

# A Study on the Miniaturization of a Product

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**Abstract :** Japanese product is highly characterized by its miniaturization, due to the economic profit, resources limitation, traditional aesthetic and space limitation. Small object designs have obvious traits and delicately communicate aesthetic senses of oriental cultures. The scale is seen as one of cultural traits of a product. In accordance with modern lifestyle of single, mobile, personal, compact, portable and growing multi-function products, most products require flexibility, integration, portability and multi-functionality. Therefore, designs of miniaturized articles are mainly for space-saving purpose. It could be divided into two parts; one is to shrink product scale aggressively with design formality for the saving of space; the other one is to reveal ordered aesthetics passively to avoid the mess of environment. This study is to analyze the miniaturization culture of Japan and the formality of traditional implements by the viewpoint of design history. The main findings of this study are four basic design formalities: modular design, folding design, stacking design and packing design. They satisfied the design requirements of flexibility, integration, portability and multi-functionality. Based upon the four basic design formalities, we bring up a deduced formality that could conform to the modern product design property and the contemporary lifestyles.

**Key words:** *miniaturization, cultural context, product design , design formality*

## 1. Introduction

In a classic Japanese literature - *The pillow Book*, there are some descriptions of a charming “small” world:

*All things small,*

*No matter what they are,*

*All things small are beautiful.*

なにもなにも

ちひさきものわ

みなうつくし

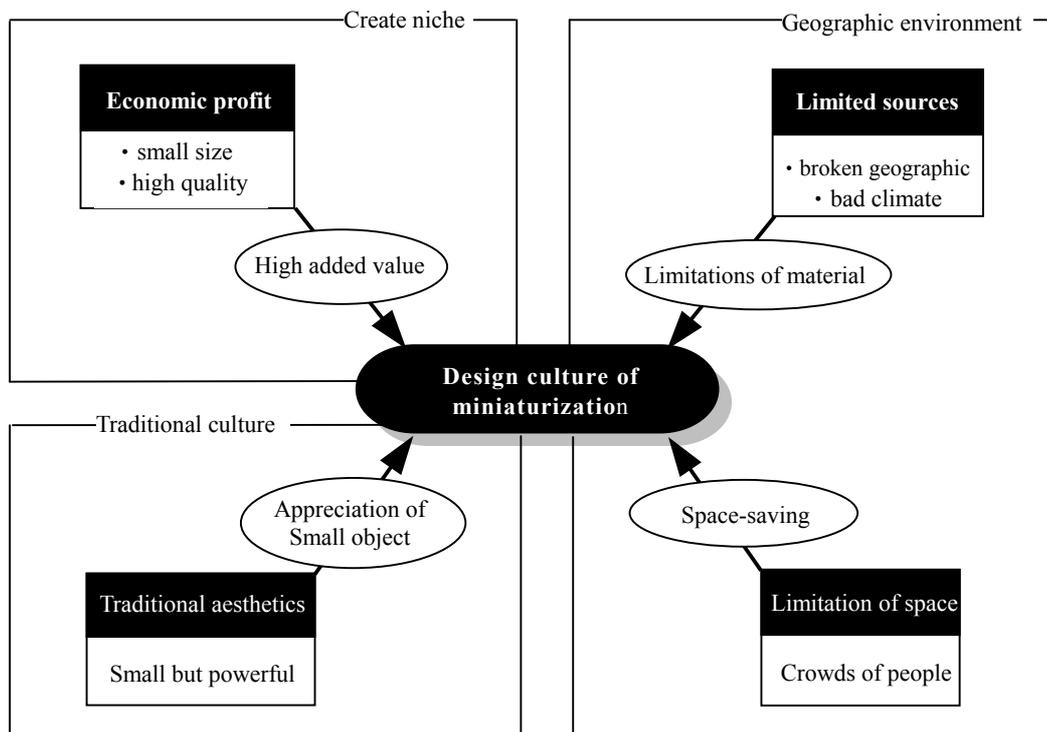
*Sei Shonagon*

*The pillow Book*

It means that all small things are beautiful, no matter what it is [ 1 ]. Therefore, small objects were considered as a character of eastern culture. Size is close related to culture. In fact, the influence is not come from the size, but

due to the relationship of environment [ 2 ] . Therefore, design of miniaturization with the context of Japanese culture is focus on the “accuracy” and limited size of the products. There are four causes of the formation of the design of miniaturization with the context of Japanese culture.

