

DESIGN PHILOSOPHY FOR PRODUCT LINE-UP

Ryoichi Tamura¹, Kazuo Sugiyama², Makoto Watanabe³

¹ Faculty of Design, Kyushu University, Japan

tamura@design.kyushu-u.ac.jp

² Sugiyama Design Solutions, Japan

sugiyama@kbe.biglobe.ne.jp

³ Faculty of Engineering, Chiba University, Japan

m.watanabe@faculty.chiba-u.jp

ABSTRACT:

This study examined the design philosophy for product line-ups. We believe that the study will be useful for the design deployment and review of the existing and new products.

Our previous study revealed that the attributes related to function played a major role in the line-up deployment of 11 products such as refrigerator, TV set and single lens reflector camera. The design differences of the 11 products were further studied using photos appearing in major manufacturers' catalogs. Three out of the 11 products were further studied to learn what time-series changes of design occurred in the product line-up. Interviews with manufacturers were conducted to learn their design philosophy in the product line-up.

The result revealed that the design was the same in the items of the same attributes related to function and performance irrespective of the fact that the attributes related to capacity, size, output

were different. On the other hand, there were two types of design philosophy in the items with different attributes of functions and performances; the case where design was differentiated by each of the attributes related to function and performance and the case where the design was differentiated for several attributes related to function and performance.

When viewed in time-series, the former was the same whereas the latter was different in scope in the attributes of functions and performances with different designs.

Thus, it was found that the reason why the design was the same in the items with identical attributes related to functions and performance but with different attributes related to the capacity, size, output, was because manufacturers tended to appeal the similarity in function and performance. The reasons why there are two different philosophies in the design of items with different functions and performance and why changes occur in time-series are because of consideration over costs and attempts to avoid de-focusing of appeals due to changes in the market environment.

The most effective design philosophy in the product line-ups is to use the same design for all the items comprising the product line-up. However, using the same design for all the items means that the manufacturer bases its appeal on their own corporate image, and is effective only when the manufacturer is superior over competitors because of their powerful brand images or the product is new based on their unique technology.

Thus, the manufacturers resolve on the design philosophy in the product line-up by considering “what to appeal” and “how to achieve efficacy” based on their business and the product strategies prevailing at the time.

Key Words: Product Line-up, Design Philosophy, Design Strategy

1. INTRODUCTION

A product line-up is constructed using plural and diverse variations of one product when the product is introduced to the market by considering needs of users, the manufacturers' position in the industry, and management resources of manufacturers. “Design” plays an important role along with “function and performance” in this trend of diversification [Note 1].

The study previously conducted by the authors [Note 2] presented a schematic drawing to show the product line-ups (Fig. 1) in order to visually present the line-ups of various products and to delineate their characteristics. Plans were drawn for each year using two axes; “attributes

related to function and performance” and “attributes related to capacity, size and output”. Models comprising the line-ups were placed on grid sectioned by the two attributes [Note 3]. Differences in “design” variation were shown by placing rectangles indicating the subject model in layers on the same grid. As a result, the product deployments were roughly classified into four; those focusing only on difference in “attributes related to function and performance”; those focusing on differences between “attributes related to function and performance” and “attributes related to capacity, size and output, those focusing on “attributes related to function and performance”, and those deployed by the same “attributes related to function and performance” as well as “attributes related to capacity, size and output” and the difference in “design”. In the latter two, design diversification was found to be closely related to the line-up deployment, whereas in the former two, the product line-ups were deployed focusing mainly on the attributes related to function.

We therefore took up 11 products of “Refrigerator”, “Television” and “Single-lens reflex camera” belonging to the former group, and studied the design philosophy in the product line-ups by seeing how design is differentiated or integrated among models with different functions. We also studied time-series changes in design philosophy of three out of 11 products. Persons in charge at the manufacturers were interviewed to discuss their philosophy.

We believe that the result of this study will be a most useful and effective material in contemplating design deployment of the existing and the new products.

