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Master's Thesis

Combining 3D printing with Traditional Crafts:
Why is it Needed and What Is the Role of the
Designer?

Jun-Tae Kim

Department of Industrial Design

Graduate School of UNIST

2016

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Jun-Tae Kim

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Approved by



Advisor

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Jun-Tae Kim

This certifies that the thesis of Jun-Tae Kim is
approved.

01.21. 2016

signature

Advisor: Joon-Sang Baek

signature

Thesis Committee Member 1: Kwan-Myung Kim

signature

Thesis Committee Member 2: James A Self

Abstract

Traditional crafts now have trouble in terms of economic losses and low interest from society, but it is true that traditional crafts have value for our society and culture. In this situation, we consider the use of 3D printer. Our focus on traditional crafts is in danger, even with their importance in social and economic terms. We started this research based on the hypothesis that the 3D printer that is now widely used in the design and technical fields will help to revive traditional crafts. Our two research questions are as follows:

RQ 1. Why do traditional crafts need to be combined with 3D printer?

RQ 2. How can designs contribute to the combinations of traditional crafts and 3D printer?

To answer these questions, we used the interview and found five interviewees that illustrate the combination of 3D printer with traditional crafts.

We found that 3D printer have the advantages of fast speed and free form. They can help traditional crafts to evolve in other ways and still deliver the meaning of traditional crafts to the people. For this to occur, the designer should understand traditional crafts first and create better products that can show the advantages of both 3D printer and traditional crafts. Finally, 3D printer can help to develop new kinds of craft designs and deliver new meanings to the user. It can also evoke the meanings of traditional crafts to the user in a social context.

We hope that these kinds of results can help whomever has an interest in developing traditional crafts or those who want to find alternative ways to use 3D printer.

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I Background and Object of Research

1.1 Revival of Traditional Crafts

1.1.A Situation and Problems in Traditional Crafts

Traditional crafts are important in our society as they have tremendous value. They have lasted for a long time and combine cultural life with social values. They contain cultural meanings as people used them to make tools, materials, and methods (Ewins, 1980). They are also important not just for meaning but also for economic value. In developing countries, traditional crafts are a key factor in the economic strategy (Ellis, 2015). Traditional crafts also have contributed positively to many other areas like art, design, and fashion (Emmett, 2014). But these traditional crafts now have serious problems because of the mass customization of products and people's lack of interest. According to an INSEAD report in 2007, traditional crafts have several challenges like a "stable cost structure due to old production techniques, excessive intermediation, lack of organization, lack of branding and awareness, low numbers of direct marketing outlets, knowledge retention and transfer and risk to compromise product quality (mass production)" (Chelladurai, Nenes, & Maithly Erande, 2007). Also, other problems in traditional crafts are that people usually don't feel any attraction to traditional ways of production. In particular, younger people have a low interest about traditional crafts. This can create a problem in transmitting knowledge to the next generation (Valsecchi, Pollastri, & Yongqi, 2012).

However, we can't ignore the importance of traditional crafts in our society not just their meaning in our society but also their economic value. Figure 1.1.a suggests the traditional crafts market was US\$235 billion worldwide in 2003, and its annual growth rate was around 5.1% from 1999 to 2003 (Frost & Sullivan, 2005). In India, approximately 130 million people were working in the handicraft sector throughout the country in 2012 as their only direct employment. If the number of people related to handicrafts and intermediary activities are taken into consideration, then the figure would be four times higher. One good example is Vietnam. There is a place called Red River Delta (RRD). More than 2000 traditional craft villages in Vietnam are around the RRD. They have connected from the rural economy to the urban one and even to the international markets (Dang, Mahanty, & Van, 2010).

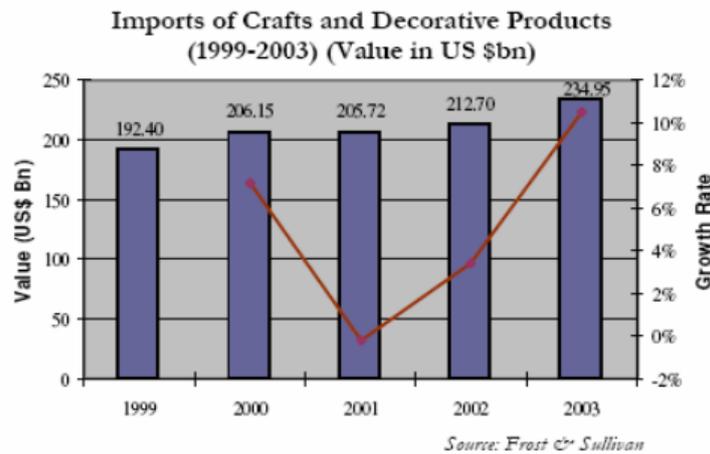


Figure1.1.a. Imports of Crafts and Decorative Products (Frost & Sullivan, 2005)

1.1.B Revival of Traditional Crafts

As mentioned before, traditional crafts are now in danger, even if they are culturally and economically important to society. Now in many fields of research, they have tried to apply their knowledge to traditional crafts to revive them. UNESCO wrote a report, “Designers meet artisans” (Nagar, 2005). It explains about why and how designers can contribute to the artisans. In the computer science field, Vibrandt et al. (Vibrandt, Vibrandt, Pasko, Stamm, & Pasko, 2011) researched interpreting traditional crafts as digital images. They found that desktop fabrication equipment can help to preserve and support craft techniques and create new designs and fabrication approaches, so digital technology is useful in extending and enhancing traditional processes.

1.2 Research Objective

We focus on traditional crafts that are in danger, despite their importance in social and economic aspects. We started to research based on the hypothesis that 3D printer, which is now popular in design and many other fields, will help to revive traditional crafts.

Our two research questions are as follows:

RQ 1. Why do traditional crafts need to be combined with 3D printer?

RQ 2. How can a designer contribute to combining traditional crafts and 3D printer?

So in research question 1, I will search why it’s good to combine traditional crafts with 3D printer. In this part, I focus on two things. First, the advantage of 3D printer is that it can act on traditional crafts, and second, some benefits result from this combination.

In research question 2, I try to find the role of designer in combining projects. How can designers act by using 3D printer tools, making output, and so on? To answer these research questions, we have implemented interview. We contacted the researcher, company, or organization that already had experienced projects that combined 3D printer and traditional crafts.

II Theoretical Background

2.1 Traditional Crafts

Actually. The term “traditional crafts” is, in and of itself, hard to define as one meaning. ‘Craft’ in dictionary means that ‘an activity such as weaving, carving, or pottery that involves making things skillfully with your hands’ (Craft, 2009) ‘Traditional’ means that ‘customs, beliefs, or methods are ones that have existed for a long time without changing’ (traditional, 2009) Ewins (Ewins, 1980) mentioned how the term “traditional” can be defined. He considered that it was not just “made for a long time.” It’s closer to having been connected for a long time more widely to the social and cultural life of the people. Peter, D (Domer, 1997) mentioned that Traditional craft is cultural production of a community and to aggregately grasp meanings, especially in rural communities. Traditional crafts, involving practices rooted in local knowledge and built up over time, are part of our cultural heritage and should be preserved and revitalized (Tung, 2012). A craft is inevitably related to its cultural context. The perceptions of beauty and meaning are very much related to an understanding of the context in which a craft is made and used (MacDowell & Avery, 2006).

Based on this, we can consider that traditional crafts can be defined as crafts that are related to cultural aspects and meaning within our community. So we can consider that traditional crafts reflect lots of the aspects in our society.

2.1.A Declining Industry

In many countries, many problems about traditional crafts and artisans have been coming out. In 2002, four traditional artisans in a southern Indian state died due to severe famine. Artisans’ families said that suicides cannot work an earn money (Reddy, 2002). In the Ulsan, Korea, the city developed a street called Cultural Street next to the Ulsan downtown in 2012. They started to gather artists and artist groups by providing them with pay for repairing places, signs, rents and so on. As a result, the commercial district along the Cultural Street has developed almost 30% compared to the past (Changhoon Cho, 2015). The street seems to have developed well, but sadly there are only 31 stores related to culture like galleries, craft workshops. The remaining 61 stores are not related to culture. There is also gap in opinions about artisans and public officials. Artisans insist that the government office should provide substantive support in addition to funding as public officials suppose the artists act inactive and lack community spirit and a sense of vocation (Choi, 2015).

In the 1980s, most Asian traditional craft industries declined severely and were deeply affected by the process of globalization, the introduction of new technologies, and the mass production of products. Figure 2.1.a, it shows how much the traditional craft industry in Japan had decreased compared to the

1970s and 1980s. This decline had serious economic and social impacts for traditional industries in the Japan (Beamer, 2010).

Table 2.1.a. Changes in the Production of Lacquerware: Three Japanese Locality Examples (Beamer, 2010)

Item	2006	Reference Value (Peak Year)
The number of people engaged in the craft	93,000 people	290,000 people (1979)
The number of companies	16,700 companies	34,043 companies (1979)
The amount of production	177.3 billion yen	540.0 billion yen (1983)
Percentage of craftsman under 30 years old	6.1%	28.6% (1974)

In Russia, the traditional craft industry is now in danger due to low profitability, high taxes, and a lack of skilled workers. About 50 enterprises have closed since the 1990s. Perhaps 250 enterprises will close in the future. A key problem is retaining workers. Many of them prefer to move away or find easier jobs. In the 1990s, about 100,000 people worked in Russian craft factories. Now, there are no more than 15,000 (Bazenkova, 2015).

Traditional crafts are now in danger from economic and social aspects because of cheap products from mass production and a lack of concern from the market. For these declining traditional crafts, many research fields have tried to use their knowledge to help traditional crafts.

2.2 3D printer

3D (Three-dimensional) printer is like 2D printer such as inkjet printer we have used before, but it uses “geometries” onscreen and make them to physical objects which user can use. Some of it melt plastic in layers, and others uses a laser to develop hard layers of powder resin. (Anderson, 2012) So people can develop physical product they want if they can do 3D modeling or have it. In this 3D printer culture, people can develop products, share them, and make as many as they want. These digital tools like 3D printer can and will play an important role in the emergence of small factories (Igoe & Mota, 2011). Gershenfeld (Gershenfeld, 2005) wrote in his book, *FAB*, that a new digital revolution is coming, only this time in fabrication. Now digital tools like 3D printer is being programmed in the physical world rather than the virtual one, and this will allow individuals to design and produce tangible objects on demand, wherever and whenever they need them. In this paper, I consider that 3D printer is not just tools for developing something with computer file. It also has cultural aspects which people can reproduce what they make with the 3D printer tools they have or shared online with people who have similar interests. This generates interest among people to meet online based on their fields of interest.

2.2.A Combining 3D printing with Traditional Crafts

Combining 3D printer to traditional crafts is still not a well-defined research area. Vilbrandt et al., (Vilbrandt et al., 2011) in their 2011 paper created 3D images from folk crafts and produce it with CNC (Computer Numerical Control) machines. They were only focusing on regenerating 3D images and producing them by using computer numerical control (CNC) and focused on using 3D scanning tools and CNC machine, not 3D printer. But they found that digital fabrication technology (like CNC machine, 3D printer) can be useful in extending and enhancing traditional processes by protecting them with a digital image. Celani (Celani, 2008) combined 3D printer with arts. Kolarevic (Kolarevic, 2001) conducted research about relating architecture with 3D printer. Zoran (2013) combined contemporary 3D printing and a traditional craft (basketry). He generated new kinds of craft designs with 3D printing output. He also mentioned that 3D printing (one of the 3D printer tools) and traditional crafts are rarely created the same these days. Researching 3D printer is at a starting point these days, so we can confirm that there are few previous research papers. But we can confirm that that possibilities of using 3D printer can help to save traditional crafts and generate new possibilities. One research suggested that difference between craft and design are receding while craftsmen start to use digital tools and overcome the limited production before. (Kettleby, 2005) It gives designer new mission to develop craft to meet current needs (Press & Cusworth, 1997)

2.3 Designs for Traditional Crafts

2.3.A Design Interventions for Traditional Crafts

There has been lots of research on how designs and designers can contribute to the traditional crafts. UNESCO wrote a report, “Designers meet artisans” (2005). It explains why and how designers can contribute to the artisans. It says that designers can interact between tradition and modernity and help to match craft output with the needs of modern life. Design intervention helps to preserve cultural resources. Successful design intervention should regenerate local markets and should aim at ensuring better earnings and empowering the artisan communities towards achieving a sustainable livelihood. Tung (2012) explained what is possible through design: accentuate the characteristics of the rush-weaving craft, the revival of pre-existing techniques, use of local materials to maximum advantage and manifest a location-specific identity, and knowledge creation and transfer through design intervention. So design can help traditional crafts to find market needs based on local resources and artisan techniques, and thereby save traditional techniques for future generations. But there is no research about the role of designers in combining traditional crafts and 3D printer. There are many research studies about designers helping with traditional crafts, but no research designer apply these 3D printer tools to traditional craft. We focus on this point, and find out why it’s good to combine 3D printer to traditional crafts and the role of designer.

2.3.B What is the designer?

To find the role of designer in combination, it's needed to find who the designer is. The term designer is defined by many organization and researcher. Design institute of Australia define designer is professional in business who can make solutions to commercial needs, and It needs to get balanced among technical, commercial, human and aesthetic requirements. From here, designer can be assumed to be technician and artist. ("What is a Designer," 2016) In paper, researched by Ralph and Wand (Ralph & Wand, 2009) suggest term of design in figure 2.2.a, They said 'design is a specification of an object, manifested by some agent, intended to accomplish goals, in a particular environment, using a set of primitive components, satisfying a set of requirements, subject to some constraints' In here, we can find design is making some object, physical artifacts, processes, symbolic systems, laws, rules and policies and so on, with specification and affected by agent. That object considers environment and constraints and so on. Then we can know that designer is someone doing that design work.

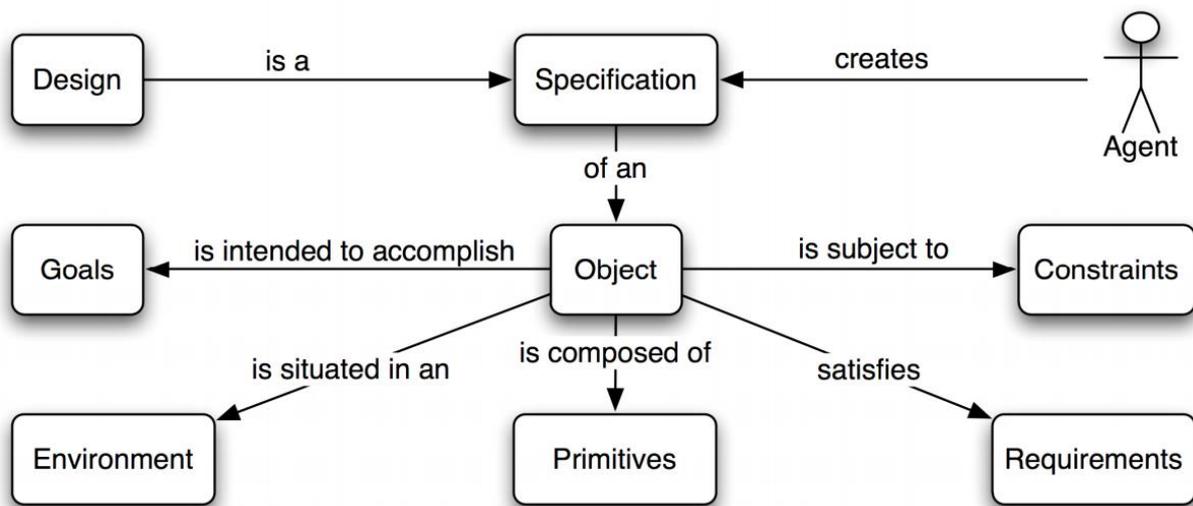


Figure 2.2.a Conceptual Model of Design (as a noun) (Ralph & Wand, 2009)

So we consider that designer who develop object which can be physical or non-physical and keep in mind many aspects like constraints, technological, business, environment about objects.

