The Display Methods and Characteristics of Diagram for The Design Development Process Model

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1. Background and Purpose

This research, as a part of a study on "Design development process management model for strategic design consulting", has been done to seek visualization expression methods of a design development process. By deducing the expression properties of the 15 design development purposes proposed at 'Design focus Diagnostic matrix' in "Suggestion of design spiral model for strategic design consulting[1]",analyzing the 50 diagrams proposed in "Information Graphics[2]", the purpose of researchstudy is to analyze characteristics of a diagram and expression methods to apply a design development process by development purposes.

2. Propertiesof design development process according to design development purpose categories

In 'Design focus Diagnostic matrix', design development purpose has been defined into 15 types based on the 4 types(Corporation, Market, Brand and Product) of axis. By the literature studies for "The New Strategic Brand Management[3]" and "Design Consulting[4]", the major expression properties for visualization of each processhas been summarized as Figure 1. By this, it was discovered that 'phase' was a common property in all the categories and that each of the categories had a difference according to the specific development purpose. For category A, the 'consistency' property that can express the relationship between the

Figure 1. Properties of design development process

inside of a corporation and brand factors is important, and for category B, 'Cycle' which can express the relationship between corporate external factors and the brand factor is important. For categories C and D which have deduced the purpose from the relationship between itself factor of product and the corporate internal and external factor, 'simultaneity' and 'influence' are important respectively.
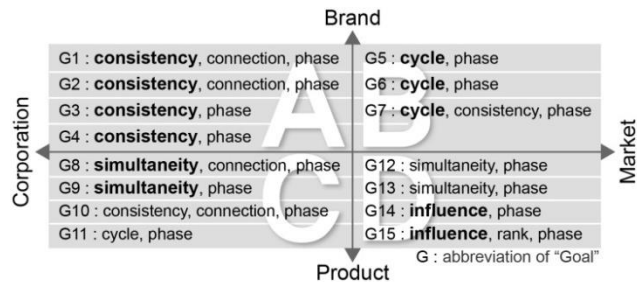
3. Categoriesand characteristics of a diagram for visualization of design development process

[Table 1] Categorization and characteristics of a diagram

category	type	mean	Examples	Character-istics	category	type	mean	Examples	Character-istics
Sequence	Cause and effect	A structure that emphasizes the influential relationship between certain subjects by the sequence.	fishbone diagram, tree diagram, fishbone diagram, etc.	Procedure Effect Causality	**Relation**	Interrelation	A structure that emphasizes the mutual relationship.	relationship diagram, Venn diagram, etc.	Link
	Feedback	A structure that influences the sequence by the selective direction changeover of Yes/No.	decision diagram, binary decision diagram, etc.	Procedure Choice Course		Organization	A horizontal/vertical organization structure that has been grouped with a certain standard.	organization chart	Horizontality Verticality Group
	Flow	A structure that emphasizes the project overview by the sequence.	process chart, PERT chart, flow diagram, etc.	Procedure Stream		hierarchy	A structure that emphasizes the hierarchical organization.	pyramid organization chart, etc.	Grade Group Point
	Time line	A structure that enables easy perception of the sequence by arranging the elements chronically.	time line chart, bar chart control chart, price chart, etc.	Procedure Time	**visualization**	Explain	Clearly arranges of detail explanations.	exploded diagram, how to chart, presentation chart, etc.	Description Arrange
	Time table	A structure that enables easy perception of the overall schedule sequence of the project.	step by step chart, progressive bar chart,etc.	Procedure schedule		Highlight	Arranges or emphasis ononly important parts.	text chart, build chart, word chart, etc.	Arrange Emphasis

Diagrams, as one of the technologies to visualize with a 2D or 3D geometric model by arranging, describing and symbolizing information, have higher visibility than text information and are effective whenhuge amounts of information are arranged. The diagrams including the 50 charts proposed in Robert L. Harris' "Information

Graphics[2]" are classified into 4 categories (14 types) totally of 'sequence', 'relation', 'visualization' and 'comparison' by card sorting according to signified features. Among these, 'comparison(4 types)' has been excluded from the target of this research as there are many cases it is being mixed with the concept of graph. Table 1 is a summary forcharacteristics by classifying the diagrams into 'Sequence' that expresses in flow of time or sequence, 'Relation' that expresses the mutual relationship and 'Visualization' that visualizes text information.