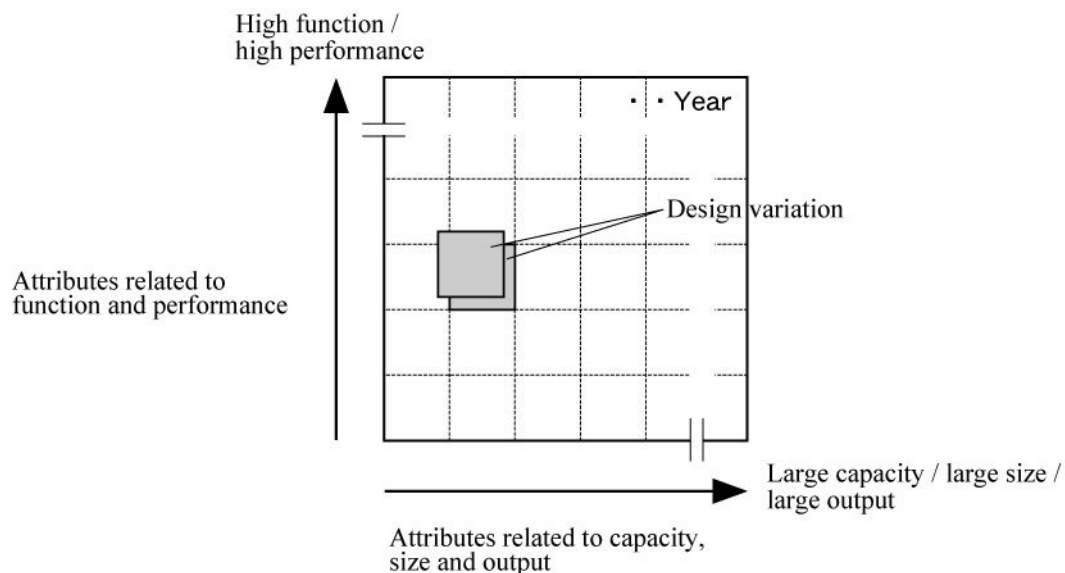


Figure1: Schematic drawing showing product line-up structure

2. STUDY

2.1. FOCUS OF THE STUDY

Product line-up for the same product may differ from one manufacturer to another. However, we tried to delineate the relationship between the line-up and the design for specific products, not the differences among manufacturers.

2.2. OBJECTS OF THE STUDY

Table 1 shows the products taken up by our previous study [Note 2];

Product line-up structure A (line type) [Note 4]

Microwave oven, Vacuum cleaner, Video tape recorder, Personal facsimile, Compact camera, Digital camera

Product line-up structure B (chain type) [Note 5]

Single lens reflex camera

Product line-up structure C (diagonal type) [Note 6]

Washing machine, Television

Product line-up structure D (straight type) [Note 7]

Refrigerator

Product line-up structure E (square type) [Note 8]

Air conditioner for home use

We selected five (5) manufacturers of refrigerator, four (4) of television, three (3) each of microwave oven, washing machine and vacuum cleaner, two (2) each of air conditioner for home use and video tape recorder, and one (1) each of personal facsimile, single lens reflex camera, compact camera and digital camera.

As shown in Table 2, a total of 26 products or 11 products of eight (8) manufacturers were chosen, since some products of plural manufacturers were selected.

Table1: Products and product line-up structures studied

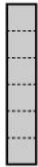

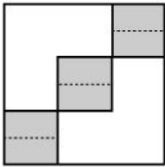
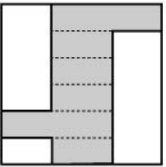
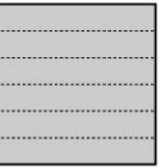
Design variation	Variation of attributes related to capacity, size and output				
	No		Yes		
No	Product line-up structure A	Product line-up structure B	Product line-up structure C	Product line-up structure D	Product line-up structure E
					
	Microwave oven / Vacuum Cleaner / Video tape recorder / Personal facsimile / Compact camera / Digital camera	Single lens reflex camera	Washing machine / Television	Refrigerator	Air conditioner for home use