So how design is different from craft? One author suggests that design aims to solve problem and develop new useful thing. But craft is not always utilitarian, and they usually are not usable. (Rochon, n.d.) One research, Howard said that in craftsmanship, conception and performance are combined as physical characteristic of materials face conceptual form and conceptual form faces physical material. Also craftsman develops a original, a one-of-a-kind thing, even they develop several products with same type. But it's not like designer. They usually develop specific kinds of modern object. So craftsmanship is more close to make original thing with hand. Designer is close to know characteristic of materials related to machine. (Howard, 2006)

From here, we can find that craft is things have cultural meaning by hands, but don't need to be useful. Design is process to develop usually for utilitarian and mass production focused.

III Research Method

This research focuses on the advantage of 3D printer, the reasons why it's good to be combined with traditional crafts, and role of designers in this combination. As mentioned, research about combining and the role of the designer have been rarely been undertaken. So we chose to do an interview to understand the experiences and perspectives of people who implemented combined projects

3.1 Data Collection

3.1.A interviewee Selection

I used 'Judgement sample' (also known as purposeful sample) which researcher participates selection actively to find the most fruitful interviewee to find proper answer for research question. (Marshall, 1996) So for this, I focused on our research question. 'Advantage of 3D printer to traditional craft' and 'the role of designer'. First, I tried to find interviewees who have experience to use 3D printer with traditional craft, so skipped even someone did project related to traditional craft, but not used 3D printer and also. If there was nothing related to specific traditional craft things, also did not consider that. And second, interviewees who are working as designer in company or who have studied or researched in design field. For finding interviewees, I searched google, google picture and You-tube. I used term; 3D printing with traditional craft and 3D printer & traditional craft. So I found 8 internet site and 1 thesis. We finally found nine interviewees. By contacting them, we have 5 interviews with 9 people. Four participants are designers who have design knowledge and experience to use 3D printer with traditional crafts. The other participants are not designers, but have experience to use 3D printer with traditional craft.

3.1.B. Interview Questions

Interviews involved nine people in five cases. They lasted about 40 minutes to 1 hour 20 minutes with semi-structured questions. We asked questions mainly about experiences on a combination project based on the research questions. Table 3.1.a shows the basic questions we asked, and we inquired about what is needed.

The first line in Table 3.1.a is about the reason why they started combining projects. The second and third lines ask about the advantages of 3D printer and the problems or cautions when using 3D printer tools. The fourth line is about their own main point they wanted to express about combining output. The fifth line is about the role of stakeholders, specifically the role of a designer or artist who

participated on case. Lines six and seven is about how to evaluate their own output, and how successful the project was.

Table 3.1.a Interview Questions

1	Why did you start the project?
2	What are the reasons why you started to use 3D printer and advantages of doing so?
3	Any cautions or problems in using 3D printer?
4	What is the main thing you wanted to show from your output?
5	What was the role of each stakeholder?
6	What is your best output and why?
7	Is there any way to evaluate the output?

As shown in Table 3.1.b, one case is in Korea, and the other four cases are in other countries. So one interview was conducted in Korean, and the other four were in English. A Traditional culture plusing center interview was done by meeting at the center. The Amit Zoran case involved an interview in person, and the other three cases were done as online interviews. We wrote down every interview's content after interviewing.

Table 3.1.b interview participants

	Name	Participants	Role of participants	Description
Case 1	Traditional culture plusing center	3	Designer and two administrators (operated by government)	Producing prototypes for artists at the center
Case 2	Amit Zoran	1	Engineer and designer (research purpose)	Combing 3D printer with crafts in Africa like basketry
Case 3-1	Kabuku-Rinkak (3D printing platform)	2	3D printing platform company (commercial purpose)	Combing traditional Japanese swords with 3D printing
Case 3-2	Kabuku-Studio shikumi (design group)	1	Designer (commercial purpose)	
Case 4	Michael Eden	1	Ceramic artist and researcher (research with 3D printer)	Combining ceramic art with 3D printer

			purpose)	
Case 5	Earl Stewart	1	Designer (research purpose)	Combing handcrafted shoes with 3D printer

In Case 1, three participants participated; one designer and two administrators at the center. In case 2, one professor participated. In case 3, there were three; two came from a 3D platform company called Rinkak and one designer came from Studio Shikumi. So we divided into two small groups: 3D platform company and design group. In case 4, one researcher in the ceramic artist field participated. In case 5, one shoe designer who had done a project in his graduate courses participated.

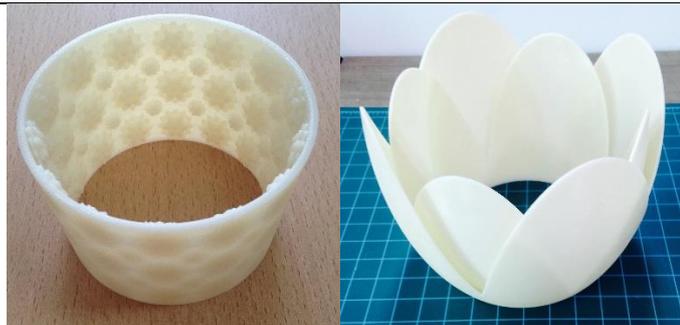
3.2 interviewee Introduction

- **Traditional culture plusing center**

Table 3.2.a Traditional culture plusing center

Name of Case	Traditional culture plusing center
Current Career	For developing products based on traditional culture-convergence, they provide business education, mentoring, and so on.
Combination	They prepared 3D printer and founded the Traditional culture plusing center.
Project	They print for artists in the center or population.

Examples of output



Cup holder (“[3D printer] Cup holder printing,” 2015) & Lighting by 3D printing (“[3D printer] Lighting printing,” 2015)

- **Amit Zoran**

Table 3.2.b Amit Zoran

Name of Case	Amit Zoran
Current Career	He is the professor at the Hebrew University of Jerusalem and operates Design Hybrid Lab. He does research about digital design, crafts, and human-computer interaction.
Combination	Project about combining 3D printer tools with African traditional crafts such as

Project	basketry, necklace, and so on.
Examples of output	 <p>Basketry (Zoran, 2013) & Vase (Zoran & Buechley, 2013) developed by Amit Zoran</p>

- **Kabuku (Rinkak and Studio Shikumi)**

Table 3.2.c Kabuku (Rinkak and Studio Shikumi)

Name of Case	Project Kabuku–Rinkak (3D printing platform company) and Studio Shikumi (Design company)
Current Career	Rinkak–Operating 3D printing platform.
Combination Project	Rinkak cooperated with design studio Shikumi and Japanese artists. They developed a Japanese traditional sword, <i>katana</i> , by redesigning it and sold it.
Examples of output	 <p>Japanese traditional sword made with 3D printing (“sumisaya,” 2014)</p>

- **Michael Eden**

Table 3.2.d Michael Eden

Name of Case	Michael Eden
Current Career	He is now working as a Crafts Council Maker Trustee and digital research fellow, MIRIAD, Manchester School of Art. He combines craft, design, and arts and redesigns culturally familiar products into modernistic works
Combination Project	Redeveloping ceramic crafts with 3D printer technology

Examples of output

Imari I (Eden, 2014b) and Bridging the gap (Eden, 2014a)

- **Earl Stewart**

Table 3.2.e Michael Eden

Name of Case	Earl Stewart
Current Career	Working in sports cooperation as shoe designer
Combination Project	Project for combining traditional handcrafted shoe with 3D printing

Examples of output

098 Shoes by Earl Stewart (Stewart, 2013a)

3.3 Data Analysis

In analyzing the interview data, we focused mainly on the meaning of what participants said. First, one researcher divided the interview content by the meaning of the interviewee's intention. Then put tag on what it means using Microsoft Word. Tagged content was divided into big three parts: 3D printer, Traditional Craft, and About Project. The 3D printer part is split into characteristics of 3D printer and advantage and disadvantage of 3D PRINTER. Traditional craft is divided into characteristics of traditional craft (TC) and problems TC has. About project is split into why start project?, role of designer, and important thing in combination and so on. We then divided all of the interview data as it related to each part and built a coding frame based on that. For checking its reliability and validity, two more researchers in doctoral degree courses participated. The purpose of checking the coding frame is that it's easy to understand the frame and the frames are fully developed to represent all of the interviews'

content properly. In here, reliability means that same result is coming out with repeated test and validity that coding frame shows meaning well. (Carmines & Zeller, 1979)

Table 3.3.a Results of checking coding frame for reliability

	#1 Researcher	#2 Researcher
T1	20%	18%
T2	40%	30%
T3	89%	86%

The verification process was done three times. At first, we explained the coding frame in detail to the two researchers, and then provided them with one case interview’s content. Each researcher divided one interview content into a coding frame. After that, we compare the coding data that researchers did with what we did. We concentrated on finding how many coding results were similar. In Table 3.3.a, second line, T1 suggests the result of the first check coding frame. There was only 20% and 18% identical. We found there was a problem for them to understand what coding a frame means. Coding a frame is duplicating each other and this caused confusion. We changed the coding frame.

In the second test, we didn’t give them one case interview’s total content, and instead, we gathered all of interview contents and chose them randomly for about 10% of the total interview. We tested again with the same participants. The reason why we chose the interview content randomly is because there are possibilities for the test participants to become accustomed to the interview content and contaminate the test results. In the second test, third line in Table 3.3.a, the result shows 40% and 30% each. This was slightly increased from the previous. We found that the test participants still had problems in understanding the meaning of a coding frame. So we had a meeting with each participant for about one hour and seek out at what point they felt confused and how changes should be made for easier understanding. Another problem was that we chose the interview content randomly, and this caused contextual meaning of interviewee’s content to disappear and generated trouble in understanding. After that, we re-made the coding frame based on their opinion and modified the interview content. We made an interview content group based on the contextual meaning of interview, but didn’t alter the sequence of the interview. After that, we conducted a final test, and as shown in fourth line, Table 3.3.a, the identity between what the researchers did and the test participants did reached 89% and 86%, respectively. We first assumed that an over 85% identity rate would be enough to check for reliability and validity.

Table 3.3.b Coding Frame

Why start the project?
3D printer

Characteristics of 3D printer

- 3D PRINTER - Lots to learn
- 3D PRINTER - Only one tool is like the tools we have used previously
- 3D PRINTER – Developing a prototype

Advantages of 3D printer

- Advan 3D PRINTER -> Easy to start produce
- Advan 3D PRINTER - Low pay and accelerate speed
- Advan 3D PRINTER - Give freedom in form aspects
- Advan 3D PRINTER - Bespoke in higher level easily

Disadvantages of 3D PRINTER

- Disadvan 3D PRINTER - Limited (no physical touch or personal meaning)
- Disadvan 3D PRINTER - Cost problem
- Disadvan 3D PRINTER - Quality issue

Traditional Crafts

Characteristics of TC

- TC - Challenge to the past
- TC - Unpredictable
- TC - Different meaning
- TC - Bespoke
- TC - Story and experience

Problems in TC

- Problem in TC - No challenge to develop
- Problem in TC - Limited production by tools
- Problem in TC - Conservative

About combining projects

Need to understand traditional craft

- Finding proper TC for combining
- Understand TC technique

Warning for using 3D printer

- Using 3D PRINTER - Should have reason to use device, not just to use it
- Using 3D PRINTER - Become one unique and irreplaceable way to develop
- No early production without deep consideration
- Not copying from traditional craft

Important factors from combination

- Using 3D PRINTER like craft work
 - Value addition in meaning aspect
-

<ul style="list-style-type: none"> ● Balance between traditional thing and digital thing
<ul style="list-style-type: none"> ● Re-culture (te-invent and re-design based on TC)
<ul style="list-style-type: none"> ● Delivering meaning of traditional craft
Role of designer
<ul style="list-style-type: none"> ● Designer keeps and reminds about their identity as a designer
<ul style="list-style-type: none"> ● Designer - Removing previously known (restrictions)
<ul style="list-style-type: none"> ● Designer - Modeling
<ul style="list-style-type: none"> ● Design - Create better products
Important to work with others (collaborate)
Ways to Evaluate
<ul style="list-style-type: none"> ● Positive evaluation: understand and develop conversation
<ul style="list-style-type: none"> ● Positive reaction by people and member
<ul style="list-style-type: none"> ● Negative evaluation from people
Possibility for social innovation
<ul style="list-style-type: none"> ● The way to advance isolated traditional craft
<ul style="list-style-type: none"> ● Can generate better society
What are you doing now?
ETC
<ul style="list-style-type: none"> ● Characteristics of modern mass production
<ul style="list-style-type: none"> ● Tired of 3D printing
<ul style="list-style-type: none"> ● Other craft or thing can be combined
<ul style="list-style-type: none"> ● People have maker's DNA

After this coding frame verification test, we finally came out with the coding frame in Table 3.3.b.

The first line in Table 3.3.b shows the object of the project. What kinds of thing they wanted to achieve from this project. In the second line, information about 3D printer is presented. In the third line are the characteristics of 3D printer. Specifically, there are three things in this category. First, Lot to learn means that users who use 3D printer software have lots to study unlike people prejudice that it's easy. Second, only one tool like tools we have used previously means that 3D printer tools are also same tools previously used: hammer, knife, and others. It's not some kind of magic tool that can make anything just by using it. Lastly, developing prototype means that using 3D printer tools to make prototypes before producing output.

The seventh line shows the advantages of 3D printer. There are three things. First, low pay and accelerated speed. This means that 3D printer helps to produce faster and at a lower cost. Second, Give freedom in form aspects suggests that by using 3D printer tools, users can generate output in any form

they want. Lastly, bespoke in a higher level easily. Some interviewees said that the characteristics of traditional craft are bespoke. So using 3D printer tools can save time to replace previous process in traditional crafts, which takes lots of time. It can help to bespoke in higher level.

In the 11th line, the disadvantages of 3D printer are shown in three parts. First, limited (no physical touching and personal meaning). Because 3D printer output is made by digital tools such as 3D printer and laser cutter, its outcome doesn't have any personal value or any physical touch to produce it. This means that it's limited somewhere. Second, cost problem means it costs more than people's perception. Finally, quality issues mean that quality from digital tools is lower than users' expectation.

The 15th line suggests information about traditional crafts. The 16th line about characteristics of traditional craft suggests the property traditional craft has. There are five things. First, challenge to the past signifies that traditional crafts have developed by comparing them to the past crafts and trying to produce better output. Second, unpredictable means that traditional crafts are produced by humans, so those output can't be uniform like before and differ by artist. Third, different meaning means that the outcome has personal traits as people produce it personally. Fourth, bespoke has already been mentioned and can be produced only for one person like handcrafted shoes. Lastly, story and experience in traditional crafts has been produced for a long time and artists put their own personality on it. It would contain culture of specific period and country.

