

Extendable Coffee Table Influenced by Beijing's CCTV Tower

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Abstract: Coffee table is one of the pieces of furniture that can be placed in the living room, a place where communication and interaction occur between people. Nowadays, an increment in population affects the size and space of the housing. Most small housing residents have a crucial time choosing their furniture due to limited space. Therefore, the aim of this study is to design and develop an extendable coffee table. Prior to the design process, the design features were determined from the questionnaire. The questionnaire was distributed to a total of 50 respondents who live in a small housing area in Skudai, Johor Bahru. Prior to the sketching process, the visual study was done on an extendable coffee table and coffee table with castor. Later from the visual research, a thumbnail and ideation, idea development and final design were prepared. The findings of the questionnaire stated that the design criteria for an extendable coffee table are a rectangle in shape, equipped with castor, minimalist style, open and closed storage, and finished with natural colour. The designs of the extendable coffee table are designed in stages based on the criteria obtained and presented in mock-up form. Later a design survey is conducted to obtain the final design to develop into a prototype. The majority (43%) of respondents choose Design 2 as the final designs. During the manufacturing of the prototype, there are minor amendments to the design and material used. At the end of the study, the extendable coffee table influenced by CCTV Tower was successfully fabricated.

Keywords: Extendable coffee table, Living room, Small housing area

1. Introduction

1.1 Research Background

Functionality and aesthetic roles, deciding forms and attractive style play a very important role in the development and design of furniture (Antal *et al.*, 2016). It is clear that furniture's purpose depends upon its shape or features produced on the furniture. Furniture comes in sizes and shapes of all sort all depends on design and purpose (Thøgersen, 2013). One of the common pieces of furniture

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is a table that fulfilled the purposes of eating, reading, typing and writing activities. Consider the activities involved in sharing a meal and consider how the form and design of a table, scale, height, materials, structural stability, edge profile, weight, and spatial location may influence behavioural patterns and meal communication (Rechavi, 2009). In his study, wall-less living rooms were used for hosting guests, as well as for the leisure activities of the dwellers. Communication and interactions are two key behaviours frequently used in the living room and the coffee table is placed in the living room (Saruwono *et al.*, 2012). Their study also mentioned that the lounge set is usually accompanied by a small rectangular coffee table. There are several coffee table types available on the market varying in form, size, and also in the material used to create the furniture. The extendable coffee table is not a new phenomenon in the market, though there are not many companies that manufacture extendable furniture (Wang, 2013). However, most of the design available were designed without inspired by either living things or non-living things. Such features can be integrated into their item of design. For instance, Jimmy's Buffet is a movable sideboard designed by Jim Postell and Janet Flory for a residential dining room where the drawer's layout was inspired by the Tetris video game, with different shapes stacked tightly over each other (Postell, 2012).

As shown in Figure 1, CCTV Tower has a unique design that can be implemented in the design is a tower with 234 m high tower located in Beijing redefines the skyscraper's shape (Carroll *et al.*, 2008). In comparison, the new CCTV headquarters is a 'generic iconic' building that represents modernity and global trade (Fong, 2016). The building's shape is unique to an exceptional one than other skyscrapers. CCTV Tower is in a single loop of linked activities around the four elements of the tower which is the nine-storey 'Base', the two leaning Towers which slope at 6° in each direction, and the nine to 13-storey 'Overhang', which suspended 36 stories in the air (Green *et al.*, 2005).



Figure 1: Beijing's CCTV Tower (Carroll *et al.*, 2008)

1.2 Problem Statements

Statistics from the Malaysian Department of Statistics indicate the population grows from 32.4 million in 2018 to 32.6 million (Department of Statistic Malaysia, 2020). Due to the increasing population and added with the growth of urban housing, a small apartment is developed (Thøgersen, 2013). Marketing expenses and rising urbanization drives people into less room. Obviously larger houses require more building materials, but there is little study on the contents of houses of different sizes (Khajehzadeh & Vale, 2017). Thus, as more material needed, the price of the house probably will increase. With the minimal space provided, occupants should be aware of the types and size of furniture they are buying (Saruwono *et al.*, 2012). Therefore, an extendable coffee table could provide space effectively to the user. Due to their transformable functionality, the extendable coffee table has

a major role to play in solving space problems (Wang, 2013). Thus, this study proposes an extendable coffee table inspired by CCTV Tower.

1.3 Research Questions

- (i) What are design criteria of the extendable coffee table influenced by Beijing's CCTV Tower?
- (ii) How to design an extendable coffee table influenced by Beijing's CCTV Tower?
- (iii) How to develop a prototype of an extendable coffee table influenced by Beijing's CCTV Tower?

1.4 Research Objectives

- (i) To identify the design criteria of an extendable coffee table influenced by Beijing's CCTV Tower.
- (ii) To design an extendable coffee table influenced by Beijing's CCTV Tower.
- (iii) To develop a prototype of extendable coffee table influenced by Beijing's CCTV Tower.