- ( 1 ) Resources limitation: due to limits of the terrains and the deficiency of source, the material and the cost of the product were limited greatly. So the products tend to be “miniaturization”. Therefore, like capsule hotel become a special architecture scale of Japanese.
- (2) Limitation of space : due to the small space of Japan, product design tends to space-saving. Therefore, the Japanese designers usually focus on the developing of the products, which are suitable in small space. Make products easy to fold, stack and carry. The function of formality were considered as unique characters of Japan, like Japanese traditional instrument such as folding fan, paper lantern and furoshiki( ふろしき) , and like modern product such as the design of nesting pots.
- (3) Economic benefit: due to Japanese economic and trade were dependent on export, the development of small size, high quality products could have more profits in market. Therefore, the miniaturization of product is the point of development in Japan, such as mini - television of watch type of SEIKO.
- (4)Traditional aesthetics: In the traditional Buddhism of Zen, it claimed“small but powerful”[ 3 ] principle. This not only influences the aesthetics of the Japanese and the creation of art formality. In the pre-industrial era, it reaches the highest aesthetic formality and reduces the dimension of an artifact to the physical minimal, such as traditional instrument of yatate ( やたて) and inro ( いんろう) .



**Fig 1.The formation of miniaturization design culture**

According to the statement of above, it revealed that product design of miniaturization with the context of Japanese culture not only influence the formality and size of the instrument, but also space design, modern product, and even lifestyle and aestheticism. Besides, the product design of miniaturization has its special design requirements, such as flexibility, integration, portability and multi-functionality. Due to the above

design requirements, integrated and deduced basic design formality of miniaturization and extend its formality evolvement from the historical document to accommodate to different requirements of modern lifestyle, and make “small but powerful” of traditional value of miniaturization deduce to “almighty but small” of modern spirit [ 4 ]

## 2.Methods

This study is focus on the analysis of the culture context. Therefore, we considered the design formality miniaturization to evolve modern design. The aims are, first analysis the formation of formality of Japanese product design of miniaturization. Second is to analysis and deduced basic design formality on traditional Japanese product design of miniaturization. Third is to deduce basic design formality, according to different design requirement. This study is to analysis of characters of Japanese miniaturization culture context and traditional instrument design formality with historical method by the viewpoint of design history. Besides, we integrated the design formality of miniaturization by induced and deduce method of grounded theory.

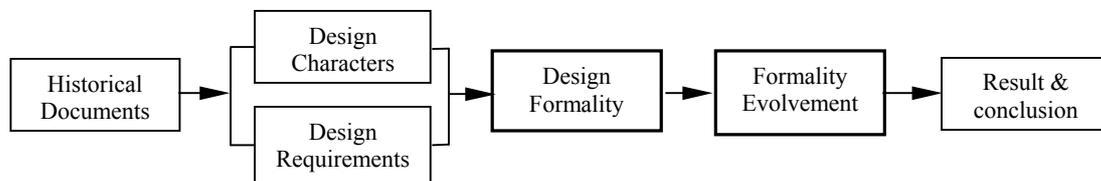


Fig 2. Research procedure

### 2.1 Definition and range

“Miniaturization” means small than general objects originally. We induced the word from the book of “Small is Better” by a scholar of Korea, O-Young, L. What we means miniaturized culture design in this study is base on the product design and evaluate as the visible design norm, so the design of miniaturization mean “convertible” product, its goal is to space-saving, it can divided into two parts. One is to use design formality to decrease the size of product aggressively. Another is to improve the mass of the environment by ordered visual image of formality aesthetics. So the research range of the Japanese’s miniaturization is to accommodate to different aim of design and present different design formality:

- (1) Spare space: used integration and make the environment order and tightly.
- (2) Flexibility consideration: consider the changeable of instrument while in use or in collection.
- (3) Convertible formality: extend of the function and the formality.

## 3. Result

From the historical documents, we have analyzed and deduced the design characters and design requirements of Japanese cultural context of miniaturization, and have found the miniaturized design products have four basic design formalities ( Fig. 2 ) .

### 3.1 Design characters

- (1) Palm-top scale : It’s obvious that a lot of Japanese design formalities are tend to palm-top scale; for example: folding fan, folding umbrella and walkman etc. This way is convenient to hold and carry.
- (2) Standardization : Japanese designers are used to dependent on standard modular or plan modular unit before

design products. On the other hand, tatami (たたみ) and kimono (きもの) are old modules in the world [ 5 ] . So standardization is design criterion of Japanese culture.

