

**A DIAGNOSTIC TOOL**  
**TO ESTABLISH THE RELATIVE DESIGN SENSE**  
**FOR DESIGNERS AND CLIENTS**

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May, 1999

# **A Diagnostic Tool to Establish the Relative Design Sense for Designers and Clients**

A Ph.D. thesis by  
**Jun-Chieh Wu**

## **Abstract:**

The design sense of key decision-makers has a critical influence on the design outcome during new product development (NPD). If these key decision-makers do not have an understanding of the design process, the context and design thinking and the resultant design output, it may cause serious delay in the design schedule or, at worst, the project may fail. Hence, the design leader, especially in a design consultant company which service many different types of organization, needs a properly structured and effective design process tailored to each clients requirements which will have significant benefits during the NPD phase.

The diagnostic tool was developed and tested by semantic differential (SD) method, by collecting 11 pairs of adjective words and 13 product concepts were reviewed by SD. This survey was made using 31 subjects including key decision-maker and design leader.

Critical conclusions include:

- There are three types of key decision-makers' design sense; (1), Design aware sense; (2), Design developing sense, and (3), No design developing sense.
- Lego toys can be used as test tool for engineering skill ability. There are two types of the engineering skill, (1), High engineering skill, and (2), Low engineering skill.
- Design sense and engineering skill information can help the design leader formulate the best design approach and set appropriate fees.

By combining types of design sense and engineering skill, six categories of deign sense were identified in key decision-makers. The thesis argues the case for a diagnostic tool to identify the category of the decision-maker client relative to the designer.

- "Senseless" those who are not confident in their own design ability but show belief in expertise of designer.
- "Engineering Sense" this group's key decision-makers have strong engineering characteristics.
- "Pre-Artist Sense" they have the lowest engineering skill but a developing artistic skill.
- "Pre-Designer Sense" those with good engineering skill and a developing design skill.
- "Artist Sense" they have poor engineering skill but a good design capability.
- "Designer Sense" those who have both good engineering skill and design sense and may wish to participate in the design.

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## Chapter 1 Introduction

In Taiwan, it is very difficult for the design consultant to understand and satisfy client needs and wants with ever-decreasing lead-times, especially those consultancy organisations which service a lot of Original Equipment Manufacturing (OEM), Original Design Manufacturing (ODM) and Original Brand Manufacturing (OBM).<sup>1</sup> Because for these organisations to stay competitive in a global environment they need to develop many new products every year. Although most of Taiwanese companies are small and middle sized businesses, those company product strategies have been “follower” or “me-too“. Hence, most companies are only concerned with how to design and produce a popular product and sell it more cheaply in the global market as soon as possible. As a result, the effective design result is increasingly important. To impact effective design results, one of the key elements is decision-makers’ design sense. If decision-maker cannot understand the design process, the background to design purpose and the output of design results could cause significant delays to the design schedule or result in a failure in the project. If a company’s decision-maker has design sense or design engineering skill, the product design process could be more effective and easier to manufacture the right product for the target market. Hence, for the design manager, especially in design consultancies who service a lot of different types of organizations, a properly structured and effective design process for each clients requirements will have a significant result during design development phase.

In the future, Taiwan as a country needs to be an originator of products rather than redesigning existing products. Therefore, to develop a designer/client model, to identify suitable and effective product design development process for design consultants in Taiwan’s environment is very important and useful for design consultants.

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1 (OEM)-organisation working to working specification only.  
(ODM)-organisation responsible for the design and development of their own product.  
(OBM)-organisation responsible for the design and development of their own brand.

## **1.1 Background of This Research**

Since the 1970s, Taiwan's industry gradually accumulated manufacturing technology and production capabilities through OEM arrangements. Under appropriate government guidance, the country was able to gradually develop its own industrial competitive edge and a system of distribution of labor. According to the Commonwealth magazine 1998 report: Since the 1980s, Taiwan's industry from the petrochemical industry change to hi-tech industry has resulted in electronic and computer organisations being classified in the top one thousand producers with three hundred and eight companies. The sales of electronics are 34% of the total manufacturing sales. Accessories such as computer monitors, computer main PC boards, keyboards, mice, scanners and modem production quantity are among the best in the world. Nowadays, Taiwan manufacturing is becoming an asset for OEM and ODM in the world. The electronic consumer products are serviced by the communication-computer industry and electronics consumer industry. These products have as a common feature, a short life cycle, are mass produced, and in plastic housing. Hence, an industrial design approach is suitable to provide design service for this kind of industry. Taiwan companies provide full product lines for buyers under ODM service or sell product by brand name thus company product design departments need to provide many kinds of design for customers to order new products for next year market.

In general, north of Taiwan's industry is communication-computer industry and electronics consumer industry. The middle of Taiwan's industry is the machine, bicycle industry. The south of Taiwan's industry is small electronics consumer product. The design consultancies client and industry varies with the location. The Chinese Industrial Design Association (CIDA) 1994 releases the index of design houses in Taiwan in total. There are seventy-seven design houses in Taiwan. Some companies use in-house designers, or outsource design consultant, or both. Most manufacturing companies provide product under OEM and ODM for customers and some companies sell their product by under their own brand. There are many kinds of customer for Taiwanese companies. Thus, it is increasingly complex to make critical decisions by the key decision-maker during the NPD process. The communication between clients and



designer also needs to be established early and provide a suitable design strategy to satisfy clients' requirement. This is one of the key main tasks of design consultants in design projects. Two design consultancies are involved in this research, Neway Design and And Design Ltd.

### **1.1.1 Author's Relationship with the Design Consultancies**

In addition to the two design consultancies, there are 39 design projects involved in the action research. In each of the design projects the detail of meeting results and the interaction between client and designer leader were included during the NPD process.

#### **Neway Product Design and Development Ltd., (Neway Design)**

Neway Design was founded in 1985. His client includes many manufacturers of electronic products and hi-tech information producers which a cover wide ranges of items. Neway Design attracted the attention of the Design Promotion Center of the China External Trade Development Council (CETRD) and from then on Neway have been repeatedly recommended to international companies like the Xerox, Primages and Digital in Taiwan. These companies design hi-tech products such as laser printers, hi-speed printer computers and so on.

From 1992, Neway applied project management into the company. The design team is set up in two groups, the A team and B team, which are financially independent. The organization chart is show in Figure1.1. The author was in charge of A team, which undertook 29 design projects from 1<sup>st</sup>/June, 1995 to 31<sup>th</sup>/Dec. 1997.

There are three departments which are supervised by Neway Design board. They are marketing department, design department and financial department. The marketing department's main task is to identify key market sectors, prospects and define marketing objectives to set targets for turnover and market penetration. In addition, they plan marketing communication processes, marketing resources, communications tools, and marketing support materials.

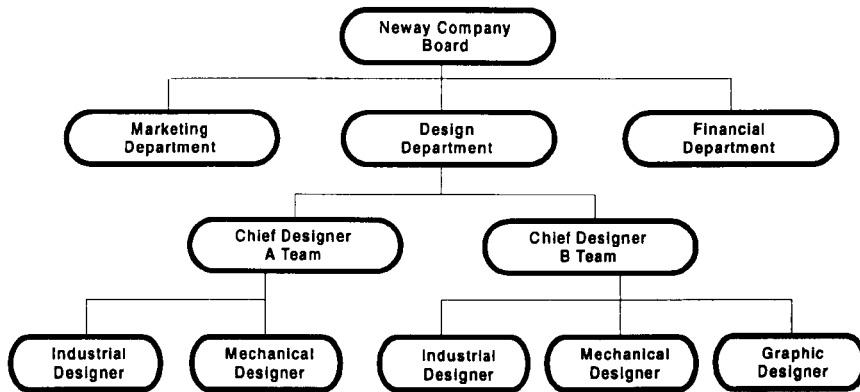


Figure 1.1: The Neway organization chart

The design department in Neway, two of chief designers play the role of the marketing department and also manage Industrial, Mechanical, and Graphic Design described below:

- **Industrial Design:** To design products, whose involvement will be comprehensive, providing concept, prototype, specification and product details for a new product, which they consider specific aspects of an existing product such as function operation, human interface, and style.
- **Mechanical Design:** The mechanical designer is an engineer who is involved in the details of product function, structure, working, and consider the mass production condition.
- **Graphic Design:** To refer information, and to establish how images are perceived in relation to their environment and their function. This work is diverse and may be sought in publications, corporate identities, packaging, displays, and exhibitions, Characterization and visual appearance of stores and buildings.

The responsibility of Financial Department is to maintain records and manage tax affairs, to ensure that the company has adequate of funds, and that it makes a suitable profit. Two teams have independent finances.

## And Design Ltd., (And Design)

And Design was established in 1996, providing design service that included graphic design and product design. And's clients includes many manufacturers of electronic products hi-tech information producers, covering wide ranges of items. And Design have been linked to international companies such as the Ford, Sega, in Taiwan, which design hi-tech products such as car interior, kids computer, videophone, note-book computer, scanner and desk top computer so on.

And Design uses the project leader in the company. The design team is set up in three groups. The organization chart is show as Figure1.2. The author handled the C team, which undertook 10 design projects from 1<sup>st</sup>/Jan. 1998 to 31th/Dec. 1998.

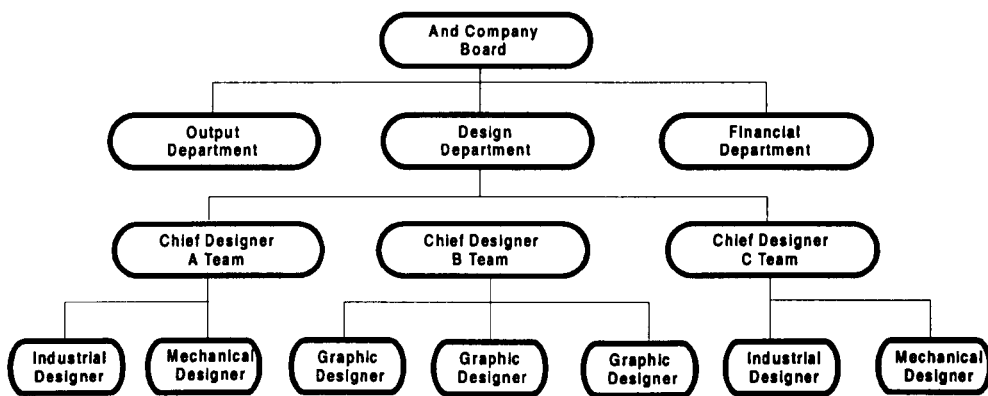


Figure 1.2: And Design organization chart

This Output Department is established for clients who need output large size images. Design department also need output the large size image for client presentation. Utilizing the Hi quality A0 printer is very attractive for client. The graphic designer also uses this facility to produce the package design.

In order not duplicate tasks, And Design and Neway Design run businesses in both design department financial department.

## **1.2 Aims and Objectives**

### **1.2.1 Aims of the Investigation**

The original aim of this study is to identify the key factors in design development process and its management of commercial projects which will improve the practice of industrial design and the rapid product development process in the commercial environment, with particular emphasis on the product design consultancy/client organisation interface.

### **1.2.2 Objectives**

The original objectives of this research are interpreted as follows:

1. To review the relevant literature on the related background and thinking on the ranges of Design Issues such as, New Product Development, and the Practice of Design Management.
2. To research the practice of Industrial Design in Taiwan's environment, in order to explain how Industrial Design consultants worked in Taiwan with particular emphasis on the electronics industry, so that the structure of companies in the sector can be identified, and to identify similarities and differences in electronic companies in terms of management culture, production methods, and market levels etc.
3. To provide background information on relevant aspects of marketing, design trends to explain how designers and designers manager are trained to become a design team, and to provide a systematic explanation of the Industrial Design process and strategy in particular on how it impacts on the practice of manufacturers and design consultancies.
4. To monitor the methods used by both design consultancy companies and client companies in product design and development processes, and all relevant negotiation stages.
5. To analyse the action research material obtained at 4.0 in order to identify all key factors relating to the negotiation, briefing and product development processes, thus identifying areas of commonality and key variables.
6. To develop a model to improve the design consultancy/client organization interface

with the aim of improving the product development response, both in terms of quality, cost and time scale.

7. To pilot in suitable company organisations the model for an improved system of managing all aspects of the rapid product development process.
8. As a result of fulfilling objective 7.0, to modify the proposed model as necessary and implement the new system of operation in both the previous action research consultancy/client organisations and in newly selected case-study organisations and monitor the outcomes.
9. To draw a report with findings and make useful recommendations to design consultant companies and client organisations.

### **1.2.3 Aims and Objectives - Modification**

The original aims were modified as a result of the identification of the key relationship between the design consultancy and the client.

The new aim adopted of this study was to identify the management of commercial projects which will improve the practice of industrial design and the rapid product development process in the commercial environment, with particular emphasis on the product design consultancy/client organisation interface.

The objectives were also modified to suit the new aims.

### **1.3 Research Structures and Methodologies**

This study was undertaken with the following specific methods.

1. Analysis of the relevant literature to identify key factors. (Objective 1)
2. Investigation research: Ten design consultants and 13 clients have been selected companies in order to have semi -interviews. (Objective 2)
3. Action research: 13 clients have been selected as action-study companies in order to satisfy objective 4, and monitoring of live projects are taking place by observation, interviews, questionnaires and recording of actions and negotiations. (Objective 3, 4)
4. Pilot study: Testing and refinement of findings of 4.0 above in new company

environment. Semantic Different (SD) method and Principle Component Analysis (PCA) to build a model. (Objective 5, 6)

5. Model practice, compile, analyse, test and refine findings. (Objective 7,8,)

### 1.3.1 Framework of the Research

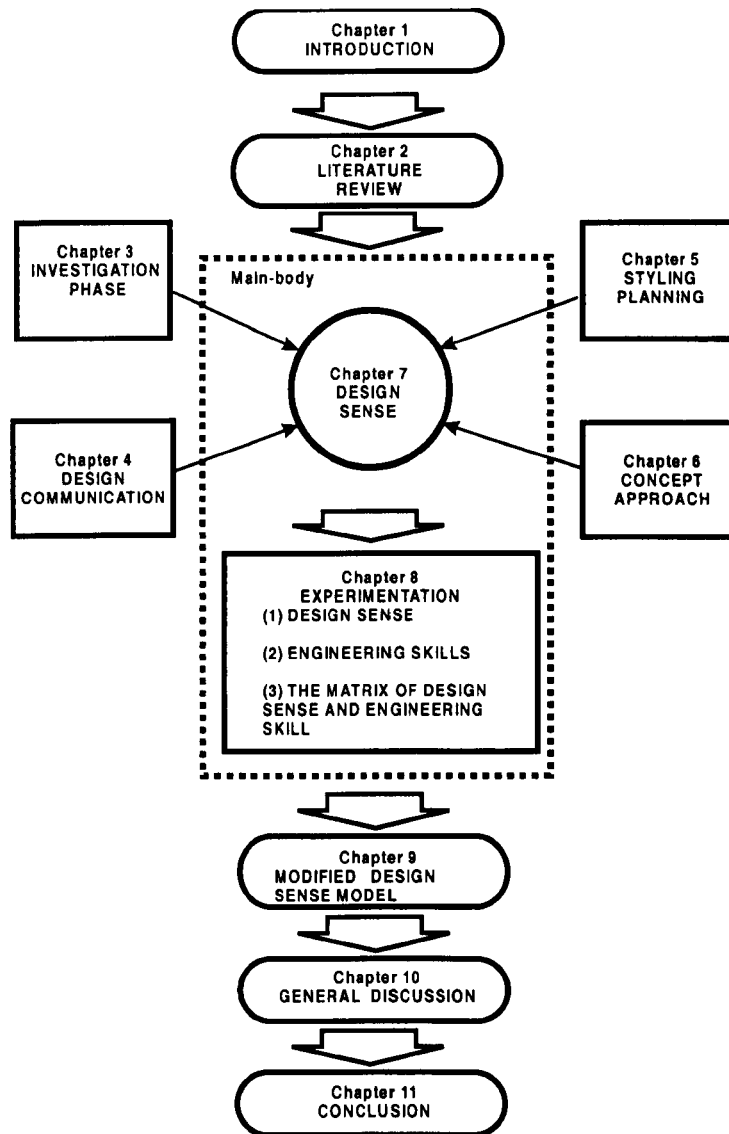


Figure 1.3: Framework of the research

Chapter 1, is an introduction to the purpose and background of this research with the aims and the objectives clearly stated as well as research structures and methodologies.

The key concepts to be considered in this research are discussed in Chapter 2. The

literature review on designer/client relationships and sense of design. The main current related research direction for effective design development in design consultant practice.

Then in Chapter 3, the investigation studies focused on the thirteen clients who were the selected sample for the action research and ten design consultants. By means of semi-structured interviews the relevant design development information focusing on designer/client relationship were collected.

Chapter 4 examines in more detail the rationale behind the initial design phase. The design communication which concerns the design results and the interaction between the designer/client defined the type of design approach. The design communication – a research project for improving understand between the client and designer was presented in the 4<sup>th</sup> Pacific Conference On Occupational Ergonomics, in 1996 (See appendix I) and the design brief in vertical design communication strategy was published in the 3<sup>rd</sup> Chinese Institute of Design conference in 1998 (See appendix I-a).

