# Notions of hybrid craft production: conversations and small-scale experiments in digital fabrication

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## Abstract

Since the advent of 3-D printing as a form of additive manufacturing technology in the early 1980s, digital fabrication has made many inroads in craft and production. The 'digital fabrication revolution' (Gershenfeld 2012) has also presented us with opportunities for hybrid craft production, or situating craft practices at the intersection of traditional and digital modes of production. In spite of the burgeoning opportunities, there is still hesitation amongst traditional craftsmen and makers when it comes to adopting or integrating digital modes of production into their workflow. With contemporary Singapore and evolving ideas of 'craft' as the backdrop, this research unpacks possibilities for production through conversations with local craftsmen engaged in traditional and digital fabrication. The conversations primarily revolve around two pottery artists (with an emphasis on functional ware) and a makerspace located in a public library. The conversations and experiments reveal three key observations. First, notions of expediency and precision can play a role in how we come to appreciate and appraise 'skill' or more specifically 'hand skills'. This has implications for how we understand 'direct experience' (McCullough 2018; Cardoso 2018) in the context of craft objects. Second, when assessing quality, conversations around 'failure' reveal differing opinions about benchmarking and quality control between artists engaged in traditional pottery and digital fabrication respectively. Third, asking more open-ended questions about what a 'tool' is and how we can shape our own tools and workflows will reveal more opportunities for hybrid craft production. Lastly, through the aforementioned research, two potential barriers to entry were identified in the form of economic barriers, and time and education barriers.

## Author keywords

hybrid craft production, digital fabrication, workmanship

## Introduction

Since the advent of 3-D printing as a form of additive manufacturing technology in the early 1980s, digital fabrication has opened possibilities for makers and manufacturers alike. One can gain a sense of the techno-optimism via Neil Gershenfeld's (director of MIT's Center for Bits and Atoms) (2012) proclamation of this technological phenomenon as the "digital fabrication revolution". Chris Anderson, a former editor-in-chief of Wired magazine, elaborated on what this meant for individuals and communities by tracing the boom of the 'maker movement' and 'makerspaces' in his 2013 book, 'Makers: The New Industrial Revolution'.

3-D printing presents us with opportunities for hybrid craft production, or situating craft practices at the intersection of traditional and digital modes of production. At a time of "postdisciplinary flux", we can observe that the "categories of making are increasingly intermingled and hybridised" (Adamson 2013). While the market potential of 3-D printing for industrial manufacturers has been growing, this paper is more interested in the possibilities afforded to individuals, from "mass personalisation" (Deloitte 2015) to the boom of the "makerspace phenomenon" (Sherlock 2021). In particular, we are interested in individuals who consider themselves to be hobbyists, enthusiasts or amateurs in the realms of traditional and digital crafts.

The "hybridization of traditional and digital processes" (Treadaway 2016) can be found in a range of disciplines, from ceramics to textiles. However, in spite of the burgeoning opportunities, there is still hesitation amongst traditional makers in Singapore when it comes to adopting or integrating digital modes of production into their workflow. Various researchers working at the crossroads of computational methods and traditional craft have provided inspiration for this research, including Zoran's 'hybrid reassemblage' (in the context of "digital fabrication to restore broken ceramic objects") and Zheng and Nitsche's 'crafter-designer collaboration' model (discussed against the backdrop of a collaboration between design technologist Clement Zheng and ceramic artist Amy Roberson leading to experiments involving pottery and interaction design).

## Singapore as context

Sherlock (2021) stated in her survey of the makerspace phenomenon covering San Francisco, Berlin and Calgary in Canada, that the "critical discourse around what is being made and why is often lacking". The same could be said of the digital

craft scene in Singapore, especially when looking for opportunities to rethink traditional crafts. In this spirit, we began our inquiry with one guiding question: how will digital fabrication tools open possibilities for hybrid craft production? In attempting to answer the aforementioned question, we conducted interviewees and studio tours with three research participants based in Singapore. In this spirit, one aim of this research was to explore the receptivity of craftsmen largely engaged in hand work to integrating digital fabrication into their workflow.

The criteria for selecting research participants was twofold: [1] craftsmen that made functional household craft objects, or, [2] craftsmen that employed either traditional, digital (such as 3-D printing) or hybrid craft production methods. The interviews enriched our appreciation for the role(s) played by traditional and digital craftsmen and possibilities for hybrid craft production.

