

**Enhancing knowledge exchange and collaboration between craftspeople and designers using the concept of boundary objects**

Suib, Sarah S.S.B.; Van Engelen, Jo M.L.; Crul, Marcel R.M.

**Publication date**

2020

**Document Version**

Final published version

**Published in**

International Journal of Design

**Citation (APA)**

Suib, S. S. S. B., Van Engelen, J. M. L., & Crul, M. R. M. (2020). Enhancing knowledge exchange and collaboration between craftspeople and designers using the concept of boundary objects. *International Journal of Design*, 14(1), 113-133.

**Important note**

To cite this publication, please use the final published version (if applicable).  
Please check the document version above.

**Copyright**

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

**Takedown policy**

Please contact us and provide details if you believe this document breaches copyrights.  
We will remove access to the work immediately and investigate your claim.



# Enhancing Knowledge Exchange and Collaboration Between Craftspeople and Designers Using the Concept of Boundary Objects

Sarah S. S. B. Suib<sup>1,2,\*</sup>, Jo M. L. Van Engelen<sup>1</sup>, and Marcel R. M. Crul<sup>3</sup>

<sup>1</sup>Delft University of Technology, Delft, the Netherlands

<sup>2</sup>Malaysia University of Technology, Kuala Lumpur, Malaysia

<sup>3</sup>NHL University of Applied Science, Leeuwarden, the Netherlands

Design and craft domains possess knowledge and experiences that are valuable to product development; however, such knowledge is often tacit, localized, and embedded within each respective domain. In this paper, we examine how a combination of design tools—prescribed as boundary objects—supports knowledge exchange and collaboration between these two domains in a design intervention setup. This setup is developed to explore the intangible values inherent within a heritage product—a product inherited from the previous generations—closely connected to local craftspeople and a point of inspiration for designers. Two design intervention sessions have been conducted in cross-domain collaboration efforts between craft and design representatives from Malaysia. The method devised and employed in this paper enabled a detailed study of different types of boundary objects that represent knowledge from each domain, stimulated knowledge exchange across domains, and transformed part of the tacit knowledge shared into explicit forms. We found that craftspeople and designers can collaborate and share knowledge more effectively by focusing on specific knowledge within their domains that might be of value to the other. Finally, we highlight the importance of promoting inclusive and conscious adaptation of content from the local cultural heritage in the product development process.

**Keywords** – Cross-Disciplinary Collaboration, Craft-Design Collaboration, Intangible Cultural Heritage, Boundary Objects, Tacit Knowledge, Design Intervention.

**Relevance to Design Practice** – This study applies the concept of boundary objects to analyze the tools used in a design intervention approach. The approach is applied in the fuzzy front end of the product development process. The findings highlight a relevant and interesting area of research between design, craft, heritage as well as culture.

**Citation:** Suib, S. S. S. B., Van Engelen, J. M. L., & Crul, M. R. M. (2020). Enhancing knowledge exchange and collaboration between craftspeople and designers using the concept of boundary objects *International Journal of Design*, 14(1), 113-133.

## Introduction

An inclusive and equitable involvement of craftspeople remains nascent in the design process, especially in the early stage of the product development process. This is rather unfortunate because, similar to the design domain, the craft domain also possesses valuable knowledge when it comes to products and their development process. Collaboration efforts between craftspeople and designers should be grounded by local participation and indigenous knowledge; however, according to Kang (2016), existing efforts between craft and design domains tend to be authoritative rather than democratic. Although stakeholders within the craft domain are often involved in the product development process, their participation is often limited to prototyping, production activities, and/or as research subjects.

One possible explanation for this situation is that although stakeholders in both domains demonstrate valuable experiences and aspirations in terms of product development, their approaches are fundamentally different (Yair, Tomes, & Press, 1999). Both domains are integral to the culture economy where cultural content is embedded in its goods and services (Isar, 2013). The cultural content, especially that of the craft domain, relates to the

intangible cultural heritage. *Intangible cultural heritage* refers to “the practices, representations, expressions, knowledge, skills—as well as instruments, objects, artifacts and cultural spaces” that have been “transmitted from generation to generation,” are “constantly recreated by communities and groups in response to their environment, their interaction with nature and their history,” and provide “a sense of identity and continuity” (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2003, p. 2). The transmission of knowledge related to the intangible cultural heritage often relies on orality rather than written text (UNESCO, n.d.) which increases the risk of losing such knowledge in the contemporary society. Furthermore,

Received January 1, 2017; Accepted November 1, 2019; Published April 30, 2020.

**Copyright:** © 2020 Suib, Van Engelen, & Crul. Copyright for this article is retained by the authors, with first publication rights granted to the *International Journal of Design*. All journal content, except where otherwise noted, is licensed under a *Creative Commons Attribution-NonCommercial-NoDerivs 2.5 License*. By virtue of their appearance in this open-access journal, articles are free to use, with proper attribution, in educational and other non-commercial settings.

\*Corresponding Author: sarah.suib@gmail.com

although this knowledge can be an interesting source of creative input for designers, its tacit nature often precludes designers from applying it efficiently and integrating it appropriately in their ideas and concepts. This presents the need to transform such knowledge into explicit forms (Galla, 2008; Prosalendis, Deacon, Dondolo, & Mrubata, 2004). Such efforts also have the capacity to nurture the understanding of local identities, recognize cultural diversity, and build cultural capital (Prosalendis et al., 2004).

Tacit knowledge is one of the defined concepts used to describe the knowledge of craft and design domains (Groth, Mäkelä, & Seitamaa-Hakkarainen, 2013). Tacit knowledge is typically personal—sometimes deeply so—and since it dwells within the human body and mind, it is often difficult to share and organize (Dormer, 1997). It can be both personal and communal; embodied within individuals as well as communities and commonly transferred in tacit forms (Dormer, 1997). Since tacit knowledge is connected to an individual's knowledge and skills, the loss of that person also means a total loss of that knowledge (Diehl, 2010; Jasimuddin, Klein, & Connell, 2005). In contrast, explicit knowledge—knowledge that has been formulated and codified (Lam, 2000)—can be transmitted formally and systematically (Nonaka, 1994). According to Michael Polanyi, “we can know more than we can tell,” suggesting that explicit knowledge is only the tip of an entire body of knowledge which remains tacit in nature (Nonaka, 1994). This indicates that the two are deeply connected, interdependent, and complementary to each other (Alavi & Leidner, 2001). As such, there is a certain need, as well as a fascinating opportunity, to make aspects of tacit knowledge explicit through collaborative efforts between craftspeople and designers.

Dr. **Sarah Suib** holds a Ph.D. (2019) in Design for Sustainability and an M.Sc. (2012) in Strategic Product Design from the Faculty of Industrial Design Engineering (IDE), Delft University of Technology. After receiving her B.Sc. (2006) in Industrial Design from Malaysia University of Technology, she worked as a product designer, R&D executive, and tutor in Malaysia before pursuing her Master's degree in the Netherlands. With a doctoral grant received from the Ministry of Higher Education Malaysia, she joined the Design for Sustainability program and embarked on a journey of exploring the gap between design, sustainability, and cultural heritage via values of heritage products. She is passionate to explore the meaningful interactions between people, the artificial, and the natural environment while finding solutions for our complex everyday problems.

Professor **Jo M. L. Van Engelen**, MSc, PhD studied physics and mathematics at Eindhoven University of Technology and Business Administration at the University of Twente. He received his PhD in 1989 from the University of Twente. In 1991, he was appointed chaired professor of Business Development and research fellow at the Faculty of Business Administration of the University of Groningen. In 2010, he was appointed chaired professor of Integrated Sustainable Solutions at IDE of the Delft University of Technology. He has (co) authored ten books, over 100 scientific papers, given more than 200 leading lectures, and guided over 25 Ph.D. students. From 2004 to 2008 he was a member of the executive board of ANWB, and from 2008 to 2012 he was a member of the executive board of APG Group in Heerlen, Amsterdam, New York, and Hong Kong. Furthermore, he was/is a member of the supervisory board of 20 companies.

Dr. **Marcel Crul**, MSc is senior research coordinator of the Design Factory at NHL University of Applied Science in Leeuwarden, and member of the affiliated staff at the Design for Sustainability Programme, Industrial Design Engineering, Delft University of Technology—both in The Netherlands. His research focus is sustainable product innovation, inclusive design, and sustainable consumption and production in emerging economies. Currently, he works and publishes on innovation projects in the Netherlands and in South East Asia.

In this paper we examine the phenomenon of tacit knowledge shared between craft and design domains by introducing the concept of boundary objects in a design intervention. Assuming that boundary objects can stimulate the exchange of knowledge in cross-domain collaborations (Carlile, 2002), we apply the concept to codify and structure knowledge shared between craftspeople and designers about products and their development processes.

We begin by addressing the paradox between the craft and design domains and the issues related to craft-design collaboration efforts. Next, we focus on knowledge transmission and the concept of boundary objects from the perspective of this study. Within this context, we present a design intervention setup that has been applied to two case studies involving craftspeople and designers in Malaysia. The outcomes are analyzed in terms of the content elicited and the different boundary objects prescribed during the intervention sessions. As a result, we propose a scaffold based on different types of boundary objects to enhance knowledge exchange and collaboration between craftspeople and designers. This paper concludes with an overview of the theoretical and practical implications of our study and a reflection on the limitations of this research.

## Literature Review

### The Paradox Between Craft and Design

The domains of craft and design both comprise cultural and creative activities (Pessoa, Deloumeaux, & Ellis, 2009) demonstrating a connection that cannot be ignored (Tsoumas, 2013). Product development is an area of knowledge that connects these two domains together, however, their perspectives and approaches are fundamentally distinct (Tsoumas, 2013; Yair et al., 1999).

On the one hand, craft is part of traditional cultural expression (Isar, 2013) and comprises elements such as “materials, tools, techniques of the body, and practical skills” that are perceived to be open, collective, and highly social (Ravetz, Kettle, & Felcey, 2013). The perspectives of craftspeople are often associated with tacit knowledge inherited from the past (Ravetz et al., 2013), acquired through practice and experience (Dormer, 1997), and their embodiment of knowledge is made tangible through their skills and techniques in creating products. The process of crafting describes “all kinds of skilled, form-generating practices” (Ingold, 2012) creating products closely connected to the people, their surroundings, social contexts, histories, and cultural heritage (Tung, 2012). Such a product has “distinctive features which can be utilitarian, aesthetic, artistic, creative, culturally attached, decorative, functional, traditional, religiously and socially symbolic and significant” (Pessoa et al., 2009, p. 26).

In the context of the cultural economy, on the other hand, design encompasses the “activities, goods, and services resulting from the creative, artistic and aesthetic design of objects, buildings, and landscapes” (Pessoa et al., 2003, p. 28). According to Krippendorff (1989), design is about “making sense of things”

and at the same time does not forsake historical continuities. In that light, although designers' activities are oriented toward the future, their process is heavily informed by both the past and the present (Margolin, 2007; Van Boeijen, 2015). Designers are considered as the key stakeholders in the development of goods and services with local cultural content (Wang, Bryan-Kinns, & Ji, 2016). Such developments have resulted in various contemporary products with embedded cultural added values (Lin, 2007). Although studies related to culture are common within the design discourse, few focus specifically on heritage. This research views culture as a bearer of heritage, and based on this perspective there are certain opportunities to explore the roles and influences of heritage in the design process. The paradox between safeguarding the past and designing for the future is perhaps the most intriguing aspect of projects shared by craftspeople and designers, as well as a vital motivation for this study to explore ways in which professionals in both domains can collaborate effectively in a product development process.