Chapter 5 reviews the styling planning by means of literature research and action research. To develop styling planning context by thirty-nine design projects, this is followed by a discussion of the role design management can have in controlling product styling planning, during the form-creation phase and how interactions occur between the designer and the design manager in the form-creation phase. Finally, a model of styling planning was developed for future effective product design development. The study attempts to utilize an experiment, which was designed to describe the key factors of styling. The key finding is described in an experiment consisting of two groups: the first group had access to styling planning data (product mapping, product semantic analysis), they produced a design which was more competitive and semantically correct following design trends than the second group, i.e., the control group who did not have access to such data during the idea generation phase.

In Chapter 6, based on action research data from the Industrial Design Consultants, a concept strategy is developed, which attempts to satisfy both clients and designers.

During the idea generation phase, critical marketing information, decision-maker attitude and design sense can influence the design position, orientation and consequently the design results. It is an important function of the design management process to match current company policy and strategy with product development. The concept strategy is an important tool in giving products the best styling position in higher competing markets. Moreover, although most young designers lack the perception of the key styling position ability which is a key factor for high competition restyling products, they can design an excellent product, which may not be the right market for the client's needs. The purpose of this study is to explore the role design management can have in controlling product styling strategy and to explore how interactions occur between the designer and the design manager in form-creation phase during the form-create phases. Finally to develop a model of concept strategy for effective product design development.

Chapter 7, reviews the thirty-seven action research case studies. Discussing with the people that make the design decisions in the company and have a key role in the company level of success or failure. It identified that both the design consultant and company manager must have an understanding of the reasoning made by the decision-makers in the following areas: design sense, engineering drawing reading ability and decoding any kinds of visual result ability. The purpose of this study is to explore the role of the industrial design team during the design development phases. Final, a model of key decision-maker whose design sense and visual ability was established. The initial design sense presented in Cross-strait & International Industrial Design Symposium, 1997 (See appendix I-b)

Chapter 8 is the experiment phase. The Semantic Differential (SD) method is used to define the type of key decision-maker's design sense. This purpose of this experiment was to extract the factors of design sense and to offer a design sense model for the design manager to understand the types of key decision-maker. In this experiment, using 11 pairs of words, which represent design sense, a survey was undertaken with a sample of 29 decision-makers and design managers. In addition, thirteen product concepts were reviewed by the semantic differential method and then statistically analyzed. A matrix



of design sense and engineering skill for explain most types of clients' characteristic as established.

Chapter 9 described 3 new projects, including two new clients and one existing client, and used the first stage methodology to refine the sense model.

Chapter 10 and Chapter 11 are general discussions and conclusions based on the analysis of the information data obtained. It considers the implications of this research for both academics and practitioners.

### **1.3.2 Literature Review**

The critical literature concerning design management, industrial design, designer-client relationship, and design communication. Allison 1993 noted that “the literature of the subject field is an important source of research topics. The text books and research journals for any subject describe what is already known about the subject and, therefore, they can also indicate the gap in knowledge.” Denscombe 1998 argued that literature:

- “Shows that the researcher is aware of available existing work already undertaken in this area.”
- “Identifies what the researcher takes to be the key issues, the crucial questions and the obvious gap in the current state of knowledge.”
- “Provides signposts for the reader about ‘where the research is coming from’ – it allows the reader to see which theories and principles have been influential in shaping the approach adopted in the proposed research.”

The initial literature reviews are focused on the designer-client relationship, especial in design sense of clients. The following each chapter has additional literature research which enhance each objective.

### **1.3.3 Investigation Study**

Ten design consultants and thirteen companies were interviewed by semi-structured format and collected the design consultants responses to specific question of the research subject. Bell, 1993 argued that “Preliminary interview are held to give you ideas about which topics to include in the study, and so an unstructured approach is

needed.” and he also noted it is for freedom to allow the respondent to talk.

The Chinese Industrial Design Association (CIDA) in 1994 released the index of design houses in Taiwan, there are seventy-seven design houses in Taiwan. Ten design consultants from those invited to attend a celebratory exhibition of CIDA fortieth anniversary were selected. Seven of these consultants are located in Taipei area (The north of Taiwan), two in Taichung (The middle of Taiwan) and one in Tainan (The south of Taiwan). These are the ten design consultants who agreed to take part in an initial interview Table 1.1.

Table 1. 1: Ten Design Consultants Agreed to Take Part in An Initial Interview

Name	Company Since	Staff	Location	Attended CIDA Exhibition	Person to Contact
Center Design	1983	17	Taipei	*	Mr. Tung
Conser Design	1989	20	Taipei	*	Mr. Fang
I+U Design	1995	31	Taipei	*	Mr. Koo
JIK Design	1985	9	Taichung		Mr. Chung
Moreal Design	1994	11	Taipei		Mr. Tseng
Nova Design	1988	22	Taipei	*	Mr. Lin
Quinte Design	1989	11	Taipei	*	Mr. Chiou
Sekond Design	1990	10	Tainan		Mr. Lin
Suivwell Design	1990	13	Taichung		Mr. Tang
Wen's Design	1990	5	Taipei	*	Mr. Wen

The 13 companies (Table 1.2) chosen were clients for whom the author had carried out design consultancy work. Thirty-nine design projects were carried out for these client companies from June 1995 to July 1998. The 13 companies are mostly located in the Taipei area and one in Hsinchu (in northern Taiwan). Most of the companies produce electronic products such as computer & communication products, audio-video products, consumer products and 16G-passenger aircraft seats.

Due to it being an action research, most design projects come from existing clients and some new projects from new clients who are introduced by old clients. Because those companies are author's clients, most of key decision-makers were willing to take part in an initial interview are shown in the following Table 1.2.

Table 1.2: Thirteen Design Consultants Agreed to Take Part In an Initial Interview

Company	Design Projects	Location	Capital (million)	Company Found (year)	Staff	New Client
Tranbon	Video telephone	Taipei	424	1980	500	
Hentak	Telephone/answering Machine	Taipei	15	1984	9	
Kingtel	Cordless Telephone	Taipei	750	1977	800	
Ligitek	DVD Decoder	Taipei	30	1985	60	
Ming-jong	Timer	Taipei	100	1978	160	New
Unication	Pager	Taipei	NA	1992	NA	New
Syntech	Laser Scanner	Taipei	195	1988	90	New
Tentel	Key telephone	Taipei	33	1979	33	
Eten	PDA with Pager	Taipei	753	1987	191	New
Philips	Key telephone	Taipei	NA	NA	NA	New
Panacom	Video telephone	Taipei	100	1998	10	New
Smartek	ISDN Telephone	Taipei	NA	1990	150	New
CAST	16G seat	Hsinchu	NA	1991	114	New

Having established that the participants match the research requirements, the aims were amended as following:

- To identify the major factors that influence design sense in new product development.
- To increase understanding of decision maker’s behaviour during new product development process.
- To identify the modes of design sense between consultants and clients in new product development process
- **To develop an effective design management led diagnostic tool for design consultants, clients and designers.**

### 1.3.4 Action Research

“ Action research combines a substantive act with a research procedure; it is action disciplined by enquiry, a personal attempt at understanding while engaged in process of improvement and reform”. Hopkins, 1993. It is a form of collective self reflective enquiry undertaken by participants to improve their own practices as well as their understanding of these practices and the situations these practices are carried out.

Action research involves the following:

1. Negotiation – Design proposal which include design process, timetable, design service charge.
2. Design Brief – Specification, constraint, focus and product position and styling

approach from client requirement.

3. Design performance – Styling planning, concept generation, concept development.
4. Interaction – How client evaluation and make decision on new concept proposal, and negotiate how to modify the new concepts.

Action research was used for this study because of its flexibility and the allowance for the designer to be involved in real projects as part of the process.

Chapter 6, 7, 8, 9 utilized action research methods to explore the relationship between designers and clients and design management tools to satisfy clients. Bell 1993 and McNeill 1990 have the same argument that “Action research is that the task is not finished when the project ends. The participants continue to review, evaluate and improve practice.” Svengren 1993 mentioned that: “action research first came from Kurt Lewin’s ‘real life experiments’ in USA and the Tavistock Institute’s treatment of war prisoners’ psychological injuries at end of the 1940s.” In the same paper, she also noted that action research method is taking advantage of knowledge acquired through consultant work and an action researcher needs to document the process thoroughly. He also argued three key points of action research method:

- The action research is concerned with change.
- The action research is focused on problem solving.
- The action research related to organization change processes.

She also argued that “Action research could provide an opportunity for researchers to acquire rich data when following design processes in the strategy works of an organization. Action research is characterized by an interactive relationship between the researcher and client.” Svengren compared the differences and similarities in action research and traditional case study and summary in Table 1.3.

Svengren 1993 stated that “ The action research method has the risk of failing or being too dependent on the consultant part.” When action research is still going on and improving the design management process. Action research is still one of methods chosen to explore the relationships between designers and clients.

Table 1.3: The Focus and Major Concerns with Action Research Versus Case Study Research

	Action research	Case study (with qualitative approach)
Research inquiries	Process-oriented, might change	Not changed
Research process	Flexible, solution-oriented	Preplanned, some flexibility
Independency on management of case company	High	Low
Research objectives	Knowledge and understanding; Focus on intended changes	Knowledge and understanding; Focus on events and processes
External validity	Credibility in the reasoning and in the quality of sources of data	Inference and replication and quality of sources of data
Internal validity (consequence criterion)	Support from other case	Transferable to other cases
Flexibility	Difficult	Possible
Objectivity (awareness criterion)	Reflect on the process and influence important as well as a critical distance to the case	Multiple sources and consistency
Analysis concern (Pragmatic criterion)	Credibility/consistency and workable for client	Credibility/consistency

Source: Svengren 1993 pp.456

### 1.3.5 Analysis and Synthesis

This research uses both qualitative and quantitative values to analyse the action research and related experimental research. The initial evaluation research, design communication, design planning, design approach and pre-design design sense in Chapter 7, uses qualitative research. In Chapter 8 some of design planning, design approach uses quantitative analyse of data. Denscombe 1998 described qualitative research sense as "A concern with meanings and the way people understand things. Human activity is seen as a product of symbols and meanings that are used by members of the social group to make sense of things. Such symbol and meaning need to be analyzed as a 'text'- to be interpreted rather like a literary critic interprets a book. A concern with patterns of behavior. Here the focus is on regularities in the activities of a social group, Such as in rituals, traditions and relationships, and the way these are expressed as patterns of behaviors, cultural norms and types of language used."

Denscombe 1998 stated qualitative research in procedures for analyzing data:

- Coding and categorizing the data.
- Reflections on the early coding and categories.

- Identification of themes and relationships.
- Return to the field to check out emerging explanations.
- Develop a set of generalizations.
- Use the new generalizations to improve any relevant existing theories.

Denscombe 1998 also argued that “The issues of objectivity, reliability and validity are as relevant to qualitative research as to any other approach” In the experiment chapter, Chapter 8, in a paper presented by Shackleton & Kazuo 1998 the Principle Component Analysis (PCA) was used in order to categorise the vehicle from users cognitive perspective and also to investigate the way in which consumers differentiate between similar products. They used 37 samples and pairs of photographs. These were presented to subjects who were asked to make judgements of the similarities on a seven point scale. This paper influenced the author’s choice of statistical method to evaluate the client’s design sense. In styling planing, Chapter 5, the t-test is utilized to analyse the two different groups. The concept approach, in Chapter 6, the scanner marketing mapping is uses Multidimensional Scaling (MDS) to analyse user mind space. In Chapter 8 the cluster analysis cluster analysis experiment, is used in the pilot tests to reduce similar samples to test subjects in different groups. The Statistical Package for the Social Science (SPSS 8.0 version) is used in the analysis of data (Babbie & Halley 1998).

The **validity of the results** obtained for this study can be measured by the tests and experiments undertaken. These tests which were related to styling-planning (Chapter 5), concept approach (Chapter 6), and design sense (Chapter 8) are summarised as follows: *Planning and styling*; the t-test was used as the first stage of experimentation. *Concept approach*; the Multi dimensional scale was used to set up the product mapping for the study. *Design sense*; Semantic differential methods and test were used for the development of the appropriate model for the study.

These tests and experiments used in similar studies are scientifically verifiable. This study however acknowledges that by using clients, most of whom were known to the author, **the possibility of some degree of error** in the results due to its subjectivity, though insignificant, cannot be ignored, especially, the adoption of the PCA approach for quantitative data.

## **Chapter 2 Literature Review**

### *Designers, Clients and Design Manager*

The textbooks, research journals and published conference proceedings describe what is already known about the designer and client, design management, industrial design subject. Initially, Prof. Margaret Bruce which research is concerned with relationships between designer and client and influenced the author's thinking deeply. Reba's "the design experience model" and Robinson's organization perception model have impact on the author's thinking in styling planning and design sense. Other literature reviews will be concerned with the identification of research related topics such as New Product Development (NPD) process, role of industrial design and type of NPD products.

### **2.1 Design Management in the Product Development Process**

Bruce & Docherty 1993 noted the family approach (long-term), arms-length approach (Short-term) and one-off approach for client-design relationship. She also argued that the long-term relationship can have many advantages for both client and design consultants. There are some elements that will determine whether or not there are on-going relations between clients and designers:

- Providing appropriate design solutions to client's problem.
- Personal 'chemistry'
- Mutual trust and respect between the clients and designer.
- Use of common language

Bruce & Morris 1995 statement that outsourcing and in-house of design expertise, the nature of relationships, whether a long-term, close relationship between client and design professional, or an arms-length and distanced relationship, have influenced author's thoughts. In this research, eight companies were interviewed on a tape recording and interview notes were transcribed, and combined with the secondary sources of information to create interview reports. Due to Bruce already having done a long-term research on clients and design relationships and especially focusing on industrial design during the NPD process, she already argued that there are three types

of approach to the perception of design expertise. The types are in-house design function, solely external expertise and a mixture of in-house and external design expertise. Bruce makes a table to compare the approach for in-house and outside designers in different important respects. (Table 2.1)

Table 2.1: Comparison of Approaches to Location of Design

	In-house	Outsource	Mixture
Purposes	<ul style="list-style-type: none"> <li>● Accessible</li> <li>● Integrated within company practice and product development team</li> <li>● Cost efficient</li> </ul>	<ul style="list-style-type: none"> <li>● Solve short-term problems</li> <li>● Relieve workloads</li> <li>● Access new idea</li> <li>● Access specialist expertise</li> <li>● Easier to abort unsuccessful project</li> <li>● Cost efficient</li> </ul>	<ul style="list-style-type: none"> <li>● Flexibility</li> </ul>
Management characteristics	<ul style="list-style-type: none"> <li>● Encouraging creativity</li> <li>● Less anxiety over control factors</li> </ul>	<ul style="list-style-type: none"> <li>● Evaluation of work more intense during the design process</li> <li>● Level of contact higher in the initial relationship stage</li> <li>● Choosing the designer is critical</li> <li>● Communication factor uppermost</li> <li>● Fear of leakage of proprietary information</li> </ul>	<ul style="list-style-type: none"> <li>● Creation of design team complex</li> </ul>

Source: Bruce & Morris 1995, pp.109

Bruce & Morris 1995 argued that “While external designers are needed for their design skill, the project engineer perceived that in-house designers have more advantages, such as:

- **Accessibility:** with an in-house department, problems are sorted out immediately.
- **Familiarity:** in-house designers know the history of the product because of the amount of upgrading and modification work that is required.
- **Commitment:** in-house staff seem more committed to meeting deadlines.
- **Briefing:** this is a problem with outside design consultants: ‘we will say we want so and so and when we get it back it’s nothing like what we asked for. Consultants do not know what you really want or what the product really does, they do not listen to you properly.’ “



Bruce & Morris also stated the short-term and long-term advantages given in Table 2.2. They also noted that security, trust and understanding will influence the short-term and long-term relationship.

Table 2.2: ‘Pros’ and ‘cons’ of Short-term Versus Long-term Relationship

Short-term advantages	Long-term advantages
<ul style="list-style-type: none"> <li>● Comparison purpose</li> </ul> <p>Having a relationship with more than one consultant enable the client to compare quality and efficiency factors between consultant</p> <ul style="list-style-type: none"> <li>● Cost</li> </ul> <p>Relationship were open to market forces</p> <ul style="list-style-type: none"> <li>● Access to different expertise</li> </ul> <p>Gave the client more choice in the type of expertise require</p> <ul style="list-style-type: none"> <li>● Time</li> </ul> <p>Consultants were used to relieve short-term in-house design workloads</p> <ul style="list-style-type: none"> <li>● Compatibility</li> </ul> <p>By maintaining a short-term relationship with a consultant, if the relationship is ‘difficult’ it gives the client the freedom to choose a more compatible design partner</p>	<ul style="list-style-type: none"> <li>● Familiarity</li> </ul> <p>This improved the effectiveness of the design input from project to project.</p> <ul style="list-style-type: none"> <li>● Stability</li> </ul> <p>Once a project had been completed successfully with a consultant, management anxiety and uncertainty about the relationship and product development in general reduced</p> <ul style="list-style-type: none"> <li>● Continuity</li> </ul> <p>Retaining the same consultant ensured that the brand proposition within and, if required, across product ranges remained the same. It also made the initial stages of each new project much easier because the ‘process’ of using the same consultant remained consistent</p>

Source: Bruce & Morris 1995, pp.112

The conclusions in this research described three different approaches to the management of design expertise in-house, out-house and a mixture. There are two approaches for design relationship, short-term and long-term. The main issues influencing the outsourcing of design expertise are accessibility, familiarity and control.