## Three craftsmen

Before we dive into our findings, it would help to better understand the profiles of our three research participants: Jolyn Ong, Goh Sing Hong and Muhammad Ismadi.

Ong is a hobbyist and pottery artist who has spent three years honing her skills in ceramics, with the goal of opening a pottery cafe one day, one that allowed patrons to find peace and relaxation. At age 25, she took up pottery classes at Toa Payoh Community Centre in Singapore before practising at shared studios and self-learning through online tutorials. Ong's motivation is driven by the endless wealth of knowledge that ceramics craft has to offer, which she believes could take her a lifetime to learn.

Goh is one of the youngest pottery artists in Singapore and spent two years learning ceramics at various studios, including Mud Rock Ceramics, Common Touch Craft and Ves Studio, before continuing her practice at her home-based studio and developing her own style. During this learning journey, she realised that she had a few decent pieces to sell and began marketing her wares through Instagram.

Muhammad is a maker coach at MakeIT at Tampines, a makerspace that is part of a National Library Board (NLB) initiative, and specialises in digital tools such as 3-D printing technologies. With a background in applied physics, Muhammad spent three years building a 3-D printer from scratch using scrap materials in 2013, a time when 3-D printers were not as affordable to the public. As a maker who now owns multiple consumer 3-D printers, he finds joy in DIY projects and customising everyday objects like wearables (e.g. watch straps).

## 'Direct experience' and making

Architectural professor McCullough took a production-based approach when he located the essence of craft in the digital realm as one that is based on the "direct experience, personal vision and mastery of a medium" of a maker (McCullough qtd. in Cardoso 2018), while Cardoso (2018) argued that the direct experience is not limited to makers, as it "stands alongside the experience of users" and that it is a 'collective' and 'open-ended' process.

When asked about their preferences regarding pottery craft, Ong shared that she has never been swayed by user or consumer preferences, explaining that "the whole point I'm doing ceramics is so I listen to myself". Rather than trying to find a fixed style, Ong envisions having dynamic styles that will speak of her different personalities and preferences that she has as a pottery artist. On the other hand, Goh is clear about her own style, as she is particularly interested in curvy forms and describes her style as "wacky". While a style can be perceived in her works, Goh mentions that consumer preferences such as cups being more popular as compared to vases tends to influence her production decisions when planning upcoming collections.

Despite having different tastes and preferences in their practice, both Ong and Goh highlight the importance of making artefacts by hand, and do not see a need to incorporate digital fabrication technologies such as CAD (computer-aided design) modelling and 3-D printing into their production process at this moment. After some years of practice, they have both learned techniques such as handbuilding and wheel-throwing to create pottery with their hands and therefore, the need to incorporate digital processes did not arise.

While Ong and Goh emphasised 'direct experience' (McCullough) and making things by hand, Muhammad explored using a 3-D printer as a tool to make his artefacts, rather than building or sculpting them *only* with his hands. Utilising the materials readily available in his makerspace, such as wax, concrete and air clay, he experimented with various casting techniques while relying on 3-D printed moulds. His casting experiments were an attempt to expand his palette of materials beyond plastics commonly associated with 3-D printing.

## Immediacy and production

Pottery is a relatively long process, from hand-building or wheel-throwing, to glazing and firing. Ong and Goh mainly practiced the wheel-throwing technique to create their forms [see Table 2].

**Table 2.** Steps for making pottery, as shared by Ong and Goh

| | Step | Description |
|---|---|---|
| 1 | Sketching Ideas | Drawing inspiration from online sources, and sketching ideas on paper. |
| 2 | Wheel-Throwing | Execute ideas on the wheel-throwing machine by perfecting the clay forms while ensuring that measurements are consistent. Perfecting the form alone takes a lot of practice (in order to get even thickness and reduce cracks during the firing process later on). It is important to note that the clay will shrink by 20% during the firing process, thus they have to compensate by making their items bigger than the finished size at this stage. |
| 3 | Glazing | The next two steps (glazing and firing) have to be done carefully as they are irreversible. Glazing itself is a whole different art form. If the compounds are inaccurate, it will affect the results during the firing phase. |
| 4 | Firing | Lastly, the glazed item is brought into the kiln to fire at above 1000°C. Once the clay is fired, it can no longer be recycled again. |

Ong (2022) shared her opinion on the tedium of pottery:

> *A lot of people think a simple mug on the table is something you can get in a day, but it is not. If you are into the knowledge of it, you realise a piece of mug, bowl, or plate takes a month. The drying process, trimming it whilst it is just dry enough but not too dry... all these little things that you have to take note of adds to the whole length of the duration of making.*

To illustrate the point further, the final steps are irreversible—once a pottery piece is fired, the clay can no longer be recycled and the potter will have to destroy the piece or start over again. In comparison, Muhammad shared his experience with 3-D printing, while making a smartwatch strap from scratch [see Table 3].