1.5 Scope of the Study

The research area of this study is Skudai, Johor Bahru. The target user for this furniture is a family or an individual that needs furniture that can perform suitable with the space available. The design and materials were determined based on the questionnaire.

1.6 Significance of the Study

The family that resides in the small housing area can optimize the space used by using the coffee table and at the same time can extend the table into a suitable arrangement. Other than that, by limiting the space for a larger coffee table, they can use the remaining space with other furniture that can bring up the ambient. The atmosphere in the living room can be rather less formal where one's family can leisurely relaxing together and execute their time together to strengthen their bond.

2. Literature Review

2.1 Demand on Space Saving Furniture

Due to urbanization that leads to the build-out of a small apartment, the urge to develop smart space-saving furniture is increasing (Thøgersen, 2013). This creates a challenge for a designer to ensure that the transformable space saving furniture needs to be both exquisite and fulfil the function (Wang, 2013). Antal *et al.* (2016) obtained result such that the demands of clients are utmost satisfied when the portion of functionality and aesthetic functions link up to the beliefs of clients. Wang (2013) stated that the market for transformable space saving furniture is due to the purchasing power of a particular city or country. Shenzhen, Beijing, Tianjin, Shanghai are four cities in china that included in the top 20 cities that have a high density of population where these four cities also the richest cities in China. Wang (2013) argued that these cities are most fit to polish the potential of marketability of extendable furniture. The demand for transformable furniture is derived by the factor of urbanization that leads to the low average living area for both countries such as the US and China.

2.2 Multifunctional Furniture

Furniture can be classified into several classes, such as health-care furniture, hospitality furniture, intuition furniture, multifunctional furniture, office furniture, recreational furniture, religious furniture, residential furniture, retail furniture and storage furniture (Postell, 2012). Exceptionally, multifunctional furniture is must-have furniture for every household with a small space. Multifunctional furniture is furniture that can perform more than one function it also goes by other names such as space-saving furniture, multipurpose furniture and transformable furniture (Thøgersen,

2013). He also mentioned that furniture that has extra functionality is important to save a doable space for better use and the researcher also stressed that the key feature of this kind of furniture is light and movable. Whereas, cramped quarter issues can be resolve by using convertible furniture where two or more purpose are packed in one piece and can be put away (Saruwono *et al.*, 2012). Postell (2012) proclaimed that multifunctional furniture includes furniture that can do Sit-Work, Sit-Sleep, and Store-Display. Wang (2013) give an example of a lamp table that can extend up to 114 inches long dining table and stated that the aftermath of the design is its space-saving capabilities when it is not in use and its furnishing of a large entertaining space when the user needs a dining room table. Malaysia experiencing modern urbanization after the independence in 1957 and due to this, modern urban housing prototypes are developed with the quick industrialization and urbanization where they highlighted the maximum use of land (Ju & Omar, 2010). Khajehzadeh and Vale (2017) stated that the size of one's house will affect both resources that go into the house and the things it contains. The urbanization trend causes cities to have comparatively less available space, and also the increment price of properties by which provide a good opportunity to develop extendable furniture (Wang, 2013).

2.3 Coffee Table

A coffee table is defined as a low table used in front of a sofa or couch (Postell, 2012). A study claimed that the coffee table is an invention from American proven by the adoption of non-hierarchical and open-plan lifestyle open-plan that replaced the function of dining table from formal eating into informal eating in front of the television. Eshun (2013) later, also stated that a similar opinion by adding that coffee table can be burdened by taking the responsibility to express people personality. The coffee table normally placed between 16 into 18 in from the chair or sofa to improve its accessibility (Eshun, 2013). A resident of shared apartment and studios in New York create space in their rooms that comprises a large seating item, coffee table at the front or end table at the side (Rechavi, 2009). Furnishing such as bed, couches or sofas, a coffee table is needed to fulfil functions of organizing, display and storage (Postell, 2012). In the early year of the existence of the coffee table, it is regarded as a fashion accessory of mid-century home furnishing (Attfield, 1997). Attfield (1997) also stated that the coffee table also well known for its function in defining a new type of space within the domestic interior. In today's society, rather than only holds beverages or placing things, a coffee table has a lot more functions (Eshun, 2013).

2.4 China Central Television (CCTV) Tower

The CCTV Tower is designed by an architect named Rem Koolhaas and his team OMA (Office for Metropolitan Architecture). It is one of China's towers that have its own uniqueness in term of their shape of the building itself located at Beijing's Central Business District (CBD) (Ma, 2008). Originally this building is built to fulfil the function of management, production, and administration but not have to be in one building, but the architect combined all the function into a single building of loop that connected around four elements that satisfy the aim for the tower to be built (Green *et al.*, 2005). Later Ma (2008) added that a good environment stimulates communication between workers from all departments and with the public. The complexity of the shape, demand engineers to consider all environmental factors such as wind, thermal contraction and also a seismic factor to make the design possible. In addition, erecting and connecting the two massive towers presented the structural engineers and contractors with further design and construction challenges (Carroll *et al.*, 2008).