### Craft and Design Collaboration

Collaboration is not only necessary to initiate the exchange of knowledge between craftspeople and designers, but moreover constitutes a fundamental approach to the knowledge-intensive process of product development (Sanders & Stappers, 2008). In order to collaborate, stakeholders need to be aware of the knowledge inherent in their domains that might be of value to others (Pisano & Verganti, 2008; Tung, 2012). By understanding what resources need to be offered during collaboration efforts, stakeholders can better understand their own motivations, identify relevant partners, and determine their roles in the process (Nieto & Santamaria, 2007). In addition, collaboration can improve professional capabilities through shared experiences and knowledge exchange (Tung, 2012), all while creating a platform for various stakeholders to apply their knowledge and experience toward influencing the process and its outcomes (Santos, Capet, & Diehl, 2013). Knowledge exchange is indispensable in stimulating local development (Tung, 2012); therefore, collaboration can be an insightful, fruitful platform to both craftspeople and designers.

In particular to the collaboration between craftspeople and designers in product development, this study focuses on activities at the fuzzy front end of product development: a phase of exploration engaged to inform and inspire and that can therefore be ambiguous and chaotic (Sanders & Stappers, 2008). The fuzzy front end also requires the assessment of internal capacities as well as external opportunities (Kim & Wilemon, 2002) in order to develop some basis for what to design or not to design in the future. However, there are several reasons why collaboration between these two domains remains scarce. For one, collaboration in craft "has not yet been systematically debated or written about" (Ravetz et al., 2013). Furthermore, cross-domain collaborations in general can be a struggle due to practitioners' reliance on domain-specific knowledge (Halpern, Erickson, Forlano, & Gay, 2013; Nicolini, Mengis, & Swan, 2012), which is often "localized,

embedded and invested" (Carlile, 2002). These factors form a barrier as experts often perceive objects and content shared during a cross-domain collaboration process based on their specific field of expertise (Nicolini et al., 2012) making facilitating knowledge exchange across domains challenging (Carlile, 2002). These insights highlight the need for an in-depth understanding on how craft and design domains can effectively share and assess each other's domain-specific knowledge.

### From Tacit to Explicit Knowledge

To sustain and conserve knowledge, it must be transferable. In that sense, explicit knowledge is easier to be disseminated than its tacit counterpart, which to be accessed requires individuals to be present (Lam, 2000). In essence, tacit and explicit knowledge are inextricably connected as "tacit knowledge forms the background necessary for assigning the structure to develop and interpret explicit knowledge" (Alavi & Leidner, 2001). As mentioned by Nonaka (1994), explicit knowledge is only the surface of a deeper pool of tacit knowledge. Hence, it is important to recognize that converting tacit to explicit knowledge may cause a substantial loss of knowledge (Grant, 1996). Although the conversion process can be difficult, there are two methods by which tacit knowledge can be transferred: *socialization*, in which knowledge is shared among individuals and thus preserved in its tacit form, and *externalization*, in which knowledge is articulated into an explicit form that is accessible to outsiders (Nonaka, 1994). *Externalization* requires constructive collaboration, in which mutual trust is vital in order "to share one's original experience [which is] the fundamental source of tacit knowledge" (Nonaka, 1994). In this sense, collaboration initiates a shared knowledge space required in the process of transforming tacit knowledge into explicit forms (Alavi & Leidner, 2001; Grant, 1996) and nurtures a common perspective between parties involved (Nonaka, 1994).

In this study, we have devised an empirical exploration based on constructive collaboration focused on *socialization*, in which tacit knowledge is maintained in its tacit form (Diehl, 2010, p. 15), and *externalization*, in which tacit knowledge is "codified, documented and delivered as stand-alone information or data" (Diehl, 2010, p. 17). Knowledge within the craft domain is known as "a repository of ancient skills and traditions" where histories of everyday people are collected (Ravetz et al., 2013). Such knowledge can be associated with the intangible cultural heritage. However, due to its latent and implicit nature, knowledge related to products and their development within the craft domain often remains untapped, at times inefficiently used, and, on occasion, improperly adapted in contemporary products. The loss of tacit knowledge is a pressing issue within the craft domain underlining the need to transform parts of the tacit knowledge into explicit forms (Galla, 2008; UNESCO, n.d.). By extension, tacit knowledge inherent in the craft domain is also a source of interest and inspiration for designers. Transforming tacit knowledge into explicit forms increases its potential to be accessed and disseminated, allowing part of tacit knowledge within the craft domain to be shared with outsiders and, in particular to the

scope of our study, effectively accessed by designers. In our study, we concentrate on facilitating this process directly with local craft communities whose input and contributions are often marginalized in the product development process. Our effort also corresponds to UNESCO's call for new development pathways between the cultural and creative sectors in order to promote economic impact and social inclusion whilst taking history and tradition into consideration (Isar, 2013).

## Boundary Objects and Their Roles in the New Product Development Process

To explore the exchange of both tacit and explicit knowledge in the context of craft-design collaboration, we apply the concept of boundary objects in the new product development process proposed by Carlile (2002) as the theoretical construct to guide our empirical exploration. The concept of boundary objects was initiated by Star and Griesemer (1989). It represents artefacts of practice that are shared between domains and at the same time capable of independently representing knowledge from each domain (Sapsed & Salter, 2004; Star & Griesemer, 1989). This concept also provides a foundation of knowledge transfer and negotiation between domains (Nicolini et al., 2012; Sapsed & Salter, 2004); hence, it is a useful concept in examining collaborative efforts between different knowledge domains (Lee, 2007; Nicolini et al., 2012). Knowledge is transformed when a member from one domain learns "how knowledge from another domain fits within the context of his own, enriching and altering what he knew" (Dalsgaard, Halskov, & Basballe, 2014, p. 747).

A boundary object is a medium of translation (Nicolini et al., 2012) in which knowledge across domains can be represented, learned, and transformed (Carlile, 2002; Star, 1989), thereby stimulating knowledge exchange across different domains (Carlile, 2002). Carlile identifies three characteristics of effective boundary objects:

- Capability to represent different knowledge domains;
- Aids to learning similarities and differences among domains (e.g., terminology), as well as their dependencies and contradictions; and
- Allows current knowledge to be transformed into something new (or different) through a collective effort.

The combinations of different types of boundary objects can serve as a scaffold that facilitates the exchange of knowledge. To describe the process of knowledge exchange, we have adapted four different categories of boundary objects originated from Star (1989) and further developed by Carlile (2002):

- *Platonic objects* refer to objects that are vague, abstract, independent, and able to both represent different knowledge domains and symbolize communication and cooperation (Carlile, 2002; Star, 1989).
- *Standardized forms* are methods of common communication (Star, 1989) necessary to reduce domain-specific interpretations; they reflect a shared syntax that needs to be learned, understood, and adapted by representatives across domains (Carlile, 2002).

- *Maps of boundaries* represent boundary objects able to generate a shared space or platform capable of adapting to different domain-specific content (Star, 1989) and that operate at a systemic level (Carlile, 2002).
- *Repositories* refer to databases based on a common reference point, constructed from collective resources (Carlile, 2002), and compiled in a standardized manner (Star, 1989).

One of the issues related to this concept is the researchers' tendency to label every object found within the collaborative space as boundary objects (Lee, 2007). This leads to outcomes that are unbounded and ambiguous (Halpern et al., 2013). According to Lee (2007), this disregards the finer definition of boundary objects as objects that *satisfy the informational requirement* of each domain and support methods of standardization.

In response to this issue, instead of examining existing objects within the context of cross-domain collaboration efforts (for example, Carlile, 2002; Dalsgaard et al., 2014; Lee, 2007) this research specifically assigned a combination of boundary objects in craft-design collaboration efforts. Through this approach, we aim to investigate the roles of specific boundary objects in supporting the exchange of knowledge between craft and design domains. For the purposes of our study, we developed a set of design tools for a design intervention session with reference to the characteristics of boundary objects found from the literature:

- Represent the knowledge of both craft and design domains;
- Provide a shared syntax or common method of communication between the domains;
- Create the means for craft and design stakeholders to adapt domain-specific content at a systematic level; and
- Generate a database based on shared resources.

## Method

To empirically explore the concept of boundary objects in practice, we adopted a design intervention approach: a method in which certain constraints are prescribed to induce change in a current situation or phenomenon (Blessing & Chakrabarti, 2009). In the context of this paper, the *implementation of an intervention* is developed based on creative facilitation methods where collaborative sessions are conducted in order to generate ideas and create solutions (Tassoul, 2009). Using that approach, we devised a setup to operationalize the activities in a design intervention session. The setup consisted of a selection of tools and a procedure to guide the session's implementation. The main aim of this approach was to investigate the roles of boundary objects, specifically on their capacity to represent, share, and transform knowledge in the context of craft-design collaborations.

Figure 1 illustrates a combination of design intervention sessions structured as a design workshop. This workshop was developed with the aim to support the process of developing new product ideas in collaboration with local stakeholders focusing on 1) simulating activities associated to the product development process and 2) incorporating heritage-oriented content as one of the creative resources in the process. The workshop included

sessions of *Exploring a heritage product*, *Identifying market trends*, *Understanding consumer needs*, *Adapting sustainable elements in design*, and *Selecting human drivers*. Then, the outcomes from these sessions were compiled in *Building a design direction* session. The design direction served as a reference to guide the last session *Generating new product ideas*. In this paper, we examine in detail the setup, process, and outcomes of one of the design intervention sessions: *Exploring a heritage product*.

### The Setup of the Design Intervention

The objective of the session *Exploring a heritage product* was to explore and elicit knowledge related to a selected heritage product. Figure 2 illustrates three primary aspects taken into consideration in setting up this intervention approach: the representatives, the process, and the outcome. The first aspect, the representatives, consisted of local design and craft stakeholders who voluntarily participated in the study. As a requirement to be part of this study, craft representatives had to be local craftspeople involved in making traditional craft products who had inherited their craft skills and knowledge from previous generations. Representatives of the design domain had to have experience in industrial design with a background in formal design education: for example, professional designers or design students. The second aspect, the process, consisted of three basic steps based on the application of tools developed specifically for this session. Finally, the third aspect was the outcome: a tangible output collectively generated by the representatives during the session.

### Design Tools as Boundary Objects

In the design intervention session, craft and design representatives were asked to share, elicit, and map their knowledge of and experiences with a specific subject—a heritage product. To

support this process, we introduced three items: a heritage product, the Multilayer Product Values (MPV) model, and the Product Value (PV) canvas as the boundary objects in the session. The combination of these boundary objects served as scaffolding to support the process of exchanging and articulating tacit knowledge between the representatives.

