the links between materials and their surroundings and constant change (see bottom link of appendix B).

(3) Feedback analysis and design adjustment

The response of the participants was used to make later modifications on the material and process experiments. Several of the respondents showed interest in the process of verdigris formation and would like to be involved, indicating that sustainable design needs to anticipate regenerative process over and above the final conditions.

To substantiate this, corrosion experiments were combined with use of printmaking. Oxidized metal surfaces were transferred to textiles by intaglio methods in digital form, preserving the time marks on copper without coming into direct contact with verdigris. This made visual permissible corrosion that had no harm to human beings. More mixed textures were also requested by the participants. Electronic knitting machines were programmed using these patterns. Digital knitting translated to allow the use of 100 percent biodegradable wool due to concerns about health and the environment raised during interviews, as the translation was precise. Machine knitting was one more technology that created zero waste as well as a pattern that appeared on a copper plate was modified and reused to produce variations, which supports the concept of recastability.

The project allowed other participants to become co-creators instead of observers as the project continued. Pattern development and knitting parameters were directly based on their remarks, so the design was a joint effort of designers, materials, and the community. This partnership furthered the rebirth of copper beyond physical recycling into the culture and thinking of people.

6. Design Practice and Recommendations

(1) Phase one: the testing of materials and public perception

This stage investigated whether people understand how they interpret copper corrosion and whether these changes can be associated with sustainable values. The research confirmed that the corrosion experiments, and the temporal marks upon them, increased awareness of the material's sustainability.

Copper moves from bright metal through green, blue-grey and rust red under natural conditions. Whilst these states are associated with ageing, they can also indicate time, durability and continuity. These transformations were investigated using miniature corrosion tests in lemon juice, vinegar, salt and mustard, with plates placed outside (DRY, approx. 40–90 humidity) and inside (HUMID, approx. 90–100 humidity). Moist conditions accelerated peacock blue and pale green. Dry conditions resulted in a grey-brown. Even when controlled, samples tested for 12, 16, 20 and 24 hours demonstrated that patina formation was variable and unpredictable (Appendix C.1).

Participants viewed the samples. Many related the colour changes to tree rings — visible indicators of time. Approximately 60% related the changes to regeneration or endurance, rather than decay. A few remarked that the changes were calming in comparison to bright metal. Overall, corrosion was understood as regeneration.

These findings demonstrate that there is an expectation that copper will hold emotional and temporal associations. This informed Stage Two.

(2) Phase two: translating copper corrosion

This stage investigated how the corrosion resistance, colour transformation and recastability of copper could be translated into textile design. The experiments show that environmentally friendly printing of copper textures, combined with knitted structure, communicates sustainability.

Stage One responses demonstrated appreciation of the corrosion patterns, but a preference for less hazardous processes. Experiments therefore replicated these transformations in copper using safer, more sustainable methods. To avoid toxicity and water use (Scott, 2002), direct fabric printing was rejected, and dry and wet etching, based on copperplate engraving, was adopted.

Dry printing struggled with clarity and layering. Smaller amounts of ink improved the adherence and sharpness of the design across prints (Appendix C.2). Wet printing diffused the images, giving an effect similar to atmospheric corrosion over time. At approx. 80% humidity, the richness of texture doubled. Respondents interpreted these patterns as temporal layers and as extensions of the copper's lifecycle.

To reduce chemical and water use further (Jackson's Art, 2016), engravings were digitally scanned and translated into knitting patterns. This recast metal transformations into fibre structure, allowing the material logic of copper to appear within the textile. Respondents found this natural and practical.

In summary, corrosion resistance allows pattern stability; colour development provides a time-based continuum; and cross-media translation offers regenerative potential. These conditions combined allow copper to act as a sustainable textile element.

(3) Phase three: sustainable utilization of copper corrosion images

This phase maintained accidental, time-stamped textures of copper plates and converted them into sustainable wool knits to draw attention to material sustainability.

Responding to the interviews, they indicated that they read and understood the patterns of corrosion as timestamps. Because these timestamps were accidental and unpredictable, the timestamps made the textiles appear more alive and collectible. Moreover, ageing was regenerated, which could give copper "a second life." In addition, they preferred gentle and non-hazardous methods and believed that using natural fibers was more comfortable and environmentally friendly.

Therefore, we replaced synthetic fibers with 100% biodegradable wool. We converted the colors of copper patinas into knitted patterns digitally. Wool is softer than metal and transmits the qualities of evolving color to enhance the material appeal and sustainability.

Figure 12. Huang, R. (2025) *Copper-based Textile Design* [Photograph of textile work].

This design demonstrated that copper has three sustainable characteristics: durability, color-based temporal aesthetics, and recastability. The evolution in color strengthened emotional engagement, and recastability enabled regeneration, which in turn increased purchase intention. Thus, these findings indicate that converting material properties into textiles can enhance sustainable mindfulness at the social and cultural levels. In response to what the research question asks — How can material properties arouse sustainable mindfulness among Chinese consumers?