3. Research Methodology

3.1 Questionnaire Survey

A survey conducted among 50 respondents that reside in Skudai, Johor Bahru. The survey form consists of three sections; Section A on demographic information, Section B on the opinion of extendable furniture and Section C on design criteria. The questionnaire was included in the Google Form and distributed through group WhatsApp. Later, the data obtained was used to determine the design criteria of the coffee table.

3.2 Visual Study

A study conducted by searching the image using a certain keyword related to the coffee table with castor and extendable coffee table. After the suitable image obtained, the feature of the coffee table was analyzed. To make it easier, the images were placed side by side and analyzed.

3.3 Sketches

Thumbnail was done with a speed without detailed parts and done in 2D either with a pencil and ball pen. A total of 59 thumbnails were sketched. While ideation was the improvement design taken from the thumbnail. A total of 10 ideations were generated for this study. After the ideation sketches, idea development was done by combining the features of ideations. The design criteria involve in this process are rectangle, has open and closed storage, have castor, element of L shape and its evolvement to extend. It was done more details and measurement also included in the sketches other than the addition of various view. Total of 5 idea development created from the process of combining.

3.4 Final Design

The final design was another improvement from idea developments. A sketch neatly using ruler and measurement also included. A total of three final design were created before selected the final design by doing a design survey among 30 respondents that reside in Skudai, Johor. The respondent was required to fill up their demographic information and choose one design of extendable coffee table that suits to their like.

3.5 Mock-up Fabrication

Basic materials needed were model making board, cutter, cutting mat, adhesive and steel ruler with the ratio of 1:3. Their functions were cutter to cut the model making board, cutting mat to avoid slipping while cutting the model making board, adhesive to join the parts, steel ruler as a marking tool, and model making board.

3.6 Technical Drawing

The technical drawing is provided using the AutoCAD software using the units' measurement in the inch that served in top view, side view, front view and isometric view. Later, the coffee table was rendered to give a better visualization of the final product by assigning the material stated in design criteria from the survey.

3.7 Prototype Fabrication

A full-size mock-up created using the materials obtained from the survey on design criteria. The respondent chooses to use a combination of steel and solid wood but instead of using solid wood, the researcher uses plywood as a substitute material. The process started with the steel base and later combined with the top where the plywood was cut and laminated with Formica and assembled with other parts of the extendable coffee table.

4. Results and Discussion

4.1 Demographic Information

Results from the survey showed that most of the respondents were female with a total percentage of 66% and the rest were male. There were 94% of the respondent were 20-29 years old while the rests were 40 and above. 90% of the respondents were single while the other 10% were married. Most of the respondents were Malays with a percentage of 96% and the other 4% represents Indian. Most of the respondents earned below RM4360 for their monthly household income. 66% of the respondents were among the students. And lastly, most of the respondents were lived in a terrace house. Table 1 tabulates the demographic information of the respondent. It consists of gender, age, race, occupation, household income, and housing area.

Table 1: Demographic information

| Question | Response | Percentage (%) |
|--------------------------|------------------------|----------------|
| Gender | Male | 34 |
| | Female | 66 |
| Age | 20-29 | 94 |
| | 30-39 | 0 |
| | 40 And Above | 6 |
| Marital Status | Single | 90 |
| | Married | 10 |
| Race | Malay | 96 |
| | Chinese | 0 |
| | Indian | 4 |
| Household Monthly Income | Below RM4360 | 90 |
| | RM4361-RM9619 | 6 |
| | RM9620 And Above | 4 |
| Occupation | Government | 6 |
| | Non-Government | 12 |
| | Self-Employed | 10 |
| | Student | 66 |
| | Unemployed | 6 |
| Housing Area | Single Family Detached | 24 |
| | Apartment | 6 |
| | Terrace House | 62 |
| | Flat | 6 |
| | Village | 2 |

4.2 Opinion of Extendable Furniture

The questions in Section B were constructed using five Likert scales namely strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5). A majority (64%) of the respondents agreed on the needs for extendable furniture in every household. This probably because furniture with more than one functions is more efficient and economic (Postell, 2012). The second questions showed that the majority (62%) of the respondent agree that extendable furniture is suitable for a small space. Wang (2013) stated that space-saving tables can solve a problem, can be utilized when needed. 30% of the respondent answered strongly agrees. Both neutral and disagree shared the same value of 16%. And the other 6% answers strongly disagree. The third questions showed most of the respondent think that the extendable function makes the furniture more interesting with a percentage of 92%. Since most of the respondent was among person from age 20-29 years old, they tend to attract with a fashionable design (Wang, 2013). And the last question for this section shows most of the users agree that extendable furniture allows them to do more activities (86%). There was much extendable furniture in the market, for example, a lampstand that can transform into a dining table and served a large entertaining space for visitors (Wang, 2013).