The first boundary object—a heritage product—is capable of representing two knowledge perspectives (i.e., craft and design) and was defined as a product inherited from the previous generations with meaningful connections to individuals, families, local communities, or societies, or a combination of those. Although heritage products may be losing their place in today’s society, their presence remains eminent in the craft industry. In the Netherlands, a tulip vase made by Royal Delftware in the 18th century is an example of a heritage product, a vase inherited from previous generations is considered as part of the tangible culture heritage. However, if the company produces the same design today, then it would be considered as part of the intangible cultural heritage because it still embodies the knowledge and values associated to the local cultural heritage. The latter sort of heritage products was the focus point of this study and we anticipated that it consists of both traditional as well as contemporary values. The compilation of values inherent within such product is regarded as intangible values in our study.

The second object is the MPV model (Figure 3) introduced to guide content sharing during the intervention session. This model was developed as one of the tools used in a strategic approach towards sustainable heritage products in Vietnam (Suib, 2012; Suib, 2019). The MPV model was adapted from a model called ‘design layer’ used in the strategic stage of the brand-driven innovation method by Erik Roscam-Abbing (2010). In his method, the *design layer* model was used to explore so-called *touch-points* related to values and meanings associated with users, services,

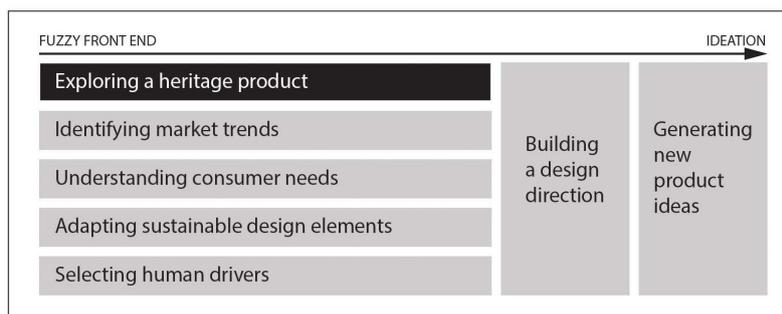


Figure 1. ‘Exploring a heritage product’- one of the design intervention sessions in the design workshop.

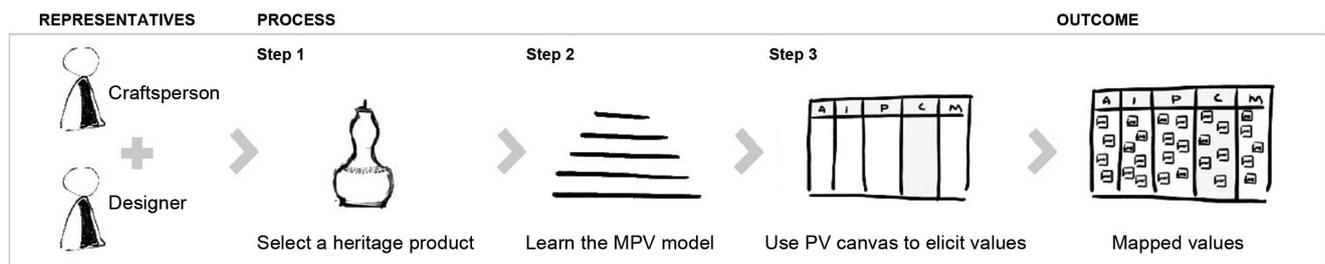


Figure 2. Operationalization of a design intervention session.

products, and organizations and the layers need to be peeled off one at a time (Roscam-Abbing, 2010). In our study, these layers are adopted to represent the compilation of intangible values related to heritage products as illustrated in Figure 3:

1. Aesthetics, or the physical look of a product;
2. Interaction, or the dynamic between a product, people, and their environment;
3. Performance, or the functions and capabilities of a product;
4. Construction, or the process of how a product is made; and
5. Meaning, or the metaphysical aspects of a product.

We also incorporated a selection of so-called “catalyst words” in each layer as a means to support the exploration process.

The third object, the PV canvas, is an extension of the MPV model (Figure 4). This poster-sized canvas comprised of five columns—one for each layer—and provided a common space where the craft and design representatives mapped their knowledge

about a selected heritage product in a systematic way. Thereby, the canvas served as a collective platform for articulating part of the tacit knowledge about a heritage product into an explicit form.

**Procedure and Collaborative Environments**

A session started by selecting a heritage product that was connected to the craft representatives. We recommended that the actual product be present—not just a representation of the product. Once the product had been selected, we provided a brief introduction of the MPV model to inform the representatives about the different layers associated with intangible values. We then prepared the PV canvas and commenced the exploration phase, during which both craft and design representatives shared their knowledge and experiences specifically on the selected heritage product. Each point elicited was written on sticky notes and mapped onto the PV canvas. Finally, the representatives gave a short presentation

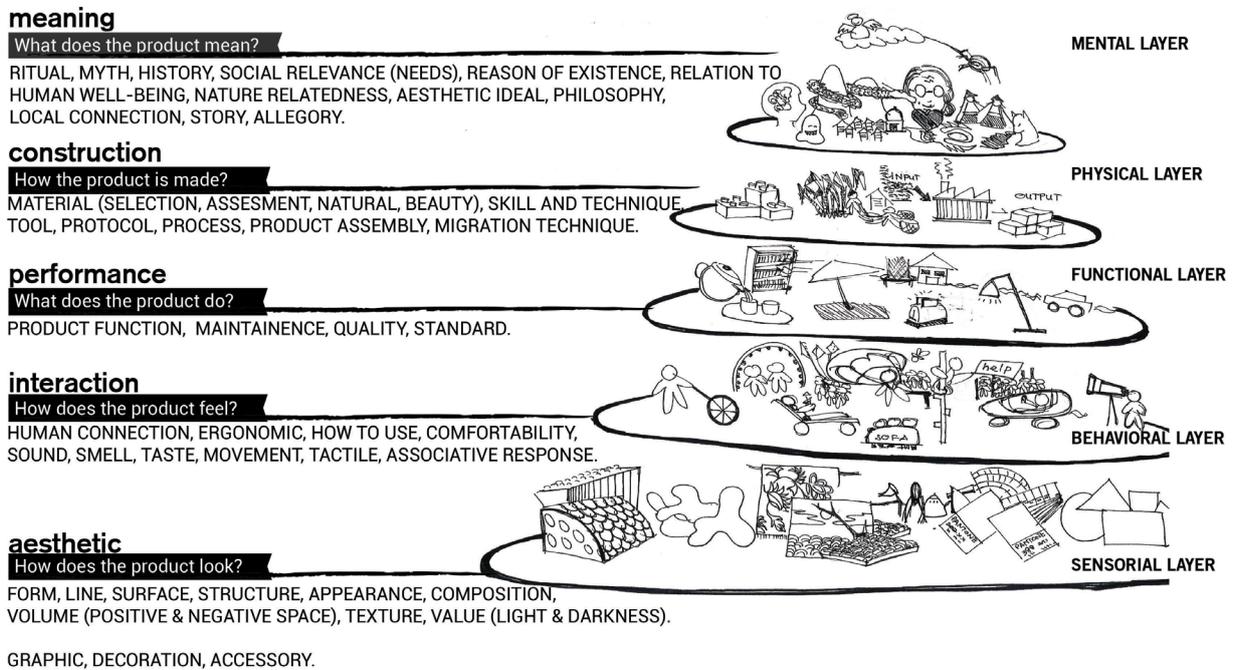


Figure 3. The Multilayer Product Value (MPV) model.

aesthetic	interaction	performance	construction	meaning
How does the product look?	How does the product feel?	What does the product do?	How the product is made?	What does the product mean?

Figure 4. The Product Value (PV) canvas.

followed by a discussion on the outcome, interesting insights acquired during the session, and selected intangible values that would be included in the design direction. By the end of the session, a mapped canvas specific for the selected heritage product was collected as part of the physical evidence for this study. The compilation of statements mapped onto the PV canvas represents an output created *in-situ* that was generated together with the participants during the design intervention session.

## Empirical Exploration

The two case studies presented here showcase the context where the design intervention sessions had been organized with the collaboration of craft and design representatives from Malaysia. It is important to highlight that although these two case studies have different background settings, we used the same design intervention setup and the data collected from both sessions served as a basis for analysis in this paper. Next to this, as Malaysia is multi-ethnic, multi-religious, multi-cultural, and multi-lingual, both sessions were conducted in English with a mixture of the local languages and dialects, namely Malay in the first case study and Malay and Mandarin in the second case study.

### Case Study 1: Malay Pottery Making

The first case study involved the collaboration of a local craft entrepreneur and local craft organization in Sayong, Perak, an area known for its traditional Malay-style pottery products and craftsmanship (Figure 5). The craft representative for the study, Mr. T, is a local native who owns a craft business in the village of Kepala Bendang that he inherited from his father. Renowned for its style and techniques, Mr. T's workshop produces traditional as well as contemporary pottery products. Under the support of the local craft organization, which also participated in the case study, Mr. T studied ceramics in Japan for three years. However, penetrating the ceramics market has been challenging, primarily due to competitiveness among producers in the local and international market.

The objective of the craft organization is to support the development of the local crafts industry in the area. Based on its experiences with the local crafts community, the organization realized the need to support local craftspeople in the development of new products. In this case study, the organization assigned one of its designers, Mr. J, an industrial designer whose roles in the organization include supporting design activities in Sayong. In this case study, both representatives aimed to develop a sustainable product collection based on a traditional water pitcher known as *Labu Sayong* native to the area by using the black-firing technique and locally excavated material.



Figure 5. Craft workshops in Sayong.

### Case Study 2: The Lion Dance

We conducted the second case study with the collaboration of a local design institute and a lion dance troupe. The latter represents the craft domain given its responsibility in making the intricate lion head that is one of the costumes used in the troupe's cultural performances. The lion dance consists of choreographed movements by two acrobatic dancers accompanied by the beating of drums, gongs, and cymbals. Their daily schedule involves training, performing, and making lion heads in the workshop under the guidance of *Sifu Z (Master Z)*, a prominent figure with 40 years of experience in the arena. *Sifu Z* is active in sharing and disseminating his knowledge in training sessions, demonstrations, seminars, as well as in talks in and outside the world of lion dancing. Apart from that, he is also responsible for managing the craft workshop, which produces an average of 40 lion heads per month for local and international customers (Figure 6). On the other side, eight design students in their third year of an industrial design diploma program at an art institute in Kuala Lumpur represented the design domain. The institute was founded in 1967 as a non-profit organization and has since been responsible for training professional artists, designers, and musicians.



Figure 6. Environment of the lion head workshop.

We conducted this case study as part of the institute's *minor design project* course, in which students collaborate with outsiders in order to learn and gain hands-on experience in the field. In response to the project brief—"to design a functional home decor item in consideration of market trends, product emotions, and the heritage values of the lion dance costume"—students explored elements related to the art of lion dancing, a traditional dance performance that forms part of the cultural heritage of the Chinese community.

We carried out the design workshop in two locations; the design intervention session itself occurred in the craft workshop, and the other sessions were conducted at the institute. This arrangement was made due to the level of involvement agreed to by the craft representative, who was eager to share knowledge but not to develop new product ideas. For the lion dance troupe, sharing knowledge and experiences constituted a way to keep their craft alive, and the troupe was open and welcoming to outsiders interested in learning more about that particular aspect of their cultural heritage. Altogether, the troupe's passion and the students' coursework generated the opportunity for a collaborative effort to explore the knowledge associated to the intricate lion heads.