The author agrees with Bruce & Morris 1995, but adds that briefing can also be a problem for in-house designers, because the Project Manager of each stage during the NPD process will ensure the design results follow the right line. Thus, the Project Manager, especially the key decision-maker who has design sense and design manager (out-house and in-house) have the ability to control design and their personal characteristics will have impact on the client and designer relationship whether it is long-term or short-term.

Bruce mentioned that short-term and long-term relationship from client characteristics (Approach to relationship, personal characteristics and company characteristics) to design consultant characteristics (Type of resource ‘discipline and specialization, reputation’ and personal characteristics) compare with the design needs (Design strategy, customer requirements, company requirement, product requirement). (Figure 2.1) These notes give the author a review of the design projects during design consultation. The author found that the client/designer relationship, especially from design consultant viewpoint, firstly, needs to evaluate the clients personal characteristics which include design sense, especially focusing on the key decision-maker. Secondly, design manager (design consultant) needs to filter information to ensure the design result matches the client’s requirement. The design sense of client and design manager’s communication and filtering role is not mentioned by Bruce.

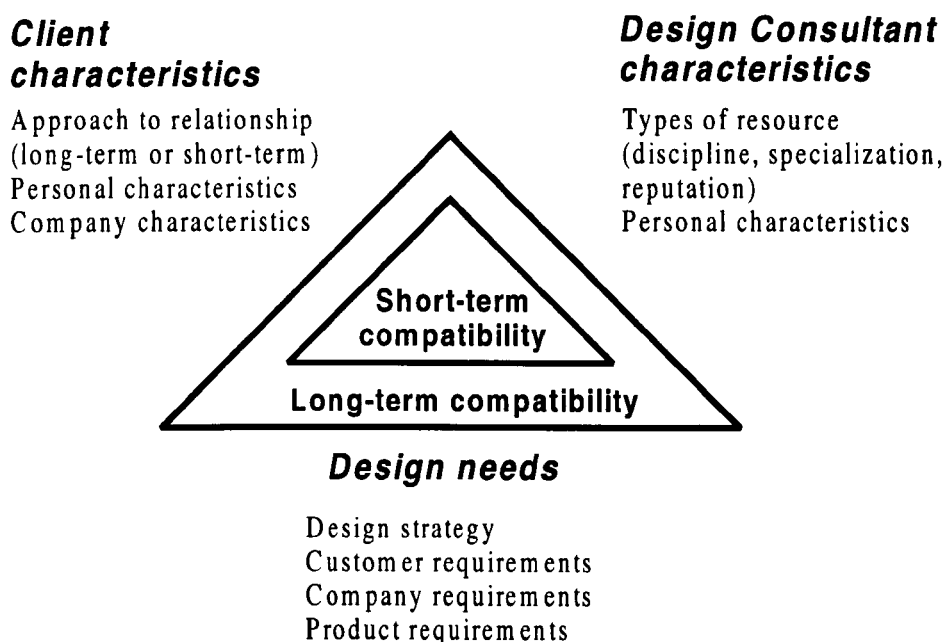


Figure 2.1: Compatibility Model of Client-Design Relationship

(Source: Bruce & Morris 1995, pp.110)

## 2.2 The Interface between Client And Designer

Bruce & Cooper 1997, Bruce & Jevnaker 1998 mentioned the matrix of design relationships. She uses simple matrix to explain the relationship of the designer-client. The x-axis is duration of relationship (short, long-term) and the y-axis is closeness of relationship. (Figure 2.2) The compatibility established between the client and design professional depends on 'social' element (Personal chemistry) and the ability of using the same language and mutual trust. For the client, the long-term relationship is important so that the design professional captures and is able to express the company's identity. Good personal chemistry lets the designer comprehend at a deep level, from the client's perspective.

		Duration of relationship	
		Arms-length Short-term	Arms-length Long-term
Closeness of relationship	Family Short-term	Family Long-term	
	Family Short-term	Family Long-term	

Figure 2.2: Relationship Matrix. (Source: Bruce & Jevnaker 1998, pp.44)

## 2.3 The Relationship between Designer and Client

Bruce & Jevnaker 1998 mentioned that relationship of a lifecycle model, from the initial stage, how is a decision is made about the location of design experience. Bruce stated the trend towards outsource is driven partly by cost considerations and a belief that outsource design cost is cheaper than in-house design. She also noted how the clients decided by cost reasons that included previous experience, external design manager's personal preference, procurement, commissioning, and design ability.

- **Compatibility:** From initial contact to appraisal of client-design compatibility, the project needs to go through to the end, therefore, contact is required between parties to ensure that the client-design relationship is continued.
- **Familiarity:** If there is a potential to establish a longer-term relationship. Moving

from a one-off project to an ongoing relationship takes time and commitment in building up a personal relationship.

- **Competency:** Compatibility between client and design firms also entail a resonance of operating procedures and the design company's ability to understand the client's business, in order to devise effective design solutions. Emerging from future repeat purchases, if client-design compatibility match, the linkages become strong. The personal relationship is a trigger for familiarity aspects. These familiarity aspects are not obvious but hidden as a design competency.

Bruce & Jevnaker 1998 concluded that "The design relationship lifecycle evolves from pure compatibility issues at initial purchase to familiarity issues through successive purchases, to a recognizable competency after an appropriate period of time."

In client-design relationship, Bruce uses a stage model to explain evolution of the grounds for long-term relationship. (Figure 2.3)

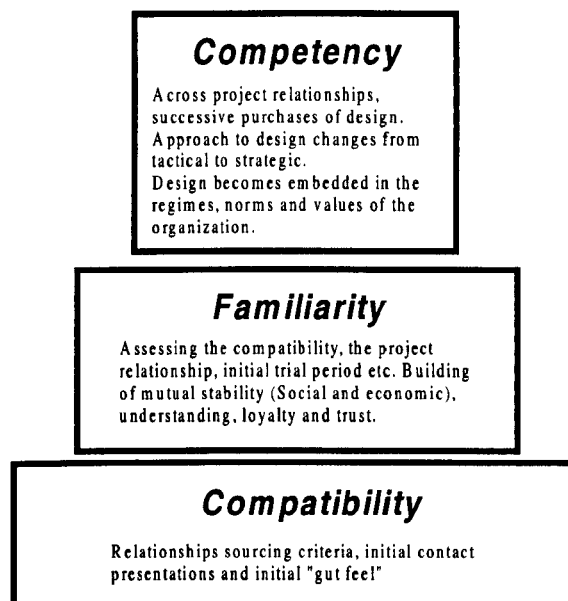


Figure 2.3: Relationship Lifecycle Model.

(Source: Bruce & Jevnaker 1998, pp.59)

## 2.4 Effective Design

One of the aims of the study was to identify effective design process and the design

leadership strategy used by both design consultant and business. The effectiveness of the design brief to the overall design, has been described by a number of researchers (Mitchell 1996, Booz 1982, Constable 1996, Law 1996). They state that as well as recording what are the client's needs and wants, the design brief also needs to consider: market, manufacture, and design departments constraints. Writing an effective design brief is an important issue during the product design development phase. The direction of design approach can be approved by either client (or decision-maker) and designer, so that the design idea generation can focus on a limited range.

Some research has pointed out that utilizing computer tools can help with the visual design communication (Tovey 1986, Tovey & Dekker 1996, Hughes & Cunningham 1996). The CAD system can create a new approach. The 3D modeling package software can provide rendered models, rapid prototype files, and it is possible to improve the quality of the design's visual output. At the same time, the concurrent engineer may combine the CAD/CAM/CAE systems, greatly reducing the overall design schedule.

Research shows effective briefing, sourcing and evaluation methods are utilized by small business (Bruce et al. 1996). More research in communication, Walton 1995 pointed out: "An effective design depends on effective communication." There is widespread agreement in the literature on the following key components of product planning for effective design. (E.g. Beckman & Mowey 1993, Ulrich & Hanser 1995, Baxter 1995, Ireland & Johnson 1995). The style of planning also contributes to effective design (Baxter 1995). Some of the research on design is at leadership level (Topalian 1990 & Walker 1993).

Bruce et al. 1996 chose eight examples of small and medium sized companies, and a methodology consisting of qualitative research in the form of semi-structured interviews. Bruce argued that "there are two design management processes taking place within the companies. Companies with previous design management experience are more likely to be successful than inexperienced companies." They argued that:

Group 1 – Design management process improve companies.

Characteristics:

- Confident about briefing, sourcing and evaluating design.
- No external help required to brief, source or evaluate a designer.
- Frequent and confident users of design within business process.
- A design consciousness firmly embedded within their organisation.

Group 2 – Design management process introduction companies.

Characteristics:

- Some companies need external help to compile a brief.
- All need external help to source a designer, this task is perceived as a high risk by all.
- All companies need to be “coached” through the design process, very apprehensive
- Some awareness of value of design but wary of potential cost, this was a barrier
- Design not firmly embedded within the organisation, some had a basic awareness

Bruce et al. 1996 noted that “Successful design is linked to the presence of transferable design management skill within the company, such as the briefing skills present in the company.” Bruce uses taxonomy of design management which is summarised from the literature review to list the case studies material. This qualitative research skill is to the attractive author. The design brief that she mentioned could be useful for listing the design brief and checking the brief attributes for research into the client / designer relationship.

In the same paper, they also argued that “‘design consciousness’ is developed over time through the trial and error and through frequent exposure to design project.” She mentioned the companies where design is part of the everyday business process. The author would like ‘design sense’ to take the place of ‘design consciousness’, because sense is a very common word. The design sense in the company, in many decision-makers, and in key decision-makers, is a strong factory influence on the NPD process, Bruce et al. 1996 offers a remedy for the author in this research.

Bruce et al. 1996 used awareness of design and management competency two X-axis and Y-axis dividing the four types of design management competencies. The awareness of design in the company is seen as similar to the design sense in the company. They also demonstrate an excellent matrix method for author 's research.

#### **2.4.1 Excellent Product**

Some researchers argue for the excellent product from marketing and engineering, such as Baxter 1995 mentions: New products are a development for customers to buy, thus a successful product needs to have attraction to customers, acceptability to retail, engineering feasibility, product durability and reliability. Ulrich & Eppinger 1995 also argue from the same point of view: Successful product development results in products that can be produced and sold profitably.

#### **2.4.2 Design Team**

During the product development process, there are three types of designer involved in the design team. The Industrial designer, Electronic designer and Mechanical designer. Ulrich & Eppinger 1995 argue design teams involve people with different skills and talents, and they come from different training, experience, perspectives, and personalities. The designers in different organizations have different types of structure, he also argues the type of organization structures: (1), Functional organization; (2), Matrix organization - lightweight project organization and heavyweight project organization, and (3), Project organization.

Recently, the Concurrent Engineering is utilized in NPD process. Development of a new product by sequential means involves passing the emerging concept from one department to another, from research design, to design development, product planning, estimating, tooling, manufacture, and assembly. This hand over approach is ineffective and led to the "time to market"; the multi-disciplinary team is set up and the team workers all work together.

Constable 1996 points out: "Concurrent Engineering is multi-disciplinary teams, no delays due to information transfer, and no delays due to territorial barriers, clarity of targets."

### **2.4.3 Design Decision**

From business opportunity, design specification, concept design, embodiment design, detail design, to design for manufacture, every level needs designers or managers or decision people to make design decisions or give direction for the next stage to design development. Some of the decisions are made by the designer themselves, but some decisions need to be made by a head of department, or with other heads of departments, and some of the design decisions need to involve top level decision makers. The new product concept presentation, especially, needs to involve marketing, manufacturing, and design departments with top managers at a formal meeting to take the proper direction of the design concept.

### **2.4.4 Design Concept Decision Organization**

One of the main subjects of organizational activity is the strategy used to decide what: to produce, how to produce it, and what resources are required (Dawson 1986). Hence, the presentation of design concepts in each phase needs the client's decision people to direct the work by making decisions. The types of decision include the following:

1. A dictatorship: Only one person makes decision, but he will consult with many department managers. The advantage is an effective design decision and a clear choice. Disadvantage is the decision-makers response to products that fail. Hence, in this situation, a decision-maker could be the general manager, the president, or high level manager who is responsible for product development.
2. The committee of NPD: Several department managers and the general managers make up the NPD committee. Utilize the vote method to choose the design concepts. The advantage is that any decisions may avoid a single perhaps biased personal viewpoint. The disadvantage is that the designer when presenting his work needs to involve the concerns of every committee member, and discussion time will take longer.

The NPD committee will have to review and consider the different presentation results, and especially: concept drawings, idea concept prospective drawings or two dimensions full size concept design drawings. Ideally a small group of experts is best as a big committee needs more copies of drawings and media prepared. Another consideration is



selecting key personnel for the NPD process and the committee should be supported and monitored. It is important in the success of any project (Cooper & Jones 1995). Hence, the design manager ought to check and monitor the key personnel in the committee and also, consider the extent to which the design manager controls the decision committee working in every phase of design concept presentation.

#### **2.4.5 Decision Path**

In every design phase, especially, the new product concept presentations need to involve marketing, manufacturing, design departments and top managers to make proper decisions on the design concept. The decision path with different projects or products, or limited time schedule, or limited budget, could be slightly different and usually follows the design presentation that the design proposal had arranged before the project launch. The decisions always must be made quickly and without completed information, (Ulrich & Eppinger 1995) and top managers need to understand that risks always exist during the design decisions.

The manufacturers need to check the results from every design stage: design brief, specification, and idea generation to soft model or mock up, There must be a close interaction between decision-maker and designer. Decision-maker should conduct evaluations in the following subjects: Functionality, usability, aesthetics, safety, production, innovation, marketability, sustainability, social value, and culture concerns (Su 1997). The literature review of a good design evaluation system is shown as following. First, art is product styling. Second, technology and function, user friendly, ergonomics. Third, economic consideration marketing, product produce. The final social function is green design, culture.

#### **2.5 Customer Experience**

Rbea 1992 stated a design experience model; he note designing a satisfying product experience is quickly becoming today's central design challenge. Rbea uses four subjects from life context, engagement, experience and resolution. It is a cycle to link the four subjects. Rbea said that it is a concept tool for designers, design management and market research. The author has created a table of this model. (Figure: 2.4 & Table

2.3:)

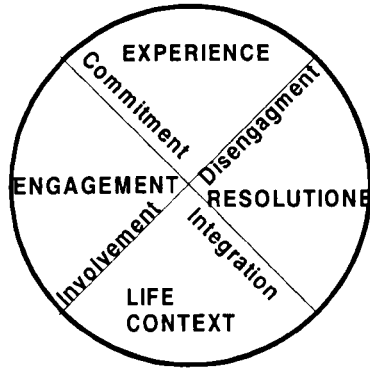


Figure 2.4: The Design Experience Model (Source: Rbea 1992, pp41)

Table 2.3: The Design Experience Model

	1	2	3	4
Subjects	Life context	Engagement	Experience	Resolution
Customer	<ul style="list-style-type: none"> <li>● Customer live -Think, Feel, Does</li> </ul>	<ul style="list-style-type: none"> <li>● Customer first interact with design</li> <li>● Design engage customer</li> </ul> <ol style="list-style-type: none"> <li>1. Prior product experience</li> <li>2. Advertising message</li> <li>3. Word of mouth recommendation</li> </ol>	<ul style="list-style-type: none"> <li>● Commitment</li> </ul>	<ul style="list-style-type: none"> <li>● Environment standards</li> </ul>
Designer	<ul style="list-style-type: none"> <li>● Identity life context – relevant to specific design, product or product category</li> <li>● Understanding customer’s needs, concerns, preference, and problems within those relevant areas.</li> </ul>	<ul style="list-style-type: none"> <li>● Cognitive presence</li> <li>● Attractive</li> <li>● Communication</li> </ul>	<ul style="list-style-type: none"> <li>● Create reliable, pleasing product meet customer’s expectations</li> <li>● Addresses concerns</li> <li>● Solves problems, and fits into customer’s lives.</li> </ul>	<ul style="list-style-type: none"> <li>● Customer’s experience of discarding the physical remnants of the product: is easy recycled, compacted, sorted and collected.</li> <li>● How customer resolve their entire experience</li> </ul>
Studies	<ul style="list-style-type: none"> <li>● Ethnographic studies</li> <li>● Expert interviews</li> <li>● Identity studies</li> <li>● Behavioral studies</li> <li>● Segmentation studies</li> <li>● Demographic studies</li> <li>● Human factors studies</li> </ul>	<ul style="list-style-type: none"> <li>● Physiological response studies</li> <li>● Visual mapping studies</li> <li>● Communication studies</li> </ul>	<ul style="list-style-type: none"> <li>● Attitudes and usage studies</li> <li>● Usability perception tests</li> <li>● In-use testing</li> </ul>	<ul style="list-style-type: none"> <li>● Customer satisfaction</li> <li>● Post-use studies</li> </ul>

This model offers clear understanding of the importance of customer experience at each stage, and how to pay attention to people’s lives and concerns are critical to success, and effective design. This model offers critical factors of the NPD process and helps the author review the design consultants work and how effective design is for satisfying clients.