4.3 Design Criteria

Table 2 shows the results of the design criteria of the extendable coffee table. From Table 2, the preferred style is minimalist by the percentage of 62% and followed by the Scandinavian (18%). Half of the respondents preferred to have a natural colour for the extendable furniture, followed by dark colour (30%) and bright colour (20%). The materials used for the final design were the combination of metal and solid wood since 50% of respondent prefer this option. The respondents choose the shape of a rectangle for the furniture by the percentage of 52%, 28% choose to use square and 14% choose circle, 50% choose to have a combination of open and closed storage. Finding also shown that 34% of respondent choose to have closed storage and another 12% choose no storage for the extendable coffee table. A total of 38% of the respondents choose to have castor, while 36% choose without and the rest choose partially with castor. The majority (80%) of the respondents preferred to have simpler decoration at the top of the table and 16% of the respondent chooses a few decorations coffee table. The extendable part preferred by the majority is 20 inches for the extension (48%) and followed by 30 inches at 30% of respondent.

Table 2: Design criteria

| Question | Response | Percentage (%) |
|------------------|----------------------------------|----------------|
| Preferred Style | Modern | 8 |
| | Minimalist | 62 |
| | Scandinavian | 18 |
| | Contemporary | 12 |
| | Traditional | 0 |
| Color | Bright color | 20 |
| | Dark color | 30 |
| | Natural color | 50 |
| Material Use | Solid wood | 0 |
| | Wood based product | 22 |
| | Metal | 28 |
| | Combination metal and solid wood | 50 |
| Shape | Square | 28 |
| | Rectangle | 52 |
| | Circle | 14 |
| | Hexagon | 2 |
| | Diamond | 2 |
| | Random shape | 2 |
| | | |
| Storage | Open | 4 |
| | Closed | 34 |
| | Combination of open and closed | 50 |
| | No storage | 12 |
| Portability | With castor | 38 |
| | Partially with castor | 36 |
| | Without castor | 26 |
| Decoration | A bundle | 4 |
| | A few | 16 |
| | Keep it simple | 80 |
| Extendable Range | 10 Inch | 16 |
| | 20 Inch | 48 |
| | 30 Inch | 30 |
| | 40 Inch | 6 |

Overall to conclude the findings from the questionnaire, the design criteria of an extendable coffee table is a minimalist style of extendable coffee table with natural colour. The material used is a

combination of metal and solid wood and the overall shape is a rectangle. The user prefers to have a combination of open and closed storage and with a castor for easier portability. And lastly, the extendable part is 20 inches long.

4.4 Visual Study

The visual study conducted by collecting the relevant image related to the extendable coffee table. The images were characterized by a coffee table with castor, an extendable coffee table and a coffee table with natural colour. Figure 2 shows the results from the visual study.

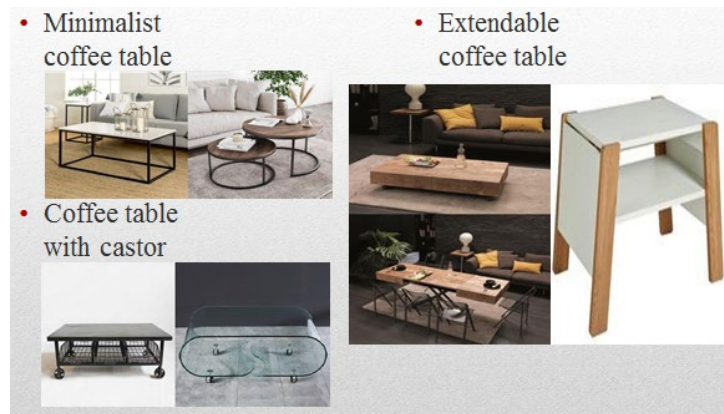
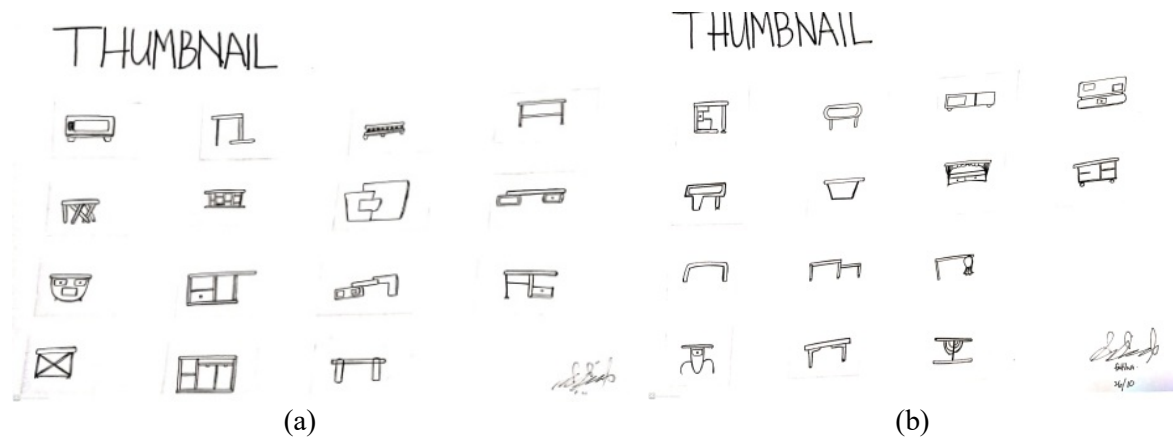


Figure 2: Visual study

4.5 Design Sketches

Figure 3 shows the thumbnails sketched. The total thumbnails obtained are 59 thumbnails of the coffee table. All the thumbnails are sketched using a black ball pen to give a clear line and a nice visual. In this survey, all the thumbnails are sketched in 2D form.