- (3) Order : Due to Japanese use of modular units in a long time, and used as an usual design practice. The rectilinearity and grid system become obvious characters of Japanese design communication. Therefore, it would found the usage of rectilinearity and grid system to form tatami (たたみ), fusuma (ふすま)(sliding partition) or traditional handiwork to modern product design. It presents order and harmony of visual balance.
- (4) Simplicity : It has two features: the first one is to make complexity into simplicity, it means to integrate a lot of complex elements into simple appearance that is like a lunchbox. It would appear simple aesthetic formality. The second one is to simplify the original formality, for example Japanese flower arrangement.



**Fig.3 : The examples of design character : tatami (たたみ), fusuma (ふすま), kimono (きもの) and lunchbox (from left to right)**

### 3.2 Design requirements

- (1) Flexibility : it would change different appearance to base on requirement and could enlarge and shrink the scale. For example: folding fan, furoshiki (ふろしき) that are provided with folding character and inro (いんろう) that is provided with stacking character [ 6 ] .
- (2) Integration : a product is provided with multi-function due to space-saving requirement in Japan, it means the product is convertible to change the different function for different requirement. It's like the yatate (やたて) and inro (いんろう) are classical packing designs and are provided with character of integration.
- (3) Multi-functionality: It was considered as a specialty of Japanese design and should be in the small space. Moreover, it would meet the requirement of unstable and temporary. The modern multi-functional products have open life cycle and different use requirements. Always use the stacking design and modular design formalities could reach the convertible efficacy.



**Fig.4 : The examples of design requirement : furoshiki (ふろしき), folding fan, inro (いんろう) and yatate (やたて) (from left to right)**

(4) Portability: Portability is first focus on compact, lightly and able to integrate the internals. Like furoshiki (ふろしき) and folding fan are use folding function to reach the design requirement of miniaturization and satisfied the portable design requirement. Traditional instrument like inro (いんろう) and yatate (やたて) are reach the convenience of portability by use integrate function of stacking design.

### 3.3 Design formalities

#### (1) Modular design

Modular design can divided into “industrial modular、established modular and natural modular”. Industrial modular would divide into architectural modular and credit card modular. Architectural modular such as tatami (たたみ), tile and brick. Credit card modular is most wide used design units, such as calculator, razor, stationery and mobile phone. The modular design was used because of accommodate to economic, reasonable production, flexibility and the detail of aesthetics factors. The general modular have the same unit, so that the different country and company can communicate and circulate each other. Different products have different modular unit, such as electric system of audio-visual systems, would used versatile modular to increase the change of design unit.

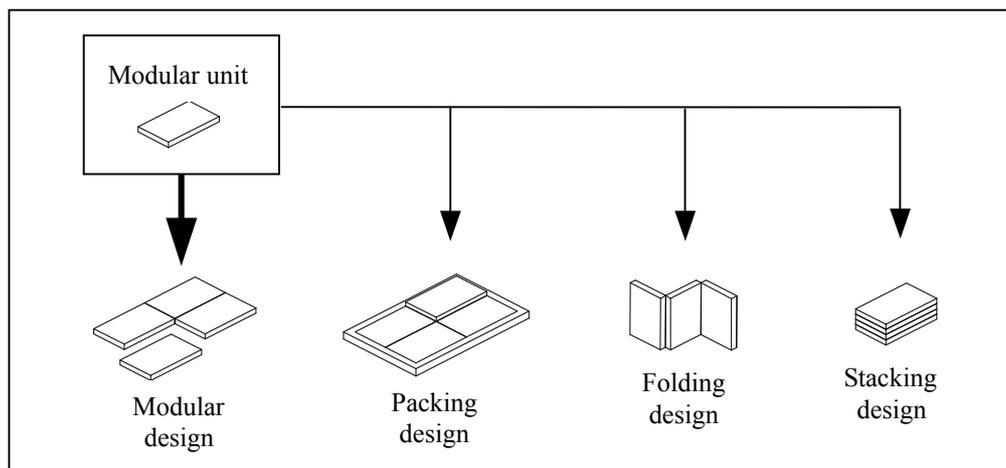


Fig 5. The modular design not only would be a dependent design formality, but also can be used accompany to other three design formalities