Table2: Products and manufactures studied

Products	Company									total
	A	B	C	D	E	F	G	H	I	
Refrigerator	○	○	○	○	○					5
Microwave oven	○	○		○						3
Washing machine	○	○	○							3
Vacuum cleaner	○	○	○							3
Air conditioner for home use		○	○							2
Television	○		○		○		○			4
Video tape recorder		○						○		2
Personal facsimile	○									1
Single lens reflex camera						○				1
Compact camera						○				1
Digital camera									○	1

2.3. METHOD OF THE STUDY

Comparison of product line-ups of plural products requires sorting out the line-ups by design philosophies or methods common to manufacturers. We therefore employed the following steps.

2.3.1. EXAMINATION FROM THE VIEWPOINT OF THE PRODUCT LINE-UP STRUCTURES

① Design similarities and differences

We studied the design similarities and differences of several models comprising the product line-ups dating from April 1999 to September 2001 by comparing their photographs shown in catalogs available from the said period.

While cost reduction by using the same parts is a major factor for design selection, improved design efficiency is also important. We therefore deemed those with “similar design motifs” as being similar rather than trying to scrutinize small and detailed differences.

□ Confirmation of the product line-up structure

Based on the result in ①, the relationship between the structure of product line-ups of which design was differentiated or similar was examined.

③ Determination of rationale and intent

We compared the products by manufacturers and tried to integrate them based on similarities rather than differences of the products among manufacturers.

By conducting interviews with persons in charge of design or product development of manufacturers [Note 9], we learned their rationales and intents.

2.3.2. EXAMINATION IN TIME-SERIES

① Similarities and differences in design

In addition to interviews discussed in 2.3.1, we compared the three products of refrigerator (Company A), television (Company G) and video tape recorder (Company H) to compare and study similarities and differences in design of the models making up the line-ups available at the time of interviews using photographs appearing in catalogues published prior and anterior to that time [Note 10].

□ Product line-up structures

Based on the result of ①, the relationship in the product line-up structures of the products having similar or different designs were ascertained.

□ Rationale and intent

By conducting interviews [Note 9], we learned the rationales and intents as well as changes in design if there were observed time-series changes.

3. DESIGN PHILOSOPHY IN PRODUCT LINE-UP

3.1. RESULT

Design philosophy in product line-up was compared with the product line-up structure identified in our previous study [Note 2]. The result is shown schematically in Table 3.

Product line-up structure A (line type)

We found that the design was differentiated by specifications for “attributes related to function and performance”, but when “function and performance” had similar appeals, the design was also similar.

Product line-up structure B (chain type)

We found that the design was different by specifications related to “function and performance”.

Product line-up structure C (diagonal type)

Product line-up structure D (straight type)

Product line-up structure E (square type)



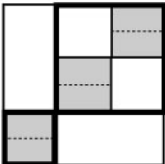
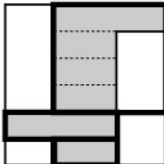
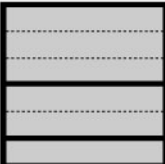
The design philosophy is the same for these three product line-up structures. That is, the design is the same for models of which specifications related to “function and performance” are the same but those related to “capacity, size and output” are different. On the other hand, the design is similar in models with different designs but with similar appeal for specifications related to “function and performance”.

As discussed above, the models with the same specifications for “function and performance” but different specifications for “capacity, size and output” are similarly designed irrespective of the product or the manufacturer.

On the other hand, there were two design philosophies for models with different specifications for “function and performance” irrespective of presence/absence of “attributes related to capacity, size and output”; in one, the design was differentiated by the specifications for “function and performance”, and in another, the design was the same for plural models.

Table3: Design philosophy in product line-up

Range for similarities

Product line-up structure A	Product line-up structure B	Product line-up structure C	Product line-up structure D	Product line-up structure E
				

3.2. FACTORS INFLUENCING DESIGN PHILOSOPHY

Tables 4 to 8 show typical comments for the product line-ups given in our interviews [Note 4]. These comments are summarized below as the factors influencing design philosophy.