In the 22th line, a problem in a traditional craft suggests a drawback that traditional craft has. There are three things. First, no challenge to develop signifies that artists in these days do not try to develop from previous things because of the many reason like economic situation and so on. Second, limited production by tools means that traditional crafts usually are made by specific tools, so they have a limitation in form factor. Lastly, 'Conservative' means that artists have possibilities not to like for someone to change their own craft.

In the 26th line, about combining projects contains content about their own project. See the 27th line, need to understand traditional craft"? There are two things in this category. One finding a proper traditional craft to combine means that one should choose what kinds of traditional crafts they want to combine with 3D printer and understand about traditional craft techniques, which means that artists need to understand how they make their crafts.

In the 30th line, the warning for using 3D printer means caution when using 3D printer tools and this contains four small groups. First, an artist should have a reason to use this device, not just merely that users should have reasons to use 3D printer tools. Second, become one unique and irreplaceable way to develop means that using 3D printer tools should be only one way. If there are other ways of making a product, there is no reason to use 3D printer tools. Third, no early production without deep consideration signifies that before using 3D printer, and user should think deeply about what they produce. Is it a better way than previous ways? They have to think these kinds of things before producing. Fourth, not

copying from traditional craft means that producing from a 3D printer tool should not print same thing as before. Users make new things compared to previous things.

In the 35th line, that an important factor came out from combination suggests that the important point is when user should show by combining and generating output. There are three five things. First, using 3D printer like craft work means generating output based on using 3D printer tools like artists use their own tools. Second, value addition in meaning aspects means that output should put value into craft and 3D printer meaning. Third, balance between traditional things and digital things means that outcome should show both attractiveness from traditional and digital things. Re-culture means that outcomes should be redesigned and re-created somewhere. Finally, delivering meaning of traditional craft signifies that outcomes should carry value as traditional crafts have for users.

The 41th line suggests the role of designers during a project. There are four things. First, designers keep and remember their identity as being a designer means that there is a possibility to meet lots of engineers and craftsmen during the project, but the designer should not forget what he or she should do is to design him or herself. Second, removing previously known (restriction) means a designer should forget what they or other stakeholders like craftsmen have done before, in other words without any stereotype. Third, modeling means that a designer can do modeling works that an artist usually does not do. Finally, create better products means designers basically object to developing a new product.

Line 46th shows the important to work with others. That means to generate good output proper collaboration is need. In the 47th line, the way to evaluate suggests how the designer and other participants evaluate their products. So there are three small groups. First, positive evaluation; understand and develop conversation means that output should encourage other people to understand the meaning of your output, and beyond this process, it should generate a conversation about the importance of working and traditional crafts. Second, positive reactions by people and members suggests at least a good response from project stakeholders, artists, engineers, and others. Finally, negative evaluation from people signifies that their experiences resulted in negative feedback from others.

In the 51th line, the possibility for social innovation means that the outcome can be active in social aspects. There are two things. First, the way to advance isolated traditional craft means that those combinations can suggest new ways to progress with traditional crafts. Second, generating a better society means that the outcome can contribute to developing a better society.

In the 54th line, what are you doing now means new jobs or working where they are now. In the 55th line, ETC gather some information not related to research topic. There are four things. First, characteristics of modern mass production means that feature of current mass production. Second, tired of 3D printing means that there is so much mysterious news about 3D printing, so people can be exhausted about it. Third, other craft or thing can be combined suggests that other crafts are good for

3D printer. Lastly, people have the maker’s DNA means that people generally have characteristics for making what they want.

IV Results

After coding the data, we analyzed it in two ways: within-case analysis and Cross case analysis. In the former, we found characteristics of each case. From this, we sought their similarities and differences among the cases for cross-case analysis. These methods are in the paper, “Building Theory from Case Study” (Eisenhardt, 1989)

Table 4.a Classification of Cases

Case	Role in Project
Traditional culture plusing center	Design (operated by government)
Amit Zoran	Design (research)
Kabuku – Rinkak	3D printing platform company (business)
Kabuku – Studio Shikumi	Design (business)
Michael Eden	Ceramic craftsmen (research)
Earl Stewart	Designer (research)

First, we classify cases in this research like Table 5.1.a. In the Traditional culture plusing center, Amit Zoran, Kabuku, Studio Shikumi, and Earl Stewart are classified as designers. This means that they got a role as a designer in their project or mentioned they were doing the ole of design during the interview. Furthermore, Traditional culture plusing center is categorized as designer, work by government, Amit Zoran and Earl Stewart are designers for research and Kabuku, and Studio Shikumi are better suited for commercial. Kabuku – Rinkak are a 3D platform company for commercial business. In this discussion, we plan to analyze cases and cross cases.

4.1 3D printer

4.1.A Characteristics of 3D printer

Table 4.1.a Characteristics of 3D printer

Characteristics of 3D PRINTER	Related interviewees (number of related statement)
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● 3D PRINTER - Lot to learn	Michael Eden (4)
● 3D PRINTER - Only one tool like tools we have used previously	Michael Eden (7), Rinkak (1)
● 3D PRINTER - Developing prototype	Traditional culture plusing center (4)

Table 4.1.a shows the characteristics of 3D printer. In the second line in Table 4.1.a, it is suggested by Michael Eden that we should learn lots of things for using 3D printer. Unlikely people normally consider the 3D printer tool as easy to use, but it’s very noisy. In the third line. Rinkak and Michael Eden mention the concept of their 3D printer tool, which is the only tool similar to the tools we use today, Mostly Michael Eden mentioned it lots of time. Michael Eden mentioned that what he learned during the project was that digital tools do not replace anything we use. It is just a new tool, not a fully developed. Rinkak also stated that like artists in the ancient times developed products with their own tools, digital tools are only one tool we have now. The fourth line is a proposal by the Traditional culture plusing center. It suggests that they were using 3D printer tools, especially 3D printers, to develop prototypes for the artists in the center. It’s not like the other cases that use digital tools for prototypes and for developing final products for research or selling. Figure 4.1.a shows an example of mold they produced for the artist. In here, we can find that ceramic artist has concept about 3D printer tool as hard to learn and only one tool like before, and Designers working in the government organization uses digital tool for developing prototypes.



Figure 4.1.a Korean word prototypes from creative design (“[3D printer] Chocolate Mold Printing,” 2015)

4.1.B Advance of 3D printer

Table 4.1.b Advance 3D printer

Advance of 3D printer	Related interviewees (number of related statement)
● Advan 3D PRINTER - Low pay and accelerate speed	Rinkak (3), Michael Eden (2), Earl Stewart (2), Traditional culture plusing center (1)

● Advan 3D PRINTER - Give freedom in form aspects	Earl Stewart (10), Michael Eden (2), Amit Zoran (1), Studio Shikumi (1)
● Advan 3D PRINTER - Bespoke in higher level easily	Earl Stewart (5)
● Advan 3D PRINTER – Easy to start to produce	Rinkak (2), Studio Shikumi (1)

Table 4.1.b suggests the advantages of 3D printer. In the second line, it says the advantages are low pay and fast speed in producing according to four cases. It is mentioned by every interviewees. In the Traditional culture plusing center, they mentioned that a digital tool (3D printer) is the proper tool now in the Korea with a low price and fast output. Especially nowadays Korea, small business operated by one person are popular. Those kinds of advantages are important. Rinkak mentioned that it can make a product cheap . These kinds of things would be really helpful to overcome initial payments. As for Earl Stewart, he mentioned that time equals money. So fast production is big advantage in this case. In the third line, there is an advantage in generative form without any restriction mentioned by Amit Zoran, Studio Shikumi, Michael Eden, and Earl Stewart. Especially Earl Stewart mentioned about it many times. Figure 4.1.b shows the shoes produced by Earl Stewart. He suggested that those kinds of design can't be produced by previous tools. 3D printers let him design everything he wants, so he can design anything he wants without restrictions.

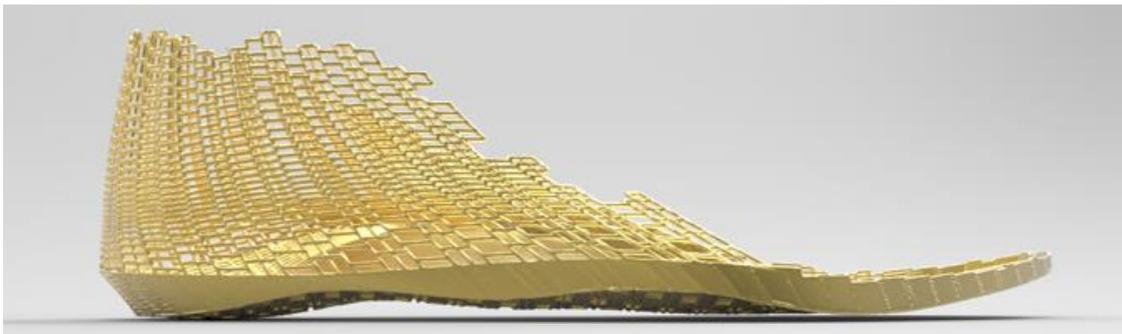


Figure 4.1.b Shoes from Earl Stewart (Stewart, 2013b)

In fourth line, Earl Stewart mentioned that one of characteristic in traditional crafts is “Bespoke.” It means that a traditional craft is made by hand over very long time, at most six month or even a year. If 3D printer comes into this process, it can help to minimize those kinds of processes that take too much time if making by hands. It generally takes more effort on other process and develops a higher bespoke product. In the fifth line, the Kabuku project (Rinkak and Studio Shikumi) mentioned that 3D printer can help to start producing easily. In the traditional craft market, demand is hard to examine correctly compared to products like cell phones. Digital tools can make one product and stop, which is why it can help to operate traditional craft businesses. In here, we can notice that most interviewees felt digital tools have advantage in time & cost. In business cases, they suggest it has advantage in producing aspects.

4.1.C Disadvantages of 3D printer

Table 4.1.c Disadvantages of 3D printer

Disadvan 3D PRINTER	Related interviewees (number of related statement)
● Disadvan 3D PRINTER - Limited (No physical touch and personal meaning)	Amit Zoran (3)
● Disadvan 3D PRINTER - Cost Problem	Traditional culture plusing center (6)
● Disadvan 3D PRINTER - Quality Issue	Traditional culture plusing center (2), Studio Shikumi (1)

Table 4.1.c shows the disadvantages of 3D printer.

In the second line in Table 4.1.c, Amit Zoran suggests that 3D PRINTER is limited in physical touch aspects and maker’s meaning. He mentioned that a craft usually has many different ways, but computer work is limited. Everything is decided in front of a computer screen. It doesn’t have any philosophical value and cannot reflect any personality. So he called it limited. In Figure 4.1.b, he suggested one of his project. He said that everything was decided in front of a computer and made with only a 3D printer. So it doesn’t have any personal value.



Figure 4.1.c 3D printed basketry by Amit Zoran (Zoran, 2013)

Traditional culture plusing center spoke of the opinion from an artist who used a 3D printer in their center. That price is more expansive than they expected, and the quality is lower than they expected. This is not good for developing some product for assembling (Third and Fourth lines in Table 4.1.c).

4.2. Traditional Crafts

4.2.A Characteristics of Traditional Crafts

Table 4.2.a Characteristics of traditional craft

Characteristics of TC	Related interviewees (number of related statement)
● TC - Challenge to the past	Studio Shikumi (2), Michael Eden (1)

● TC - Unpredictable	Amit Zoran (6)
● TC - Different meaning	Amit Zoran (3)
● TC - Bespoke	Earl Stewart (4)
● TC - Story and Experience	Michael Eden (4), Amit Zoran (3), Earl Stewart (2)

Table 4.2.a shows characteristics of traditional crafts. In the second line, Studio Shikumi and Michael Eden suggest that traditional crafts are a process to challenge the past. This means that traditional crafts have developed by challenging older craftsmen’s techniques and has tried to do better than that.

In the third line, Amit Zoran suggests aspects of traditional craft as being unpredictable. Compared to computer work, traditional crafts are made by hand or a traditional fire pot. Even professional craftsmen can’t predict the outcome.



Figure 4.2.a Traditional craft produced from a fire pot (Matsuzaki, 2015)

Figure 4.2.a is an example of the unpredictable suggested by Amit Zoran. This craft was made by melting glaze in the fire pot. Even these crafts are coming out of the same pot by the same craftsmen, and yet the results are different from time to time. This shows the unpredictable characteristics of traditional crafts. He also mentioned that traditional crafts have different meanings judging by crafts in the fourth line. Because an artist produced it by hand, every artist reflects themselves. He gave examples about smartphones. Smartphones have same feature when we buy it, but it’s changed by people to use it as they want. It is the process of personalization.

Earl Stewart, in the fifth line, said that traditional crafts are bespoke. It takes lots of time for making one craft. He gave an example of his hand-crafted shoes. Before mass production, all shoes were bespoke. It took lots of time and effort at most six months. Traditional crafts have a story and the experience of craftsmen as shown in the sixth line. It’s mentioned by Amit Zoran, Michael Eden, and Earl Stewart, who said that he loved the idea of craftsmen. It has a history of hundreds of years. Michael Eden said that traditional crafts have a story about why it was made, who made that for whom, and its

meaning.

4.2.B Problems in Traditional Crafts

Table 4.2.b Problems in traditional craft

Problems in TC	Related interviewees (number of related statement)
● Problem in TC - No challenge to develop	Studio Shikumi (1), Earl Stewart (1)
● Problem in TC - Limited production by tools	Earl Stewart (4)
● Problem in TC - Conservative	Earl Stewart (2), Rinkak (2), Michael Eden (1)

In Table 4.2.b, we see the problems of traditional crafts.

The second line shows that traditional craft isn't a challenge to develop. This is suggested by Studio Shikumi and Earl Stewart. What they said is that craftsmen usually forget there is a better way to new thinking and processes. Earl Stewart suggested that traditional crafts are limited by tools (third line). This means that traditional craftsmen usually focus on the tools they have used before. So the shape of traditional craft is restricted by tools they use. Also in the fourth line, craftsmen become conservative about changes. This is suggested by Rinkak, Michael Eden, and Earl Stewart. They said that craftsmen can be conservative for changes like combining projects and did not want to participate deeply in a project. This slows progress in a project.

4.3 Combination Project

4.3.A Need to Understand Traditional Crafts

Table 4.3.a Need to understand traditional craft

Need to understand traditional crafts	Related interviewees (number of related statement)
● Finding proper TC for combining	Rinkak (3), Earl Stewart (1)
● Understand about TC technique	Michael Eden (4), Studio Shikumi (2)

Table 4.3.a shows a need to understand traditional crafts for projects.

The second line in Table 4.3.a suggests finding proper traditional craft for combining. This was said by Rinkak and Earl Stewart. In Rinkak's case, this is the reason why they chose the Japanese sword (*katana*). It's already famous among worldwide citizens, so it's good to communicate. The third line, Studio Shikumi and Michael Eden said that project participants needed to understand about traditional craft. Shikumi mentioned that project members should know about technology in traditional craft and share it to everyone understand. In Michael Eden case, he usually got ideas by seeing objects at the

museum and then start to design craft.