## Result and Discussion

### The Design Intervention Sessions

Figure 7 shows the different environments where the design intervention sessions were conducted. The session for Case Study 1 (*water pitcher*) was conducted in the organization’s office whereas the session for Case Study 2 (*lion head*) was conducted near the craft workshop. Both settings resemble a typical creative facilitation session; however, the setting of the Case Study 2 session was less formal as it was conducted within the craft environment. The students were free to roam around the workshop while the troupe members were still working and the members engaged with the students and shared their knowledge about the heritage product. This situation reflects the notion proposed by Ravetz et al. (2013) about the craft domain as “highly social and open to shared working”. Both sessions commenced based on the procedure introduced earlier. The eight design students were divided into two groups; hence, two PV canvases were prepared in Case Study 2.

### The Selected Heritage Products

The selection of the heritage products came naturally. For both craft representatives, the selected heritage products are part of their cultural inheritance and local identities. The existence of these products can be traced back through previous generations of family members as well as their respective communities. At the same time, these products also relate closely to their daily activities. The first product was a *Labu Sayong* (Figure 8a), a traditional water pitcher native to the Sayong area, which is made of locally excavated clay with a black luster finish and decorated

using a stamp-impressed relief technique with nature motifs. This symmetrical bottle gourd exerts major influence in the development of the local craft industry and inspires the production of various types of craft products, including souvenirs, corporate gifts, and home-decor items. The second heritage product was a lion head (Figure 8b), a costume used in lion dance performances to mimic a lion’s various emotions and expressions. The lion head is designed with a basic mechanical system that allows the movement of its ears, eyes, and mouth. Rattan, square-aluminum tubes, and masking tape are used to make the skeleton, which is then covered with paper and glue, and decorated with various colorful designs using paints, sticker papers, and fur.

### The Exchange of Knowledge During the Sessions

In both sessions, we observed the representatives’ actions and discussion, mainly on how knowledge was shared, elicited, and mapped onto the canvas. For example, in Case Study 1, the design representative shared his impression about the water pitcher based on a design principle *form follows function* in which he explained that the small upper chamber of the gourd reduces the chance of overflowing while pouring water (refer to statement A and B in Figure 9). The craft representative shared that in the old days, water pitchers were made from pumpkin gourd (refer to statement C in Figure 9). This explains the name *Labu* meaning *pumpkin* in Malay language, and, according to Whitaker and Cutler (1965), water pitchers made from gourds were common household items in the pre-pottery era. Next to this, insights related to traditional design principles were also elicited. The repetitive pattern stamped on the surface of the water pitcher not only has aesthetic value but it also has a functional purpose as well as an embedded social meaning (refer to statement D, E, and F in Figure 9). The impressed



Figure 7. The environment of the design intervention sessions: a) Case Study 1 and b) Case Study 2.



Figure 8. Selected heritage product: (a) Labu Sayong and (b) lion head.

patterns improve the grip as they increase friction during use and a principle in a form of allegory was used to guide the design of the surface patterns. *Tajam tidak menikam*, which means “what is sharp should not be piercing”, dictates that any shapes or lines with sharp edges should not be touching another shape or line. This principle holds a deeper meaning within the Malay community as it serves as a reminder: “do not stab someone (or your friend) in the back”. Such discussions with different sources of information and experiences create a meaningful knowledge exchange among the representatives and nurture a healthy discourse between the craft and design domains about design in general.

Case Study 2 provided insights on the way craft representatives shared their knowledge. For example, when asked about their interactions with the heritage product, instead of

answering, one of the troupe members demonstrated how the lion head is used during one of his routines. The design representatives were even given a short training on the traditional way of moving with the lion head. Then, they interpreted their experience and mapped it onto the PV canvas. Figure 10 illustrates the situation and three of the statements mapped in the interactions layer reflecting the fundamental skills required of a lion dancer in order to perform. This situation presents an example of *socialization* where knowledge is transferred in its tacit form; and *externalization* where design representatives articulated part of the tacit knowledge shared into explicit forms. It also demonstrates that the explicit forms (i.e., the statements) represent only the tip of the knowledge shared highlighting the inextricable connection between tacit and explicit knowledge.



Figure 9. Samples of the statements mapped onto the PV Canvas from Case Study 1.

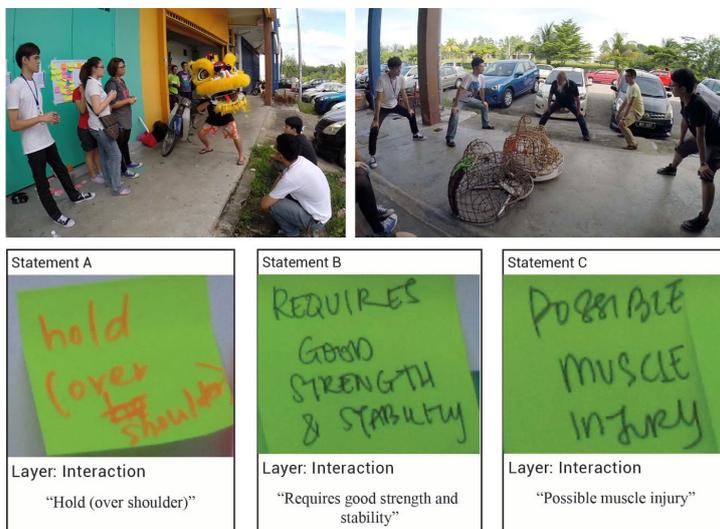


Figure 10. The collaboration environment and samples of statements from Case Study 2.

The craft and design representatives in both case studies demonstrated similar ways of sharing their knowledge. In both sessions, the craft representatives often shared their knowledge in a casual manner and their narratives resemble informal and personal storytelling. They are experts about heritage products; however, their knowledge is a mixture of experiences, for instance their personal history, the local cultural heritage, and their traditional as well as contemporary skills and techniques. On the other side, the design representatives understand the various aspects related to products in general. Furthermore, due to their design training, they are experienced in probing, eliciting, and clustering information in a design intervention session. This highlights the different roles played by the representatives. The combination of these areas of expertise enables them to explore and map knowledge associated to the selected heritage product during the design intervention sessions whilst enriching knowledge in their respective domains.

In both sessions, the representatives involved elicited and mapped content not necessarily according to the sequence of the layers but rather as they occurred naturally during discussions, indicating that each layer can be accessed interchangeable during the sessions.

### The Intangible Values Mapped onto the PV Canvases

Figure 11 presents the three PV canvases collected from the design intervention sessions. To identify the themes of their discussion, we performed a content analysis. Each statement on a sticky note was numbered, turned into a quotation, and coded to contextualize the content shared during the sessions. In all, 36 statements emerged from Case Study 1 (Figure 11a) and 143 statements from Case Study 2 (Figure 11b and 11c). Content for each PV canvas and the detailed result from the content analyses can be found in the Appendix.

Figure 12 and 13 present the overview of the themes obtained from the analysis for each case study. The network of themes in each layer is structured according to the main-theme, theme, and sub-theme. All themes represent the knowledge shared during the sessions; moreover, they also provide a new perspective of the composition of the intangible values inherent within heritage products. Both figures show a mixture of contemporary and inherited values; the former represents knowledge that has been adopted through current development within the society and the latter is based on the knowledge inherited from the previous

generations, i.e., part of the local cultural heritage. During the design workshop (Figure 1), participants were asked to incorporate five interesting intangible values (as statements) from the PV canvas in their design directions. These statements served as one of the creative resources for the participants to generate new product ideas. Through this method, we intended to discern the link that connects new product ideas to the local cultural heritage, specifically the heritage products.

### The Roles of Boundary Objects in Enhancing Knowledge Transmission

We conducted this study to examine how the exchange of knowledge between craft and design domains can be proficiently articulated by using the concept of boundary objects. Specifically we explored how a combination of different types of boundary objects act as scaffolding that facilitates the exchange of knowledge across two domains. During the design intervention sessions we observed both methods of sustaining tacit knowledge as proposed by Nonaka (1994): *socialization*, as tacit knowledge is shared among representatives throughout the design intervention session; and *externalization*, in which the prescribed boundary objects support participants to seek, identify, and transform part of the tacit knowledge shared during the session into explicit forms. These empirical results therefore indicate that the prescribed boundary objects stimulate knowledge transmission across domains. The combination of these boundary objects forms a systematic approach to enhance knowledge exchange and collaboration between craft design domains. Results from the design intervention sessions suggest that the use of different types of boundary objects as a medium of translation allows tacit knowledge to be represented, learned, and transformed. Based on the four categories of boundary objects, the empirical results underline four different boundary objects as shown in Table 1.

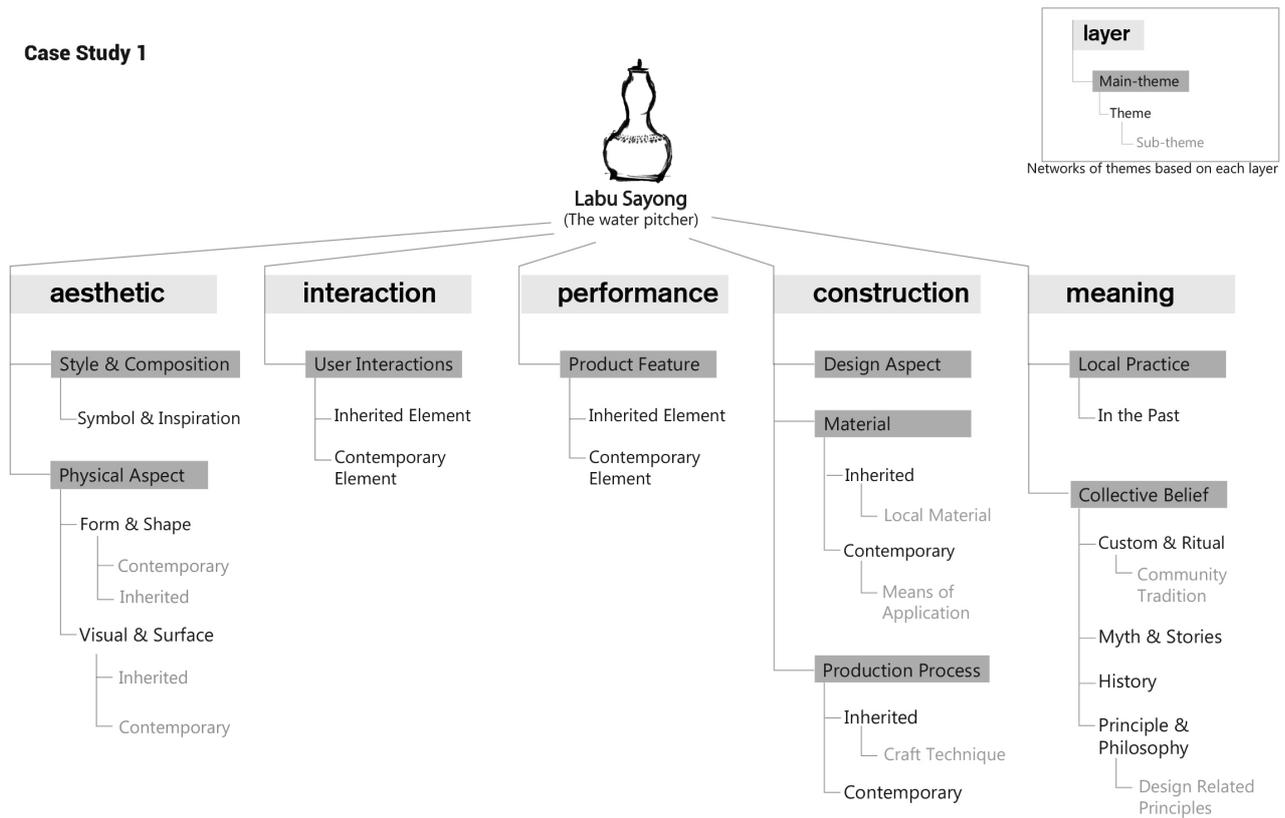
### Boundary Objects: Their Roles and Characteristics