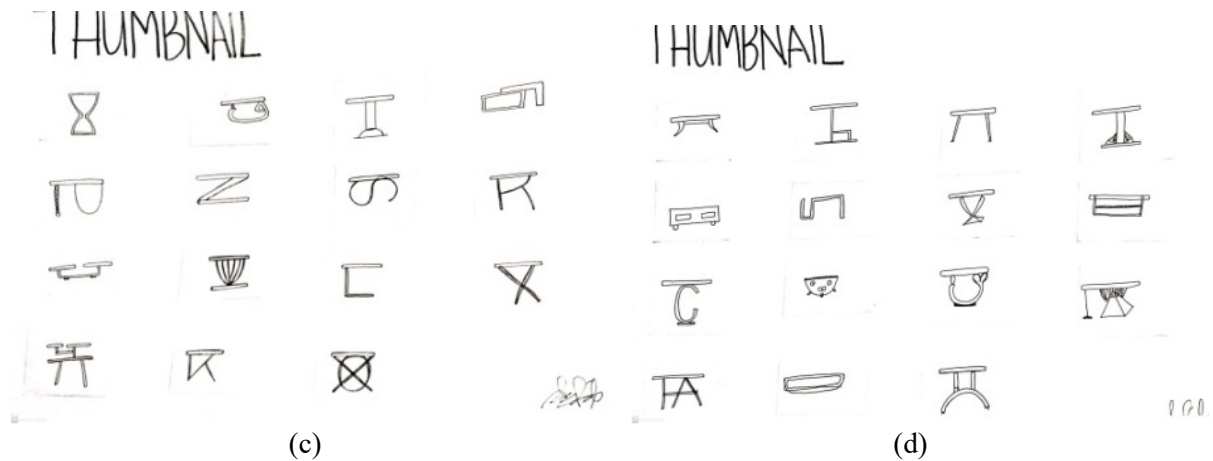
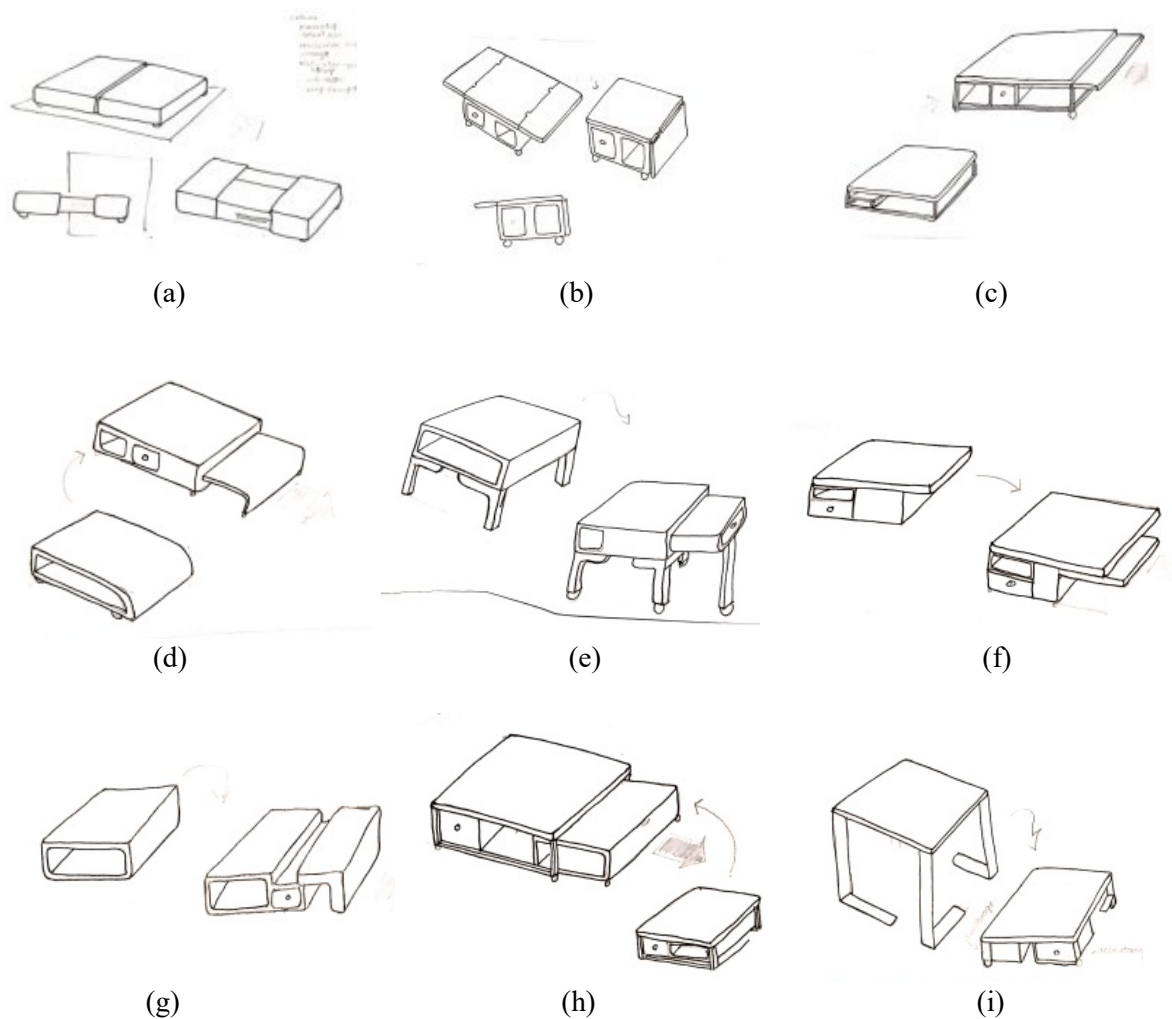