Attempts were made to make the design similar for the models with “attributes related to capacity, size and output” , while efforts were made to appeal the differences in design for those models with “attributes related to function and performance”. On the other hand, consideration over the cost and an attempt to avoid de-focusing of appeals were instrumental in incorporating the design, improving efficiency in design and development, and emphasizing the appeal in plural models with “attributes related to function and performance”.

Table4: Product line-up structure A (line type)

Product	Company	Example of comment
Microwave oven	B	... this model uses stainless steel and therefore incurs higher costs.
Vacuum cleaner	B	... we want to avoid criticisms toward the identical main body in spite of such differences related to function and performance; so the same parts are used where possible.
Video tape recorder	B	... one reason is high costs. We would rather not make plural models if the structure is the same. Another reason is that they appeal to different genre of customers.
Personal facsimile	A	... we would like to present something obviously new, and induce prospective customers to accept differences in function and performance.
Compact camera	F	... the reason we use different designs is based on our inclination toward increasing variations. We want to present them as new and different models.
Digital camera	I	... the reason why we change the design so much is because we target at different users.

Table5: Product line-up structure B (chain type)

Product	Company	Example of comment
Single lens reflex camera	F	... we try to present better appearance for a single model.

Table6: Product line-up structure C (diagonal type)

Product	Company	Example of comment
Washing machine	A	... high grade models should look high grade, and popular grade should look popular grade.
Television	B	... customers demand different sizes to suit their conveniences, and if we have different designs for all the screen sizes, that would create confusion.

Table7: Product line-up structure D (straight type)

Product	Company	Example of comment
Refrigerator	A	... the reason why we use the same design is that we wish to emphasize that this model and that model have the same functions.

Table8: Product line-up structure E (square type)

Product	Company	Example of comment
Air conditioner for home use	C	... the reason why we use similar design for the models of different characteristics related to output is because we do not have the space for displaying all the models of different output.

4. DESIGN PHILOSOPHY IN PRODUCT LINE-UP AS VIEWED IN TIME-SERIES

4.1. RESULT

Changes in design philosophy in the product line-up as viewed in time series are shown schematically in Table 9.

Product line-up structure A (Linear type)

With video tape recorder (Company H), the design is not similar for plural models with different specifications for “function and performance”, but is differentiated for each specifications in the years preceding the survey.

Product line-up structure C (Diagonal type)