A heritage product is an object capable of representing knowledge from different domains. From the perspective of the craft domain, it represents knowledge of product making that is commonly inherited, informally learned, and tacit in nature. From the perspective of the design domain, a heritage product although exotic is still a product. Therefore, design theories related



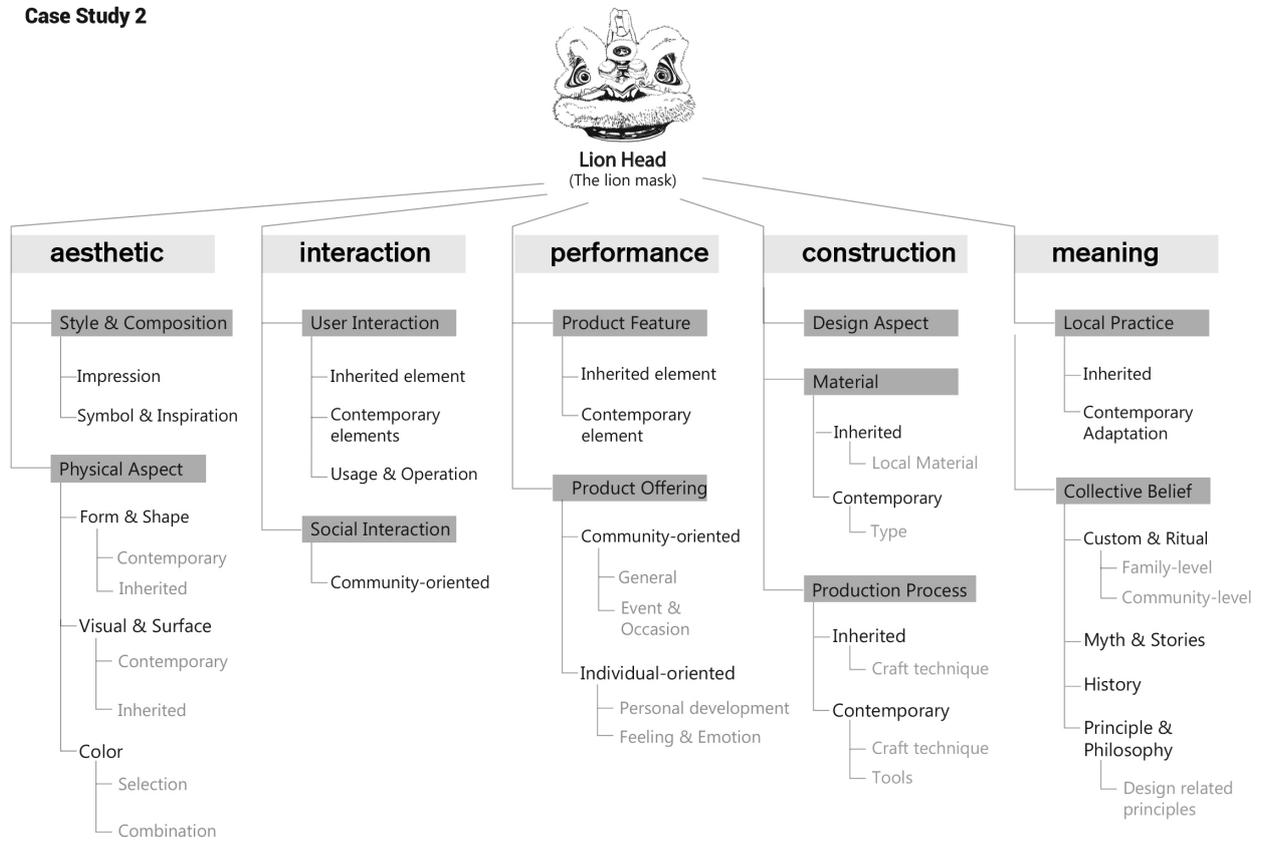
Figure 11. The PV canvases collected by the end of the design intervention sessions.

**Case Study 1**



**Figure 12. Themes derived from Case Study 1.**

**Case Study 2**



**Figure 13. Themes derived from Case Study 2.**

**Table 1. Boundary objects, their characteristics, and usage by craft and design representatives in the design intervention sessions.**

Categories	Boundary Objects	Characteristics	Design Intervention Session			
			Case 1		Case 2	
			Design	Craft	Design	Craft
Platonic object	<b>Heritage product</b>	Represents knowledge from different domains	✓	✓	✓	✓
Standardized form	<b>MPV model</b>	Provides a shared syntax between domains to be learned	✓	✓	✓	○
Maps of boundary	<b>PV canvas</b>	Provides a means to adapt domain specific knowledge in a systematic way	✓	✓	✓	○
Repository	Mapped PV canvas	Generates a database based on shared resources	✓	✓	✓	✓

to modern products and its production processes are equally applicable in understanding heritage products. The intersection of informal knowledge acquired by craftspeople and formal knowledge learned by designers can be an interesting point for knowledge exchange. These characteristics place heritage products in the first category of boundary objects—*platonic objects*, an independent object capable of representing knowledge from both craft and design domains, sparking interest, and bringing these two different domains together.

Table 1 shows that all representatives in Case Study 1 directly used the MPV model and the PV canvas; however, it was different in Case Study 2 as the craft representatives did not use the MPV model and the PV canvas directly. The MPV model constituted a shared format for supporting the session by using layers as points to trigger discussion between the craft and design domains. Design representatives seemed comfortable with adopting the layers as their means to communicate, probably because the model was adopted from design theories. The craft representatives, particularly in Case Study 2, relied more on their design counterparts to ask questions based on the layers. Furthermore, their answers are not necessarily limited to content related to the specific layers as the craft representatives’ knowledge about heritage products represents a complex, abstract relationships cultivated by a network of informal knowledge system. In this situation, design representatives’ involvement in clustering the information was useful in the session. As this sharing and clustering happened *in-situ*, it filtered and deconstructed the craftspeople’s tacit knowledge, which often emerges in the form of personal stories and narratives.

In brief, the craft representatives shared their knowledge and expertise about the heritage products; the design representatives elicited, synthesized, and clustered this knowledge according to the MPV model. By the end of the sessions, knowledge about the selected heritage products was transformed into explicit forms that fitted in the context of both craft and design domains, enriching and altering their knowledge prior to the session. For the craft representatives, the process disrupted their conventional narratives about the selected heritage product and reconstructed them into a new, simpler structure. For the design representatives, the process presented the means to learn about the different aspects of heritage products based on contemporary design theories.

These findings suggest that the MPV model has the characteristic of *standardized forms* (Carlile, 2002; Star, 1989), indicating its potential to reduce domain-specific content by providing simple, yet relatable knowledge to be shared, and can thus be used as a shared syntax between the craft and design domains.

Next to this, the PV canvas represents a shared space allowing representatives to map part of the knowledge shared during the sessions. It accommodates and adapts domain-specific content by splitting it into brief statements and reconstructing them based on the layers of the MPV model. By extension, the layers within the canvas were accessed without any hierarchical order, which suggests a discursive nature of the canvas. The process is exploratory and the content generated depends on the participants, selected heritage products, and the collaborative settings. The insights captured demonstrate that the PV canvas does resemble a *map of boundary* (Carlile, 2002; Star, 1989) where specific areas of knowledge from craft and design domains can be assimilated in a systematic manner.

The mapped PV canvas constitutes an early form of a database because it comprises codified content structured using the layers of the MPV model as its format. It can serve as a starting point of a database about heritage products that is constructed from local sources and compiled based on a specific standard. Each statement mapped onto the PV canvas can be accessed individually, if required or desired. This means that the content is modular and can be independently accessed, used and/or borrowed by representatives from different domains for various purposes (Star & Griesemer, 1989). The mapped PV canvas corresponds with the characteristics of a *repository*: a database based on a specific structure, composed from collective resources, and systematically organized (Carlile, 2002; Star, 1989).

## Conclusion

In this paper, we have shown that craftspeople and designers can work together more effectively with the support of different types of boundary objects. These objects act as scaffolding that supports knowledge exchange and collaboration, particularly on specific knowledge within each domain that might be of value to the other. Using these objects, part of the tacit knowledge shared is made explicit and structured.

A good platonic object is an object of inquiry that can act as a catalyst for discourse that brings different domains together. Within the context of this study, a heritage product is perceived as an object of inquiry that is capable of representing the craft and the design domains. However, it is important to note that a selection of these objects needs to be authentic and relevant within each domain, accessible by both domains, and applicable as well as useful for the collaboration efforts.

Based on the four types of boundary objects prescribed in the empirical exploration, heritage products were input factors that differed between sessions whereas the MPV model and the PV canvas used to elicit and map intangible values were the same. This suggests that the MPV model and the PV canvas represent universal objects essential to replicating the session. The mapped PV canvases represent a compilation of information acquired through collective efforts of craft and design representatives and knowledge from each domain that has been transformed to fit the context of the other. For craft representatives, their knowledge about heritage products is no longer just their personal narratives; it has been disrupted and reinforced based on contemporary design theories. This thematic structure is useful for craftspeople to share their knowledge among each other as well as with outsiders in a simple and systematic manner. Design representatives have the opportunity to gain in-depth knowledge about a heritage product and its connection to the local craftspeople and their cultural heritage. Such understanding can nurture awareness among designers in adapting values associated with local cultural heritage in their product ideas—consciously and responsibly.

The method devised and employed in this paper enabled a detailed study of a specific combination of design tools as boundary objects in design interventions. This highlights the potential to evaluate and compare other existing design tools as boundary objects to enhance knowledge exchange and collaboration across domains. However, the findings in this paper can only serve as a preliminary study in this topic as data from two design intervention sessions can be vulnerable and specific to this study. Therefore, conducting more sessions with similar conditions will offer more compelling and robust results with substantial analytical and evaluation benefits.

Apart from empirically examining different types of boundary objects in design intervention sessions, we have also recognized the linkage between heritage, craft, and design domains in the form of heritage products. We used theories established in the design domain as media to seek the intangible cultural heritage embedded in the craft domain, specifically in heritage products. Further research should also explore how the intangible cultural heritage can be used as a creative input to generate new product ideas and marketing content that connects the old and the new. In addition, probing heritage products for elements of sustainability may also reveal unexpected solutions to today's pressing challenges and promote inclusive and conscious adaptation of content from the local cultural heritage in the design process. Altogether, design research that focuses on the cultural heritage will also add to the understanding of the dynamics of sustaining knowledge from the past with the aspiration to integrate them in our future living.