## 2.6 Making Sense

Robinson 1994 presented a perception model, he argued that “perception is more like conversation than it is like vision” He mentioned the executives responsible for managing organization perception base this on individual, social and cultural frameworks. From his viewpoint, design sense is a similar case. The social and cultural element are represented by a person who every day is in contact with things. Design sense is also influenced by culture and social elements. (Figure2.5)

Object, messages and organization are interpreted not merely received. The personal framework through which this interpretation is done is built up of cultural, social, and individual frameworks. People, meanings, and contexts are all more interactive than in the earlier model.

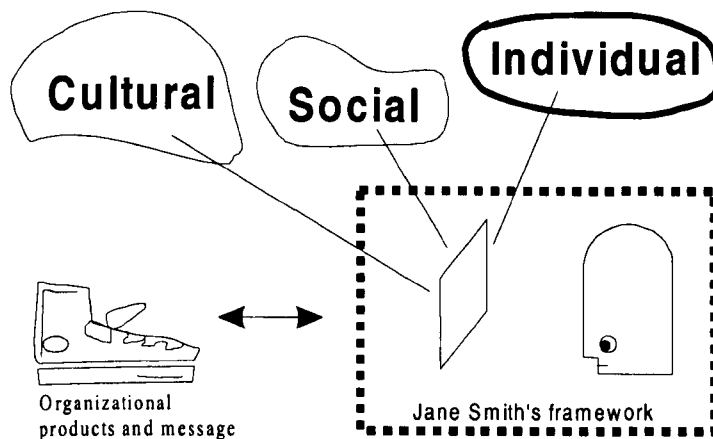


Figure 2.5: Organization Perception Model

(Source: Robinson 1994, pp.11)

### 2.6.1 Basic Design Sense

Dumas 1994 mentioned that “the sense of design is to put idea into action and could be

described as finding creative resolution of the joint demands of technology, price, function, social system.” Design sense involves the people’s habits and life style in different areas is of culture common to their social system.

### **2.6.2 Design Manager - Silent Sense**

Dumas 1994 argued that the design manager who is the business decision-maker is not equal to a designer, who weighs up the product style, material, suppliers, wastage rate cost, they play the “silent” sense not the “seen” sense of the design. From this viewpoint, the design manager needs to filter and choose the ideas, which are suitable for the business to consider. Therefore she also explains the most effective NPD is both “silent” sense and “seen” sense working together.

### **2.6.3 Design Sense**

Sense, according to Chamber’s dictionary, is an awareness or appreciation of or an ability to make judgements and wisdom. Davidson 1992 related design sense to the proposal of new concept for product design. In general, sense means touch, sound, taste, sight, and smell. Alroy 1985 noted that design sense is an ability to tell whether the user is experienced and to predict the design quality which will satisfy the user.

Cross et al. 1992 noted that the specific product included (1), Physical attribute (size, capability, power source, and ease of operation); (2), Style (shape, colour and fashion); (3), Quality (durability, operating costs, and life expectancy); (4), Brand (identity for similar groups of identical products), and (5), Package. Another researcher, Hancock 1992 argued that there are two subjects in design sensitivity, physically and culturally. However, most NPD projects involved restyling, and during the front-end Industrial Design process, style, marketability, and user culture are important aspects for evaluating a newly developed product.

#### **Style (shape, color, and fashion)**

Style in product design is to make a more attractive appearance than competitor products. Baxter 1995, Hancock 1992, and Vickers 1990 also noted that style (shape, colour and fashion) influence buyers to buy the product. Vickers 1990 also argued that “To the fashion-conscious consumer ‘style’ may be perceived mainly in products which

reflect the current trend.” He also mentioned that style can be changed by analyzing the preference, taste and cultural influence. In summary, shape and colour is the designers basic ability to create a new style and fashion, which is the current trend, and impacts upon the product taste and culture.

### **Design Trend**

Vickers 1990 argued that “As consumers, our visual expectations about design are conditioned by all sorts of things, such as fashion, television, newspaper, magazines, movies, computer, graphic, telecommunication, transport, architecture and advertising.” He also mentioned that “Many product designs are created in association, that duplicate someone else’s success by adapting the imagery” .In general, people usually sense that which is out of date by the time it appears on the market.

### **Culture**

Again Vickers 1990 noted that “All products bear the signs of their times.” Another market researcher argues that culture is a way of life that is accepted by a group of people and is learned by members of the society by the process of socialization and it defines the behaviours that are acceptable within society.” Rice 1994 He also suggested that the culture is cumulative in the sense that it is passed from generation to generation. Hancock 1992 argued for these two subjects in design sensitivity; and that the cultural one is respectful of international, national, and local circumstance. Design management researcher, Cooper & Press 1995 argued: “The social and cultural changes already evident in the 1990s will be reflected in new concerns and priorities on the part of the designer and those who employ them.” From perception viewpoint, Robinson 1994 suggests that managing organization perception includes individual, social and cultural. Heskett 1995 also considered that human factors, physical, cognitive, social and culture are the principal influences. He also noted that culture is the best route to the understanding of the life of social groups.

### **Marketability**

Managing design is one of the activities closely aligned to marketing. Marketing has key role to play throughout the of NPD process. Marketing often identifies a “trigger’ for design change (Bruce & Copper 1997, Bruce & Morris 1995, Cooper & Press 1995). In addition, one of the success factors is market orientation in the NPD process, Baxter

1995. Lydiate 1992 mentioned that marketing is part of the responsibility of design work for a design consultant and all must understand marketing principles in relation to design and the company's marketing strategy. In addition, Reba 1992 argued that a customer experience model is needed to remind the designer of the need to focus on customer experience, thus providing key marketing information. Cooper & Press 1995 also noted that understanding the consumer is important for the designer. Cross et al. 1992 mentioned that the successful companies design for the market.

## **2.7 Product Design and Development**

### **2.7.1 Defined Product Design**

Products are artifacts that are created by people. People need products for satisfying their life. Design is a development process for produced products. There is a lot of research giving the definition of the product design. Cooper & Press 1995 pointed out that " Design brings together the needs of consumers and the objectives of the firm in creating products and services which perform a proprietary, express a commitment to quality, have positive aesthetic qualities and can be produced efficiently". Roozenburg 1995 argued that " Products are artifacts conceived, produced, transacted and used by people because of their properties and the function they may perform. Product design is needed for the manufacturing of a product. The British Standard, BS7000, defining the design is " (verb) to generate information from which a required product can become a reality. (Noun) The set of instructions (e.g. specifications, drawing and schedule) necessary to construct a product." The products must be need by people and produced by a firm or manufactured. This means, the products could be made by means of a quantified production. However, design is a must for people.

### **2.7.2 Product Development**

Ulrich 1995 pointed out "product development is the set of activities beginning with the perception of a market opportunity and ending in the production, sale, and delivery of a product." Roozenburg & Eokels 1995 argued that " Product development is the development of a new business activity around product. Product development is part of the industrial innovation process. Industrial innovation encompasses all activities that

precede the adoption of a new product in a market, such as basic and applied research, design and development, market research, marketing planning." Baxter 1996 mentioned that the product development is how to design and create the product for meeting the consumers wants. Constable 1996 argued that development is the continuing improvement of a product over a period of years.

### **2.7.3 Commercial Environment**

A product is concerned with production into a market from expected sales, nature of product, the price and sales costs are called the 4Ps. This means, product as a basic marketing tool. A successful product needs to be concerned with the commercial environment, from taking the first product idea as a basis for marketing planning to expect commercial results. This predicate future technical product is based on experience, scientific theories, the behaviour of markets and consumers, and the tests from market or consumer (Roozenburg & Eokels 1995). A commercial environment for satisfying customer needs is marketing. The core marketing concepts include human needs, wants, and demands on the product market (Kotler & Armstrong 1996).

### 2.7.4 Product Development Process

When customer needs and technology change, the company ought to design new products and apply new technology to keep abreast of such changes in the marketplace. Kotler & Armstrong 1996 pointed out the new product development process in nine main steps. (Figure 2.6)

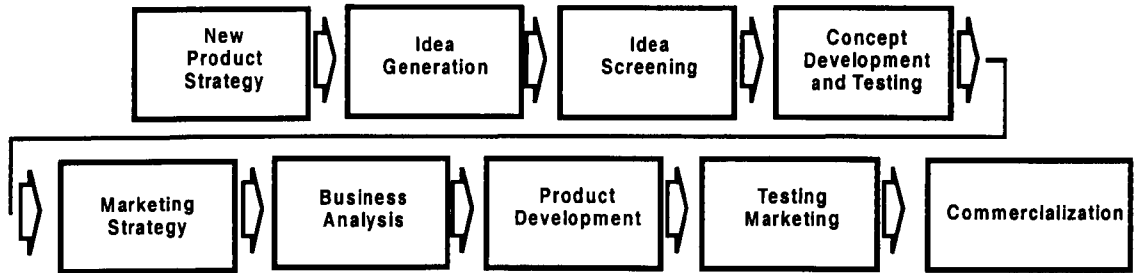


Figure 2.6: Steps in New Product Development

(Source: Kotler & Armstrong 1996, pp.315)

Ulrich & Eppinger 1995 mentioned that the concept development also means the front-end process. It is concerned from the designer's viewpoint. (Figure 2.7)

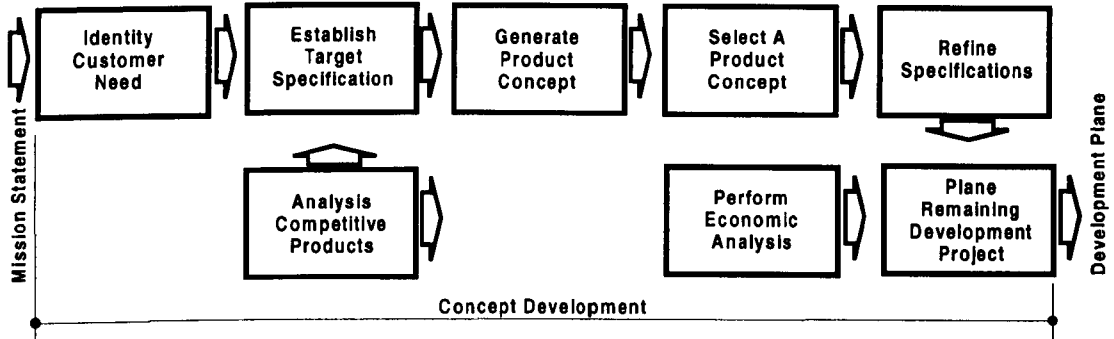


Figure 2.7: Concept Development/ the Front-end Actives

(Source: Ulrich & Eppinger 1995, pp.18)

Baxter 1995 argued the product development process shown in Figure 2.8. This process is based on the market and design viewpoint.

The product development process involves so many departments, such as marketing, design, production and sale department. During product development, each department



co-operates together to become a team. Baxter 1995 mentioned about all the stages in new product development, the most important are the initial stages. During the design concept stage, the investment return ratio is five times that spent on the design.



Figure 2.8: Design Actives at Different Stages of Product Development.

(Source: Baxter 1995, pp19)

### 2.7.5 Success and Failure in New Products Design

Gardiner 1996 mentioned that a success or failure of new products design is multi-factored. From the product system integration to 3 software/1 hardware. Baxter 1995 argued that the most important difference of three factors between the success and failure as follows.

The successful product design must learn to live in the mind of the customer. The decision of new direction needs to consider the customer dreams, needs, and wishes. Based on market orientation, products are five times as successful as poor market orientation products.

Products which underwent a thorough and astringent assessment prior to development were 2.4 times as likely to be successful as those that had not. Products which are sharply and well defined in a design specification prior to development were 3.3 times as likely to be successful as those that were not. This means, when designing a new product more effort should be put into getting right it at the start.

Where the company's technical skills were well matched to the activities needed to develop the new product; the chances of success were 2.8 times greater. Where the company's sales and marketing skill were well matched to the new product the chances of success were 2.3 times greater.

Constable 1996 mentioned that the average product that has been in production for two years, could be designed to improve market demand by 28% and to reduce production cost by 24%. This means that 52% of products from initial process have a mistake. The quality of the new product development come from the design brief taking care that every process is the best situation.

### 2.7.6 Invention, Innovation and Re-innovation

Rothwell 1983 mention " Design and innovation are two of the central elements necessary for the long-term success of firms and organizations in the manufacturing sector." He also pointed out that in the 1980's, most firms needed increasingly design and innovation as central issues. Design and innovation were not just for success but survival.

The invention is practical and material embodiment of the basic idea or concept. The innovation is commercial exploitation of the basic idea or concept and specific product characteristics at a particular price. The re-innovation is altered product and process specifications to improved performance at lower cost. (Rothwell 1985) The Figure 2.9 lists the relationship between the invention, innovation and re-innovation.

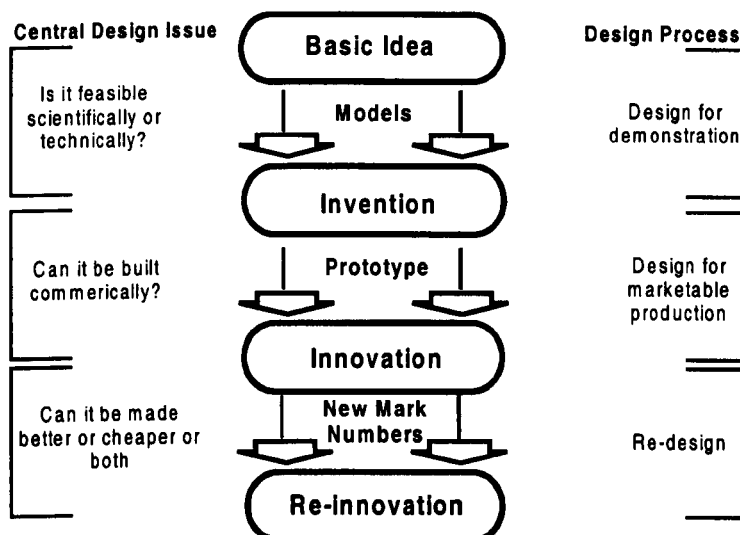


Figure 2.9: Stages of Technical Change. (Source: Rothwell 1983)

During the industrial design process, the re-innovation is most concerned with the product development. During 1980-1990, products used 20-40% software and 60% mechanics, but during 1990-2000, the product has become automated. The product has 30-50% software 20% mechanics and 30% electronics. (Gardiner 1996) This means that the major parts of the industrial design works are concerned with innovation and re-innovation.

## **2.8 The Role of Industrial Design**

So far, the industrial designer from consumer products to aeroplane projects plays a very important role. They influence the customer by product trend, universal appeal, and user new interface. The industrial designer is becoming a pioneer in the product development team.

### **2.8.1 Definition of Industrial Design**

Industrial design was defined by the Industrial Designers Society of America (IDSA): "Professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer". Dreyfuss 1967 suggested five important elements that industrial design could provide when developing new products:

1. **Utility:** the product's human interfaces should be safe, easy to use, and intuitive. Each feature should be shaped so that it communicates its function to the user.
2. **Appearance:** Form, line, proportion, and color are used to integrate the product into a pleasing whole.
3. **Ease of maintenance:** products must also be designed to communicate how they are to be maintained and repaired.
4. **Low costs:** Form and features have a large impact on tooling and production costs, so these must be considered jointly by the team.
5. **Communication:** Product designs should communicate the corporate design philosophy and mission through the visual qualities of the products.

## **2.8.2 The Industrial Design Process**

Concept development is called a front-end process. The Industrial Design process is: (1), investigation of customer needs; (2), conceptualization; (3), preliminary refinement; (4), further refinement; (5), control drawings, and (6), coordination with engineering, manufacturing and vendors. (Ulrich & Eppinger 1995) The industrial design leader's mission is to understand the language for the marketing and manufacturing people or a client and therefore be able to transmit the data to the industrial design team. The designers need to listen carefully to the project leader, as they have no contact with the clients. In this stage, the leader needs to decode data which includes company culture to policy, product planning, product strategy, The chief designer needs to translate the client wants and needs into a design language that is a word or a drawing. Therefore, the chief designer needs to be very close and give clear communication between both the client and the designer working for him.

During the conceptualization the industrial design drawing is idea sketches, and rough sketches. These sketches are a fast and inexpensive medium for expressing ideas and evaluating possibilities. In the preliminary refinement phase a soft model is used for industrial designers, engineers, marketing people and focus group for feeling and holding. Therefore, in the further refinement and final selection phase, 2D or 3D rendering shows the detail of the further product. At the same time, the soft model is modified to a wood or plastic or dense foam for final selection. The next phase is a general arrangement drawing for the final concept, therefore the control drawing can be handed out for coordination with engineering, manufacturing and external designer.