'Sequence' is classified into 5 categories based on time. It has deduced expression characteristics such as effect, choice, time and schedule by types through time–based diagram cases such as "Fishbone diagram" or "PERT Diagram'. In particular, this category has the 'procedure' characteristic in common that emphasizes the process by sequence. 'Relation' is classified into 3 types by the forms of structure relation, and the characteristics of this category are, link, horizontality, verticality and gradeas in the case of "relationship diagram". 'Visualization' is classified into 2 types according to the degree of explanation, has the 'arrange' characteristic in common that briefly arranges complicated information and has the characteristics of 'description' and 'emphasis' besides that.

4. Expression methodsof diagram by major properties of design development process

Major expression methods by expression properties should be found out prior to visualizing a development process by the 15 types of purposes. For this, based on the expression properties deduced in Figure 1, the processes were defined as Phase emphasizing process, Consistency emphasizing process, Cycle emphasizing process and Simultaneity emphasizing process and Influence emphasizing process. The significant features of each process were compared by the diagram 'Characteristics' based on semantic differential Scaling and arranged in the visualization elements and the morphological characteristics as Figure 2.

From the analysis result of the visualization elements of the diagram through the cases of "Information Graphics[2]", it was discovered that although utilization of lines and arrows was high, the purpose of utilization was diversified with flow of time, influential relationship, up/down structure and feedback. Additionally, it was discovered that Enclosure was mainly used to imply each phase or role of a process, and the form of Enclosure did not go off very much from the geometric shape.

By looking at the expression characteristics based on the characteristics of a diagram, it could be known that the form of a diagram could be expressed differently by the difference of major features of a process, although the major properties were identical. Comparing 'phase emphasizing process' and 'simultaneity emphasizing process', although the 'phase emphasizing process' has identical characteristics of a diagram, shows forms such as CE diagram and Decision diagram by having the features of 'phased expression, and the 'simultaneity emphasizing process' shows the form of a process chart and a flow diagram by having a 'bi-directional flow'.

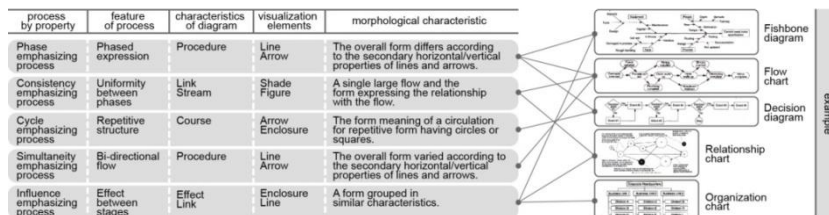| process by property	feature of process	characteristics of diagram	visualization elements	morphological characteristic		
Phase emphasizing process	Phased expression	Procedure	Line Arrow	The overall form differs according to the secondary horizontal/vertical properties of lines and arrows.		Fishbone diagram
Consistency emphasizing process	Uniformity between phases	Link Stream	Shade Figure	A single large flow and the form expressing the relationship with the flow.		Flow chart
Cycle emphasizing process	Repetitive structure	Course	Arrow Enclosure	The form meaning of a circulation for repetitive form having circles or squares.		Decision diagram
Simultaneity emphasizing process	Bi-directional flow	Procedure	Line Arrow	The overall form varied according to the secondary horizontal/vertical properties of lines and arrows.		Relationship chart
Influence emphasizing process	Effect between stages	Effect Link	Enclosure Line	A form grouped in similar characteristics.		Organization chart

Figure 2. Expression methods of diagram by major properties

5. Conclusion

The following conclusion was deduced from the analysis result of the properties of design development process for a design development process visualization work and the characteristics of a diagram. Firstly, significant expression properties phase, consistency, cycle, simultaneity, influence) have been deduced for process visualization according to design development purposes. Secondly, availability of various expression of visualization elements has been discovered by arranging the diagram methods and morphological characteristics according to the major expression properties of a design process. Although it was only limited to seeking expression methods of a process on the typical 5 types of properties of the 4 types (A, B, C, D) of categories in this research, researches on detail expression methods of 15 types of design development process will go on in the future.

6. References

[1] Jin-RyeolLee 2 others, "Suggestion of design spiral model for strategic design consulting", Asia Digital Art and Design Association Conference kit, Vol.2013 No.12 pp.454
[2] Robert L. Harris, "Information Graphics : A Comprehensive Illustrated Reference", OXFOGE, 1999
[3] Jean-Noel Kapferer, "The New Strategic Brand Management: Creating And Sustaining Brand Equity Long Term", Kogan Page Ltd, 2004
[4] Jin-RyeolLee, "Design Consulting",Ahn Graphics, Korea, publication arrangement in 2014