## Acknowledgments

For enthusiastically participating and supporting our study, we would like to heartily thank the craft community in Sayong, staff of Kraftangan Perak, the lion dance troupe in Selangor, and students and lecturers at the Malaysian Institute of Art. In particular, Mr. Yusak, Mr. Pareb, Master Siow, Mr. Sohbul, Mr. Rizan, Mr. Liew, Ms. Zati Hazira, and Ms. Nuraini for their efforts and contributions in assisting us in this study.

## References

1. Alavi, M., & Leidner, D. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 25(1), 107-136.
2. Blessing, L. T. M., & Chakrabarti, A. (2009). *DRM, A design research methodology*. Berlin, Germany: Springer.
3. Carlile, P. R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Institute for Operations Research and the Management Sciences*, 13(4), 442-455.
4. Dalsgaard, P., Halskov, K., & Basballe, D. (2014). Emergent boundary objects and boundary zones in collaborative design research projects. In *Proceedings of the Conference on Designing Interactive Systems* (pp. 745-754). New York, NY: ACM. <https://doi.org/10.1145/2598510.2600878>
5. Diehl, J. C. (2010). *Product innovation knowledge transfer for developing countries: Towards a systematic transfer approach* (Doctoral dissertation). Delft University of Technology, Delft, the Netherlands.
6. Dormer, P. (Ed.). (1997). Craft and the Turing test for practical thinking. In *The culture of craft* (8th ed., pp. 137-157). Manchester, UK: Manchester University.
7. Galla, A. (2008). The first voice in heritage conservation. *International Journal of Intangible Heritage*, 3, 10-25.
8. Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109-122.
9. Groth, C., Mäkelä, M., & Seitamaa-Hakkarainen, P. (2013). Making sense: What can we learn from experts of tactile knowledge. *FormAkademisk-Forskningstidsskrift for Design Og Designdidaktikk*, 6(2), 1-12.
10. Halpern, M. K., Erickson, I., Forlano, L., & Gay, G. K. (2013). Designing collaboration: Comparing cases exploring cultural probes as boundary-negotiating objects. In *Proceedings of the Conference on Computer Supported Cooperative Work* (pp. 1093-1102). New York, NY: ACM.
11. Ingold, T. (2000). *The perception of the environment: Essays on livelihood, dwelling and skill*. New York, NY: Routledge.
12. Isar, Y. R. (2013). *Creative economy report* (Special ed.). New York, NY: United Nations Development Programme and United Nations Educational, Scientific and Cultural Organization.
13. Jasimuddin, S. M., Klein, J. H., & Connell, C. (2005). The paradox of using tacit and explicit knowledge strategies to face dilemmas. *Management Decision*, 43(1), 102-112.

14. Kang, L. (2016). Social design as a creative device in developing countries: The case of a handcraft pottery community in Cambodia. *International Journal of Design*, 10(3), 65-74.
15. Kim, J., & Wilemon, D. (2002). Focusing the fuzzy front-end in new product development. *R&D Management*, 32(4), 269-279.
16. Krippendorff, K. (1989). On the essential contexts of artifacts or on the proposition that “design is making sense (of things).” *Design Issues*, 5(2), 9-39.
17. Lam, A. (2000). Tacit knowledge, organizational learning and societal institutions: An integrated framework. *Organization Science*, 21(3), 487-513.
18. Lee, C. P. (2007). Boundary negotiating artifacts: Unbinding the routine of boundary objects and embracing chaos in collaborative work. *Computer Supported Cooperative Work*, 16(3), 307-339.
19. Lin, R. (2007). Transforming Taiwan aboriginal cultural features into modern product design: A case study of a cross-cultural product design model. *International Journal of Design*, 1(2), 45-53.
20. Margolin, V. (2007). Design, the future and the human spirit. *Design Issues*, 23(3), 4-15.
21. Nicolini, D., Mengis, J., & Swan, J. (2012). Understanding the role of objects in cross-disciplinary collaboration. *Organization Science*, 23(3), 612-629.
22. Nieto, M. J., & Santamaria, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. *Technovation*, 27(6), 367-377.
23. Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14-37.
24. Pessoa, J., Deloumeaux, L., & Ellis, S. (2009). *The 2009 UNESCO framework for cultural statistics*. Quebec, Canada: UNESCO Institute for Statistics.
25. Pisano, G., & Verganti, R. (2008). Which kind of collaboration is right for you. *Harvard Business Review*, 86(12), 78-86.
26. Prosalendis, S., Deacon, H., Dondolo, L., & Mrubata, M. (2004). *The subtle power of intangible heritage*. Cape Town, South Africa: HSRC Publishers.
27. Ravetz, A., Kettle, A., & Felcey, H. (Eds.). (2013). Introduction: Collaboration through craft. In *Collaboration through craft* (pp. 1-15). London, UK: Bloomsbury Publishing.
28. Roscam-Abbing, E. (2010). *Brand driven innovation: Strategies for development and design*. Lusanne, Switzerland: AVA Publishing.
29. Sanders, E. B. -N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, 4(1), 5-18.
30. Santos, A. L. R., Capet, L., & Diehl, J. C. (2013). The value of collaborative design to address the challenges of the humanitarian sector. In *Proceedings of the 3rd International Conference on Integration Design, Engineering & Management for Innovation* (pp. 301-310). New York, NY: Academia.
31. Sapsed, J., & Salter, A. (2004). Postcards from the edge: Local communities, global programs and boundary objects. *Organization Studies*, 25(9), 1515-1534.
32. Sennet, R. (2009). *The craftsman*. London, UK: Penguin Books.
33. Star, S. L. (1989). The structure of ill-structured solutions: Boundary objects and heterogeneous distributed problem solving. In M. Huhns & L. Gasser (Eds.), *Readings in distributed artificial intelligence* (pp. 37-54). Menlo Park, CA: Morgan Kaufman.
34. Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, “translations” and boundary objects: Amateurs and professionals in Berkeley’s museum of vertebrate zoology, 1907-39. *Social Studies of Science*, 19(3), 387-420.
35. Suib, S. S. S. B. (2012). *Heritage product for future living: A strategic approach towards sustainable heritage products in Vietnam*. (Master thesis). Delft University of Technology, Delft, the Netherlands.
36. Suib, S. S. S. B. (2019). *The intangibles: Values of heritage products for design and sustainability initiatives* (Doctoral dissertation). Delft University of Technology, Delft, the Netherlands.
37. Tassoul, M. (2009). *Creative facilitation* (3rd ed.). Delft, the Netherlands: VSSD.
38. Tsoumas, J. (2013). The ideal of handicrafts and the modern design formation: Coincidences and failures. *METU Journal of the Faculty of Architecture*, 30(2), 55-62.
39. Tung, F. (2012). Weaving with rush: Exploring craft-design collaborations in revitalizing a local craft. *International Journal of Design*, 6(3), 71-84.
40. United Nations Educational, Scientific and Cultural Organization. (n.d.). *Transmission*. Retrieved from <http://www.unesco.org/culture/ich/en/transmission-00078>
41. United Nations Educational, Scientific and Cultural Organization. (2003). *Convention for the safeguarding of the intangible cultural heritage*. Paris, France: UNESCO.
42. Van Boeijen, A. (2015). *Crossing cultural chasms towards a culture-conscious approach to design* (Doctoral dissertation). Delft University of Technology, Delft, the Netherlands.
43. Wang, W., Bryan-Kinns, N., & Ji, T. (2016). Using community engagement to drive co-creation in rural China. *International Journal of Design*, 10(1), 37-52.
44. Whitaker, T. W., & Cutler, H. C. (1965). Cucurbits and cultures in the Americas. *Economic Botany*, 19(4), 344-349.
45. Yair, K., Tomes, A., & Press, M. (1999). Design through making: Crafts knowledge as facilitator to collaborative new product development. *Design Studies*, 20(6), 495-515.

## Appendix

The statements mapped onto the PV canvases were the primary data used in this content analysis. To prepare the data for the analysis, each statement on a sticky note—mapped onto the PV canvas—was numbered and converted into textual data. Each textual data was considered as a statement and given a code (see below). Next to this, additional notes were included in order to provide context and meaning to an otherwise fragmented statement. Details on the method of coding and categorization can be found in Suib (2019).

- \* [X:Y] = the code given to each statement; X refers to the number given for each statement (see Figure A & B) and Y refers to the codes for each layer.
- \* **Layer codes:** Meaning = 5; Construction = 4; Performance = 3; Interaction = 2; Aesthetic = 1.

### Case Study 1: Labu Sayong

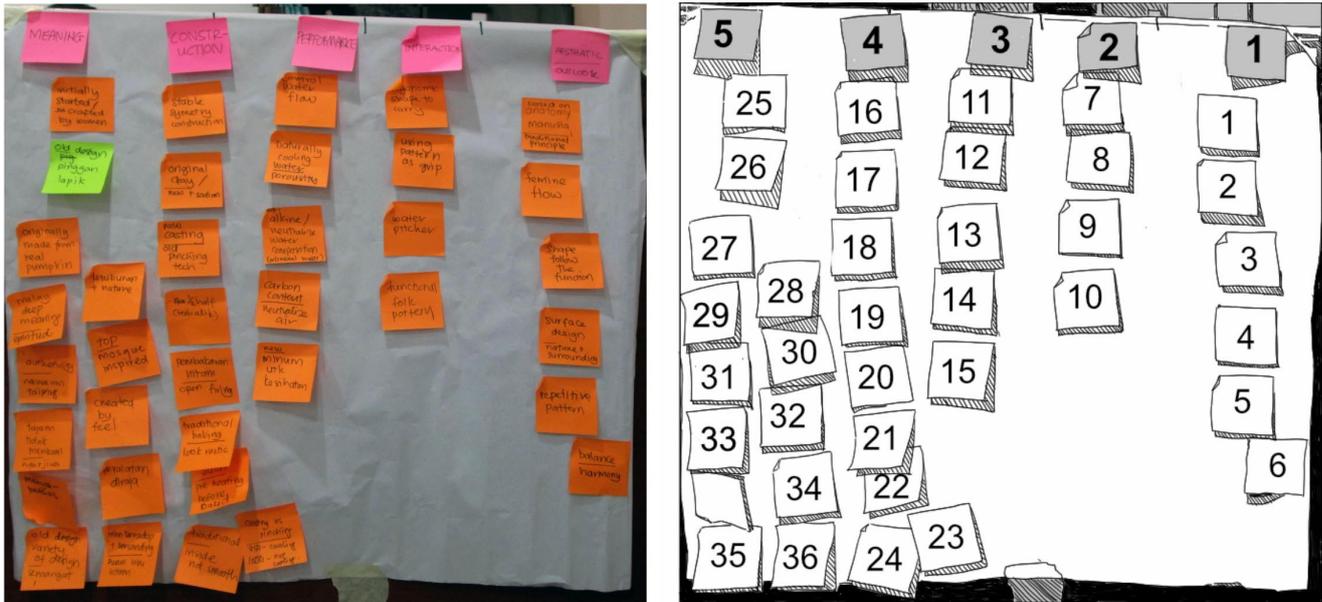


Figure A. Numbered statements based on the outcome of Case Study 1.