Figure 3: (a) Thumbnails 1, (b) Thumbnails 2, (c) Thumbnails 3, and (d) Thumbnails 4

Partially, ideation is taken from the thumbnail and detailed features are included in the sketches. Figure 4 shows the ideation sketches. The feature taken from the thumbnails is a rectangle shape, the combination of closed and open storage and castor. A total of 10 ideations are created. Ideation 2, 6, and 7 are generated from Thumbnail 1, Ideation 1, 3, 5 and 8 are generated from Thumbnail 2, Ideation 9 generated from Thumbnail 3, and Ideation 4 and 10 generated from Thumbnail 4.



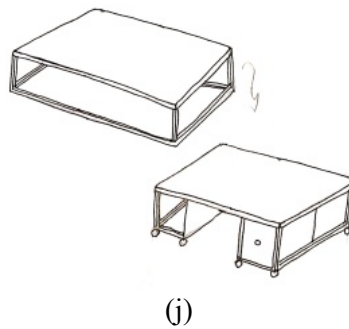
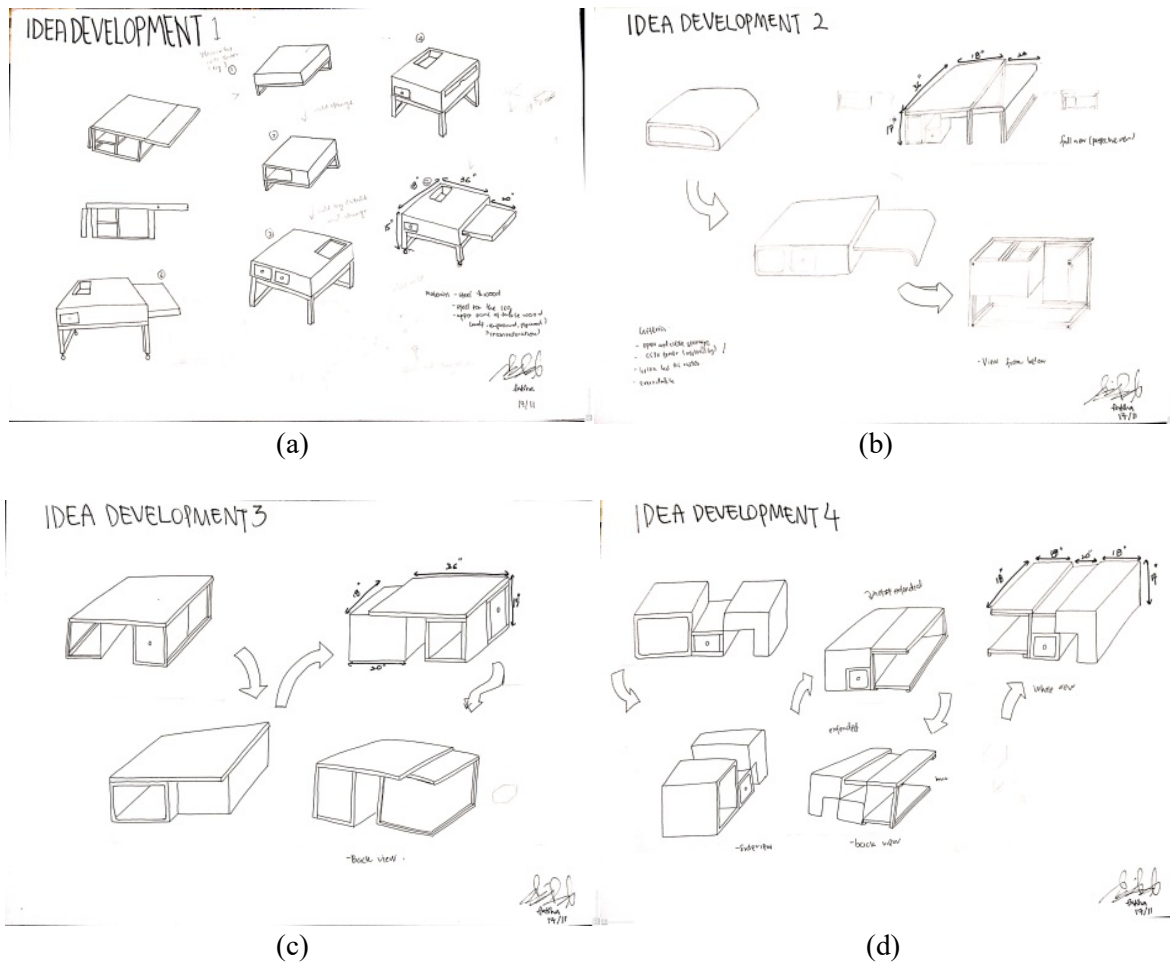