## **2.8.3 Effort of Industrial Design**

From the industrial design view, the product is durable, easy to manufacture, and has strong customer appeal. Those features are very important to the customer. Ulrich 1995 mentioned five points in assessing the quality of industrial design.

1. Define the user interface: The product design is applied to the user center method to find out how easy the product is to use. Interface quality is related to the product's appearance, feel, and modes of interaction.

2. Emotional appeal: So many existing consumer products have functions, price, and color, which are similar. So, how the consumers are attracted to purchase the product is important. Appeal is achieved in part through appearance, feel, sound, and smell.
3. Easy to maintain and repair the product: So many optional components, rechargeable batteries and fuses all need to be repaired by the consumer themselves, and in case products are out of order, it also needs to be easy to take off the cover for checking out the problem and maintenance.
4. Appropriate use of resource: How the functions are suitable or the material selection appropriate for the customer. The design also needs to consider the environmental factors.
5. Product Differentiation: Products are part of company corporate identity. Industrial design plays a critical role in communication between customer and company.

## **2.9 Product Planning**

Baxter 1995 pointed out "Product planning is one of the most difficult activities in the development of the new product." He also mentions about product planning that there is no single correct way. Product planning is through a systematic and realistic approach and is conducive to sound decision-making in the end. Roozenburg 1995 argues that product planning is the first part of the innovation process. There is widespread agreement in the literature on following key components of product planning. (E.g. Wheelwright 1992, Beckman 1993, Ulrich & Eppinger 1995, Roozenburg & Eokels 1995, Baxter 1995, Ireland & Johnson 1995).

### **2.9.1 The Product Planning Process**

Baxter 1995 argued that the four stages of the product planning, from company's product development strategy and ends with design specification for a new product. Figure 2.10 displays the product planning process. Beckman 1993 pointed out a process to help with designing high-tech products: (1), Customer and user need assessment; (2), competitive analysis; (3), Analysis of regulatory; (4), Technology assessment; (5), Use of a priority - criteria precision list; (6), Risk management; (7), Leadership and guidance from management; (8), Project resources, and (9), System integration.

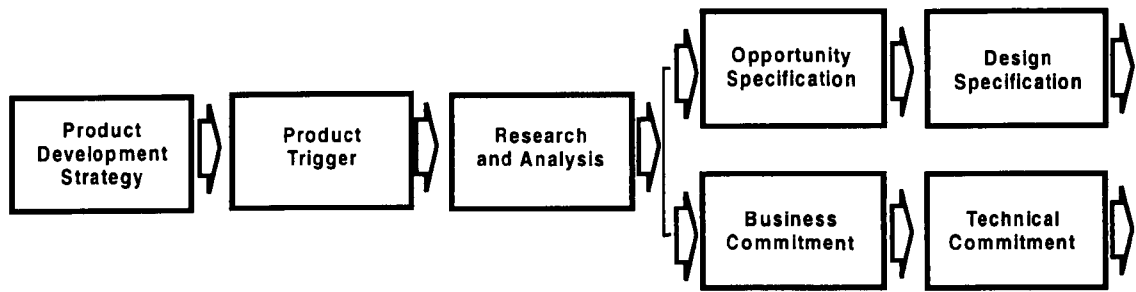


Figure 2.10: Stages of Product Planning (Source: Baxter 1995, pp.145)

## 2.9.2 Opportunity Specification

Baxter 1995 stated that the opportunity specification was a "core benefit proposition", thus opportunity specification might be:

1. To ensure commitment to development of the product, it must fulfill two functions: it must describe the opportunity and justify it in business.
2. To be seen as satisfactory, a business opportunity must present good prospects of profit for the company.
3. To be profitable, a product must sell in enough numbers to exceed its development cost.
4. To sell, a product must offer customers a clear benefit over existing products.
5. To offer such a benefit, there must be significant product differentiation between the new product and its competitors.

The opportunity justification is concerned with financial matters, such as, the variable and fixed cost for the product. What is the target price for the product and hence what is its margin over cost. What is the projected life cycle of product sales? The non-financial aspect concerning the company's ability to manufacture, distribute, market and sell the new product.

An important business opportunity exists in identifiable difference between (1), The demands and wishes of customers, and (2), Products offered by competitors. (Roozenburg & Eokels 1995) He also argued that an important new product idea comes from a technical possibility and a market need. Baxter 1995 mentioned the same that an

idea is called market pull and technology push. Market pull refers to the demand by the market for a product or product feature not currently offered by a company. Technology push refers to the availability of a new technology creating an opportunity for product innovation.

### **2.9.3 Competing Product Analysis**

The competition can provide the subsequent market needs research with a much clearer focus and allow more structure and meaningful questions to be asked to potential customers. There are three aims of competition product analysis: (1), To find out the number of ways existing products will compete with the proposed new product; (2), To identify or evaluate opportunities for innovation, and (3), To set targets which the new product must meet in order to compete effectively. Baxter 1995 noted that this means that products, on this basis of competition market analysis could find opportunities.

### **2.9.4 Market Research**

Ireland 1995 mentioned that the "Traditional approaches to consumer research, which emphasize asking consumers what they want or think, often fail in today's turbulent market." This means that asking customers direct in a market survey is unbelievable. He also mentions about research break down when customers are unable to predict their preference under changing conditions, and when their current purchasing habits do not forecast future buying behaviors. Ireland & Johnson also mentions the process of applied exploration in Figure 2.11. There are three stages to explore the market needs and wants. 1). Understanding the context that people, places, things and processes are from to understand the detail of their life style. 2). Synthesis: In an applied exploration, the patterns found typically take three forms, that is, analogies, core meanings and conceptual models and this information is put together. 3). Communication findings include a profile of market direction, design principle and user need.

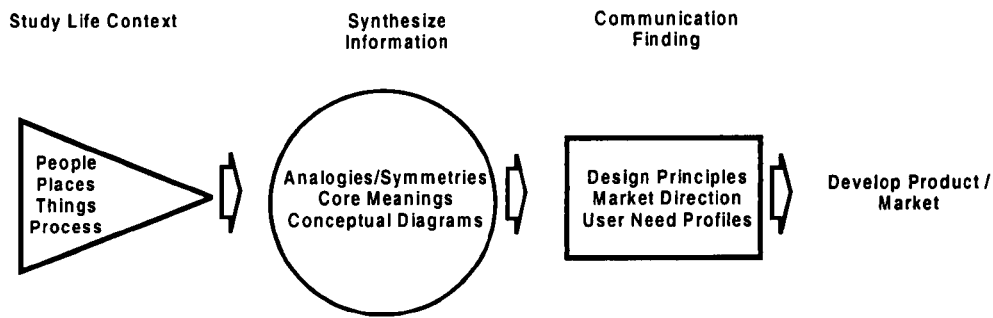


Figure 2.11: The Process of Applied Exploration (Source: Ireland & Johnson 1995, pp.59)

## 2.9.5 Product Policy

Roozenburg & Eokels 1995 pointed out that policy is including the goals and strategies. He also argued “ policy gives direction and continuity to the behavior of an organization, and a strategy is the way plans realize one or more goals. The product policy directs the idea finding process and provides normative information for making choices in process.”

## 2.10 New Product

With New Product Development (NPD) process, many kinds of the new products were being designed and are promoted to the world market. Those products can be sorted out and become many types of the new product development strategy. Marketing Researchers points out “the new products are mean original products, product improvements, product modifications, and new brands that the firm develops through its own research and development.” Many market researchers argue the new product types are as following:

1. New-to-the-word; products that are really innovative; original product
2. New product line: addition to existing product line: replacement for existing products that are significantly different from the existing goods, new brand.
3. Improvements in or revision of existing products or Imitative products, one new to a particular company but not new to the market. Improvement that includes reposition and cost reduction.

(Kotler & Armstrong 1991,1995,1996, Crawford, 1994, Cooper, 1993, Stanton, & Futrell 1991, Austed, et al. 1989, Schewe, 1987, Mason, et al. 1974)



Cooper 1993 argued that “the three classes of new product in terms of innovation were:

1. Highly Innovative products, namely new-to-the-world products and innovative new product line to the company.
2. Moderately Innovative products, consisting of new lines to the firm, with products that are not as innovative; and new items in existing product lines for the firm.
3. Low innovative products, consisting of all others: modifications to existing products redesigned products to achieve cost reduction, and reposition.

What is a “new“ product, Austed et al. 1989 argued that from innovation level there are three categories:

1. Continuous innovation: involves alteration of existing product. Such as toothpaste.
2. Dynamically continuous innovation: involves creation of new product or alteration of existing one. Such as electronic toothbrush.
3. Discontinuous innovation: Creation of previously unknown products. Such as microwave.

Cooper 1993 mentioned that the new product such as “Discontinuous Innovation ” which is a new-to-world product is used by only 10%. The other 90%, is new product line 20%, additions to existing products line 26%, improvements in or revision of exiting products 28%, repositions 7% and cost reduction 11%. Most new products of a company are utilizing the innovation method or market method.

### **2.10.1 Me-too Product**

A lot of market researchers mention the “me-too” product, that is, a product new to a company but not to the market. (Kotler & Armstrong 1991,1995,1996, Crawford 1994, Stanton, & Futrell 1991, Austed et al. 1989, Mason et al. 1974) Due to marketing having so many factors, which cause the products to fail, thus Kotler 1991 argued how to reduce the risk and budget from NPD: (1), To buy a brand new company; (2), to develop a me-too product, and (3), to improve an old product. Kotler 1996 mentioned that about 30% of new product ideas come from analyzing competitor’s products.

Many medium and small sized firms utilize the “me-too” method to avoid the high risk NPD process, because the market leader pioneers have spent most of the NPD cost for the technology development. Me-too products also are less costly and risky to introduce than a new product into the market, due to the market leaders already having developed this market.

Many small and medium business companies, especially in the Taiwan environment, which lacks materials and carries quite a high cost of labor, have no relative superiority. However, most companies utilize the “me-too“ method to produce a lot of the best products in the international market. Acer, a famous Taiwanese computer company, used this method to build a huge territory. The president, Mr. Stan Shih, explains the “me-too” method in the computer industry: The latest products are released from many companies in each year, but not every product can survive in the market. Whatever the changeable environment, Taiwanese industry still can play its global part in global logistics. When leading technology is becoming mainstream, the Taiwanese industry must catch up this mainstream to develop products to provide for its clients. Mr. Shih also mentions about: Contribution in the Taiwanese computer industry is not to develop the invention of the product or use high edge technology to produce a new commercial product, but sort out some technology to produce a low cost and popular product, which is useful and of benefit to others. 95% of people have not yet used this computer product. (Yeh 1996)

To utilize the “me-too” in the Taiwanese computer industry is useful, but other industries show, from a Government publication, that the R&D research budget is lower than Korea. Many researches have been done by semi-government institutes. However, many companies concentrate on how to produce cheaper and high quality products in a high competition market and are quite important. During the wave of transplanting industry to Mainland China or Southeast Asia, the “me-too“ could be an advantage in competition, specially, in the Taiwanese ODM environment.

Kotler 1996 mentioned that the new product includes original product, improved

product, refined product and new brand. The “ me-too” product could be included in all kinds of NPD products that copy the feature of a successful competitor product.

### **2.10.2 Product and Marketing Strategy**

“Effective product strategy requires the integration of new products with existing products and marketing and manufacture capabilities of the firm. The product decisions are usually particularly important in corporate strategy.” (Kelley 1966). Another marketing researcher, Day et al. 1990 argued that product strategy for NPD and technology bear an integral relationship to a company’s strategy by helping to define the range of that company’s choices. The company goal in the new product strategy, was argued by Stanton & Futrell 1987 that: (1), To defend a market share position - Introduce an addition to an existing product line or revise an existing product, and (2), To further the company’s position as an innovator - introduce a really new product not just an extension of an existing one.

There are three methods to improve marketing strategy, specially in mature products, that is alter the product quality and modify the product and model of the new product. (Pride & Perrell 1989) To improve product quality in Taiwan industries both redesign and re-styling are very common in Taiwan commercial industry. He also mentions the “product mix” that includes promotion, distribution, and price. Why is there a need to manage the “product mix“. Because of customer’s product presence, and attitudes change or the desire for a product may dwindle. The modification of existing products to catch up the consumer is the best way, in which the style modification is popular in the world market. Others such as function and quality modification.

Handsombe 1989 argued that the product/market matrix (See Figure 2.12):

- **Box A** current position: the product has been based on previously proven product design and manufacturing technology. The current market dimension will be defined by current territories where the product is sold.
- **Box B** Improved product: (1) B1 is utilizing existing technology; (2) B2 is introduction of new technology or a reformulation.
- **Box C** new product: it could be added profitably to the product range as in-fill

products, extension to the range, choose options or replacement products, or entirely complementary to new product to enhance the product package.

- Box D extended market base: (1), D1 is exploitation of similar product applications in new industries for product or service, and (2), D2 is exploitation of new product applications within current or new territories or industries.
- Box E expansion of customer base: new market, new applications for the product.
- Box F improved products and extended customer base
- Box G improved products attractive to entirely new customer base
- Box H new products and extend customer base
- Box I diversification: new technology and new territories.

Both product strategy and marketing strategy are opening up new markets and new business opportunities. That utilizes the marketing tools and NPD process to innovate or re-innovate products. Industrial Design can contribute by changing style and function to satisfy clients or customers.

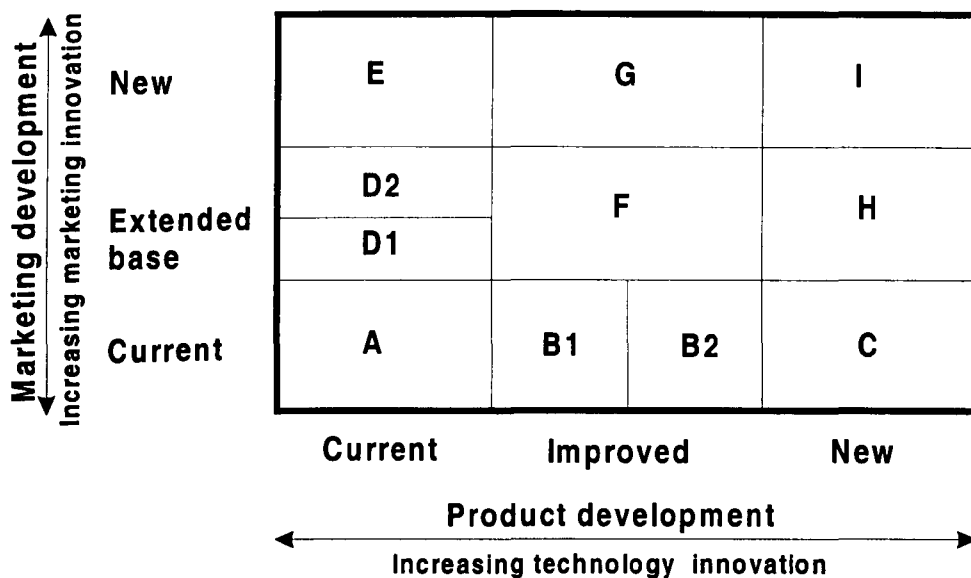


Figure 2.12: The Product / Marketing Matrix (Source: Handscombe 1989, pp.32)

## 2.11 Design Brief

As mentioned above, the design brief is very important, especially in the early phase of a new product development project. Many researchers have emphasized this point of view. Mitchell 1996 explained that the design brief for a product development can proceed in the way where a client answers some simple questions and describes the purpose and requirements of a design product. Booz 1982, moreover, stated that a designer should try to get the initial design concept right by a design brief. He emphasized that during the 10% early stage of a product development process, 90% of decisions will be made. Besides, Constable 1996 mentioned that, according to design research, the task in the early design process is to keep an eye on the frame work of the product, but not on the design details. As we know, the design brief is part of the design management tools, by which the designer can be put in control under the company's strategy. According to Law 1996, a design brief can be generated by three ways: briefs issued by the client verbally or in a written format, or proposals by the designer through the interpretation of the design problem. Generally speaking, any kind of design brief can be obtained from the result of the first meeting, and may be modified and verified by both the client and designers in the later stage of product development process.

Constable 1996 pointed out that a vital aspect of planning is the design brief. Furthermore, he mentions that only 19.9% of designers in the UK do the design brief properly, which means that, even in the developed country, many designers do not fully understand the context of their design problems. In many cases, it is true that most designers are not able to take advantage of the good opportunity of communicating with each other or with the client through an appropriate design brief.

A design brief consists of performance, cost, and time tables. Though a design brief is typically proposed by a design upon the basis of the client's needs, the contents of these elements should be verified by the client. In a nutshell, the design brief is one of the design management strategies to assist designers during the design process.

### 2.11.1 The Detail of a Design Brief

Both Constable 1996 and Law 1996 argue that it is essential that the design brief should inform the designer of the constraints within which he or she has to work. The design brief is usually tied to four departments: the design, marketing, finance, and production departments. According to the framework of the above-mentioned researchers, the design brief structure should be constructed in the way that will be discussed in the later parts.

According to Constable 1996 and Law 1996, a design brief should cover the following properties as can be seen in Table 2.4. The clear picture that some of the constraints may be simple and obvious, such as size, weight. For example, the item "safety" is an aspect of performance, and it is essential to specify in the design brief all standards and regulations. The final aspect of performance is that the brief should specify any general marketing factors that are appropriate.