Layer (no. of statements)	Main-theme	Theme	Sub-theme	Statement [X:Y] – additional notes
Aesthetic 6 mapped	Style & Composition	Symbol & Inspiration		<ul style="list-style-type: none"> <li>• Surface design/nature &amp; surrounding [4:1]—The surface designs of the gourd are inspired from nature and local surroundings.</li> </ul>
		Physical Aspect	Form & Shape	Inherited
	Visual & Surface		Contemporary	
			Inherited	
Interaction 4 mapped	User Interaction	Inherited Element		<ul style="list-style-type: none"> <li>• Using pattern as grip [8:2]—Apart from decorative purposes, the stamp impressed relief patterns on the surface of the gourd also improve the grip as it increases friction during use.</li> <li>• Water pitcher [9:2]—Traditionally, the gourd was used as a water pitcher.</li> </ul>
		Contemporary Element		<ul style="list-style-type: none"> <li>• Ergonomic shape to carry [7:2]—The shape of the gourd makes it easy to carry.</li> <li>• Functional folk pottery [10:2]—Currently used for decorative purposes and souvenirs.</li> </ul>

Layer (no. of statements)	Main-theme	Theme	Sub-theme	Statement [X:Y] – additional notes
Performance 5 mapped	Product Feature	Inherited Element		<ul style="list-style-type: none"> <li>Porosity; naturally cooling water [12:3]–The evaporation through the porous pottery lowers the temperature of the water; providing cool water on a hot tropical day.</li> <li>Neutralizing air (water) due to the carbon content [14:3]–Due to the black firing technique, a certain amount of carbon content is embedded in this clay gourd thus potentially neutralizing the water it contained.</li> <li>Alkaline–naturally cooling water [13:3]–Refer to the note for [14:3] and believed to produce alkaline water.</li> <li>'Minuman untuk kesehatan' (Water that is healthy/good for the body) [15:3]–Drinking the water from the pitcher is believed to be good for health.</li> </ul>
		Contemporary Element		<ul style="list-style-type: none"> <li>Control water flow [12:3]–Referring to the form of the gourd that controls the flow of water while pouring.</li> </ul>
Construction 9 mapped		Design Aspect		<ul style="list-style-type: none"> <li>Stable and symmetry construction [16:4]–Referring to the design and production of the water pitcher.</li> </ul>
	Material	Inherited	Local Material	<ul style="list-style-type: none"> <li>Original clay/new + sodium [17:4]–For generations the clay used to make this particular gourd is excavated from a local source.</li> </ul>
		Contemporary	Means of Application	<ul style="list-style-type: none"> <li>Original clay/new [current practice] sodium is added [17:4]–Currently, sodium chloride (salt) is added to improve the clay properties.</li> </ul>
	Production Process	Inherited	Craft Technique	<ul style="list-style-type: none"> <li>New: Casting technique/Old: Pinching technique [18:4]–Traditionally, the pinching technique was used to form the gourd; however, this technique has now been replaced with a casting technique.</li> <li>½ Half ('terbalik') (turn upside down) [19:4]–For the traditional pinching technique; a plate (e.g., plates used for food) was used as a base to construct the gourd. The construction starts in the middle of the pitcher and proceeds to the bottom. Then, it is turned upside down and completed from the middle to the top.</li> <li>Traditional–inside not smooth [24:4]–Using the pinching technique, the surface of the gourd is smooth, but the inner part would be jagged with the maker's fingerprints.</li> <li>Technique: 'Pembakaran hitam' (Black firing technique) and open firing [20:4]–Referring to two traditional baking techniques: (a) The black firing technique is used to create the black luster finish in which a formed gourd is baked in a kiln (or a pit fire) and then immediately put into a pile of rice husk; (b) An open firing technique was used instead of a kiln.</li> <li>Traditional baking–look rustic [21:4]–Referring to the outcome of the black firing technique and the traditional baking procedure that is rustic and can be done by a household themselves</li> <li>'Sala' (smoked)–pre-heating before baked [22:4]–The newly formed gourds are traditionally smoked before baking.</li> <li>Casting vs pinching/850°C–cooling (contemporary method); 1000°C–not cooling (traditional method) [23:4]–Traditional method refers to the use of pinching technique and the black firing technique in which the newly baked gourd is immediately put into a pile of rice husk.</li> </ul>
Contemporary				
Meaning 12 mapped	Local Practice	In the past		<ul style="list-style-type: none"> <li>Initially started/crafted by women [25:5]–In the past, these gourds were made by women for home use.</li> <li>Created by feel [32:5]–Traditionally, the gourd is formed based on the instinct and feeling of the craftsman. However, with the casting technique the shape of the gourds is now uniform.</li> </ul>
	Collective Understanding	Customs & Rituals	Community-level	<ul style="list-style-type: none"> <li>[Products have] a deep and spiritual meaning [in the Malay culture] [29:5]–Products are often perceived as spiritual objects with connections to the other realms. The Labu Sayong is one of the examples of objects with deep and spiritual connections to the Malay community.</li> </ul>
		Myths & Stories		<ul style="list-style-type: none"> <li>Represent 'kesuburan' (fertility) and nature [29:5]–According to the local belief, the gourd represents nature and fertility.</li> </ul>

Layer (no. of statements)	Main-theme	Theme	Sub-theme	Statement [X:Y] – additional notes
		History		<ul style="list-style-type: none"> <li>• 'Peralatan diraja' (Royal items) [34:5]–One of the items used for the royal processions.</li> <li>• 'Makan beradap' (Royal banquet) + 'bersanding' (royal sitting). 'Tersusun labu hitam' (rows of black water pitchers) [36:5]–The gourds are often lined up as part of the items during royal processions such as royal banquet and royal sitting.</li> <li>• Old design–'pinggan lapik' (a base plate) [26:5]–In the old days, a plate is placed under the gourd to collect drips from the water pitcher.</li> <li>• Authenticity–Museum Taiping [31:5]–The authentic gourd; collections of water pitchers inherited from the previous generations can be found in one of the local museums known as Museum Taiping.</li> <li>• Initially started/crafted by women [25:5]–Traditionally, the gourd is made by women at home for personal use.</li> <li>• Originally made from real pumpkin[27:5] –Historically, these gourds were made from pumpkins</li> </ul>
		Principles & Philosophy	Design related principle	<ul style="list-style-type: none"> <li>• Old designs [consist of] variety of design [or creations representing various] 'semangat' (spirits) [35:5]–The old/traditional products are often associated with different spirits or souls. This belief stemmed from the folk religion link to animistic and polytheistic beliefs.</li> <li>• 'Tajam tidak menikam' (What is sharp should not be piercing); 'melayu-berkias' (Malay culture: allegory) [33:5]–Designs of traditional Malay products often adopted principles in the form of local allegories. This particular allegory has both an explicit and an implicit meaning. Explicitly, any shapes or lines with sharp edges should not be touching another shape or lines. Implicitly, it serves as a life principle that one should not stab another in the back.</li> <li>• Top–mosque inspired [30:5]–The gourd's covers are believed to be inspired by mosque's domes.</li> </ul>

Case Study 2: The Lion Head



Figure B. Numbered statements based on the outcome of Case Study 2 (Top: Group A; Bottom: Group B).

Layer (no. of statements)	Main-theme	Theme	Sub-theme	Statement [X:Y] – additional notes	
<b>Aesthetic</b> 27 mapped 1 discarded = [110:1]	Style & Composition	Impression		<ul style="list-style-type: none"> <li>Bright/Striking/Shiny [37:1]–The design of the lion head often comprises a bright, striking, and shiny composition.</li> <li>Majestic, grand, grandeur [42:1]; Majestic [108:1]–The lion head as well as the dance depict something majestic and grand.</li> <li>Exaggerated proportion [46:1]–The size of the lion head is exaggerated in proportion to the body.</li> <li>Mask (cultural) [106:1]–A cultural mask associated to the Chinese diaspora.</li> <li>Creative [114:1]–A creative work by each craftsman</li> <li>Fierce [118:1]–The lion head also demonstrated a sense of fierceness of the animal.</li> </ul>	
			Symbol & Inspiration	<ul style="list-style-type: none"> <li>Animal/Nature inspired motives–eagles, flame, Leo (the zodiac sign), Godzilla, Phoenix, curves [43:1]</li> <li>Points, line depth, elements motives [45:1]–These different design elements comprise their own meanings. For example, there are no straight lines in the design on the lion head skeleton, thus each of the crossing points in the constructions of the skeleton is vital.</li> <li>Symbolize a character [115:1]</li> <li>‘Sun Wen’ (referring to motive on the surface) [116:1]</li> <li>Local cultural identity [119:1]–The motifs used on the surface represents certain cultural identity closely connected to the local Chinese community.</li> </ul>	
	Physical Aspect	Form & Shape	Contemporary		<ul style="list-style-type: none"> <li>Shapes; Sphere, cylindrical [41:1]–The form of the lion head consists of the combination of various spherical and cylindrical shapes.</li> <li>(Nose) Spiral [113:1]–The nose is made of two fur balls attached to metal springs.</li> </ul>
				Inherited	<ul style="list-style-type: none"> <li>Lined 3D structure [38:1]–Lines are created using rattan and bamboo forming the 3D structure for the mask.</li> <li>Lining [109:1]–Referring to the structural lining of bamboo/rattan strands on the skeleton of the lion head.</li> <li>Crossing [112:1]–Referring to the crossings (or connections) between the bamboo/rattan strands in the skeleton which are vital in its construction.</li> </ul>
		Visual & Surface	Contemporary		<ul style="list-style-type: none"> <li>Furry [39:1] / Furry (Fluffy) [105:1]–Some parts of the lion head use fur for aesthetic impact, both in static and in motion.</li> <li>Innovation (new pattern) [107:1]–New patterns have been developed over the years, e.g., inspired from ‘batik’ motifs.</li> </ul>
				Inherited	<ul style="list-style-type: none"> <li>Animal parts–skin textured/fur textured: motives [44:1]–The motives of the surface designs are inspired from animal parts, notably the fur and the skin textures.</li> <li>Easy acceptance [111:1]–Traditional patterns and designs are easily accepted by the local market.</li> <li>Pattern [117:1]–There are different pattern designs on various parts of the lion’s head.</li> </ul>
		Color	Selection		<ul style="list-style-type: none"> <li>Bright/Striking/Shiny [37:1]</li> <li>Warm/Cold colors [40:1]</li> <li>Neon [103:1]</li> </ul>
				Combination	<ul style="list-style-type: none"> <li>Colorful–Contrast–Bright–Harmony [104:1]–The different color combinations used in creating the lion heads.</li> </ul>
	<b>Interaction</b> 23 mapped 4 discarded = [54:2]; [57:2]; [58:2]; [124:2].	User Interaction	Inherited Element		<ul style="list-style-type: none"> <li>Weighted/Heavy [49:2]–Referring to the traditional lion head skeleton made from rattan. It is heavier than its bamboo counterpart thus often used for training purposes.</li> </ul>
				Contemporary Element	<ul style="list-style-type: none"> <li>Grip Handles [50:2]–Additional material, such as fabric, is added to improve friction, providing better grip during use.</li> <li>Simple mechanism [55:2]–The lion head is designed with a simple mechanism allowing movements of the eyes, ears, mouth, and tongue.</li> <li>Facial control [52:2]–The mechanism (that enables movements for some parts of the lion head) helps the dancer to create various facial expressions during the performance.</li> <li>Back pillow [for] comfort [59:2]; Cushion for protecting head [122:2]–Referring to a padded area in the mask. The cushion provides extra support and protection to the dancer’s head.</li> <li>Extra lining for sweat [123:2]–The lion head is also lined with additional lining to absorb sweat during use.</li> </ul>