Figure 4: (a) Ideation 1, (b) Ideation 2, (c) Ideation 3, (d) Ideation 4, (e) Ideation 5, (f) Ideation 6, (g) Ideation 7, (h) Ideation 8, (i) Ideation 9, and (j) Ideation 10

Figure 5 shows the idea development of 5 designs. Idea development was generated from the ideation where a detailing of measurement also included in the idea development. Idea Development 1 was created based on Ideation 2, Idea Development 2 was created using Ideation 4, Idea Development 3 was created using Ideation 10, Idea Development 4 was created using Ideation 7 and lastly, Idea Development 5 was created based on Ideation 8.



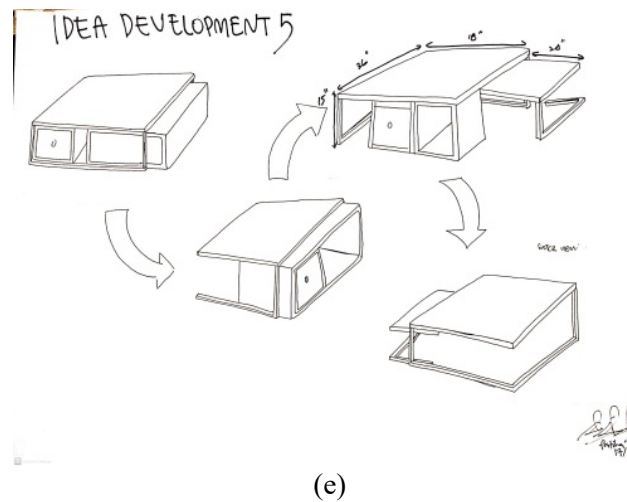


Figure 5: (a) Idea Development 1, (b) Idea Development 2, (c) Idea Development 3, (d) Idea Development 4, and (e) Idea Development 5

4.6 Final Design

Figure 6 shows three pre-final designs obtained by improving the idea development sketched neatly. Before proceeding to mockup fabrication, a design survey is conducted to determine the final design. Three designs in Figure 4 were included in the survey and the majority of the respondent selected Design 2 as the final design with a percentage of 43.3%.