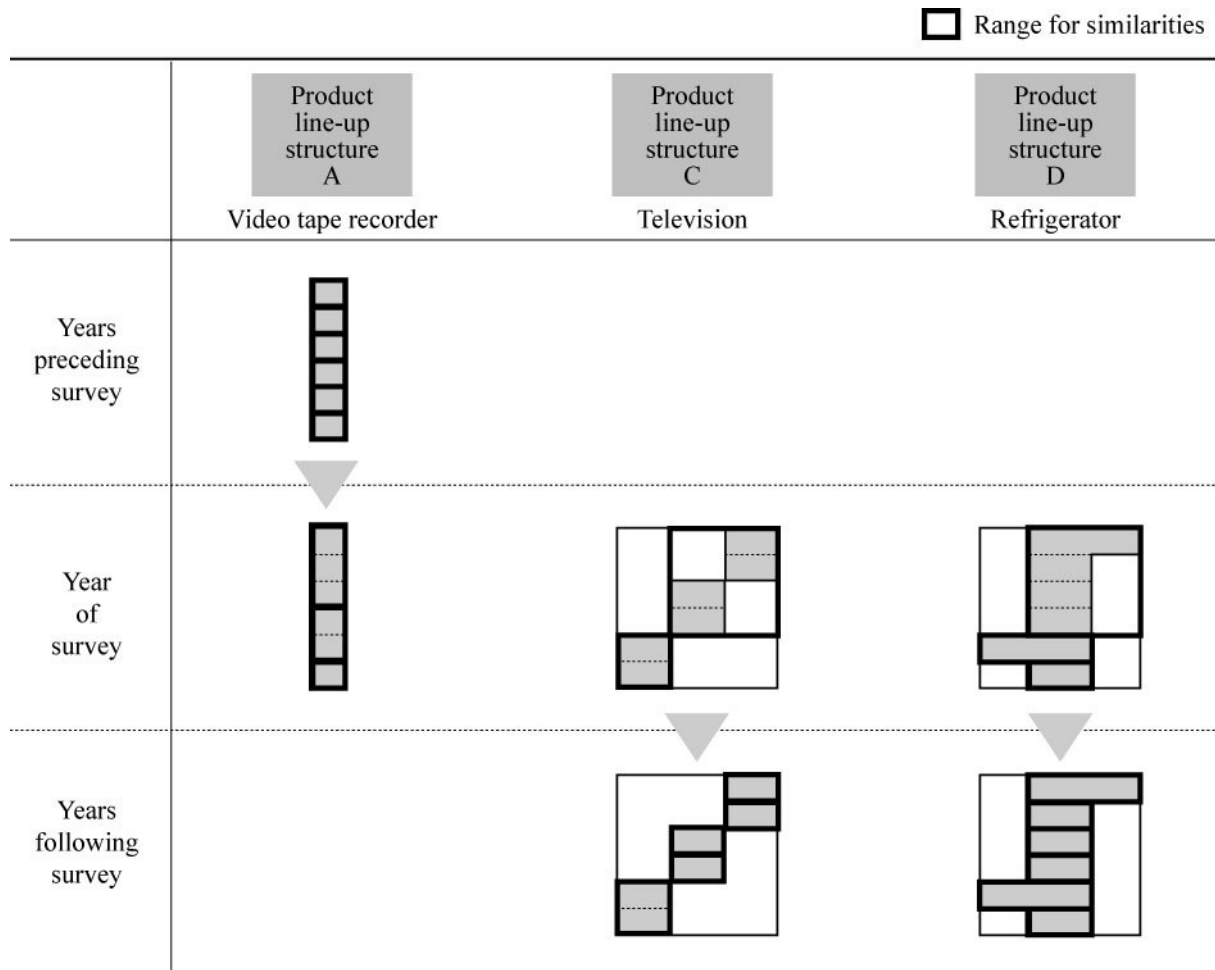
Product line-up structure D (Straight type)

With television (Company G) and refrigerator (Company A), no change was observed in making design similar for models with different specifications for “capacity, size and output”. However, it was found that the range of products with similar design for different “function and performance” decreased after the survey.

As discussed, the design was similar for models with the same specifications for “function and performance” but with different specifications for “capacity, size and output” irrespective of the time they were available in the market. On the other hand, in the products with different specifications

for “functions and performance”, the range of difference for the specifications related to “function and performance” varied in the same product or with the same company.

Table9: Changes in design philosophy viewed in time-series



4.2 RATIONALE FOR CHANGES IN DESIGN PHILOSOPHY

Typical comments made during our interviews [Note 4] regarding reasons for changes in design philosophy are shown in Tables 10 to 12 and summarized below.

Regarding video tape recorder, the changes were due to the trend of times where the degree of perfection for model was evaluated more than the improved productivity such as pursuit for the development and production efficiencies, and the cost reduction currently prevailing in the industry. As for television, the appeal to users based on similar designs, mainly for flat Braun-tube television (Company G) diminished, creating needs for appealing detailed characteristic for respective specifications for “attributes related to function and performance”. Similarly with refrigerator, its

appeal for design in Company A's sales strategy was found to be based on the appeal for higher grade based on the different specifications for "function and performance".

Table10: Video tape recorder (Company H)

Example of comment
... therefore, in those days we tried to improve the degree of perfection for a single product, rather than aiming at integrated design or at a specific strategy. Video deck itself was not a popular grade product then and we tried to create a sense of extra value attached to the finish or design. We were ready to spend a lot to overcome difficulties in technology or cost. Speaking of finish, video decks of previous years cost a lot more.