4.3.B Warning about Using 3D printer

Table. 4.3.b Warning for using 3D printer

Warning about using 3D printer	Related interviewees (number of related statement)
● Using 3D PRINTER - should have reason to use device, not just use it	Michael Eden (2)
● Using 3D PRINTER - become one unique and irreplaceable way to develop	Earl Stewart (9), Rinkak (1), Michael Eden (1)
● No early production without deep consideration	Studio Shikumi (2)
● Not copying from traditional crafts	Rinkak (5), Earl Stewart (2), Amit Zoran (1)

The second line in Table 4.3.b mentioned that there should a reason to use digital tools, not just using it for its own sake. This was suggested by Michael Eden. He said that this thinking was critical about the tools, and it means that we don't use it because we have it. He also mentioned that using technology is like challenging new technologies. Still, we should have reason to use it. Based on this, Earl Stewart suggested that using these tools should be an irreplaceable way to develop in the third line. Rinkak suggested the example in Figure 4.3.a. There, they developed a transparent case with a white vertical line. It shows a new aspect of the material, which is only possible by using 3D printing.



Figure 4.3.a Transparent case in Sumisaya project (“sumisaya,” 2014)

Michael Eden also suggested that if production is possible using hands, then it's better to develop a product by using hands and not digital tools. In the fourth line, the need for deep consideration before producing with digital tools is noted. Studio Shikumi mentioned that jumping into the answer directly is not meaningful or sustainable. Amit Zoran, Rinkak, and Earl Stewart in the fifth line suggested that output should not copy from previous craft. Rinkak said when they operated their project, there was the opinion to copy previous crafts, but they didn't do that because they considered that replacing materials

and technology wouldn't create any value.

4.3.C Important Factors in Combination

Table. 4.3.c Important factors in Combination

Important factors in combination	Related interviewees (number of related statement)
● Using 3D PRINTER like craft work	Amit Zoran (4), Michael Eden (1)
● Value addition in meaning aspect	Earl Stewart (5), Michael Eden (2), Rinkak (1),
● Balance between traditional and digital	Amit Zoran (7), Michael Eden (4), Earl Stewart (3), Rinkak (1)
● Re-culture (re-invent and re-design based on TC)	Studio Shikumi (3)
● Delivering meaning of traditional crafts	Rinkak (2), Studio shikumi (2), Earl Stewart (1)

In Table 4.3.c, an important factor is suggested in combination with traditional craft for 3D printer. Amit Zoran and Michael Eden said that they want to use 3D printer tools like traditional craft techniques in the second line (Table 4.3.c; Figure 4.3.b). He explained his project, Free D. For this project, he developed small Computer Numerical Control (CNC) machine that can held in hand. By using this free D, people can put digital tool in their hands and maintain personal characteristics.



Figure 4.3.b Free D (Zoran, Shilkrot, Nanyakkara, & Paradiso, 2014)

In the third line, Table 4.3.c suggests it needs to add value in meaningful aspects by according to Michael Eden and Earl Stewart. Putting a value on the combination is an important factor to evaluate. If a combination doesn't have any value, then it's meaningless to do it.

In the fourth line, Amit Zoran, Rinkak, Michael Eden, and Earl Stewart state that importance of a balance between 3D printer and traditional craft. It means output should have both characteristics. Amit Zoran mentioned that balance between unpredictable from a craft's perspective and "predictable" in a digital perspective. Figure 4.3.c shows one of Amit Zoran's projects. Here, he used 3D printing based

on existing craft. It show the balance between a previous craft and contemporary 3D print outputs.



Figure 4.3.c Amit Zoran Vase Project (Zoran & Buechley, 2013)

Another example is in Figure 4.3.d. It's also produced by Amit Zoran. But here, he worked with the African craftsmen. So the pendent was produced with 3D printing and the circular ornament on a string was made by the African craftsmen. It shows what the Amit Zoran meant about balance.



Figure 4.3.d Necklace by Amit Zoran and African Craftsmen (Jacobs & Zoran, 2015)

Figure 4.3.e is an example mentioned by Michael Eden. Here, he used past manufacturing techniques (called lost wax casting) and current 3D printer (3D printer). Michael Eden said what he was doing was jumping 4,000 years bring this two worlds together.



Figure 4.3.e A tiny Wedgwoodn't Tureen, Michael Eden (Eden, 2014a)

Studio Shikumi mentioned in fifth line that he was focusing on re-culture. That means he tried to re-discover and re-invent using traditional crafts and 3D printer. It's more than changing a design. From this combination, output should deliver the meaning of traditional crafts (sixth line, Table 4.3.c). This was suggested by Rinkak, Studio Shikumi, and Earl Stewart. Studio Shikumi suggests that what he wants is to show authentic value. That authentic value comes from the dignity of materials and technology, and it's a thing from almost 2,000 years ago. Earl Stewart said that he is a designer and we are communicators. So he should send his message to other people.

4.3.D Role of Designer

Table. 4.3.d Role of Designer

Role of Designer	Related interviewees (number of related statement)
<ul style="list-style-type: none"> ● Designer keeps his/her role and reminds others of their identity as designers 	Earl Stewart (3)
<ul style="list-style-type: none"> ● Designer - Removing previously known restrictions 	Earl Stewart (3)
<ul style="list-style-type: none"> ● Designer - Modeling 	Creative design (2)
<ul style="list-style-type: none"> ● Design -> Create better products 	Earl Stewart (4), Amit Zoran (1), Studio Shikumi (1)

Table 4.3.d shows the role of a designer during a project.

In the second line in Table 4.3.d, Earl Stewart mentions that designers should keep their own identity as designers. This means designers should be separated from craftsmen and the limitations in crafting. He also mentioned about forgetting previous restrictions (third line). That restriction is what he said is baggage from a previous situation. So the designer tries to leave baggage and develop a better life. Earl Stewart mentioned that the designer should have developed a better product in the fifth line. Earl Stewart said that the design should create a better product in very basic level. In this situation, the designer changed a thought into something tangible. He also mentions those kinds of roles as interpret. Amit

Zoran mentioned that when he did a project, he had a design process. That process kept changing until it started to feel stable and looked happy. Lastly, in the Traditional culture plusing center, the designer works by helping to develop modeling with craftsmen’s work. So he said if a craftsman has a drawing and exact numerical values, she can help to make a model.

4.3.E Important to Work with Others (Collaboration)

Table. 4.3.e Important to Work with Others (Collaborate)

Important to work with others (collaboration)	Related interviewees (number of related statement)
<ul style="list-style-type: none"> ● Important to work with others (collaboration) 	Amit Zoran (5), Rinkak (5), Studio Shikumi (1) , Earl Stewart (1)

Table 4.3.E suggests the importance of collaboration. Amit Zoran said that his research project is a Hybrid. With a Hybrid, it’s important to work with others like engineers and African craftsmen. Rinkak mentioned that it’s important to find proper technology to combine. But before that, it’s more important to find who is collaborating with whom. He said that the reason they cooperated with Studio Shikumi, was that they have lots of experience working with craftsmen.

4.3.F. Ways to Evaluate

Table. 4.3.f Ways to Evaluate

Ways to Evaluate	Related interviewees (number of related statement)
<ul style="list-style-type: none"> ● Positive reaction by people and members 	Studio Shikumi (3), Michael Eden (3), Amit Zoran (2), Earl Stewart (1)
<ul style="list-style-type: none"> ● Positive evaluation: understand and develop conversations 	Michael Eden (8), Earl Stewart (1)
<ul style="list-style-type: none"> ● Negative evaluation from people 	Amit Zoran (1), Michael Eden (1)

Table 4.3.F suggests the ways to evaluate combined output. In the second line of Table 4.3.f, the importance of positive reactions by people and members are noted. Amit Zoran mentioned that the interviewer who came to meet him was happy as a result of his result. So other people was excited and glad about his project. He felt excited about that. Studio Shikumi said that at least project members and craftsmen agree. This is an important point of evaluation.

In the third line, Michael Eden and Earl Stewart mentioned that it’s important to make people converse to gain understanding. Michael Eden especially said what he tried to do was deliver his thinking to others, and make others be engaged in his project and make conversation. But, on the other hand, a

negative evaluation in the fourth line is that outputs don't get good evaluations and other can't understand it. Amit Zoran mentioned that he got a bad feeling when he developed a 3D printed guitar. In that project, people in the music field understood it and were interested, but people in his research area couldn't understand it.

4.3.G Possibility for Social Innovations

Table. 4.3.g Possibilities for social innovation

Possibility for social innovations	Related interviewees (number of related statement)
● The way to enhance isolated traditional craft	Amit Zoran (5), Earl Stewart (4), Creative Design (2)
● Can generate a better society	Studio Shikumi (2), Earl Stewart (2)

In Table 4.3.g is about possibility for social innovation from this project.

In the second line in Table 4.3.g, someone can develop traditional crafts yet get no attention by others. This is suggested by the Traditional culture plusing center, Amit Zoran, Earl Stewart. The Traditional culture plusing center case said that their plan was basically to develop new kinds of traditional crafts. Because in Korea, other cultural businesses like movie and music are popular, but traditional craft fields fail to find success in the market. So they consider using a 3D printer. It can help to develop new products for traditional crafts, and it also helps to activate a craft business. Earl Stewart mentioned that we love experienced craftsmen and he consider these kinds of projects will help to keep those experienced workers busy. He also mentioned that if a combination project does not happen, the traditional craft becomes like islands of isolation.

In the third line, projects can generate a better society. Earl Stewart mentioned that we should develop not only products but also a better society and culture. Studio Shikumi said that through 3D printer, we can enhance meaning of the culture.

V Discussion

In this section, we plan to answer our two research questions:

1. What is the need to combine 3D printer with traditional crafts?
2. What is the role of design in a combination project?

5.1 Why Is a Combination Project Needed?

5.1.A Advantages of 3D printer

Through this case study, we found that traditional crafts have limitations in the form of its tools and the craftsmen themselves are conservative about changes and do not evolve for a long time. These kinds of problems in traditional crafts usually come out of designer's cases. In contrast, 3D printer is predictable as it produces with computers and can produce faster and doesn't have limitations on form. From this, we know traditional crafts can solve limitation problem by using 3D printer tools. It also can make various designs in a short amount of time, so it can help to make prototypes. These kinds of advantages can work as positives for communicating with craftsmen on a project. In the Traditional culture plusing center case, they are already using 3D printers and making prototypes, and craftsmen him or herself can use it for checking before mass production. Also we can develop bespoke products. These products already exist in the traditional craft field, but by adapting digital tools we can develop faster than before. So it can help to develop bespoke products with faster speed.

For the commercial case, Rinkak and Studio Shikumi told about advantages in production wise. They are making products for sales using 3D printers. Especially in the traditional craft market, demand is hard to examine compared to other business like phones or home appliances. It makes them not to be suitable in mass production market in these days. But using a 3D printer, we can control the quantity as needed, even for only one product. Based on that, digital tools can help to overcome limitations that ordinary traditional craft business has. From this, we can know that using a 3D printer can affect positively not only designing and making in form factor, but also producing and selling.

5.1.B What Should Care about Using 3D printer?

Even though 3D printer has advantages from many perspectives, there are still points to watch out for. Michael Eden is a ceramic artist, and he said that it is not easy at all to use in 3D printer, not as easy as people normally consider. He even used a term 'Noisy' when he mentioned 3D printer. Michael Eden is basically a ceramic artist. Compared to the other cases, there is a possibility that he was not accustomed to using 3D printer software and tools. In Michael Eden's interview, he also mentioned his experience with teaching students. Students usually didn't like to learn about 3D printer. From these objects, we can assume that traditional craftsmen participated or conducted a combination project. There is a need to provide proper education or understanding about how to use it and why it is needed.

In the case of Michael Eden, he is a craftsmen, and he mentioned that there should be a reason to use 3D printer tools and using digital tools should become only one irreplaceable way to develop. He is a craftsman always working by hand. From his perspective, there is no reason to use 3D printer tools if he didn't have any further value over previous tools. Relatedly, he emphasized his perspective when

using new tools. Also from the Rinkak case, they mentioned the same opinion that using 3D printer was only one way. It seemed that they were charging for role of producing a Kabuku project. They wanted to show characteristics of 3D printer through developing output. In the case of Michael Eden (craftsmen) and Rinkak (3D Platform), they mentioned their perspectives of the 3D printer tool. They said that 3D printer is only one tool, not different from past tools which craftsmen uses. We can know that even 3D printer has many advantage, it is still same tool like before. It puts more importance in how to use it. In the cases of Amit Zoran, Earl Stewart, and Rinkak, they suggested not to copy from previous crafts. And Studio Shikumi said do not produce with 3D printing too early without deep thinking. For these reasons, we know that the 3D printer tool is the same as a tool we have used before. So before choosing to use 3D printer, we should consider why we should use it. If there are other ways to make, then choosing the digital tool may not be the best option. There are already many production technologies, and hands-on and mass production items as well. So using 3D printer should have its own field where it is possible to emphasize their own characteristics and advantages. For this reason, if we choose to use digital tools, then we should not copy and develop ordinary products. We ought to think deeply about what things we will produce, which seemed impossible before but now is possible by using digital tools.

5.1.C Contributions to Traditional Crafts by Combining

These combination projects should add in value in the final analysis. The value did not exist before. So it can help us to find new possibilities for traditional crafts. These projects can deliver the meaning of traditional crafts to the people. Also, they can help to protect craftsmen, which are being dismissed these days by using digital images. As mentioned, traditional crafts are now not a concern in many countries. We can notice that these combination projects have possibilities in social aspects. These possibilities make people see the attraction of traditional crafts and they can help to revitalize traditional craft markets. Actually, we have heard that many of their projects usually received good feedback. This makes people happy and can generate positive discussions about projects. It can also arouse public opinion not just about traditional crafts but also about 3D printer tools.

5.2 Role of Designer in a Project

5.2.A Role of designer following process

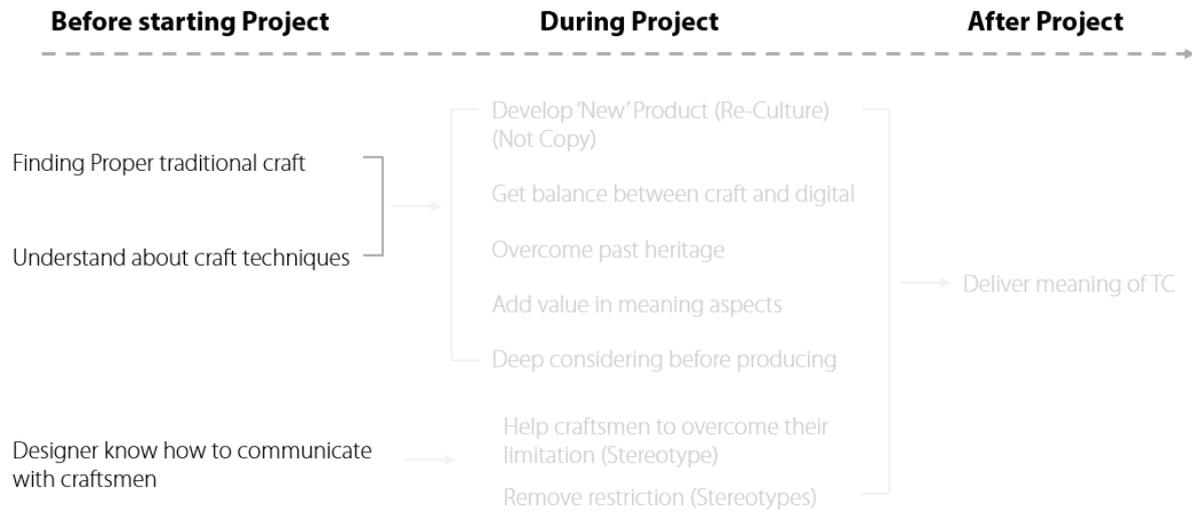


Figure 5.2.a. Before starting project

In figure 5.2.a. suggests role of designer before starting project, it's necessary to find proper traditional crafts for combining and understanding craft techniques. This is because the designers are basically not professionals in the traditional crafts. If they don't have a deep understanding about traditional crafts, they have the possibility to design better output. In the case of Rinkak, he mentioned the importance of collaboration. They said the reason why they chose Studio Shikumi to cooperate is that they already had experience doing projects about traditional crafts and knew how to communicate with craftsmen. In other words, the designer also needs to know how to communicate with the traditional craftsmen as they are one of the stakeholders. Michael Eden said that there is a need to understand about traditional crafts, but he suggested specific ways to do it. He got ideas by visiting a museum and seeing traditional crafts for himself.