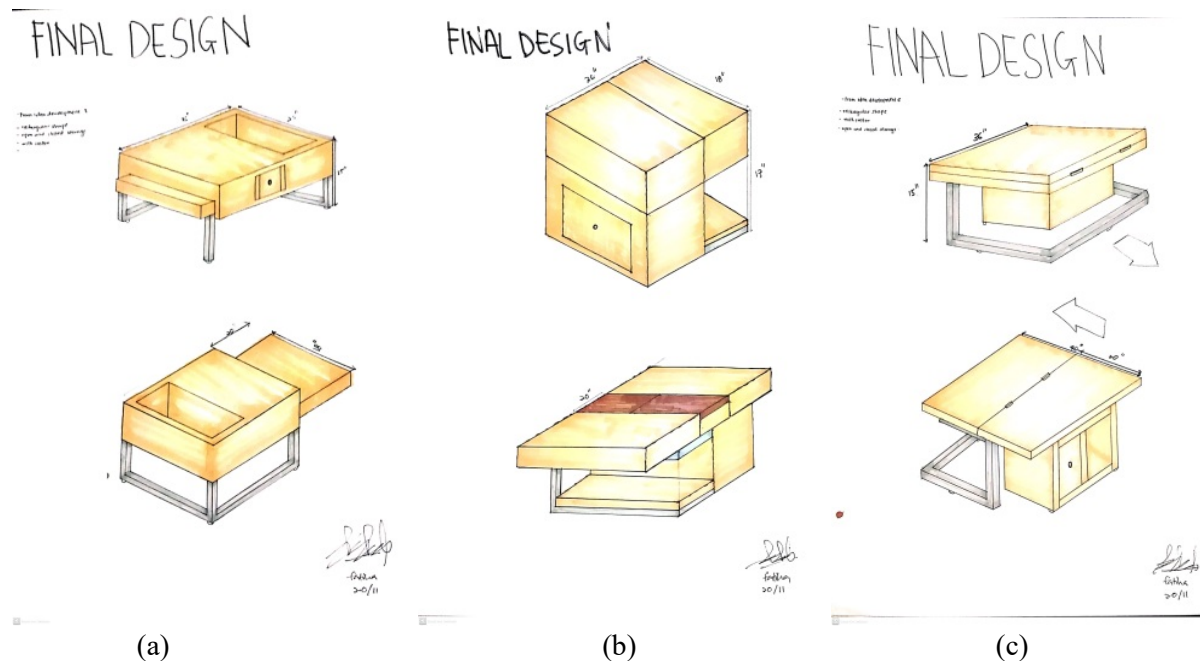


Figure 6: (a) Design 1, (b) Design 2, and (c) Design 3

4.7 Mock-up Fabrication

Figure 7 shows the mock-up for the final design. After the final design obtained a mock-up with the ratio of 1:3 was generated using the necessary materials. The mock-up was fabricated in white colour resembles the final prototype.



Figure 7: Final design mock-up

4.8 Technical Drawing

The technical drawing is done using AutoCAD Software. Other than mock-up fabrication, technical drawing also can give a better illustration for the design. All the measurement is taken using inch. Figure 8 shows the technical drawing on various sides and the rendered technical drawing.

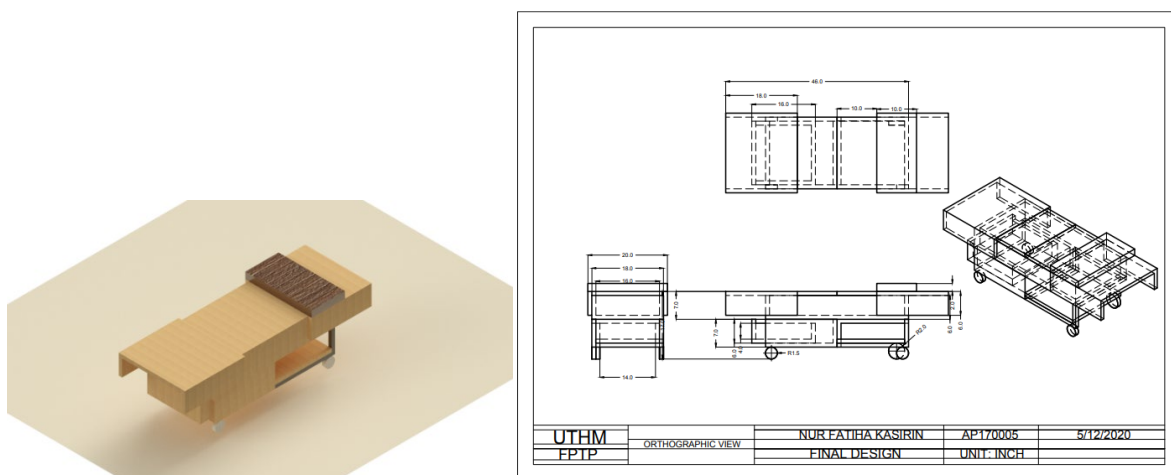


Figure 8: Rendered technical drawing and technical drawing

4.9 Prototype Fabrication

The prototype fabrication started with the creating steel base using hollow stainless steel. Later there was a repetition of cutting and laminating the part with Formica until it forms the desired product. Figure 8 (a) shows the coffee table before extend and (b) after the coffee table extended. There are a few amendments done with the design suitable with minimalism. And it does not disturb the functionality of the prototype as it does also serve other function. The extendable coffee table originally comprises three storages which are two closed storage and open storage. There are different sizes for closed storage. Bigger storage located at the top of the extendable coffee table where the extendable features are being put. Originally, instead of plywood, the respondent preferred to use solid wood for this design. According to Islam *et al.* (2012), the usage of solid wood can cause drawbacks and overcome the drawback, an alternative material such as plywood is created. And to conclude that plywood with 5 layers is used in this prototype making. As influenced by Beijing's CCTV Tower, the top of the coffee table is overhanging the base of the prototype. As shown in Figure

9, there was a space between the base and the top parts meanwhile there was hollow steel that connects the base and top part for the other side.



Figure 9: (a) Before and (b) after extended of coffee table inspired by Beijing's CCTV Tower

5. Conclusion

In conclusion, all the objectives are achieved by phase started from data collection to obtain the design criteria and prototype fabrication. There is still a chance for improvement for better results in future research. This study successes identify the design criteria of an extendable table influenced by Beijing's CCTV Tower through a survey conducted with 50 respondents that reside in Skudai, Johor. The design criteria of a minimalist style of the extendable coffee table are rectangular shape, has a combination of open and closed storage, equipped with castor at the leg part and has an extendable part of 20 inches long. Meanwhile, the prototype was made from a combination of metal and solid wood and finally finished with natural colour. Along the way, 59 thumbnails, 10 ideations, and 5 idea developments are developed. A prototype of extendable coffee table influenced by Beijing's CCTV Tower using the substitute material of plywood instead of solid wood and a few amendments done towards the design and the measurement of the extendable coffee table. This study definitely has a chance to develop more design that served the best function as long as there is sufficient time for the researcher to find inspiration on the designs developed and it will be great if there was a little support financially.

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