Table11: Television (Company G)

Example of comment
... flat Braun tube was a telltale evidence of our superiority (Company G) over competitors and we offered quite a wide range of sizes. We aimed to project a very strong image for all the models of new FD Trinitron so that potential customers would instantly recognize our strength. However, as we entered the age of digitalized TV, mere flat Braun tube was no longer an advantage and we changed our design philosophy.

Table12: Refrigerator (Company A)

Example of comment
... the problem was that CM for 400 liter size was not viable for 300 liter size, which were differently designed. So we decided to use the same design theme. If we aired CM for our main model, we would be selling all other products similarly designed as well as our corporate image. A customer who is impressed by our CM goes to a shop, and sees other products with the same design priced less. Our dilemma was cheaper models sold more than the expensive ones which we wanted to sell. The same design but cheaper prices and the same number of doors ... this appealed more to customers.

5. CONCLUSION

The most effective design philosophy in the product line-up is to use a similar design for all the models that make up the line-up. However, this philosophy will bring about the appeal for manufacturer and is effective only when the company is in a position superior over competitors with its strong brand image, and the product is a new one based on the new and original technology of the company. Assuming that differentiating the design based on difference in

specifications for “function and performance” is a prerequisite, design may be made similar for plural specifications in view of cost considerations and to avoid de-focusing of the appeal. The critical challenge is how to set the range for using the similar design.

It became clear that manufacturers’ design philosophy in the product line-up were based on “what to appeal” and “how to achieve maximum efficiency” based on their business and marketing strategies prevailing then.

ACKNOWLEDGMENT

We wish to acknowledge with thanks assistance and cooperation offered by the design and product development divisions of manufacturers supplying materials and giving interviews. For confidentiality purposes, we shall refrain from naming the individuals to whom we remain most grateful for their assistance.

REFERENCES AND NOTES:

- [1] Kataoka Hiroshi, ed., 2000. Product diversification strategy to change dynamics in the market, Chuo-keizaisha, pp. 50-75 (in Japanese)
- [2] Tamura Ryoichi, Sugiyama Kazuo, Watanabe Makoto: The Study of Relationship between the Product Line-up and the Design, International Design Congress-IASDR 2005, Proceedings of International Design Congress, p.161 & CD-ROM, 2005
- [3] There may be two ways of division by axes representing “attributes related to capacity, size and output”; that by concrete values and that by class having a certain range of values. The division therefore differs according to the products and also according to the range of values adopted by manufacturers.
- [4] The need for introducing new models continuously and plural items simultaneously create linear deployments.
- [5] Because of time-consuming technology and research developments, the cycle of cost depreciation is necessarily extended, making it impossible to introduce plural models simultaneously. On the other hand, it is necessary to add even slight changes to the specifications to overcome competition, limiting the number of models introduced within a year. Thus, the plural products are lined up continuously over plural years, showing a chain like pattern.
- [6] “Attributes related to capacity, size and output” suitable for specifications for “attributes related to function and performance” are deployed, showing diagonal pattern.
- [7] Because “attributes related to capacity, size and output” are restrained by the users’ household structure

and use conditions, there is a central value which cannot be reduced to a specific value. Thus, plural specifications related to “function and performance” are deployed for this value, creating a net-like pattern.

[8] Difference in specifications related to “capacity, size and output” is constrained by the users’ use condition, making it impossible to reduce it to a specific value. Thus, diverse specifications for “capacity, size and output” are deployed for “function and performance”, creating a planer pattern.

[9] The intent of this study was explained to interviewees, their philosophy was confirmed and their general opinion for the products were sought. This is the reason for uneven number of companies, but we believe that the actual situation became apparent. While a person in charge of design was asked to give interview, there were more than one designers or those in charge of product developments were present in some cases. The study period was for one year from September 2000 to September 2001. The interview lasted for about two hours.

[10] For comparison, the study in respect of refrigerator (Company A) and television (Company G) was conducted in 2001 , and that for video tape recorder (Company H) in 1995.