Table 2.4: The Context of A Design Brief

	Marketing	Design	Manufacturing
User/buyer (Customer)	User age, sex, country	Product appearance, texture, color	
Product	Competition Product feature Price Styling	Static require-size, mass Dynamic require-input/output Environment condition - (humidity, shock)	
Quality		Reliability Maintainability	Reliability
Standard/legislation	Socio economic group	Safety Disposability	
Cost	Retail price Warranty cost Maintenance cost Other product support cost	Design cost	Tooling cost Manufacturing cost
Time scale	Product launch date Product life Sale life	Design schedule Design presentation Date of exhibition/photo	Tooling time scale

### 2.11.2 The Type of Failures in a Design Brief

In most cases, the design brief is often very short and it is hard to explicitly express the

concept of a product design at the early stage of design process. And that is part of the reasons that there are so many design projects going astray after the project leader has the first meeting with the client. Constable 1996 explained that the phenomenon is due to three possible reasons. First of all, the designer may misunderstand the requirement from the design brief. Secondly, the leader, due to some certain reason, may give a wrong instruction. Finally, it may be owing to the fact that the design solution fails to meet what the client or the design leader has within his or her own mind.

## 2.12 Style Planning

During the product planning phase, one of the critical stages is the style planning. An important part of Industrial Design is how to create an appealing style for target marketing. Gross & Peterson 1987 stated that one of the specific factors of a product is its style, which may include shape, color and fashion. Another researcher Baxter 1995 commented that although the styling is the artistic part of a design, it does not mean the style is free to follow any direction. The newly styled product must appeal to the target market. There is a need to find the common factors in the existing competitors products, especially, in Taiwan, where many organizations use the "me too" strategy for product development. The only difference is styling. Therefore appearance becomes a critical aspect more than others. These kind of products always need careful styling, so that, when the product is launched the success rate may be higher than on a product which has not had good style planning.

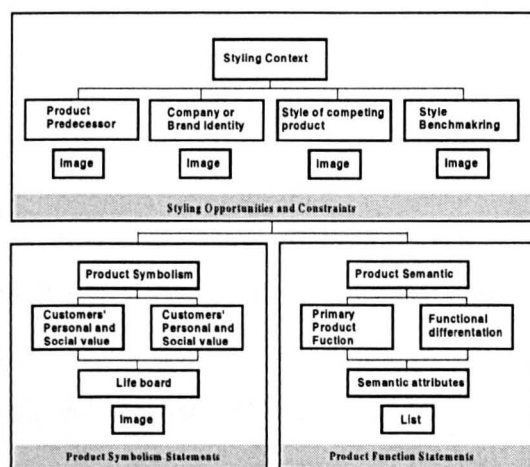


Figure 2.13 : Styling Planning

(Source: Baxter 1995, pp.178)

The style planning can help the designer to sort out the styling strategy; this helps the assistant and the junior designer to quickly approach the client's need and requirements. However unfortunately, most clients and employers do not know what type of appearance can fit future marketing. So the question is how the styling opportunities can be defined and approved by the client.

Baxter 1995 also noted, that the client companies product identity and competing market products were two major subjects which impact the front end Industrial Design process. He argues: there are four main categories of contextual styling factors:

1. Company product identity
  - Product predecessors.
  - Company or brand identities.
2. Competing market product
  - Style of competing product.
  - Styling benchmarking. (Figure2.13)

### **2.12.1 Product Predecessors**

Stanton & Futrell 1987 discuss manufacturing criteria for new products: they stated that products should be in keeping with the company's image and objectives. This image represents both the intangible and tangible aspects of an object. For example, all Sony products represent reliable, compact, sophisticate, and high quality. Philip products tend to show European high tech, precision, international corporation and advantage images. Different successful companies tend to keep all the company's products family-like. Baxter 1995 said: "If the proposed new product is an update of an existing product currently sold by the company then it is important to preserve the visual identity of the product. This will ensure that existing customers continue to recognize the product and purchase it again." This image or visual identity is not like a united form, but it represents the management effort, that could be from the NPD committee from top level managers down to an assembly person, every person at all levels, throughout the company contributes at a level of their own ability.

The Product Identity (PI) within a brand or family of product is of value. However



unfortunately, most companies in Taiwan are not large firms and do not have a famous brand or company name, thus product predecessors tend to be useful for big companies only. Product predecessors for medium and small size companies are represented by the product design quality and make sure the ODM client can purchase them again.

### **2.12.2 Company or Brand Identities**

Baxter 1995 said: "brand identities can give a similar degree of purchasing confidence to customers. Establishing what determines a company or brand identity is, therefore an important part of product planning." Gross 1987 also mentioned "that one specific product brand is an identity for a similar group of identical products. "The Brand" represents a quality that comes from a company. It should be a guarantee that when you buy the product you will have the same as previously experienced. Austed 1989 has also argued that one product concept is "The Brand" A product satisfies customer needs, thus a product is more than a physical thing. "The Brand" is not a physical quality but many only are buying a certain product because it is a reliable brand. Oline 1989 argued: "In small companies and young companies the management of identity is intuitive. It is a direct reflection of the founder's obsessions and interests." He also mentioned that to utilize this identity is one of commercial tools, commonly call the "adding value". Balmer 1995 argued that corporate identity is one of the most powerful tools that results in consistency in consumer demand and it gives added value to products and services.

### **2.12.3 The Style of Competing Products**

Baxter 1995 commented that collecting together images of competing products will focus attention on their styling and will help designers decide which features enhance their attractiveness and which detract from it. Muller 1996 an Industrial Design lecturer, argues for the use of typology to sort information and assist in the generation of ideas.

### **2.12.4 Style Benchmarking**

Kotler 1996 noted that: "benchmarking is a process of comparing the company's products and process to those of competitors or leading firms in other industries to find ways to improve quality and performance." Magrab 1997 noted that benchmarking is the search for best practices that will lead to superior performance. Oliver et al. 1997 also

mentioned that benchmarking the design and development process, such as done by Japanese producers proved to be a trigger for programs of reform in many Western companies. (Shida 1994, Finiw 1992 also has noted the same) Baxter 1995 mentioned that: Studying products from different markets can help you to establish a style benchmark that you wish to aspire to match with the style of the company's new product. Images of ideal or benchmark products from a wide range of markets provide styling objectives for the design of the new product.

Intrinsic styling factors has the two main parts of factors.

1. Symbolic value
2. Product semantic.

There are two types of symbolic value. Firstly, a product can symbolize things about itself. Secondly, a product can symbolize things about the person who owns it. Designers use product symbolism to describe the human value aspect of the product.

Kippendorff & Butter 1984 argued that “product semantic is the study of the symbolic quality of man- made forms in the context of their use and application of this knowledge to industrial design.” Product semantics should also make the product look like it works better than any other product.

## **2.13 Visual Tool for Management**

Visual maps can play a role in illustrating and sharing product images amongst a design group. Visual maps are also a visual tool for management, who can benefit from both greater product and strategy information during the new product development. Many researchers have noted different types of visual maps. Some are described in the following section:

### **2.13.1 The Typology**

Existing and previous products are an important source of knowledge in the design process, especially, some products that were developed long time ago. Many product lines will have been created by user need and desires and also many types of styles will

be generated from different user preference. However, the designer can utilize the different data collecting approaches. In addition, the design leader can use the data to control future product images. This section presents and discusses the typology method and the part it can play in the design process.

Muller 1996 high-lighted the following: "the topological model is useful for the description and decomposition of the design knowledge that can be extracted from existing form concepts." In this model, the industrial designer can acquire and apply design knowledge in the generation and development of new forms and concepts. The topological model has three levels.

1. A product represents typical features in view of its function as a prototype, which includes function category, product class, and product sample.
2. Products use, as a behavioral-type includes sociocultural style, historical style and style articulation.
3. Products which form a solution-type include spatial type, form type, material category, and morphological. This is an image information database. By selecting those keywords which refer to the typifications in which the designer is interested, fields of product images will be selected for the database and display.



Figure 2 Multi-imagined collection of the product class 'chair' representing shared behavioural typical features

Figure 2.14: Typology (Source: Mull 1996, pp.122)

The topological model can also assist in long term product development. In the model The Industrial Designer can easily understand from the product evolution process how products became a product line or new concept product. This information can influence

the design concept during the idea generation phase. But, many kinds of product could be new generation products or not family types of product, thus some times the large data bank system may be of little use. The Figure 2.14 shows the software of typology.

### 2.13.2 Market Maps

The Market Maps illustrate information in the marketing field, such as product positions and market segmentation. From market positioning comes the actual designing of the companies image and thus an understanding the of target customers and competitors. Maps of marketing data are useful for both developing a market strategy and design strategy. The design manager will need to monitor this information. Hooley 1993 argued that the market positioning is an activity carried out to determine the best location for a product within a product's field. The market researcher, Kotler 1996 noted "A product's position is the way the product is defined by consumers on important attributes." Croft 1994 argued that "the process market segmentation thus brings a much increased understanding of user's needs, their decision criteria and approach, and therefore gives a much clearer direction to the management of current products." From the mapping, a designer will understand the product attributes, competitors and product class. (Figure 2.15)

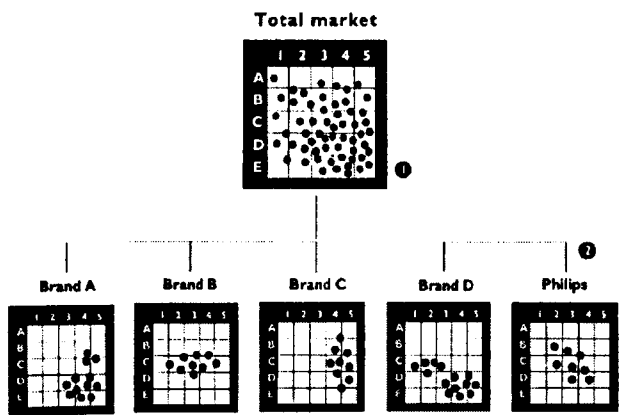


Figure 2.15: Market Position (Source: Robertus 1994, pp.7)

### 2.13.3 Image Board

Baxter 1996 describes three types of image boards. These are: (1), Life style; (2), Mood, and (3), Theme board (Figure 4). Firstly, Life style boards, according to Baxter 1996 provide predevelopment information to the manager level, what are typical need tangible needs and manufacturable forms. The designer can suggest from the images on the life style board, the type of target customers. They will show likely customers, jobs, houses, tests, and some reference products. Secondly, the Mood board is derived from the life style board, it tries to identify a single expression of values for the product. Hancock 1992 also mentions the mood boards are variously used by designers to plot trends in color, shape and texture, and to deduce possible stylistic directions for the design project.

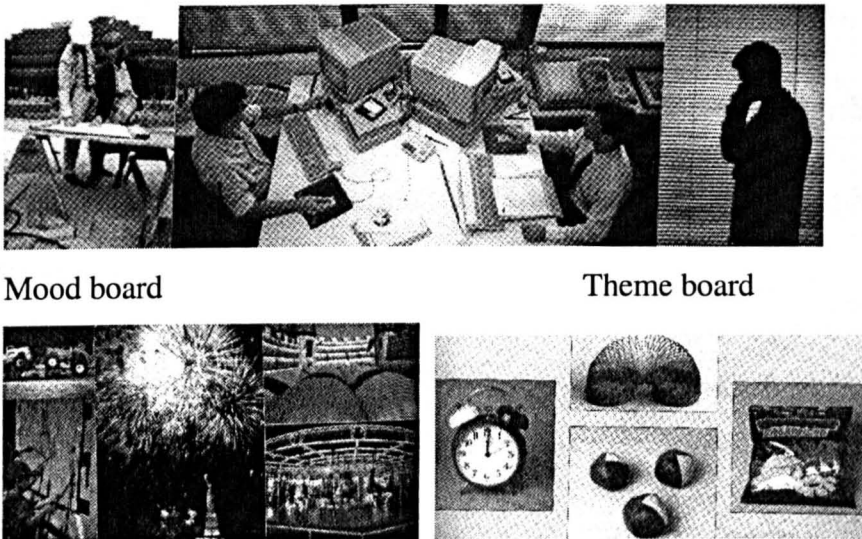


Figure 2.16: Life Board (Source: Baxter 1996, pp224, and 227)

All images on the board will be developed by designers, and assist in communication amongst all the design team members. Finally, Theme boards derived from the mood board allow the physical feeling of the images of products which manage to convey the target mood. Examples of design companies using image boards are given below.

GK- Japanese design consultant shows the life style design method (Figure 2.17). Firstly,

trying to describe characteristics of life style by contrasting key words, secondly, collecting press cuttings illustrating life situations which are then arranged according to key words. The designers can lead to product ideas by those maps. (Cross et al. 1992)

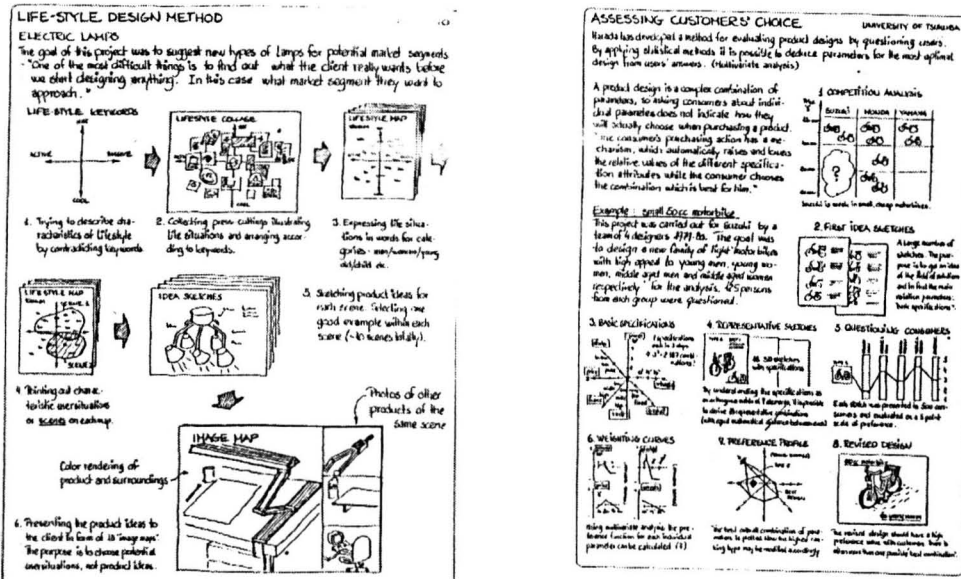


Figure 2.17: GK- Japanese Design Consultant Shows the Life Style Design Method.

(Source: Cross et al. 1992, pp81)

Another international company Philips utilizes visual mapping when discussing the characteristics of Philips products to designers. It is an essential part of the high design

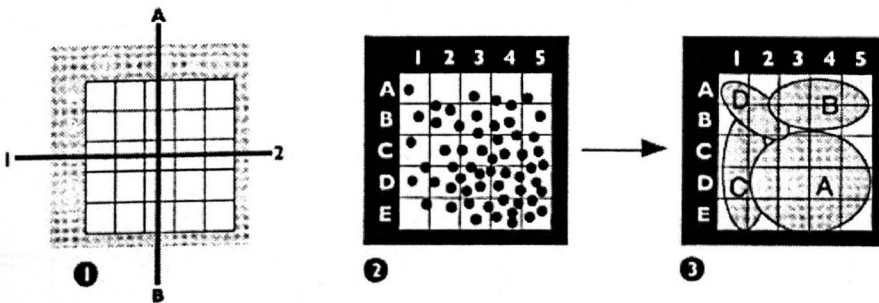


Figure 2.18: Visual Map of the Total Market, Individual Competitors and Footprints.

(Source: Robertus 1994, pp.6)

Process. Within this process; the design manager, designer, competence manager, visual trend analyst, and product strategy people form the workshop. The workshop result is in

the format of a design indicator such as, a visual map of the total market, individual competitors and footprints and directions (Figure 2.18). Those maps include the competitor product position analysis and the design direction of competitors future products. The final data is a life style board for the designer's reference (Robertus 1994). The famous USA design consultant, ZIBA Design, uses the simple map of baby care product lines, showing the baby from reclining, sitting, crawling to walking. ZIBA wish to design not only to make products better looking but also to lead the way in the market-marking solution. ZIBA also utilize the product position to classify the benchmarking of the opportunity zone (Mecallion 1995). See as follows Figure 2.19.