**Table 3.** Steps for making a smartwatch strap, as shared by Muhammad

| | Step | Description |
|---|---|---|
| 1 | 3-D Modelling | Create a 3-D model of the strap using TinkerCAD, a 3D-modelling software. |
| 2 | Preparing for 3-D Printing | Convert the 3-D model file (.stl) into a 3-D printable format (.gx) using FlashPrint. |
| 3 | 3-D Printing | During the 3D Printing process, several iterations can be made based on the measurements and prototypes in order to get the strap size and fitting right. |

While pottery has irreversible steps (especially after glazing and firing), digital fabrication allows multiple iterations even after the initial 3-D printing. It is also clear that 3-D Printing is not an instantaneous process that allows you to see results or output immediately. Unless one downloads ready-to-print 3-D files from open-source portals such as Thingiverse.com, 3-D modelling requires time to refine and render; the step of 3-D modelling being a crucial one.

## Quality benchmarking and defining 'failures'

When analysing how different craftsmen benchmark their craft pieces, it would help to understand how they define a 'good' or 'failed' piece. For Ong, she still considers herself an amateur and student after three years of practice, as she is constantly trying to hone her skills to the reach the level of a master ceramist before launching her own collection. On the other hand, Goh launched her first collection after about a year of practice. When asked how they each defined a failed ceramic piece, Goh described pieces that were "too thick, heavy, uneven [the opening is off centre], random holes" while Ong focussed on "cracks, patchy glazes".

To Ong, uneven forms can be seen as expressions of 'wabi-sabi', or the idea of intentional imperfections, and that the beauty of ceramics is that "there is no right, bad, good or wrong art". Goh believes that as a pottery artist, it is necessary to experience failures, while Ong thinks that "there's no such thing as failures, just lessons in pottery". For example, Ong usually slices her failed pieces in half to analyse what went wrong before recycling the clay. Both Ong and Goh agree that it was only after making progress over time, that they began to see their initial pieces as failed attempts. While different craftsmen have differing ideas of a good quality craft object, and the definition of failure is also equally subjective or deeply personal.

While Ong and Goh mainly described failures in terms of the physical characteristics of pottery pieces such as uneven forms and cracks, Muhammad experiences failures either during or after the 3-D printing process (e.g. during a casting process). With digital fabrication, iterations originate from the 3-D modelling process leading to an existing 3-D file that allows repeatability.

## Possibilities for hybrid craft production

When presented with the possibilities of incorporating 3-D Printing into her process, Ong saw an opportunity to make a chuck using 3-D printing. A chuck is a tool that Ong often used to help trim her vases with narrow or uneven rims during the wheel-throwing process. Currently, Ong has been making chucks out of clay, but believes that there might be an opportunity to make her own tools using 3-D printing. Rather than relying solely on hand skills to achieve a certain form, pottery artists can make use of additional jigs when working with unusual or complex geometries.

Muhammad, on the other hand, has been experimenting with building his own tools since 2013. Rather than wait for 3-D printing to become more affordable and widespread, Muhammad spent three years experimenting and building his own first 3-D printer in 2013. Later, he purchased a Creality Ender-3 Pro, a beginner-friendly and relatively affordable 3-D printer suitable for makers. Muhammad prefers the Ender over competing models due to its flexibility. He is able to customise or upgrade different parts on his own, and print custom parts if required.

Many digital craftsmen have been experimenting with building their own 3-D printers for ceramics in recent years. Ong added that she thinks it is "quite exciting" and that she "will personally try it, in future" and she "might even include it if [she sees] some value in it... [and she sees herself] selling 3D printed ceramics because it's a series that is interesting and people might be interested". Digital fabrication can be used in a 'tool-making role', in addition to directly fabricating of end products (Jorgensen qtd. in Zoran et al. 2015).