#### (2) Packing design

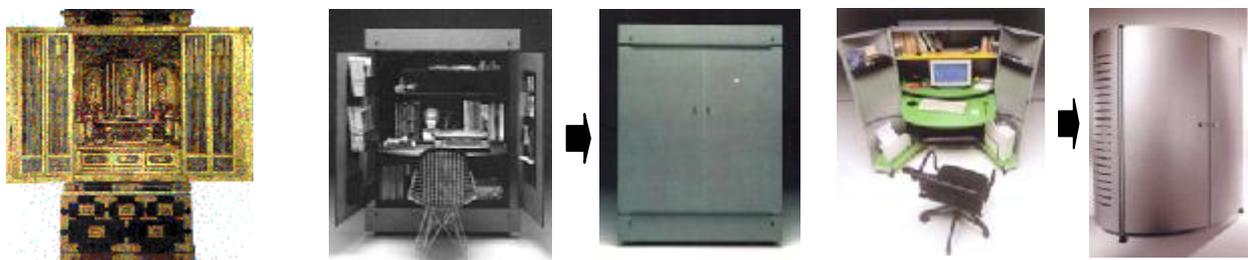


Fig 6. Design examples of all – in - one: household Buddhist altar design of Japanese and two kind of eastern and western miniature office design (from left to right).

Packing design is not a single object but composed by many units. Its design appearance is the form of box that could let the space has most efficacies. So that, packing design just like package, it has the function of protective, movable, purposeful and meaningful. The most representative instrument is like a lunchbox.

Formality evolvement of packing design would divided into “modular unit, puzzle layout, all-in-one”. Inside of modular unit, there is the same unit, just like tatami (たたみ) inside the room. The size of room is determined by how many tatamis (たたみ) are in the room. Puzzle layout would have the most efficacy of the space and have the characters of miniaturization, portability, and integration. It would compose different size of units. In general speaking, it most used on product kits, such as stationery kits and tool kits. All-in-one has more multiple function units and the form is always changing. The representative instrument is the Baddish design of Japanese. This kind of design give a lot of idea to modern design, such as two kind of eastern and western office design have the same idea with the Baddish design of Japanese.

(3) Folding design

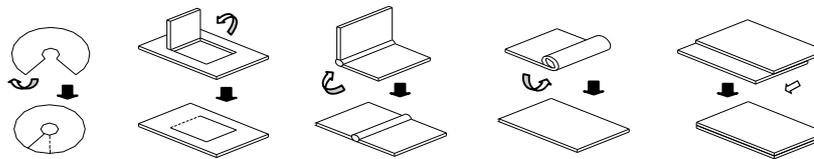


Fig 7. The present of folding design in a simple action.

Folding design is the best formality of space-saving and flexibility, especially to those who used it in a very long time period, but not used it always, small space and need to carry it on all the time. On basically, folding design would divided into “Mobile design, folding flat, roll design, cut out design”. Mobile design means the detail design of the hinge, would be bend, fold or slide to decrease volume of instrument. Folding flat would used the 2D flat type and constructs a 3D structure by bending or folding. Roll design use the character of materials and structure design to have a bending action and form in roll type and decrease the volume. There are two styles; one is use the material bending directly, another is use snake-like structure to have bending effect.

(4) Stacking design

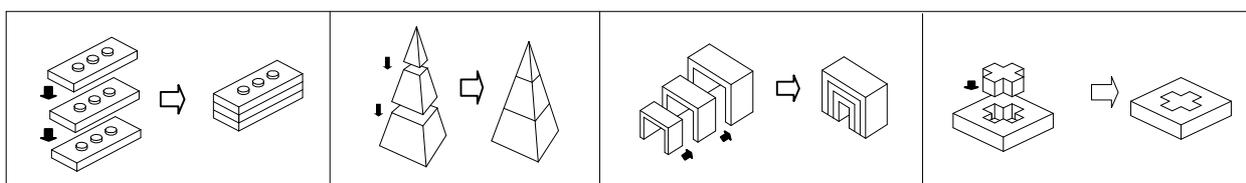


Fig. 8 the formality evolvement of stacking design : brick design , set design , nesting design and cut-out design ( from left to right )

Japanese stacking design and nesting system are considered as the best integrate designs to have spare space, not only improve the quality of life but also present the best space usage. In general speaking, the deduced form of stacking design would divided into “brick design, set design, nesting design and cut-out design” . Brick design uses the same formula unit and pile up from the bottom to the top. According to brick design, it would divide into “linear stacking, stagger stacking and puzzle stacking” . Set design is composed different size of component and make a linear pile and composed a well instrument. Nesting design is used the same shape, but different size of components to unified to the biggest instrument. Cut-out design is based on one unit and two units composed a component. The basic component has at least has two units.