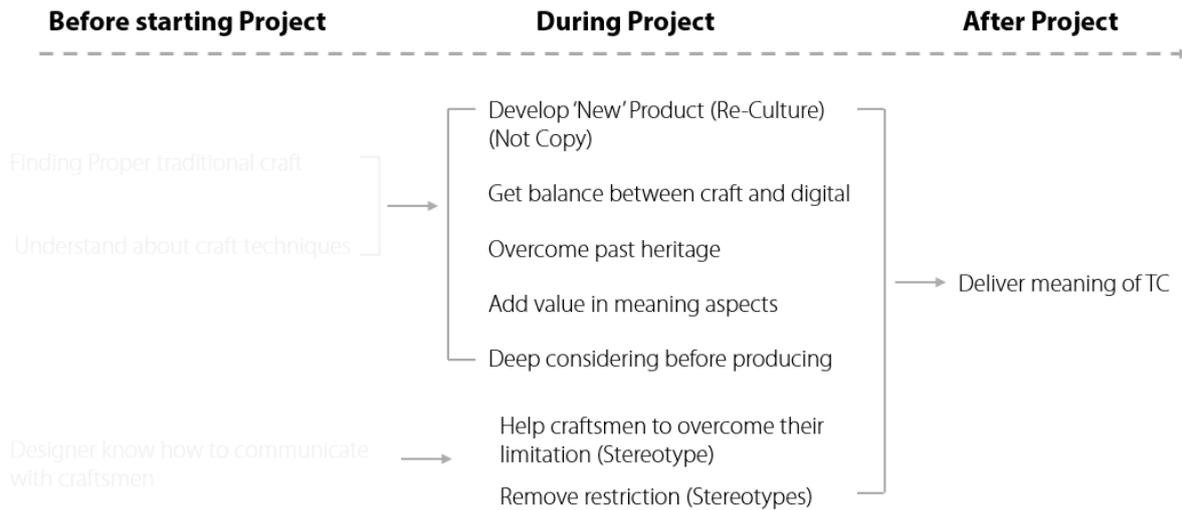


Figure 5.2.b. During & After project

In figure 5.2.b suggest role of designer during & after project. The basic role as a designer is to develop better products. There is specific term for developing better products. Studio Shikumi mentioned that it's re-culture. This means that as a designer, they develop new kinds of designs, not just replicating or copying materials. For this kind of re-culture by Studio Shikumi, it's necessary to get a balance between 3D printer and traditional crafts by Amit Zoran. In this paper, we found characteristics of traditional crafts; unpredictable in the output, having personal meaning, and bespoke. In other cases, 3D printer has the characteristics of predictable output, no limitation in form, and so on. It is necessary to balance those two thing and show attentions from both sides. While doing these things, designers should overcome the limitations they have known. Limitation means production way of traditional crafts or projects they have previously done. Also designers should keep their position as the designer during a project because traditional craftsmen usually have their own way and it can be limited in some cases. So designers keep themselves in place as mentioned, and they basically play a role in developing a better product. Also product they are developed only possible by using 3D printer mentioned by Earl Stewart. Uninterested and conservative craftsmen may adversely affect the project, so it is important to make them to keep a good attitude. Designers also help to do what the artist cannot do. In the interview, Michael Eden mentioned the difficulty in learning 3D printer software. In this case, a designer can help to design using modeling to improve their skills. This can help craftsmen use the 3D printer tools. Before producing output with 3D printer tools, there is a need to consider if the result is well developed. This means that they should be sure that the result don't have any better way to be developed further. From this we can know that basic role of a designer is developing a better product. During this process, the outcome should be a balance between 3D printers with traditional crafts. Also, they can provide help to develop modelling works for craftsmen.

Based on this, we can find that upper part of chart showing that role of designer as inventor which

develop new & meaningful product based on traditional craft. And in lower part, we can find the role of designer as communicator who communicate with craftsmen and also to ordinal people to deliver meaningful message what traditional craft has.

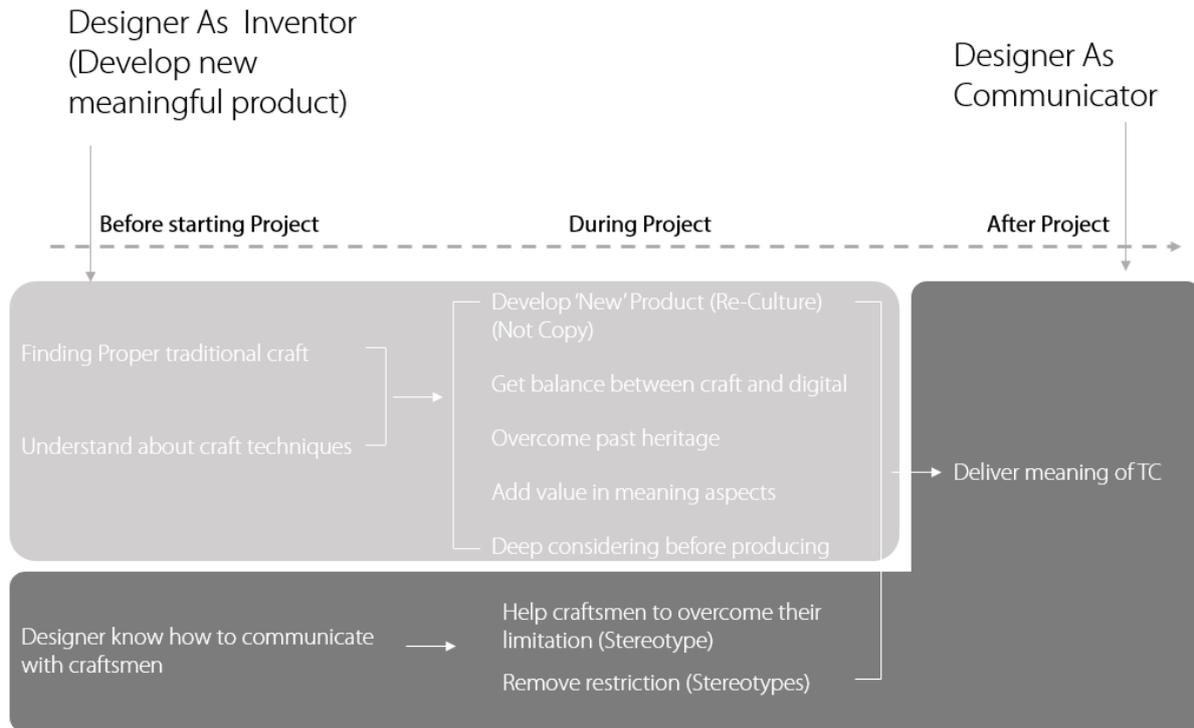


Figure 5.2.c. Designer as inventor & communicator

5.2.B Difference between Designer Participation or Not

Michael Eden said craftsmen didn't consider that traditional crafts have a problem. He considered that what he is doing, using digital tools, is just one option and not a newly developed way compared to the traditional way. In other words, the designer group considered that there are problems in the traditional crafts. Because Michael Eden was originally a craftsman, it seems natural that he didn't have any negative ideas about traditional crafts. But designers are working to design many other things, and they can have negative opinions about traditional crafts. In the project, difference about project is shown that designer group got concept from traditional craft like Amit Zoran tried to figure out unpredictability in craft by using digital tools and Earl Stewart figure out bespoke from craft with digital tools. Ceramic artist used 3D printer tool just as one option, just different from previous one not developed.

About the perspective of 3D printer tools, the cases give almost the same opinion about designers' participation or not. They agreed on the same things being used in 3D printer was only one irreplaceable way to develop and its advantages were fast product speed and freedom in form aspects. So there is no difference between groups in the characteristics of 3D printer. Also like a designer, Michael Eden started a project with the understanding of a traditional craft. Combined, these groups together emphasized the importance of value addition and balance between two things.

So from this, we can find the even craftsmen like Michael Eden have a similar attitude and behavior during a project, except he concepts about traditional crafts. It seems that the cases have a similar attitude about a project in developing new output by combining 3D printer with traditional crafts. Michael Eden ran his projects by himself. He also got a position similar to designer in other cases.

5.2.C Difference by Object of Project

In this case study, there are two commercial purposes (Kabuku – Rinkak, Studio Shikumi), two research purposes (Amit Zoran, Michael Eden), and one operated by government (Traditional culture plusing center).

In the Traditional culture plusing center, designer participates to help modeling files based on blueprints and numerical values that craftsmen provide. But the Traditional culture plusing center case as operated by government has limitations in role of a designer only interested in developing modeling and producing from it. It's been shown that because it's operated by the government, they are hard to provide profitable services, purchase any further equipment or hiring new person. But they are connecting directly to the craftsmen. They have opinions coming from craftsmen. They suggested that craftsmen felt cost and quality aspects problems. Especially, the cost issue is coming out only from this case. These come out because craftsmen paid for printing. It is suggested that we try to make craftsmen participate in the projects. There are possibilities for them to feel that cost is more than they expected. About quality issue, it is issue that other cases do not deal with that much. It's related to the difference of 3D printer they use and their method for finishing output. In the case of Rinkak in Kabuku, Rinkak takes the role of production and finishing. They suggested that there is no dissatisfaction, even after they sold it to the customer. In the case of research purpose, they emphasized using a 3D printer tool like traditional craft techniques and getting a balance between 3D printer and traditional craft. It's not like a commercial project highlighting re-culture in the output and delivering the meaning of traditional craft. In the case of research purpose, their emphasis point depends on their own research objective. In contrast, in the commercial case, they should sell their product. So they develop new products and deliver their meaning to the people. In case of Amit Zoran, he mentioned that problem in 3D printer is limited when output is only developed by 3D printer, so he suggested that it is needed to use 3D printer like craft does. But in case of Rinkak, Studio Shikumi, Michael Eden and Earl Stewart, they developed only by using 3D printer, but they didn't mention that same problem. From this, we can find that only using 3D printer to product output can be limited as it does not have personal meaning in output. But there are other ways to designer can figure out by using 3D printer like showing only possible by 3D printer doing by Earl Stewart or Re-culture doing by Studio Shikumi.

VI Conclusion

6.1 Meaning of Research and Contribution to the Design Field

From this research, we can find cases that combine 3D printing with traditional craft that have not been widely researched before. We can get data about why project is needed and what kinds of designers can do this combination.

Through this research, a combination project can deliver the meaning of traditional crafts that story & experience or unpredictable to the people, and can generate new way of development for traditional craft. We know that digital tools have many advantage like helping traditional crafts to overcome their weakness. It can provide freer forms and lower costs to produce as compared to before. As a designer, he or she should understand traditional crafts first, and then they can develop totally new designs called 'Re-culture'. That new design can deliver characteristics of both traditional craft (Unpredictable) and 3D printing (Predictable) based on a proper balance between the two. Also, we can find what kinds of precautions while using 3D printer tools and attitudes that designers should take when developing a better product. By this research, we can know that not just advantage of 3D printer has, but also finding some caution using 3D printer which not using it, if it doesn't have any difference previous tools, not copy traditional craft. Those information can help someone who are using 3D printer to combine project. They can use this one by emphasizing advantage of 3D printer has like developing physical thing not possible before. Also it can help to avoid problem in using 3D printer. Also it suggest important factor which previously conducted, so other researcher or entrepreneur can use or refer to develop combination output. Also we find out the role of designer it can help designer which kinds of action they take following phases of project.

6.2 Limitation in Research

In this research, it started to find related cases which designers participated in the combination project. But there were not many research studies about combining traditional craft with 3D printer. For that reason, there were also few cases in which designers worked together. It makes it hard to collect the right cases for research. When getting data, information about artist who participated in the project is not found. They are also important role in the project, but I didn't research about that. Also, we focused on overall role of designer. It makes us not gather data about confliction among stakeholders and difference following specific statue of designer. So some specific points are missing in this research.

6.3 Future Research

Based on this research, we plan to find other cases for the problems mentioned. We expect to gather cases with a designer participating, commercial projects, artist's doing it alone, and individuals or groups that are using 3D printer tool like Fab Lab, Makerspaces, and so on. Also we can find more things about how to develop better combination output and go up to develop new product based on traditional craft in the Korea

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Appendix

Appendix 1. Abbreviation of cases

Case	abbreviation
창작디자인실	창작
Amit Zoran	A
Kabuku – Rinkak	K R
Kabuku - Studio Shikumi	K D
Michael Eden	M
Earl Stewart	E S

Appendix 2. Why Start Project?

Why Start project?	
M	His group of social friends so no different arts and scientist and humanities they didn't see divide line we have the moment. I'm very keen to set in education. we need back together bring this world back together we need to break down barrier arts and science. This the topic i work on
창작	전통 문화 컨텐츠 소재 자원들이 기존들의 전통문화로만 있지 않고 새롭게 3D프린터의 기술이나 현대적 산업화를 통해서 상품개발을 하는 게 1차적인 목표였고, 그 일환으로 창의디자인실을 구비하고 있는 거죠.
창작	행정가 A 일단 설립 취지에 관해서는 안쪽에 실장님이 더 잘 알고 있는데, 문화체육관광부에서 전통문화 융복합 상품 개발 사업이라고 전통문화의 창조적인 발전 방향으로 생긴 거예요.
창작	인터뷰어 설립 자체는 문화센터에서 설립을 하신건가요?

디자이너 예 전주진흥원에서 사업 중에 하나예요 영상 정보센터에서

인터뷰어 센터 자체가 융복합 사업에 맞물려서 시작하시게 된건가?

창작

행정가 A 전통문화의 창조적 발전 전략이라고 그게 한복진흥센터가 있고 갈래가 네 가지 정도가 있는데 그 중에 하나예요.

K R

For my instinct intuitively, I have this idea of one day. This going to be new stage to 3D printing for jumping to product evolvement area.

Why you start to project?

K R

You know kabuki. Kabuki provides 3D printer started from 3D printing I also background is industrial design. 3D printing technology has been risen so much over the past few year.

A

Sometimes, someone need to remind Hey we also do other thing very interesting. So computers are well great.

E S

The main reason why I got into design is certainly things that I just didn't enjoy about the objects I was interacting with.

E S

It's a very traditional process, then what I like about looking at how does that become enhanced through manufacturing, how do you enhance that process more.

E S

I think what I wanted to do is look at how can we get this idea of the individual fit that fits within a future system of mass customization. So you can still provide goods to the masses but make those goods also bespoke to the individual.