## Barriers to entry

Having discussed the potential for hybrid craft production, we cannot overlook barriers to entry.

Firstly, there is an economic barrier as pottery is considered an expensive craft to learn. Although Ong was keen on learning ceramics from a young age, she was only able to commit to learning pottery after having a stable personal income at the age of 25. Goh mentioned she is one of the youngest potters in her studios, where most potters are aged 30 and above. An average five-week pottery course can cost between SGD300 to 400 (USD 226 to 302) and Goh mentioned that she bought a second-hand wheel-throwing machine for around SGD300 (USD 226). On the other hand, the makerspaces (MakeIT) at public libraries in Singapore offers free usage of 3-D Printers to public users (age 13 and above), as long as they have a registered National Library Board account and completed a free three-hour starter course. In addition, visitors can receive guidance from maker coaches.

Secondly, there are also time and education barriers. When Ong and Goh first began learning pottery, they had to attend at least five physical lessons in order to learn the fundamentals of clay. Goh spent three weeks learning hand-building and two weeks on wheel-throwing, while Ong spent ten weeks learning wheel-throwing. With the basic skills acquired, they were then able to progress to self-practice or self-learning via online video tutorials. On the other hand, there are many free online resources that encourage self-learning about digital fabrication. For example, there are free 3-D modelling softwares such as TinkerCAD.com and Blender and many websites share user-generated content such as digital design files hosted on Thingiverse.com. In addition, studio space and overheads are a concern. While pottery artists who do not own a wheel-throwing machine have to rent spaces in pottery studios, one can do 3-D modelling relatively inexpensively.

## Conclusion

In Gershenfeld's (2012) words, "personalisation, producing products for a market of one person" is what makes digital fabrication a 'killer app'. By being directly involved in the process of making, craftsmen can develop an emotional and personal attachment to the product as they feel less alienated in the course of making (physical or digital). Digital fabrication will not replace traditional crafts but opens opportunities for hybrid craft production, and new paths for customisation and personalisation in the today's consumer and craft landscape. While much attention has been given to 3-D printing for industry, the craft scene in Singapore can also reap benefits from advances made in additive manufacturing.

## References


Adamson, Glenn. (2007). *Thinking Through Craft*. Berg.

Anderson, Chris. (2013). *Makers: The New Industrial Revolution*. Crown Business.

Cardoso, R. (2018). Craft Versus Design: Moving Beyond a Tired Dichotomy. In G. Adamson (Ed.), *The Craft Reader* (pp. 321–332). Bloomsbury Visual Arts.

Deloitte. (2015). *Made-to-Order: the Rise of Mass Personalisation* (The Deloitte Consumer Review). Deloitte. www2.deloitte.com/content/dam/Deloitte/ch/Documents/consumer-business/ch-en-consumer-busines s-made-to-order-consumer-review.pdf

Gershenfeld, N. (2012). How to Make Almost Anything: The Digital Fabrication Revolution. *Foreign Affairs*, 91(6), 43–57.

McCullough, M. (2018). Abstracting Craft: The Practiced Digital Hand. In G. Adamson (Ed.), *The Craft Reader* (pp. 310–316). Bloomsbury Visual Arts.

Nitsche, M. & Zheng, C. (2018). Combining Practices in Craft and Design. In Storni, C. & Leahy, K. (Eds.), *Design as a Catalyst for Change – DRS International Conference 2018* (pp. 1610-1623). Design Research Society.

Sherlock, D. (2021). Capitalizing on Community: The Makerspace Phenomenon. In Black, A. & Burisch, N. (Eds.), *The New Politics of the Handmade: Craft, Art and Design* (pp. 125-145). Bloomsbury Visual Arts.

Treadaway, Cathy. (2016). Crafting Textiles in the Digital Age: Printed Textiles. In Nimkulrat, N., et al. (Eds.), *Crafting Textiles in the Digital Age* (pp. 17–33). Bloomsbury Visual Arts.

Zoran, A. & Buechley, L. (2013). Hybrid Reassemblage: An Exploration of Craft, Digital Fabrication and Artifact Uniqueness. *Leonardo*, 46(1), 4-10. MIT Press.

Zoran, A., et al. (2015). Hybrid Craft: Showcase of Physical and Digital Integration of Design and Craft Skills. *Leonardo*, (48)4, 384-398. MIT Press.