7. Conclusion

The project deals with homeware and textile-based decorative surfaces that place a strong emphasis on domestic experiences, tactile experiences, and emotional responses instead of a simple functional homeware environment in the design, as shown in the next figure. The main focus of the research is the modern Chinese city consumer who is in the conflict of rapid consumption and the new sustainability consciousness. Through the interpretation of the traditional symbolism of longevity and frugality using modern design, the project seeks to rejoin material reality to cultural identification and induce sustainability ethics in daily residential places.

This research addresses three core limitations of copper in textile applications:

This project deals with three fundamental shortcomings of copper in textile applications: To begin with, metallic fibers (including copper) do not have the physical flexibility and continuity of weaving and knitting practice (Erdumlu et al., 2015); second, its corrosion process can release dangerous materials, and it is not suitable for direct contact with the skin (Scott, 2002); and third, corrosion patterns have a dynamic and changing nature which does not allow long-term maintenance (Scott, 2002). In order to bypass these physical and safety limitations posed by the automobile use of copper, the project transports corrosion textures into rubbing, digitizing, and electronic knitting, thus allowing a resourcefulness of time to become preserved and haptic to be felt and used over time as an inexpensive fibrous substance.

Experimental methods of corrosion at the corrosion level create surface texture with slight gradations of green,

turquoise, and brown colors naturally merged to form what is called traces of time, and altering the natural aging process of copper to an artificially visible symbol of sustainability. In the area of color, the project derives the changing color schemes of verdigris through the stages of copper wear and tear, developing the language of color gradient that could be inserted in the structure of textiles to depict the change through time of the material. In regard to recastability, using morphological re-shaping and cross-media translation, this study identifies the regenerative capabilities of copper in a cyclic manner as a metaphor for sustainability design.

It is worth noting that this project shows how the ancient techniques of copperplate printing could be used, and traces left by corrosion could be printed onto itself as images. Comparative tests were made on print paper that is recyclable as well as with traditional inks that used wet printing and dry printing after applying etching to the copper plates. It was found that wet printing under pressure had the ability to transfer fine layers of textual features that could not be seen by the naked eye, making the temporal imprints of etched shapes more prominent. These sent motifs were later translated digitally to electronic knitting motifs, and this gave a re-cast of metals to fiber materials. The process will allow maintaining the patterns in the long term and integrating them into regular situations. Ranging through pattern generation, transfer, translation, and recreation, this path is made through various dimensions of color development, material plasticity in form, and recastability in materials, revealing the cross-media regenerative potential of material that traverses etching, printing, and knitting.

On the whole, the project does not merely explore the substance, but it is a redefinition of the concept of copper and sustainability. The collaboration of traditional metalworking technology with digital textile technology is set to reestablish the concept of design linked to craftsmanship, time, and users, and respecting the time-based nature of the material and its evolutionary characteristics. The regenerative translation of copper in textiles does not just demonstrate the possibilities of the technical and formal but also gives new reasons to reconsider the ways materials can incorporate cultural experiences. Therefore, the concept of sustainable design is not restricted to the idea of environmental friendliness or recycling but rather a pragmatic approach to design that prolongs the life of a particular object in a non-abrasive and refined way.

It is worth noting that the corrosion patterns of copper have incidental and arbitrary attributes, i.e., every pattern generation is unique. Such randomness not only provides aesthetic possibilities that are renewable, but consumers are also able to engage directly in the process of generating the pattern, turning them into viewers rather than co-creators. At the same time, digitization and electronic knitting integration provide the ability to replicate, produce in large quantities, and be integrated into the home environment once the pattern is captured, to create a balance between what can be called uniqueness and scalability , and to exhibit versatility for reuse in a variety of settings.

Nevertheless, this project has shortcomings. The area of the knitting experiment was mainly related to visual reproduction, and the issues of the structure of the fabric and durability had to be explored in more detail. Experiments were restricted to corrosion and texture variations because there was not enough time to integrate the experiments with other craft techniques. Furthermore, some of the interviewees were interested in partnering in patina production, in which designers utilize user-generated textures to create textile patterns to create more interactive sustainable design loops. Lastly, this research had to rely on the schedules of the project and could not run experiments on remelting used discarded copper materials. Remelting and recorrosion of recycled copper would not only make useful the practice of circular reuse but would give even more variety to the creation of patterns.

Such restrictions and research directions steer the designing intention not to aim at researching the surface printing translation methods but to investigate how the translation methods could become an impetus for a breakthrough in copper fabric structure to reveal the sustainability of craft per se. This causes the designer no longer to be interested in textile appearance but in engineering textile structure.

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