Layer (no. of statements)	Main-theme	Theme	Sub-theme	Statement [X:Y] – additional notes	
		Usage & Operation		<ul style="list-style-type: none"> <li>• Right posture [53:2]–It is important for a dancer to maintain the correct and stable posture during their performance</li> <li>• Requires good strength and stamina [60:2]; Strength of the player [126:2]–Every performer needs to establish good strength and stamina which enables them to effortlessly move the lion head according to the choreograph movements.</li> <li>• Possible muscles injury [61:2]–There is always a risk of muscle injury during product use.</li> <li>• Pull string inside [120:2]–There is a string attached to the mechanism inside the lion head which is used to control the movements of the eyes, ears, and tongue.</li> <li>• Hold over shoulder [121:2]–During a performance, the lion head is held over the shoulder of the dancer.</li> <li>• 2 hands [48:2]–The lion head is always operated using both hands.</li> <li>• Balance (head and back) [127:2]–Due to its size and weight, it is important for the dancer to keep the balance of the lion head during movements.</li> <li>• Support [125:2]–There are a few features inside the lion head which have been designed to support the dancer during use, e.g., the cushion, handles with grip, and extra lining.</li> </ul>	
	Social Interaction	Community-oriented		<ul style="list-style-type: none"> <li>• Social–good bonding [47:2]–Offers a means of socialization among the troupe members as well as with the local community.</li> <li>• Make people like it [56:2]–One of the important aspects of the performance is initiating positive connections and interactions with the audience and the community.</li> <li>• Attention grabbing–attraction with the audience [51:2]–The troupe uses various elements (from visual to sound) to grab attention and attract audiences during their performances.</li> </ul>	
Performance 23 mapped	Product Feature	Contemporary Element		<ul style="list-style-type: none"> <li>• Durable (5 years life span) [128:3]–The lion head produced by the workshop is often guaranteed to last for five years.</li> <li>• Waterproof [131:3]–The modern lion head is waterproof to improve its life span and durability.</li> </ul>	
		Inherited Element		<ul style="list-style-type: none"> <li>• Costume/prop [67:3]–Maintains its traditional functions as part of the costume or prop used in a lion dance performance.</li> <li>• Movement [134:3]–Referring to the different movements of the lion head parts, e.g., mouth, eyes, and ears.</li> </ul>	
	Product Offering	Community-oriented	General		<ul style="list-style-type: none"> <li>• Entertainment for human [66:3]–A form of entertainment for people.</li> <li>• Generational/Hand-down (inherited) [70:3]–A practice that has been passed on for generations.</li> <li>• For the preservation of culture [68:3]–The continuation of this cultural performance is part of safeguarding the intangible cultural heritage.</li> <li>• Celebration [129:3]–As part of a dance performs in local and traditional celebrations.</li> <li>• Dance [130:3]–A type of (folk) dance performance.</li> <li>• Entertainment–Army [132:3]–In the old days, this dance was part of the entertainment in the military.</li> </ul>
			Event & Occasion		<ul style="list-style-type: none"> <li>• Weddings [62:3]–An event during which a lion dance is performed.</li> <li>• Business (and) shop opening [63:3]–same as above</li> <li>• Chinese New Year celebration [64:3]–same as above.</li> <li>• Temple rituals [65:3]–same as above.</li> </ul>
		Individual-oriented	Personal Development		<ul style="list-style-type: none"> <li>• Many steps (in the performance) [69:3]–The lion dance consists of various steps and choreograph movements that need to be mastered by the dancers.</li> <li>• Good training product [72:3]–The lion head skeleton is also a suitable product for training as well as exercise.</li> <li>• Allows person to be skillful/Talent beneficial [73:3]–Being part of the troupe allows the members to refine their skills and talent from craft making to performing.</li> <li>• Teamwork [135:3]–The process of crafting and the act of performing require good teamwork to ensure its completion and success.</li> <li>• Cymbal–Stunt (drum)–music [136:3]–Playing cymbal and drum together with stunt skills are part of the skills learned by the troupe members.</li> </ul>
			Feeling & Emotion		<ul style="list-style-type: none"> <li>• Create excitement/Stir emotions [71:3]; Impulse [133:3]; Energetic [138:3]–The energy from the lion dance creates excitement and stirs people emotions.</li> <li>• Power [137:3]–The performance is also associated with power and affluence.</li> </ul>

Layer (no. of statements)	Main-theme	Theme	Sub-theme	Statement [X:Y] – additional notes
<b>Construction</b> 35 mapped 1 discarded =[149:4]	Design Aspect			<ul style="list-style-type: none"> <li>• Craft [81:4]–The lion head represents the craft aspect of this intangible cultural heritage.</li> <li>• Pillow [85:4]; Cushion [147:4]–A small pillow that rest at the back of the dancer's head is added for comfort.</li> </ul>
	Material	Inherited	Local Material	<ul style="list-style-type: none"> <li>• Rattan [74:4]; Rattan [139:4]–Rattan stems are traditionally used to construct the lion head skeleton. Currently, the rattan made skeleton is use only for training as it is heavier compared to its bamboo counterpart.</li> <li>• Bamboo [84:4]–Bamboo stems are also one of the materials used to construct the skeleton for the lion head.</li> <li>• Bamboo paper [157:4]–Bamboo paper and glue are used to cover the skeleton creating the skin/surface of the lion head.</li> </ul>
		Contemporary	Type	<ul style="list-style-type: none"> <li>• Masking tape [76:4]; Masking tape [142:4]–Masking tape is one of the main materials used in constructing the skeleton. This particular technique has been developed in the workshop to secure the connections (between bamboo strands) in the skeleton construction.</li> <li>• Aluminum [77:4]; Metal frame [152:4]–Aluminum tubes are used as the main structure for the skeleton due to its strength and lightness.</li> <li>• Wire/battery/LED [78:4] Battery [143:4]; LED [150:4]–In some designs, LED lights are installed as part of the new features used during a performance.</li> <li>• Sheep fur [80:4]; [148:4] Rabbit fur [82:4]; [145:4]–The furs from these animals are used to decorate the ears, the eyes, the horn, and the mouth of the lion head.</li> <li>• Paint [159:4]; Poster color [156:4]–Acrylic paint is used to create patterns on the skin/surface of the lion head.</li> <li>• Sticker [141:4]–Apart from acrylic paint, various types of stickers are also used to create patterns and designs on the lion head.</li> <li>• Net [153:4]; Cloth [149:4]–In addition to paint and stickers, fabric such as net and colorful cloth are also used to create patterns on the lion head.</li> <li>• Spring [144:4]–Springs are used to connect two fur balls as the nose of the lion head.</li> <li>• Rope / String (pulley mechanism) [86:4]; Rope [151:4]–Craft rope/ strings are used in the pulley mechanism to move different parts inside the lion head.</li> <li>• Glue [155:4]–Glue is used to bind bamboo paper to the skeleton.</li> <li>• Mirror [158:4]–A round mirror is attached on the forehead of the lion head–the mirror is believed to chase away monsters and bad influence.</li> </ul>
	Production Process	Inherited	Craft technique	<ul style="list-style-type: none"> <li>• Rolling/Bending/Pressing [79:4] Bending [154:4]–Referring to methods or the craft techniques used to form bamboo and rattan strands into the skeleton.</li> </ul>
		Contemporary	Craft technique	<ul style="list-style-type: none"> <li>• Bandage (masking tape) [83:4]–Referring to a new technique of securing the points of connection between bamboo strands developed by Sifu Z.</li> </ul>
				Tools
<b>Meaning</b> 35 mapped 3 discarded =[93:5] [99:5] [174:5]	Local Practice	Inherited		<ul style="list-style-type: none"> <li>• 1000 years and keep changing until now [96:5]–The craft of making lion heads together with the art of lion dancing have a history of almost 1000 years and have been evolving together with the diaspora of Chinese communities.</li> </ul>
		Contemporary Adaptation		<ul style="list-style-type: none"> <li>• Mix with own culture [100:5]–This statement refers to the adaptation of the art of lion dancing to the local culture. For example, when Chinese communities established their roots in Malaysia, various local practices were assimilated into their cultural practices.</li> </ul>
	Collective Belief	Custom & Ritual	Family-level	Community-level

Layer (no. of statements)	Main-theme	Theme	Sub-theme	Statement [X:Y] – additional notes
		Myth & Stories		<ul style="list-style-type: none"> <li>• Monster Nian/Years [89:5]; Unknown animal [179:5]–<i>Nian is a monster within the Chinese mythology that lives under the sea or in the mountains. Nian is also one of the Chinese characters in “Chinese New Year.”</i></li> <li>• Step first (first step)–created by playing soldiers [98:5]–<i>This folk dance is believed to have been created by soldiers during their free time.</i></li> <li>• Journey to the West/poem by Bai Ju Yi [163:5]–<i>This cultural performance is also linked to the poem Journey to the West by Bai Ju Yi</i></li> <li>• Guang Dong [169:5]–<i>A place in the East of China is believed to be the place where this folk dance originated.</i></li> <li>• 1000 years [177:5]–<i>This traditional folk performance is believed to have originated 1000 years ago.</i></li> <li>• From Buddha India [178:5]–<i>The lion dance is also associated with the story related to Gautama Buddha who came from India.</i></li> </ul>
		History		<ul style="list-style-type: none"> <li>• Substituting history and story [101:5]–<i>The background related to the lion dance is considered to be a combination of heritage and history.</i></li> <li>• Han Dynasty [176:5]–<i>Rituals/performances in which people performed as animals were recorded in texts written during the Han Dynasty.</i></li> <li>• Soldier entertainment [172:5]; Entertainment of war face (time) to dance [94:5]–<i>This performance was part of soldiers’ entertainment during a period of war.</i></li> </ul>
	Principle & Philosophy	Design related principles		<ul style="list-style-type: none"> <li>• Not forgetting our root [92:5]–<i>One of the key motivations behind the continuation of this tradition is to remember and safeguard one’s cultural root.</i></li> <li>• Aesthetic/design of the lion head varies depending on events, purposes, and usage [95:5]–<i>There are various different designs of the lion head for different events and purposes.</i></li> <li>• Come [originate] from nature [97:5]–<i>The design elements embedded within the lion head often originate from nature.</i></li> <li>• Innovation on the outside not the meaning [171:5]–<i>Innovation in the lion head is associated with its tangible aspects (e.g., its style and outlook); however, the functions and meanings it offers to the community remain unchanged.</i></li> </ul>
		Feeling & Emotion		<ul style="list-style-type: none"> <li>• Joyful [88:5]; Happiness [162:5]; Joy [167:5]; Blessing [164:5]; Luck [166:5]; Hope [175:5]–<i>Refers to the different feelings and emotions associated with the lion head.</i></li> </ul>