E S

We're celebrating the individual, or we can have the potential to celebrate the individual, in a system full of masses.

E S

That's the other thing. We want to be able to give one-to-one fit for a shoe.

E S

I think the main point of the project was celebrating the individual. How do you find the individual in the future of mass production?

Appendix 3. 3D printer

3D PRINTER

Characteristic of 3D

PRINTER

3D PRINTER – Lot to learn	M	It can not just sit down and meaningful object in five minutes. That a lot to learn. and my experience. Having done this quite few years now. It's noisy it's noisy at all. You know to make this tool what i want to do. That's a lot of learn and that's a lot of craft. That's a lot of thinking. That's brought from my previous art making (felp, 펄프)
	M	

	M	I also think there is perception that is easy. This is computer and design something and you just press button. Outcome will be in other hands.
		Challenge to what?
	M	Because that is perception is 3D printing and new technology. I think People in general i think they underestimate what is possible and potential of technology.
	M	Certainly in my own practice i felt very strongly that the tools are used do not replace anything That has gone before. If i make certain saucer, i would not going to print 3D print i go down store into the studio down here and i am going to go under wheel. (4분 쪽)
		Then you just consider that your way is the one way, not developed way?
	M	Yes it's just one way of working. I'm not saying this is proper able this is better. It's more meaningful.
	M	I'm sure I could create the object using opening up down in workshop. I can work with same things not using digital technology and the outcome would be different.
	M	There are plenty of people who are using traditional way of making beautiful very provoking work. I choose to work in this way.
3D PRINTER - only one tool like tools we have used previously	M	Important for me is making objects are meaningful and don't necessarily be tagged 3D printing, so i tried to move beyond that's my aim is
		What you mean beyond?
	M	I think what i want to show them is that what we are doing now using new tools. It's actually part of evolutionary process since the beginning of human kind we have main tools we have used tool all the way through Europe set in world i set in here could not have created without tools and right now
	M	Nothing has changed we are still human being we still have same DNA, genetic make-up we still have biology creature with same pattern. What we are doing now is part of evolutionary process to me nothing is changed. But the thinking in used tools has particularly changed, so um That's how i felt anyway.
		Q. How 3D printer can help those kinds of re culture?
	K R	3D printer only one of the tool, if you look back the history of evolution. For example, In the past, <i>craftsmen only behold like for example one story house, one story temple, but for the thanks to those innovation started to sword, at one time craft could behold 3 story temples</i>
	창작	디자이너 그건 아까 말씀 드린 의료보조기구 사업자께서 계신데 금형

		대신에 하신 거 같아요.
		인터뷰어 주로 뽑으시는 제품들은 어떤 제품들이?
	창작	디자이너 주로 공예품 위주로, 홈페이지에 보셨나요? 거기에 나온 것 처럼 한글 몰드틀 같은 거 상태나 모양을 보고, 금형 제작 전에, 칫솔 같은 거 작업하고 있는데, 금형 제작전에 해보고 파이프나 의료보조 기구 같은것도 미리 뽑아보고
3D PRINTER - 금형 제작		금형 제작전에 공예품이나 일반 사업 아이템 가구 미니어쳐 같은거
		인터뷰어 활동을 같이 하시는 분들은 밑에 거주하시는 분들이랑 또 있나요?
	창작	디자이너 개인 사업자 분들이 테스트로 뽑아보시는 거죠 미리 제품의 금형 제작 전에
	창작	디자이너 예 처음에 아무래도 시제품 위주로 했구요. 융복합 공모전이라고 해서 현대에.. 융복합 많이 하시잖아요? 그 공모전 당선 되신 분들 위주로 하구요. 전통 문화 현대 기술 결합 이나 나무나 가죽 등에 재료 결합 등도 하는 경우도 있구요.
Advan 3D PRINTER		
	K R	in science point of view, it's definitely productive technology, you can stop one single product what i mean by
Advan of 3D PRINTER -> Easy to start produce	K R	That's one biggest advantage. Of course collaborating with craftsmanship, this kind of -- is very important. You never know. For example, i-phone case or smartphone cases, you can estimate they can sell in this kind of big number, so you can invest initially.
	K D	But in the 3D printing technology, you don't need that. you just simply start up with one simple idea and one simple inspiration
	K R	You can come up one output very short amount time and very less budget. And you can evaluate one idea and concept it is relevant or not.
Advan of 3D PRINTER -> Low pay & accelerate speed	K R	It's really accelerating the speed of production.
	K R	In traditional craft area or category, of course when you say in number they are not too much, so regarding also the selling this big overcoming in initial fee and resource is the big advantage.
	E S	During your project, as you think, what is the kind of advantage of the 3D printer tool? There's a couple of things. I mean production wise, the advantage is always time.

		Production wise, it's always time equals money. If you can have quicker turnarounds and more precise production times, then obviously, that's a big advantage.
		Yeah, I think to innovate ... I think there's a couple of flip sides.
	E S	For rapid prototyping, if we just want to quickly prototype something, then that's fine.
	M	We want to be able to ramp up(늘리다) its effectiveness.
	M	but it's allowed me engaged me idea how we, about our relationship with digital technology.
		인터뷰어 혹시 3D프린터를 선정하신 이유는?
	창작	행정가 B(실장님) 기존은 절삭기나 금형을 이용했잖아요. 그러면 300~500만원씩 드는데. 3D 프린터는 대세도 많이 들어보아야 30~50만원 밖에 안되니까 저렴한 가격으로 내가 원하는걸 만들 수 있다는 장점이 있어서 1인 창조 기업이라는 트렌드에 잘 맞는데 유용한 창작 도구라서
	M	It gives me unlimited freedom creative freedom and so it's purely well now the starting point was that is' unable to make i could not make any other way so That is the starting point,
	M	Very simple reason start to use this technology is able me make that i could not make things i could not make in any of the ways.
		I think you step outside the box.
	E S	You become a little more unrestrained from designing whatever you want. You focus purely on the brief and the soul of the project.
Advan 3D PRINTER - Give Freedom in form aspects	E S	The brief on this project was, "How do I make a shoe that fully resembles me as an individual?" Essentially, that was the only brief I had. I was able to do that because I wasn't worried about how it was going to be made.
	E S	I think the limitations are a great incentive, where you release these limitations on yourself and you just get to focus purely on the brief.
	E S	I think the advantage of digital manufacturing, like using modeling software like Rhino or Grasshopper, trying to look at 3D printing, then you kind of get to unlock some of those conventions that we learned to box ourselves in. I think you step outside the box.
	E S	Yeah. We were trying to get rid of the limitations on what we can make.

		Digital tools generally allow you to make more new forms.
		That's the other thing. We want to be able to give one-to-one fit for a shoe. That's the ultimate, the holy grail is fit for footwear. That's where digital manufacturing comes in,
	E S	Where your precision and your ability to look at data, massive amounts of data, like your reading scans, mold of foot and pressure gauges or how much pressure or weight is applied to that foot.
	E S	What I like about the digital world is that you can have unlimited imagination and with 3D printing, you can kind of bring that imagination to life. Yeah. That is the reason you choose this application tool.
	E S	Maybe the other, maybe a more interesting example, is the idea of you get to unleash yourself from the tools.
	E S	The only restriction I had was I had to model in it 3D and it had to be able to be 3D printed. Those restrictions, compared to traditional production restrictions, are quite freeing.
	E S	I think the main point is we want to flip that thinking where we say technology, hopefully, gets to unleash the craftsman on focusing purely on what they can do.
	A	Computer can do very complicate thing human can't do like paramount design millions of shaper change all the time.
	K D	Another advantage you can create output not regarding to constrain, in case of injection molding you need to consider many consider that comes to the production, production technology and production background. When you come to a 3D printing you don't need to consider, you can get your own expression.
	E S	Advanced precision so you can get one-on-one perfect fit for the foot, and then you can also get that very handmade, handcrafted ... that's what I love.
	E S	We can do that bespoke in a higher level as well. It no longer takes three to six months to make a hand bespoke shoe. We can pretty much make bespoke shoes for your foot in 24 to 48 hours.
Advan 3D PRINTER – Bespoke in higher level	E S	The opposite from mass production, where you make a high volume so you can offset the cost of it, now you can do a high volume and bespoke.
	E S	Now this craftsmanship and this artistry can go towards a thousand pairs of shoes. He focuses solely on the craft and artistry of keeping those shoes to a high standard, and the machines and the advanced technology, they do all the heavy lifting on the boring stuff, like getting the size of the lasp right and maybe 3D printer of the sole.
	E S	You consider the same point between the handcrafted and digital publication tools, some kind of individualism or personalization?
	E S	Yeah. I guess the ultimate angle is that with production, we can always make

		things faster. We can always make things more precise, but what we can also do is make things very bespoke.
Disadvan 3D PRINTER		
3D PRINTER – Limited (No physical touch & personal meaning)	A	<i>You know craft is many many different way. Computer is more limited sometimes.. I don't want to say. I like.</i>
		<i>Here for example, this one is designed computer. There is only label put it in. There is no really philosophical high way.</i>
	A	<i>The problem is here structure is 3D printed. This is only thing wined inside. This is fully defined by computer there is no really.. It's fully decided by computer.</i>
	A	<i>Well Digital technology is not much richness as we sometimes believe. People in the engineer, work in that territory. Sometime we forgot they are quite limited, they are so far this kinds of type of thing we don't do well subjective personal meaning.</i>
Disadvan 3D PRINTER ->Cost Problem	창작	디자이너 정확하게 조사를 안 해봐서..... 전반적으로 만족은 하시는데 비용 같은 게..
	창작	디자이너 근데 이 프린터 자체가 다른 보급형 프린터랑 다르게 비용이 비싸서 수익을 내기가 힘들거든요 재료가 비싸서
	창작	그리고 기기가 하나 밖에 없어서 대량생산은 좀..... 가격 면에서도 안 좋아지고요. 재료 때문에 가격 면이 크고
	창작	디자이너 재료비가 비싸서 판매목적으로는 이윤이 안 남아요.
	창작	디자이너 프린터가 하나밖에 없어서 많은걸 한꺼번에 해야 할 때에는 시간이 촉박하다. 한꺼번에 몰릴 때가 있어서 그 외에는 하나로 충분하긴 한데.
	창작	디자이너 아무래도 기계에 의존을 많이 하다 보니까 기계 값이나 재료비에 따라서 많이 달라질 것 같다. 다른 서울 업체는 10만원 안에 사람 등을 다 뽑아 드리는데 저희는 재료비도 비싸다 보니까 재료비에 구매를 많이 받는 것 같아서..
Disadvan 3D PRINTER -> Quality Issue	창작	디자이너 만족도가 기대하신 것만큼 정밀하진 않아요. 분말 같은 거에 비해서 해상도나 정밀도가 떨어지고, 볼트 너트 같이 정교하게 쓰는 건 FDM 방식은 정밀도가 떨어져요.
	창작	3D 프린터 만족도에 관해서는 비용에 관한 불만이 이거는 디자이너 분 의견이신가요? 디자이너 대부분이다 그렇게 이야기 하세요. 제 개인적인 의견으로는

		비용에 비해서 정말도나 해상도가 못 미치는 게 있지 않는가?
		3D printing and 3D printer point of view, as i said, regarding the quality, quality
	K D	itself is emerging keyword. It will be emerging keyword couple of the year at least.

Appendix 4. Traditional Craft

TC		
Characteristic of TC		
	M	If have something traditional that has evolved over time very long period time
TC - Challenge to the past	K D	Actually as you know his company hold many projects that challenge to tradition, but a never a less tradition by mean has long history to challenge to the past and finding new frontier
	K D	For craftsmanship point of view, traditional craft is all about challenging to the past craftsmen. For the past craftsmen of technique or skill
	A	This is not so much about computer. You look at that you will understand what computer never do. It's almost take two week. They don't know what is going on. You can understand how it's stressful for the master. If you look at the work. He is very very famous artist. You cannot never will be know what will get. You technic work and put in effort for two weeks,
TC - Unpredictable	A	But you don't know what get. This is the beauty, so different what computer work, so..
	A	Right now really a few things, fascinating that put ceramic with wood machine, and get out now you are unpredictable what you will get? This is so different in computer work. You put something in the fire. You will get week later. This is beauty what nature can do that. Computer so far. This process is now fascinated me.
	A	This unpredictability is fascinating
	A	In the past, I did ceramic wood making, guitar making wood making in the Africa. Right now I'm really fascinated unpredictable.
	A	Yes. I saw one movie in the YouTube. It's 15minutes Japanese artist. Doing this type of process. It working after you If one enough failed, putting hundreds artifact in the kill for two weeks. He doesn't know what in the end, that's very stressful.
TC - Different meaning	A	When you look something its beautiful complex many different meaning
	A	Then you are going to different complex so much richness in that
	A	Yes I use lots of 3D printer. I think when you are. You have that (Phone). When it's new, you lose it. You can get new one, have software. It's yours, because data and information but not a artifact. But, now, I have scratches, scar. It's more

		personalized. <i>In traditional craft, this concept is so much bigger, if you carve something. You mark signature of artist.</i>
TC -> Bespoke	E S	I thought, in terms of footwear, I thought footwear was probably one of the best examples of how you can combine a very traditional process as a handcrafted leather shoes which are being made the same way for many, many years.
	E S	Whereas that knowledge and that craft or this craftsmanship, this artistry was going towards one pair of shoes over six months' time,
	E S	Before mass production or the industrial revolution, everything was handmade. Everything was bespoke. If you wanted anything, you'd probably going to go to the factory, where somebody would be sewing it, or hand cutting it.
	E S	Handcrafted shoes have a great history and a great legacy in terms of being very craft very bespoke. When you go seeing these people who are making handcrafted shoes, they carving bits of wood to make the lasps and then they're forming the
	E S	I think, we want the experience and the knowledge of the craftsman
TC - Story & Experience	E S	I think what I like about that idea is the idea of the craft. If you look at these people ... John Lobb is the shoemaker for the king, in London. You go there and it's a very professional process. You've got history of the craft for the last 120 years. They've been making shoes and it's very traditional.
	A	There is good value other type of making it's philosophical value,
	A	it's about culture, sensitivity to detail, not only about technically achievement. Bring some of your passion into something
	A	<i>This is I looking at the something you make. It's way to communicate with you for the object. Like the poetry, some other communicate with music. Chef communicate with cooking. I like this communication with people through material creation It's very important</i>
	M	Why this object is made? who would make it for? What is significant and what is meaning where they symbolic, do they represent an yes so basically why this made, who would made for what they try to say
	M	That story is brought from 21st. So this is i evolve which bases and pieces as served made for French loyal family. That's story i brought since 21 century and it was about financial and cultural value of countries
	M	I am going to print some paint and ceramic. I already This one here (Show example in 3D printed ceramic pot) What i am hoping won't be interesting how it's made. They will be interesting in objects and story the object. That's the adventure way untile then
	M	Yes i have story and i have narrative. The way i develop that is by using this new tools.