#### 4. Discussion:

From the result of study, we would find the four basic design formalities of miniaturization to accommodate different design requirement and evolve different formality evolution and we discuss below:

- (1) Modular design: The modular design must have contract the basic form of modular unit and should be notice the method of composition and the organization and the composition are convertible and diversiform. So that the modular unit must be simple and the composition should be diversiform.
- (2) Packing design: No matter to the same modular unit or to different form, on basic, it should have well regulated inside form, size and then it decided what size of outside is. In general speaking, outside is composed of a box. Because it is the form that has lesser space and can have the most internal space efficacy.
- (3) Folding design: Due to different category and requirement of product, there are different folding design structure. No matter what formality it is, it needs an active structure. So we must notice the stability of expansion and miniaturization while in folding.
- (4) Stacking design: Stacking design depended on product character and requirement to choice suitable design formality. From the product category of its composed, decided which composed unit. To increase the stability of integration, the adjoin method should be carefully.

This study is to accommodate different design purpose and use different design formality to resolve different design requirement of miniaturization (appendix A). So the study is not only to realize the miniaturized design formality of Japanese traditional instrument, but also accommodate to modern lifestyle and deduce a modern design formality of miniaturization in accordance to modern meaning and value of miniaturization. In other word, it is “almighty but small”. So that, from culture context to recognize the usage of design formality, not only realized the spirit and meaning of traditional culture, but also have more deep realization to the design culture and could precede the tradition. We hope we could have a development of cross-culture design in the future.

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## Appendix A

**Table 1: The comparison of different design formality and the satisfactions of miniaturization design requirements.**

Design formality	Formality evolvement	Suitable of product character	Design conditions	The characters of miniaturization
Modular design	Industrial modular	<ol style="list-style-type: none"> <li>1.product has the requirement of developed system design</li> <li>2.product has the aim of “opening design” and could expand function and change the composed methods</li> <li>3.have requirement of collection and could decrease the waste of space and have the function of integration</li> </ol>	Construct the modular basic form first and notice the development and change of form construction and collection	<ol style="list-style-type: none"> <li>1. Standardization</li> <li>2. Order</li> <li>3. Simplicity</li> </ol>
	Established modular			
	Natural modular			
Packing design	Modular unit	<ol style="list-style-type: none"> <li>1.a lot of composed units could use modular or puzzle form and reach the integration</li> <li>2.different size and form of units can composed to different composed unit by external box</li> </ol>	Packing design should regulate the internal shape and then could decide what size of the external box. In general, the external box are box form always, due to more efficacy of space saving.	<ol style="list-style-type: none"> <li>1. Palm-top scale</li> <li>2. Standardization</li> <li>3. Order</li> <li>4. Simplicity</li> </ol>
	Puzzle layout			
	All-in-one			
Folding design	Mobile design	<ol style="list-style-type: none"> <li>1.to the product that are used in a long time period but not used always</li> <li>2.have the requirement of expanding, decreasing function and shrinkage to the delicate size and easy to hide.</li> <li>3.decrease the amount of material and change to different design feature</li> </ol>	Accommodate to different product, there are different folding design and should notice the stability while construction is expanding or decreasing	<ol style="list-style-type: none"> <li>1. Palm-top scale</li> <li>2. Order</li> <li>3. Simplicity</li> </ol>
	Folding flat			
	Roll design			
	Cut out design			
Stacking design	Brick design	<ol style="list-style-type: none"> <li>1.no matter the same or different form and size units have all need integrate requirement</li> <li>2.in general, it takes vertical stacking design</li> <li>3.the requirement of expanding space and function.</li> <li>4.have the opening design, could change the function of design feature by the user</li> </ol>	Select appreciated design formality according to the product character and then decide the form of the composed unit. It should notice the method of adjoin for product stability.	<ol style="list-style-type: none"> <li>1. Palm-top scale</li> <li>2. Standardization</li> <li>3. Order</li> <li>4. Simplicity</li> </ol>
	Set design			
	Nesting design			
	Cut-out design			