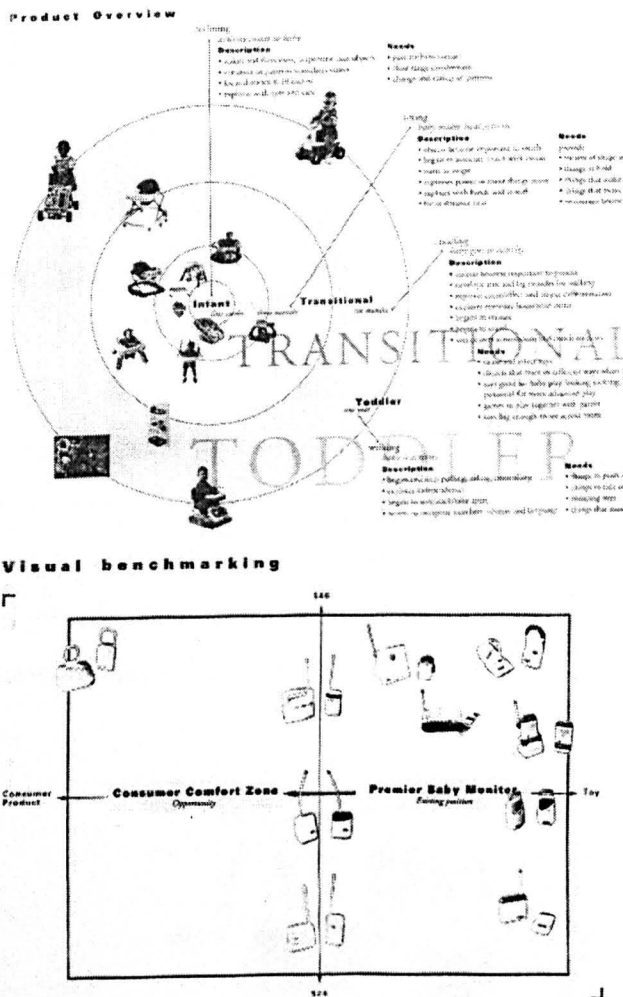


Figure 2.19: ZIBA Utilize the Product Position to Classify the Benchmarking of Opportunity Zone. (Source: Mecallion 1995, pp.113)

Fuji Xerox laser printer design strategy shows such mapping; firstly, computer and fax production position: secondly, existing laser printers position; thirdly, product images, finally, new product position - design strategy (Sanaka 1995). (See Figure 2.20)

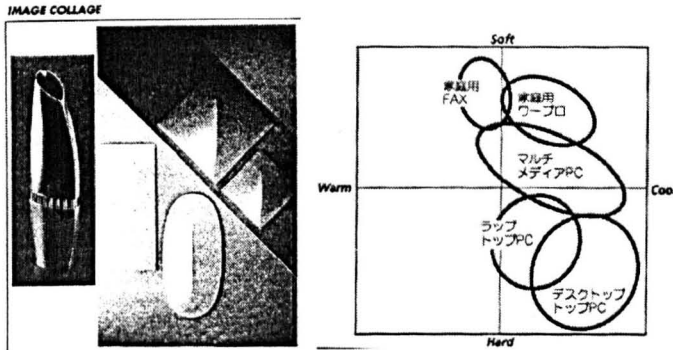


Figure 2.20: Fuji Xerox Laser Printer Design Strategy  
(Source: Sanaka 1995, pp.1 & 6)

### 2.13.4 Metaphor Maps

Fentem et al. 1996 argued that the different metaphor maps are used in different ways and by different people, and it is important for maps to identify the boundary object and to map out a terrain. He also mentions maps for the new luxury car concept. The X-axis ranges from clever and unusual, to mysterious. The Y-axis from stylish and elegant, to luxurious. He argues that firstly, boundary object tools on such metaphor maps support good group communication, and affects a new product and strategy. Secondly, boundary object tools provide an explicit link between product value, strategy and actual development work. (Figure 2.21). Dumas 1994 argued that metaphors could act as an

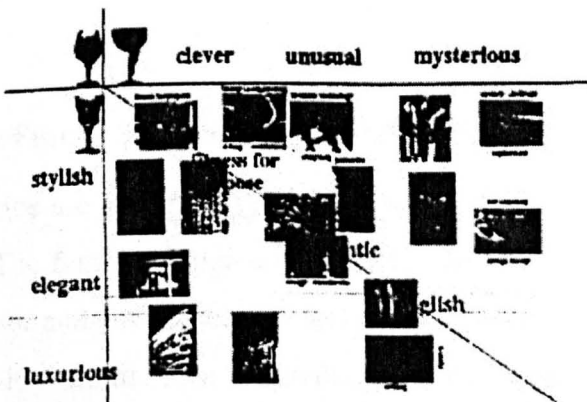


Figure 2. A possible Metaphor Map for the new luxury car concept

Figure 2.21: Metaphor Maps (Source: Fentem et al. 1996, pp.6)



important position as integrators for a team involved in development of a new product. She also explains “totem” developed by the group itself, this can coordinate development design work among the group members into the concept and implementation stages

### 2.13.5 Taste Matrix

Blaich & Blaich 1993 noted that taste matrix is a visual approach to market research which is an intuitive skill and must be done by the designer. (See the Figure 2.22) He also mentioned that taste matrix is a product planning tool according to designers who have an aesthetic and cultural basis to make the judgments about matrix positions.

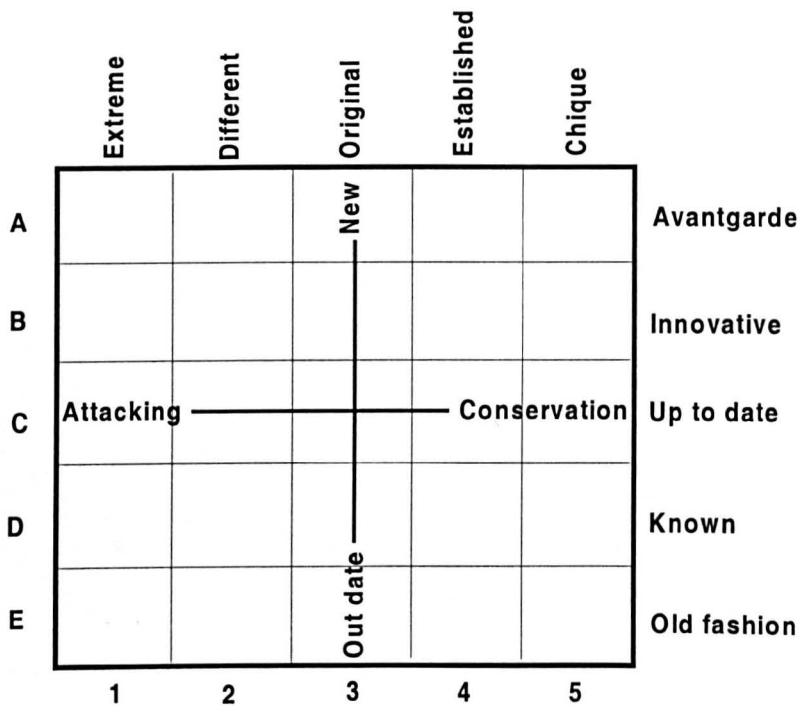


Figure 2.22: Taste Matrix (Source: Blaich & Blaich 1993, pp.135)

### 2.13.6 The Future Scenarios and Storyboards

The scenarios are created to describe how the future user will interact with the product concepts. The famous design consultancy, IDEO 1992 explains that the scenario draws from the user and environment observation. The storyboard (See Figure 2.23) involves a series of illustrations, then following the illustration, the writing of a future scenario

helps to create new opportunities for designing a complex project, after the future scenarios and storyboard process have been evaluated.

Shay & Duncan 1993 noted that in early 1930s, the Disney cartoon makers were the first to use a storyboard to divide the different scenarios. He said that in the Walt Disney Studio, Studio artists used sketches pinned onto bulletin boards to structure their story line. They established the visual framework to produce animation. This means the storyboard is a common vision. Thus, in the movie field, many directors use the storyboard for helping the camera operation.

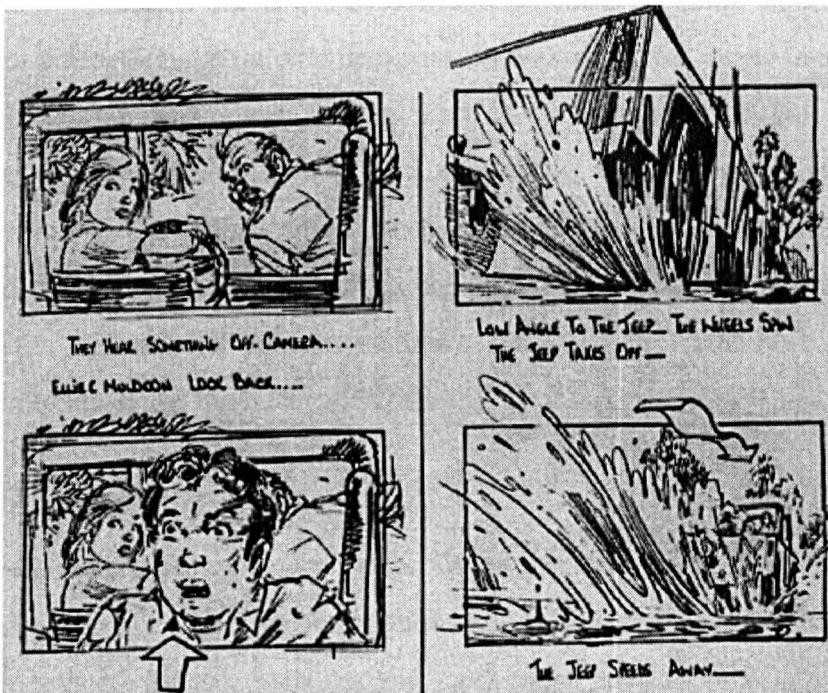


Figure 2.23: Jurassic Park Storyboards (Source: Shay & Duncan 1993, pp.160)

## 2.14 Strategy and Design Strategy

Noorderhaven 1995 defined strategy, "strategy is associated with the choice of a course of action in order to reach a given goal in a given situation" There are many kinds of strategy such as organization strategy, business strategy, military strategy. But based on design activity is design strategy in which some researchers mention the relative strategy is NPD strategy, (Ansoff & Steward 1967) and product development strategy, (John & Nelson 1990) as well as new product strategy (Day et al. 1990). In design territory, the

top level design strategy is policing design (Oakley 1986) which outlines the activity of design management from setting the design object, defining, setting and maintaining design standards, audits of design, organization of design activity to evaluation of design results. Lydiate 1992 argued that marketing is part of the responsibility of every person working in a design consultant company. Thus, in the design level, design strategy is process planning and also links with marketing the design target of the client's company.

Noorderhaven 1995 argued organization strategy has 4 concepts. He points out the strategy situation characters by complexity and uncertainty and decision makers by the interaction to make rational decisions, as well as by the ability to exert control over their organization. The design strategy also has the same as condition. Moreover, the famous marketing researcher Kotler 1996 argued that the strategy planning is the process of developing and maintaining a strategic match between the organization target objection and capabilities as well as changing its marketing opportunities. He set up a process, firstly, defined the company mission, secondly, set company objectives and goals, thirdly, designed the business profile.

## **2.15 Conclusions**

The effective design process depends on the relationship between designer and client. However, the long-term relationship builds on compatibility, familiarity and competency. Hence, both designer and client need to establish design competencies, such as familiarisation of each organisation's business, use of the same language to communicate. The relevant finding is that design consciousness or design sense could have impact on the design process. Therefore, design sense might influence the design approach and concept approach. Due to design sense being difficult to observe, the author uses the action research methodology that involves every detail of design processes, from client contact, design proposal, style planning to concept idea generation approach. It is the best approach to observe the interaction between designer and client. At the same time, the design leader (Author) can, by participating in each design project, develop the design management tools for effective design. Hence, the action research methodology is the best recommendation for this research.

## **2.16 Propositions to be Investigated in the Research**

The above discussion suggests a number of propositions about effective design between client and design consultant. In both clients' organisation and design consultant, the following investigated proposition has been developed with regard to the characteristics processed by effective design project.

- Effective design, from both client and design leader, is formulated by understanding the context of the design brief. (Bruce & Cooper 1996, Mitchell 1996, Constable 1996, Law 1996, Booz 1982 )
- Effective design is based on use of the adjective word (Semantic) to describe the design concept. (Tomes et al 1998)
- Effective design is to choose the appropriate design consultant. (Bruce & Morris 1995, Hancock 1992)
- Effective design relies on the client's decision-maker having design sense. (Bruce & Cooper 1996, Robinson 1994, Dumas 1994,)
- Effective design needs NPD members to understand product attributes for evaluating the design concept. (Bruce & Cooper 1997, Bruce & Morris 1995, Baxter 1995, Cooper & Press 1995, Robinson 1994, Hancock 1992, Vickers 1990)

The design consultant was exclusively interviewed about the following investigated propositions with regard to the characteristics processed by effective design project.

- Effective design is considered to be the result of appropriate design approach. (Tovey & Dekker 1996, Hughes & Conningham 1996)
- Effective design is satisfying the client's requirement. (Bruce & Docherty 1993, Bruce & Morris 1995, Bruce & Jevanker 1998)
- Effective design is control of the design quality. (Baxter 1995, Ulrich & Eppinge 1995)
- Effective design is the need of the designer to understand design trend. (Vickers 1992)

## Chapter 3 Investigation Phase

The aims of the investigation phase, as mentioned in chapter two, were to find out the clients who belong to action research projects, and ten design consultants within product development and communication process within the electronic consumer product environment.

The findings of the investigation phase are divided into two parts. The first part is based on interviews with thirteen clients, who focus on design sense within new product development process. The second part is based on interviews with ten design consultants who focus on understanding of design sense between design consultants and their clients.

The results of interviews with action research's clients are described in the first part consisting of the type of NPD, design brief, design sense and decision-maker. The results of interviews with design consultants are described in the second part consisting of design process and approach, design brief, design quality control, design sense and decision-maker.

The ten design consultants and design leaders are chosen from the CIDA (China Industrial Design Association) published book, and also by reference to the design consultants invited by CIDA to the 40<sup>th</sup> annual exhibition. Most participating design consultants operate in Taipei (north Taiwan), two design consultants in Taichung (middle Taiwan), and one design consultant in Tainan (south Taiwan).

### 3.1 The Action Research's Company Information

Commonwealth Magazine 1998 mentioned that in computer and electronic manufacture, Taiwan has 307 manufacturers in the top 1000 manufacturers and has 37% of the total sale. This means, computer and electronic manufacture are very important in Taiwan and most manufacturers are medium and small-sized corporations. The size of company is medium and small-sized corporations. According to Hsu in 1995, medium and small-

sized corporations mean, firstly, capital under NT: 40 million-dollars, secondly, employee numbers under 300. This comes from the government identifying medium and small-sized corporations in 1991. Hsu suggested that capital should change to 80 million and employee numbers change to 500. Therefore, only Tranbon and Kingtel are not medium and small-sized corporations. These two companies specialise in communication product areas, and also manufacture in Mainland China. Both Kingtel and Tranbon are two top brands in the local cordless telephone market. Kingtel's capital is 750 million and their staff number is 800. Tranbon's capital is 424 million and their staff number is 500. Others companies are small-sized corporations.

Commonwealth Magazine 1998 mentioned that Eten has the priority position of 623 in the top1000 manufacturers in Taiwan. Eten is developing the Personal Digital Assistant (PDA) and built in pager for monitoring the stock market information. Eten is only one of the action research's companies in the stock market, thus Eten have 753 million capital and their staff number is 169. Syntech is developing the handle barcode scanner and uses Cipher as its brand name in sales all over the world. Syntech's capital is 195 million and their staff number is 90. The Ming-jong Company produces timers for the world, and also manufactures in Mainland China. Ming-jong's capital is 100 million and their staff number is 160. Unication and Smartek are pager producers. Unication employs other manufacturers to produce the product. Smartek produces some in Taiwan but also employs Mainland China manufacturers to produce their product. Hentak produces the wooden classic telephone, Hentak used to have a small factory in Taiwan, but now, also employs Mainland China manufacturers to produce their product. Ligitek produces DVD Decoders and most of these products sold in the local market use their brand. Ligitek's capital is 30 million and staff number is 60. Tentel produces the office telephone in Taiwan. 80% of these products sold in the local market use their brand. Tentel's capital is 33 million and staff number is 33. Panacom is a new company that produces the videophone. Panacom's capital is 100 million and staff number is 10. One of the companies not producing electronic products, is the Center of Aviation & Space Technology (CAST) who is under the Industrial Technology Research Institute. CAST design aerospace products for their client.

Some clients are old clients and some, who are new contact clients, are introduced by other clients or the designer's acquaintance. Nearly 100% of companies have ODM services and OBM also. 50% of companies have OEM service. Tranbon, Kingtel, Unication and Ming-jong have OEM, ODM, and OBM service. Tranbon, Kingtel, Eten, Ligitek, Tentel, Smartek use their brand of product to sell in the local market. Syntech use their brand of product to sell in the European market. The barcode scanner is a hi-tech product, thus the manufacturer needs to promote the product themselves. In summary, ODM is the service most offered by the manufacturer for their clients. The OBM service focuses on the local and Chinese market only. Commonwealth Magazine 1998 mentioned that Taiwan is not a brand area.

According to Schewe 1987, there are different types of new products: (1), New to the world; (2), New Product line; (3), Additions to existing product; (4), Improvements to existing product; (5), Reposition and (6), Cost Reduction. Most manufacturers have two to six types of new products. But only a few new to the world products are manufactured. Tranbon focus on use of new material in products, such as Acrylic in the telephone. The Ligitek DVD decoder is a market gap product, a small business but hi-tech product. Eten combines the PDA and Pager for transmitting stock market information to the user. The idea is new to the world. Philips communication department in Taiwan develops the new function for Asia. Panacom handle the videophone technology, this type of product is new to the world. In summary, the new product type, new to the world product is rare. Thus most design projects follow the existing market product to develop a product for the company itself. The basic company information show as follows Table 3.1.