Problem in TC	
Problem in TC - No challenge to develop	K D all of those long period of time craftsmen and other culture divorce new challenge those kinds of technology and material.
	E S Sometimes traditional craft is so focused on doing what they've always done that sometimes I forget that there's maybe a better process or a new way of thinking.
Problem in TC - Limited foam by tools	E S Before, when we had maybe more traditional tools, you'd be in the workshop with a lathe and you have the files or you have your sewing machines. You're always restricted by the tools.
	E S Once I stopped that restriction of how do I make this because I'm going to have to use a two part model, with this type of material using these types of machines, You're always restricted to design your patterns in a certain way so they could run it through the sewing machine to get them cut in a certain way.
	E S Traditional manufacturing, you have the limitations of the machines or the tools in order to make something, but
TC - Conservative	E S I think that's important for me, as well, because I don't want to ... sometimes you've got to keep that vision fresh and I thought that if I talk too much to too many shoe designers, they'd give me too much baggage to bring into the project, in terms of too many rules, what they'd already learned about manufacturing and all these rules.
	E S In order to approach those relationships, you have to do it in a way that you can get them on board, because they are using very traditional tools, sometimes they're not too excited about the idea of changing, introducing advanced manufacturing.
	K R I think this is one of important factor, because quite difficult with craftsmen, they are quite conservative and they even they said they like to challenge, they start project
	K R i have previous experience that craft get to conservative over the whole project not achieving anything.
	M and also this tools is not everybody is duty to use them. I teach Rhino and cad software, there are i would over half of student do not like to use cad as design. They said let me open --- and clay. They much happier using hand.

Appendix 5. Combination Project

Combination Project	
Need for understanding traditional craft	
Finding proper	K R Second the technology, which theme of technology you are focusing on is also

TC for combine	important
	<p>But my opinion is going to be stage where technology where key factor.</p> <p>K R Fortunately in japan, there is many traditional post-processing such as de coating finishing polishing.</p>
	<p>of course katana, is already global audience ideal. Which not something that no one doesn't understand at the first place, everybody happy everybody know.</p> <p>K R Katana is what samurai, so that's the same, katana is perfect for communicating with global audience,</p>
	<p>think that will be the first discussion, I think there's many traditional processes out there that will flourish with this idea of merging current technology with this methodology or traditional craft.</p> <p>E S</p>
	<p>Those kinds of technological cultural background anybody to share beforehand otherwise the run out to simply redesign, reshaping,</p> <p>K D</p>
	<p>designer: another factor in the project all member has at least great idea is what the technology is about. In case of this project, how sword is made, how sword is used.</p> <p>K D</p>
	<p>The way i usually go about design some object.</p>
	<p>M sometime it might be in the museum see the object, triggers the idea. it's about reinterpretation of object.</p>
Understand about T.C technique.	<p>It's often around the object i have seen in the museum and connecting that object story and narrative. That's the normal topic. The moment i working on it a group of piece for exhibition later this year. and theme is around industrial revolution around particular group of thinker people like 조지와이드 맥스우드?(세라믹 아티스트)</p> <p>M</p>
	<p>That s a lot of new thinking I have to be combined with the way i used to think.</p> <p>M That's a lot of craft skills i have to learn and i have to also collaborate with view of producing my work.</p>
	<p>and i will make note and write in my sketch and start for gather information start for gather images. and that's the starting point.</p> <p>M</p>
Caution during using	
3D printer	
Using 3D PRINTER - should have	<p>M It's about challenging to new technologies & make them to what we want to do not necessarily what they design to do.</p>
reason to use device, not just use merely	<p>M It's also good to explore but i think be critical valuate, and critical don't just do it because we have this tool you got to use them.</p>

		Any disadvantage?
	M	The object i make i design them they could not be made by hand. In other wise, i just go downstairs and open up back in play. It was a lot easier. It's would be a lot of easier.
	E S	it should be the only way you can make that object.
	E S	If you could make it any other way, then you should make it in another way. It needs to be this process for the project.
	E S	The technology, I thought I pushed them to the limit, where that was the only process where I could make these shoes with the geometry and all the other parts. I couldn't really make those shoes in any other process. I think there was, for me, the compass needed to be those value sensitive methods, methodology from Peter Kahn.
Using 3D PRINTER - become one unique & irreplaceable way to develop (유일무이한 방법)	E S	If we want to 3D print something for the market, I think it should be purposeful as well. I think we are seeing a few examples where there's some 3D printed items on the market that you could probably make in a better way, in some other way.
	E S	I think some of these other examples, where we're looking at 3D printing for very mundane (재미 없는, 일상적인) purposes. I see a couple of examples you see people 3D printing toothbrushes. We can already make those through mass production. They're cheaper, and they're quicker.
	E S	Some of the criteria needs to be, keep asking yourself, "Why am I 3D printing this? Can I make this on the lathe, can I make this in 2 part mold? Does this need to be 3D printed?"
	E S	All those shoes I tried to design, I wanted to make sure that the geometry was so complex that I couldn't make it in a model, couldn't have it lathed. There was only one process that could make that and it was 3D printing.
	E S	How is it becoming an object that can only use that processes.
	E S	Yeah. One of the major things I wanted to do was ... I kept asking myself, "Am I designing something that only the 3D printer can do?"
	K R	For the forming actual product, we are using 3D printer, for the Sumisaya, sword case, we used demol(?) printer. That can print transparent printer, material, but they are only 3D printing.
No early production without deep consideration	K D	Designer: regarding 3D technology, 3D printing. you need to be care of that , we can easily get down and come up with nice neat simple forms, simple design of shape, not jump into the answer directly,
	K D	This is so simple neat form and idea of design. It's very easy to jump into answer. You need to think carefully. the solution is correct or not sustainable meaningful those kinds of evaluation is very important

Not Copying from previous traditional craft	A	Second part of work, more technology, think and making different way. It's not just about I design something and all what to do it. It's I design work together with computer, or..
	K R	it just <i>replacing material or replacing technology</i> . Not pushing the boundaries, not pushing the any value.
	K R	My thought just replicating old style, replicating old form factor won't create at all and not sustainable idea.
	K R	Actually, i look at website trying to decide all kind of interesting project for craftsmanship and 3D technology. i found like later there are just interesting put harmony to show to the beauty how material is. More importantly they are going to forget their root.
	K R	For example, the sumusaya case, in idea development phase, there was many idea come out with, one idea is replicating old, traditional style sword case, and produce 3D printing, but in serious discussion, and looking at other project, those kinds of idea won't create anything.
	K R	My feeling is that only replicating current product design factor from my past experience. It doesn't create well, it doesn't create any value.
	E S	We've seen some vase makers and weavers. I think there's plenty of ways where you can combine it. Even if 3D printing was a scaffolding that may apply there, they craft onto.
E S	I think there's multiple different ways to combine them whether you design one and the other one grows out of it.	
Important factor during combination		
Using 3D PRINTER like Craft	A	<i>I want to 3D printer similar this people craft. So when it's deployed it needs many different place and philosophy It's all good</i>
	A	This is exactly what this question is. Can you put the machine in the hand of someone. Still preserve in control.
	A	Let's say I don't know work with my hand. Computer can help me, but still give me you know presser my signature. I will give it it's mine. You give it it's yours. It will not look at the same.
	A	Q You not just 3D printer, you are focusing computer software thing combining others?
	A	Exactly, and naturally a lot of 3D printer today, but more fundamentally.
A	B & F	
A	I can compare about F comparing the rest of basket the other. Basketry is out of two elements tied together, and a lot of they create structure.	
M	When i make it When i start this in front of computer. is to certain extant exactly	

		same as it was when i was setting a wheel through pots
	E S	Interviewer: Is there some kind of criteria what you should keep in your mind during project, using 3D printer tool to special craftwork? Respondent: I think the main criteria is, "Are you adding value?"
	E S	I think the criteria ... you're right, there should be a very clear value addition.
	E S	What I like about it is looking at the criteria of ... if you want to create something and you want to design something for advanced manufacturing, then how are we adding that value to it?
	E S	I think the main criteria for 3D printing or advanced digital manufacturing, it has to be purposeful and it has to be adding value.
Value addition in meaning aspect	E S	I think it's important that their mentality shifts with it towards the openness and the feasibility of how do you keep the soul of traditional craft, but celebrate it or make it more effective, bring it to a new level.
	M	Any recommendation you want to say if there is someone who want to use 3D printer tools I want to ask why? It might new technology can add something to that. They cannot add to it, then leave it be Let it just leave along.
	M	Because you might actually take something your way. You might actually degrade you might take away some of quality, so it's about propriety this new tools in technology.
	K R	First this is also related to the all kinds of 3D printing, not just tradition. From my previous experience, when you create, when you try to apply 3D printing technology and create some value or create at least some new to global audience.
	A	<i>It's like between balance. Here it's looked like craft ©. Everything is decided in front of screen. Final research is more respectful for both work. Because computer work, shape from computer it is more balanced.</i>
	A	<i>Unpredictable vs predictable So we need maker and research.</i>
Merging with balance between digital things and traditional things	A	<i>Our job is I think Rut our mind put conceptually what type of process predictable and controlled what we can allow unpredictable.</i>
	A	<i>This is deep question. It's big question. If you think about making. Where would you like to put unpredictability and would like predictability.</i>
	A	<i>Here (B), I can make decision this decision stop here, I made new in the process.</i> <i>It good in the craft. Where you changed in your mind. But here I could not because everything was already defined.</i>
	A	<i>But here (F) the computer choose direction and density depend on my craft. It's better integration philosophy. The shape is very computational. Quality of surface is coming from the craft. This is the better.</i>

-
- (사진을 보여주며) ----- and—cooked with fire. This is what people did and
A pendent is 3D printer
 This one is design with cad and rhino.
-
- E S** I think it's all about the relationship, the relationship between these two objects
 and how they life starts together. Whether it starts out as two separates coming
 together, or it starts as one that grows out of the other. I think that's why I'm
 interested in researching.
-
- E S** You take that advanced precision of digital manufacturing and try to combine
 that with artistry of bespoke, handmade footwear, and you try to bring both of
 those elements together to figure out how do you elevate both of these processes
 so that they can actually enhance each other.
-
- E S** I like the idea of merging worlds, these worlds coming together that kind of
 celebrates the individual.
-
- E S** That's what I saw. These two worlds coming together how you can celebrate both
 of them. I like some of the rawness that you can get as well from those
 combinations.
-
- M** Jumping and skipping industrial revolution by jumping 4000 years bring in this
 two world together to do something That was previously not possible So that
 supposed to mean relationship with traditional working and using new
 technology and new tools.
-
- M** It's also way to comparing way to people thinking way to people thought. Way to
 people behave in 18 century. How we related to each other. It's comparing 18
 century people and 21 century people. How we engage in each other.
-
- M** i notice yesterday one of our Olympic champion he beaten the record cycling for
 one hour. Article is about the bike specially 3D printed titanium handle bar on his
 bike. Well they didn't talk about the rest of bike. How it's beautifully, so crafty in
 carbon-fiber you know it was beautiful object with this bike made combination
 with digital & hand skills. They just focused on 3D printing part, so his bike is
 very good example. What i am doing is bringing some body made up bike has
 fantastic craft skill. I understand 3 dimensional form i understand material and
 processes. That is come together with new material new ways of designing and
 produce object that can be lead 54 kilometers over an hour, so that's right that is
 really good example illustrated what I'm tried to say.
-
- M** This ornament is made last year really is experiment. It's printed in nylon, 3D
 printed than it went through the wax costing process the nylon melted out
 replaced by the bronze. there we have 4000 years technique, and what's called
 post-industrial manufacturing coming together create object. It can not created in
 any other way. For me that was perfect example.
-

	K R	My personal point of view is quite similar to Kauchi. To me, collaborating 3D printer with traditional craftsmen, I want to show attractiveness both side. digital and also analog in traditional and that's one i care of when finding a output of the project.
	K D	In this project collaborating with traditional craft and craftsmanship, he mentioned keyword re-culture.
Re-Culture (Re-invent & re-design based on TC)	K D	Those kinds of thing we want to re-invent and re discover, and for kauchi those kind of vision is quietly important when collaborating traditional craft and craftsmanship
	K D	It' only action slightly changing design of form of detail, but what he really want to emphasize is re culture that include not only the product why the sword was made why the sword is used, meaning of holding sword.
	K D	Those kind of authentic value he wants to show the users emotionally dramatically and because those what he said so those kinds of technology has been entered from the content 2000 years ago more than 2000 years ago.
	K D	or value is the dignity of material and technology for Urushi and Katana sword.
	K R	i think, this depend on your goal you are trying to achieve, and for example, for sumisaya. It's important to create good product, also we want to stand out meaningful message for worldwide audience.
Delivering meaning of traditional craft	K R	That's why i came up with completely different kind of sword case. Transparent material as you looking surface you see wife knife, that indicate the katana's essential value of this.. way on a surface during the production. i felt those kinds of natural output of production. i want to play out actual design of sword case.
		Interviewer: Okay, I see. Can you tell me the exact role of designer?
	E S	Respondent: Yeah, I think the designer is a communicator. Most of the roles I've been in it's been meaning to communicate a message.

Appendix 6. Role of Designer

Role of Designer		
Designer keep & remind their identity as designer	E S	For me, there was a clear separation between traditional manufacturing and the baggage. I go about it, my background is product design, so I've got an industrial design background. I think it's quite important to hold onto that identity.
	E S	I think I design shoes but I still see myself as a product designer, I don't see myself as a footwear designer.
	E,S	At what level do you start combining them? Do you make them separately and then combine them or can you design one and make the other on top of it? The combinations going forward ... at what stage do you combine them? Can you mold them together, can you combine them together all the way through?

<p>Designer - Removing previously known (restrictions)</p>	<p>E S E S E S</p>	<p>I didn't want to be gutted by those rules. The only brief I wrote myself was how do I make this shoe express my individuality and how does it fit my specific needs. Essentially, that was my own brief.</p> <hr/> <p>The first things I had to do was forget about restrictions. Some of it is also trying to leave behind the restrictions of what we previously learned.</p> <hr/> <p>I think you can become lazy. There is a tendency to also bring in baggage. You bring in baggage from previous things.</p>
<p>Designer - Modeling</p>	<p>창작</p>	<p>인터뷰어 일반 시민 분들은 전통문화와 관련되지 않은 거라도? 그럼 여기서 모델링도 하고 계신데. 제품 도면이 있으면 모델링도 도와주시는 건가요?</p> <p>디자이너 드로잉하고 정확한 수치만 있으면</p> <p>인터뷰어 회사처럼 모델링하고 이렇게 뽑겠다고 보내드린 다음에 뽑는건가요?</p> <p>디자이너 예</p>
<p>Design -> create better products</p>	<p>창작</p>	<p>인터뷰어 그럼 모델링을 해준다고 하면 비용이 어느 정도가 되는지?</p> <p>디자이너 하루에 15만원</p>
<p>Design -> create better products</p>	<p>E S K D A E S E S E S</p>	<p>I think the role of designer is very ... there's a couple of different levels. I think the very basic level is that you should be creating better products</p> <hr/> <p>so for him kauchi whether than design whether than quality whether than output has some challenges whether the challenges convince output that they overcome the past heritage technique <i>and close</i></p> <hr/> <p>Design process, It's difficult explained it's training. Take lots of your time. until it looks happy. Change change until it start to feel stable.</p> <hr/> <p>I think what's important is that they can have a new way of thinking then maybe that's enough of a shift so that they can still be very traditional and fulfilling the artistry but if they shift the way they think, then maybe they start thinking in a more contemporary and advanced way, which is quite important as well.</p> <hr/> <p>I think we should curate the thoughts of many individuals into something tangible.</p> <hr/> <p>I think the designer is like an interpreter where we have many different cultures, many different people, many different languages but we should be able to distill all those languages in to some sort of physical tangible object that makes sense to people.</p>

Appendix 7. Important to work with other (Collaborate)

Important to work with other (collaborate)	
A	So I continued to do hybrid. Because I like to do make things. So I think it's important to work with other. Because it's if I want to hybrid. Not just with myself. Working with Africa this is one part of work.
A	I will show I do another. Types of experience I got many people said it's nice, but when speak about hybrid. Out of I only hybrid by myself. Not with other people.
A	Depend on the project, sometimes work I hear presented yesterday. It's collaboration. Few of my work collaboration. Some of them I did alone. It's depend on the project. In the beginning, I was post doc. I work alone. But I am professor. So now I need collaborate with student it's changed.
A	What about doing with it. Engineering and craft work together. Then I went most extreme traditional craft people you can find in Africa, so..... They do this jewelry. In Africa, we work jewelry together. I can send paper to you.
	Q. If you collaborate usually collaborate with who?
A	Colleagues. When I was in the MIT, friends. Now mostly student. It's my idea and student will do it. things are tallni close to my heart. I can do it alone. It's changing.
K R	When i started project, Not only which technology you focus on, but beforehand, to whom you collaborate with, the person, human resource is one of the key factor.
K R	and as a whole, Kauchi and Kabuku and Sicumi part together finding actual make progress in the project of Shumisaya
K R	So once again yes human, person is very important. If they can really act, is really important. That's why kauchi and i knowing each other for several project previously before several project, sumisaya. We could try new project
K R	And get in touch with cauchi sang(name) he has many connection and has many project with regarding traditional craftsmen, So I contacted with him and started over project and he also had idea of collaborating past --- with 3D printer.
K D	He has lot of knowledge in technology of craftsmen, not only that he can also understand to communicate and organize how to handle and make progress with traditional craftsmen. That's the reason why project run smoothly.
K R	Kauchi holds project called origami. It's the project for producing Japanese craftsmanship product, so they had communicate and organized of craftsmen of katana sword.
K R	so for human and technology is most key factor i think
E S	Previously we would collaborate quite a lot. Makers, as well, talking to makers and getting them on board with the vision in quite important.

Appendix 8. Way to Evaluate

Way to Evaluate	
Positive	M So I use my work to investigate and to and.. To provoke to encourage conversation

<p>evaluation: understand and develop conversation</p>	<p>to encourage debate to hopefully and just stop people to.. And allow them just think relationship between real world and their engagement to real world for object and competent.. their engagement to real world through screen</p>
M	<p>What I am tried to do say people that the thinking that i'm engaged to it.</p>
M	<p>then I'm happy to help to people to understand what is involved with this technology. I want to go beyond that to the stage where they don't care.</p>
M	<p>What I'm trying to say work i am making evolve developed and conversation and try to engage people with. Also evolve an develop, so In conversation. Friends in Parsons and we have conversation. He's about making, perception in 21st, so i think once that conversation published in web-site in next year</p>
M	<p>And so i supposed what i am tried to educate this two ground world, but i just i hope encourage people start to think That's it really. Just to demonstrate What we are doing still has a large craft element and requires at craft thinking as well as you are using design skills and a lot of sort of skill as well.</p>
M	<p>My aim is always to ring these world together to certain to. I aim to work in a way where adventure goal, adventure aim to people not to be concerned about how object was made.</p>
M	<p>I used to tools in a way this was digitally design even though i based of object historic pieces, they are culturally familiar i give digitally aesthetic that parts are this encourage conversation around object around technology.</p>
M	<p>Because they are craftsmen, there are 21 century craftsmen. There are machine. There are tools, so in terms of challenge what I am thinking and want to do challenge people understanding of this new technology and how we can relate to them. And suppose what i tried to do in a way humanism them.</p>
E S	<p>That people can easily understand and they can ... it enhances their lives.</p>
A	<p>Some else look into that and exited. This is biggest joy craft can have. This type of thing I want to connect with technology work. If I see the people like that. It's main importance</p>
A	<p>The fact you speak with me now. The fact you contact me and speak with me.</p>
<p>Positive reaction by people & member</p>	<p>Another criteria is how it's received by people whether people react to it, and how they react of the object. Who is reacting positively and who is reacting? You know, i usually don't have negative reaction,</p>
M	<p>Aesthetic, fine natural in terms of people's reaction. I don't there is no technical aspects</p>
M	<p>The criteria that i judged the pieces are i guess aesthetic whether is pleasing to the eye they looked right. That's one criteria.</p>
E S	<p>Main accomplishment is to reach me people, and so communicate about culture of important is not only innovation. If they see the people, excited and glad is that. This is the main importance. All of these in the end of the day,</p>

	K D	also actual craftsmen himself he has own well or not is very important is well
	K D	Especially in this new kind of project, it's really important have this kind of big well at least project member.
	K D	So it's kind of like whether you can said all the project member at the first glimpse, at the first they said well or not is the most important factor decide important output. has achieved some kinds of new value or not, of course there are several criteria there can be evaluated in number.
Negative evaluation from people	M	But i thought most negative reaction. People just ignore it walking pass object, so the reaction of the people criteria judge to work.
	A	When people didn't understand it. When I did guitar, my supervisor didn't understand it. Music people like it. But I don't want to talk it only with music people I want to with technology people. i was bit sad. Like five years ago, things getting better

Appendix 9. Possibility for social innovation

Possibility for social innovation

The way to enhance isolated traditional craft	A	This is really about weaving computer & manual. This is out of computer come to save craft destroyed. This two is my favorite.
	A	I try to see they live together and why it's important? Because it's all human creation. We need to be able to live with piece our own different side.
	A	The development velocity hard to follow culture. It's our people see themselves in the world. It's important to find where is digital role
	A	in my work I try to bridge the gap with traditional modes of working (=craft) to contemporary tech, but this is only a "cover", i.e., what I really care is to acknowledge the traditional social working setting: small communities, people know the source of their raw materials, products value come from quality of the material and work and not some external fetish such as some advertising slogan, etc. The social and cultural context of craft vs contemporary technologies were already discussed by many scholars, however engineers and designers rarely read theses materials, so I am trying to develop technologies to open the door for craft back to modern society, with a hope it will also bring its social context.
	A	Q. Restore & regenerate which one is more appreciate
	A	I think all of them. Why? If I like craft it's also direct development.
		행정가 B(실장님) 사례 조사를 마땅히 사례 조사는 없었고
	창작	당시 문화부에 창조적, 2012년도 창조적 육성전략이었나 전통문화창조적 발전 전략 당시에 대중문화가 한류 붐을 일으키고 있었는데 영화 방송

	<p>이쪽으로는 수출이 잘되고, 대중 소비가 서울에 강한 소비가 있었기 때문에 전통문화는 계속 산업화 해야 한다 하는데 어렵잖아요. 사람들이 다 현대적이고 IT관련이 판을 치고 있어서 전통문화사업을 육성해야 된다고 해서 전통문화산업진흥법을 만들려고 기존에 문화 산업 진흥법이 있었는데 그건 콘텐츠 중심이고 문화산업 기본법이라고 해서 전통문화 관련이 포함되어 있었는데 이걸 떼어내서 콘텐츠 관련해서는 잘 돌아가니까.. 유럽이라든지 일본은 자기네들 전통음식 스시나 기모노 중국은 도자기 이런 게 있는데 한국은 전통적인 게 없다.</p> <p>그런 차원에서 전통문화 상품을 개발 지원이 필요하다 라고 해서.</p> <p>해외는 민간시장 일본도 다 민간주도지 국가차원에서 지원은 없어요.</p>
창작	<p>행정가 A 저희가 약간 애매한 위치인데, 창조경제혁신센터나 전국단위에 정보문화산업진흥원이나 문화산업진흥원이 시 단위 광역시 단위로 있어서 그분들 하는 사업이 겹치는 경우가 있는데 전통문화를 바탕으로만 현대적으로 재탄생 하는 경우는 없어요.</p>
E S	There are a few different combinations where we elevate the craft, and for me, that's the exciting part where we don't want to lose craft.
E S	We don't want to lose the experience and the love of the craftsman,
E S	Because I think that's the artistry which becomes lost in technology.
E S	I think what you lose by not combining these things is you separate them and they become islands of isolation, where,
E S	But then I think beyond that which should be driving every designer is how do you create better cultures, better society.
E S	You can kind of mold the world around you.
Can generate a better society	<p>K D In those context, 3D printer is another new tool. It enhance design, not only design, also meaning of the culture.</p> <p>K D I believe, to combine Japanese traditional crafts that has been inherited through our society for hundreds of years with the latest technology, has a lot of impact both social and local.</p> <p>The challenge would inspire many people, from creators to craftsman, and I think this would lead to further creation and innovation in the long run.</p>

Appendix 10. What are you doing now

What are you doing now?

Q Before you are using 3D printer which kinds of tools you used?

A

Before that I was working as engineer, develop software, programmed software sound processing for guitar

QIs their any reference

A I was engineer. I work in Israel developed synthesize guitar, but everything was computer. I work in the company. I didn't like it because, It's all about software, nothing about wood. This is first time when I start to thinking.

인터뷰어 이 센터가 전주를 베이스로 하는 건가요?

창작 행정가 A 원래는 전국 지금은 전주에 머물러 있는데,
인터뷰어 그게 말씀하신 데로 다른 센터가 말물려서 그런 건가요?
행정가 A 그것보다는 아직 센터가 입주한지 얼마 안돼서..

인터뷰어 그때부터 쪽 일하고 계신 거죠? 센터의 제작 계기 같은걸 알고 계신가?

창작 디자이너 창작디자인실이요? 공예 쪽 일을 하다 보니까 시제품 개발을 위주로 하고
있어요 프로도 타임 밀에 공예가 분들 계시는데 디자인이나 설계도 가져오시면 제가
스리디 모델링 데이터로 변환해서 직접 뽑아보는

인터뷰어 여기에서 디자이너로 일하고 계신 거죠?

창작 디자이너 내 11월부터 시작을 했구요

디자이너 원래는 3월달부터 전통문화창조센터가 시작했고, 제가 들어온 건 11월달부터

창작 시작했어요. 11월달부터 원래 구입은 작년 여름에 했는데 스리디 프린팅 가동은 작년
11월달부터

주된 사업이 융복합 사업으로 상품개발인데 추가적으로 다른 진행 중인 것은?

행정가 B(실장님) 그게 지금 메인 이에요. 전통문화 융복합 상품 센터로

창작 전통문화창조센터가 만들어진 사업은 점차 추가되고 바뀔 수는 있지만 일단은
전통문화의 공예일수도 있고 소재나 나무, 짜맴힘 기술 수공예 적이면서 다양하게
소재간의 융합을 할 수도 있고, 옷칠과 한복의 만남 현대적 디자인 기술의 만남이면
융복합 기술이죠. 전통문화 뿐만 아니라 융복합은 어디에서도 일어나니까 대세지

저희 유통 채널 중에 하나가 온지앵이라고 있어요. 이걸 아직 시장에 내놓지는 않았는데

창작 사람들의 반응이 보고 싶다. 공예가들이나 이 사업에 관심이 있는 사람들 위주로 가입을
해서 공유를 하는 앱입니다.

인터뷰어 앱 활용도는?

창작 행정가 A 활용도는 약간 애매한 위치인거 같아요 한참 홍보를 하다가 저희가 판매까지
목표를 하곤 있지만 새로운 앱을 만들어야 할지 아니면 소식 공유나 사업 참여하고
싶은 사람들 위주로 해야 할지 그게 결정이 안 나서 3차년도 사업에서는 확실하게 선을
긋고, 그거를 센터앱으로 가져갈지 새로운 판매용 앱을 만들지 고민하는 단계에 있어서

활용도가 크지는 않아요.

Q Business model of you system

Rinkak, is platform for 3D printer, provides market place also production as 3D places as long as their own idea and their own data. They can create upload they can create their product page start promoting start selling 3D design, and regarding of production area. We have 100 connection 3D printing factory worldwide. Actually we don't have 3D printer itself. What we connect user who want to use 3D printer and the owner who has 3D printer. We connect those two side and we give revenue for the two side. Also in the near future connecting to the traditional craftsmen, so that we hope to develop platform manufacturing platform for 3D printers.

What do you do for a living? What is your job?

E S I'm a footwear designer for Nike.
I'm sorry?
I design footwear for Nike.

Appendix 11. ETC

ETC

Characteristics of Modern Mass Production	K R	for example, like injection molding, those kind of technique you need to invest so much,
	E S	In the industrial revolution, you have a factory making a thousand pairs of shoes where they're all a general size.
	E S	Mass production, we lost the individual.
Tired of 3D printing	M	3D printing is always on the page, and new technology come along. People will tired of 3D printer 3D printer. That's so rush year and so i am anticipating not here to focus and what i gonna be left with.
		Q. cooking with tools?
	A	Digital philosophy as general. Computational role but not fully automatic. Not 3D printer make it all. Work with shef together.
Other craft or thing can be combined	A	I also consider similar philosophy with Cooking cause it also craft. It's different craft. you don't put it and look it. You eat them. It disappeared. It's also beautiful It's many technical and material and Many countries dependent. So I also fascinated about that.
	A	What I am trying to do- they do other thing they well- educate many people strong side of computer, also the limitation.
	A	For After developing craft with 3D printer, don't you conduct additional activity with those craft? First, educate other do it. second build new technology that allow you to do more.

		Third Our student survive with what do they do.
		Q Other traditional product has possibility to combine with 3D printer
	K R	금박, 자기공예(조개 껍질) Those kind of approaches from top surface, finishing surface has a good synergy with 3D printing technology
		인터뷰어 제품 제작은 개인에게 맡기고
	창작	행정가 B(실장님) 저작권은 본인에게 개발자 창작자가 그거를 지원기관은 전시하고 2차적 활용은 합의하에 책으로 만든다든지 2차적 활용은 지원기관 공동으로
	창작	작년 한해 1차 2차를 했어요. 일년씩 하는 건데 1년에 2개차를 다하고 올해부터 3차시가 시작하거든요. 3차년도에는 상품 개발을 기본으로 하고, 지방의 풍속이나 공예품이 공예가만 하는데 일반 민중들이 했던 상품 개발을 하는 걸 대중화하는걸 3,4 년 계획을 하고 있어요.
	E S	I think maybe some of the disadvantages are probably more mental in terms of how do you ... what's the future designer going to be where your only relationship is with the computer and a 3D printer?
	M	the People are and people are generation of makers who have their smartphone they have their digital technology, but they want more and They want to engage with material and processes tools and great thing i am observing. it can have both.
People have maker's DNA	M	Well we are in certain fortunate time whereas maker as designers as artist we have much larger tool box, much large great choice of the tools and there are not, They are mutually compatible it create using mixture that's what i find most interesting. The interesting area is hybrid way of working.
	M	I think Probably one of the group of makers and emerging, who are existed and realized creative potential. Bring this different work together.
Value sensitive design	E S	At the start of the project, I gave myself my ... I had my methodology which was value sensitive design. It's this methodology where, [inaudible 00:22:55], one of them was Peter Kahn and they looked at this methodology to broad based, sensitive design.
	E S	The developed this methodology of three parts. One was conceptual development, you'd have a strong conceptual development. The other one was, more empirical data, looking at what was available. The other one was technological data, which was looking at technology. Those three elements or concepts, empirical, harness and technology, coming together should help keep you grounded in the needs of project.