Table 3.1: Basic Company Information

Client information		Basic Information			Product Type			NPD Type					
Company	Design Projects	Capital (million)	Company from (year)	Staff	OEM	ODM	OBM	New to the world	New product line	Additions to existing product	Improvements to existing product	Reposition	Cost reduction
Tranbon	Video tel.	424	1980	500	*	*	*	*	*	*	*	*	*
Hentak	Tel./ans.	15	1984	9	*10%	*90%			*	*		*	*
Kingtel	Cordless Tel.	750	1977	800	*	*	*		*	*	*	*	*
Ligitek	Decoder	30	1985	60		*20%	*80%	*	*	*	*	*	*
Ming-jong	Timer	100	1978	160	*	*	*		*				*
Unication	Pager		1992		33%*	33%*	33%*		*	*	*	*	*
Syntech	Laser S	195	1988	90		15%*	85%*		*	*	*	*	*
Tentel	Key tel.	33	1979	33		30%*	70%*		*	*	*		
Eten	PDA	753	1987	191		20%*	80%*	*					
Philips	Key tel.	NA	NA				*	*	*	*	*	*	*
Panacom	Video tel.	100	1998	10	*	*	*	*	*			*	
Smartek	ISDN tel.		1990	150		10%*	90%*		*	*			*
CAST	16G seat		1991	114					*				

### 3.1.1 NPD Strategy and NPD Innovation

Kotler and Armstrong 1995 noted new product development strategy: (1), Acquiring new product; (2), Reviving old product and (3), Me-too. Most manufacturers' strategy is in reviving old products and me-too. Only Philips, Panacom and Smartek NPD strategy is in acquiring new products. Me-too means learning from existing market's leading products, and this is mostly Taiwanese manufacturers' NPD strategy. The reason is that the NPD risk is lower. (Table 3.2)

NPD innovation involves: (1), Adding new function; (2), Improving function; (3), Reorganising function and (4), Designing different appearance. Most companies develop a product with different design appearance and improved function. Hentek's product is a wooden telephone, which interests the buyer for its style not its different function. Ming-jong produces a timer with a simple function, thus does not add new functions or reorganize functions. Eten produces a PDA, which is the company's first product, thus no improved functions are needed.

Only two companies have NPD committees, Tranbon and Ming-jong. Tranbon is an



innovation company, so the new idea and new style design needs approval by a committee. Ming-jong has a similar committee, but the committee accesses the NPD proposal. A small group decides the style of design.

Hentak, Kingtel and Ligitek use one key decision-maker to make the decision. This kind of key decision-maker has confident design ability. Hentak's key decision-maker is a graphic designer, and as the company size is small, the president, and key decision-maker make the decision. Kingtel's president, the key decision-maker, is keen on playing a designer role, so the company's product is only handled by him. Ligitek's key decision-maker is the R & D manager and he also is a large stockholder. He knows the design trend in DVD decoder products, so makes the decision himself.

Other companies use small groups to make decisions. Small groups combine the different department managers to decide which style designs are suitable for companies

Table 3.2: NPD

Client information		NPD Strategy			NPD Innovation				NPD member		
Company	Design Projects	Acquiring new product	Reviving old product	Me-too	Adding new function	Improved function	Reorganize function	Different design appearance	Committee	Small group	One key decision maker
Tranbon	Video tel.		*	*	*	*	*	*	*		
Hentak	Tel./ans.		*					*			*
Kingtel	Cordless Tel.		*	*	*	*	*	*			*
Ligitek	Decoder		*	*	*	*	*	*			*
Ming-jong	Timer			*		*		*	*	*	
Unication	Pager		*	*	*	*	*	*		*	
Syntech	Laser S		*		*	*		*		*	
Tentel	Key tel.		*			*	*	*		*	
Eten	PDA	*			*		*	*		*	
Philips	Key tel.		*	*	*	*	*	*		*	
Panacom	Video tel.	*			*	*				*	
Smartek	ISDN tel.	*		*		*	*	*		*	
CAST	16G seat			*		*		*		*	

### 3.1.2 Design Brief

Only Ligitek and Ming-jong do not offer design briefs for design consultants. The respondents include the president, product planning or project manager and marketing

people. The brief contents involve design direction, product feature or specification, competitor products marketing data, benchmarking product, schedule, design budget, retail price or cost, and schedule. In design briefs, the first priority is specification or feature (38%), market information (15%), others are style direction, product cost, product dimension and schedule. (Table 3.3)

Table 3.3: Design Brief

Client information		Design Brief		Design Brief	Design Brief Priority		
Company	Design Projects	Brief	Who deals with it	Brief Contents	1	2	3
Tranbon	Video tel.	*	PP				
Hentak	Tel./ans.	*	President	Design direction, production feature	Style Direction	Feature	
Kingtel	Cordless Tel.	*	President	Cost, retail price, competitor products marketing data, product specification	Cost	market	Spec.
Ligitek	Decoder			Benchmarking product, schedule,			
Ming-jong	Timer			Specification, feature, design strategy (Style approach, Function)	Specification	Function	Price
Unication	Pager	*	PP	Feature, specification, target price	Feature	Spec.	Price
Syntech	Laser S	*	PM	Design specification, schedule, design budget	Specification	Schedule	Budget
Tentel	Key tel.	*	Marketing	Competitor products marketing data, core benefit,	Marketing	Schedule	Budget
Eten	PDA	*	PM	Marketing information, and develop concept, target customer	Marketing	Concept	Customer
Philips	Key tel.			Feature, specification, target price (offer from manufacture)	Specification	Function	Price
Panacom	Video tel.	*	Vice President	Specification, schedule	Dimension	Product Position	Design Position
Smartek	ISDN tel.	*	Marketing	Client, style, benchmarking product	Schedule	Budget	Style
CAST	16G seat	*	Team Leader	FAA specification, technology, material resource, target market, weight	Specification	Tech.	Material

PP: Product Planning    PM: Project Manager

### 3.1.3 Adjective Word

Companies use adjective words such as, traditional, hi-tech, soft, vivid, stable, fashionable, middle, advanced, compact, conservation and professional. These kinds of adjective describe the style approach. For example easy to handle and robust describes the ergonomic condition. (Table 3.4)

53% of companies offer adjective words to describe the future concept. The respondents include the president (30%), product planning or project manager (30%), market people (15%) and R & D managers (7%). Most adjective words come from market information, style approach, personal intuition, client argument and specification.

Table 3.4: Adjective Word

Client information		Adjective Word			
Company	Design Projects	Adj.	Who deals with it	Origin of Adjective Word	Used During the Design Project
Tranbon	Video tel.	*	PP		Traditional, Hi-tech
Hentak	Tel./ans.	*	President	NA	Gentle, Soft
Kingtel	Cordless Tel.	*	President	Integrated marketing information,	Vivid, Stable, Fashionable,
Ligitek	Decoder	No	R&D Manager	Style approach, soft, curved.	NA
Ming-jong	Timer	No			NA
Unication	Pager	*	PP	Customer, feature, function, style approach, colour	Middle, Advance
Syntech	Laser S	*	PM	Personal intuition and client argument	Easy to Handle, Soft
Tentel	Key tel.	No	Marketing		NA
Eten	PDA	No	PM		NA
Philips	Key tel.	No	General Manager	Product market niche and specification.	Friendly, Robust.
Panacom	Video tel.	*	Vice President	To use the semantic in nature.	Compact, Robust, Conservation
Smartek	ISDN tel.	*	Marketing	Younger, colourful / hi-tech, professional	Hi-tech, Professional
CAST	16G seat	No	Team Leader	NA	NA

### 3.1.4 How to Buy Design

How to buy design (See Table 3.5): Design experience includes familiarity with company products and material resource, direction of client’s inquiry, design prestige, response, and the winning of a design award.

Table 3.5: How to Buy Design

Client information		How to buy design	Buying Design priority		
Company	Design Projects	Contents	1	2	3
Tranbon	Video tel.				
Hentak	Tel./ans.	● Design experience includes familiar with company product and material resource.	Experience	Material	
Kingtel	cordless	● Design Consultant needs to understand the client’s needs. ● Design quality: Design prestige, familiar with company product ● The famous design consultant is not important.	Quality	Charge	Interactive
Ligitek	Decoder	● The design sense includes presentation quality, response.	Sense	Charge	
Ming-jong	Timer	● Reputation includes deign award. ● Design style matches client’s requirements.	Reputation		
Unication	Pager		Ability	Philosophy	Charge
Syntech	Laser S		Quality	Charge	Interactive
Tentel	Key tel.		Ability	Interactive	Charge
Eten	PDA	● Design consultant keens on style design.	Innovation	Style	Colour Scheme
Philips	Key tel.	● Design consultant size is not very important.	Expertise	Experience	
Panacom	Video tel.	● Prestige, schedule. ● Designer needs to check from user viewpoint.	Communication	Design Visualise	Marketing Understanding
Smartek	ISDN Tel	● Between designer and clients there needs to be good interaction. ● Related product design experience.	Ability	Charge	Schedule
CAST	16G seat		Quality	Response	Charge

The first priority of 46% is in design quality and design ability; others are experience, sense, reputation, innovation and communication.

### 3.1.5 NPD Members

Who Chooses NPD Members? The president (23%) and the organisation function (77%). (Table 3.6)

Table 3.6: NPD Members

Client information		NPD Key Member	NPD Member										
Company	Design Projects		Who Chooses NPD Member	President Vice	General Manager	Marketing Manager	R&D Manager	Product Manager	Product Planning	Project Manager	EE Designer	MD Designer	Other
Tranbon	Video tel.	President	*Key	*	*	*	*	*	*	*	*	*	
Hentak	Tel./ans.	President	*Key				*						
Kingtel	cordless	President	*Key			*							
Ligitek	Decoder	Org. Function			*	*Key	*				*		
Ming-jong	Timer	Org. Function		*Key		*							
Unication	Pager	Org. Function		*Key	*	*		*				*	
Syntech	Laser S	Org. Function	*		*	*	*Key		*				
Tentel	Key tel.	Org. Function			*	*Key	*				*		
Eten	PDA	Org. Function		*Key		*	*		*		*		
Philips	Key tel.	Org. Function		*	*								
Panacom	Video tel.	Org. Function		*Key	*	*							
Smartek	ISDN Tel	Org. Function	*Key	*	*	*			*		*	*	
CAST	16G seat	Org. Function											

### 3.1.6 Design Sense

92% of respondents said that design sense is important for the decision-maker. 85% of respondents agreed that engineering skill is important for the decision-maker. Only Syntech's key decision-maker argued that the decision-maker does not need engineering skill. Design Sense Priority is firstly: 30% aesthetics, 23% market, 15% design trend, and 15% manufacturing technology and user interface. (Table 3.7)

Table 3.7: Design Sense

Client information		Design Sense			Design Sense Priority		
Company	Design Projects	Design sense is important for decision-maker	Engineering skill is important for decision-maker	1	2	3	
Tranbon	Video tel.						
Hentak	Tel./ans.	Yes	Yes	Market	Manufacture		

Kingtel	Cordless tel.	Yes		Yes		Aesthetics	Product Trend	Market Survey
Ligitek	Decoder	Yes		Yes		Aesthetics	Engineer Skill	Design Trend
Ming-Jong	Timer	Yes		Yes		Market	User Culture	Engineer Skill
Unication	Pager	Yes		Yes		Manufacture	Mechanical	Market
Syntek	Laser S	Yes			No	Aesthetics	Product Trend	Market Survey
Tentel	Key tel.	Yes		Yes		Aesthetics	Product Trend	
Eten	PDA	Yes		Yes		Manufacture	Market	
Philips	Key tel.	Yes		Yes		Market	Product	
Panacom	Video tel.	Yes		Yes		Market Trend	Design Trend	
Smartek	ISDN tel.	Yes		Yes		Market Trend	Design Trend	
CAST	16G seat	Yes		Yes		User Interface	Manufacture	Aesthetics

### 3.1.7 Product Attributes and how NPD Members Evaluate the Concept

How is the decision on the niche position made and who makes it? 30% marketing manager, 30% project manager and 15% buyer. There are 61% of companies that use market information to decide the niche position.

How do NPD members evaluate the concept: 76% use discussion, 38% use devotees and 15% one key decision-maker to make the decision. Product attribute priority is firstly: style (colour, texture, printing), quality, cost, marketing and user interface. (Table 3.8)

Table 3.8: Product Attributes and How NPD Members Evaluate the Concept

Client information		Product Attributes	How NPD Members Evaluate the Concept			Product Attributes Priority		
Company	Design Projects	How & by who is decision made on niche position	Discussion	Devote	One Key Decision	1	2	3
Tranbon	Video tel.	Marketing Data/ PP	*	*				
Hentak	Tel./ans.	Buyer			*			
Kingtel	Cordless tel.	Marketing Data			*	Style (Colour, Texture, printing)	Brand (CIS)	Cost
Ligitek	Decoder	Marketing Data/MM	*	*		Quality	Feature	Style
Ming-jong	Timer	Marketing Data/MM	*	*		Cost	Safety	Style
Unication	Pager	Marketing Data / PM	*			Colour	Style	Function
Syntek	Laser S	Clients/ PM	*			Marketing	Style	Product (Assembly)
Tentel	Key tel.	Buyer	*			Style, Colour	Texture, Material, Printing	Feature
Eten	PDA	Marketing Data /PM				User interface	Style	
Philips	Key tel.	Adding Value, Region, Segment	*	*		Marketing	Specification	Style
Panacom	Video tel.	Marketing Data/MM	*	*		Style	Texture	User interface
Smartek	ISDN tel.	Marketing Data/MM	*			Style	Price	Specification
CAST	16G seat	Environment /PM	*			Function	Safety	

\*PP: Product Planning MM: Marketing Manager PM: Project Manager

### **3.2 Interview of Design Consultants**

There are 10 design consultants were interviewed, first is Center Design, Center was founded in 1983. Company structure consists of a manager in marketing, Industrial Design (ID) group, graphic design under the ID team, Mechanical Design (MD), model making, and financial personnel. Every team has a leader. Two ID designers share one project, but when the design develops in detail, then it is changed to one designer. Center Design is one of the oldest design companies in Taiwan. The total staff is about 16 persons. The product design department office is in the Fareast Trading building, which is located in His-Chih. Two design leaders have a U.K. MA degree.

The follows is Conser Design, Mr. Fung founded the Conser Design Company in 1989 and he came from Acer Company. Conser's profile is as follows: "Conser Design has 20 staffs and each possesses talent, professional experiences & achievements, specialising in handling tough and high quality projects. Vision, self-confidence, frame work and self-discipline make Conser outstanding." Design structure includes ID, MD, Marketing, CAD, Management, and a financial department.

The third of visited design company is I+U Design, who was founded in 1995, and has 31 staffs. Company structure consists of a general manager with marketing and chief designer, ID department, MD department and Graphic Design department. Each department has a principal leader but the ID department has three leaders. I+U Design is one of the biggest design companies in Taiwan.

The located Taichung (Middle of Taiwan) is JIK design. This company was founded in 1978, and has 9 staffs. The company structure is ID and MD with two departments. Design leaders handle the design projects and the general manager contacts the clients.

The next interview company is Moreal Design, Who was founded in 1994, and has 11 staff. Mr. Tsung has a USA MA degree, initially based on design of furniture, sport and exercise products. The design structure is ID, MD, and EE, with three departments. There are two teams within the company. Design leaders handle the design project and

also contact the clients.

Nova was founded in 1988 and it has come from one of the famous transport manufacturing groups in Taiwan. Nova is independent and also corporate with the original company. Company structure is ID, MD, Marketing, Management, CAID (CAD Industrial Design), and RP (Rapid Prototype). Two design teams have a leader. Nova Design is the largest design company in Taiwan, if the transport department is included. The total staff is about 70 persons. The Product design department has 22 staffs, and its office is in the Design Centre building located in His-Chih. The chief designer acts as the project leader.

The only use the telephone interviewed is Sekond Design. Sekond Design was founded in 1990. The company structure is a general manager with marketing and chief designer, ID and MD group, and model department. The total staff is about 10 persons. Mr. Lin, general manager, chief designer, has a USA Masters degree.

The following visited is Wen's Design. Wen's was founded in 1990. The company structure is general manager with marketing and chief designer, ID group, and MD department. The total staff is about four persons. Mr. Wen, general manager, chief designer, has an USA MA degree.

Sumwell Design, Mr. Tang founded the company in 1990 and he came from the Renault group in Taiwan. The company has been designed for Singer and Kodak. Company structure is ID, MD, Marketing, and Management. Two design teams have a leader. 80% of the company's new design business is handled by Mr. Tang, but the ID designer needs contact with the clients. Due to the company being located in Taichung, it is able to design more large power products than Taipei companies. The Industrial Designer needs to consider mechanical design in the brief and transfers data to the Mechanical Engineer by Pro. Designer and Pro. Engineer. The ID then needs to finish the design of plastic parts and then deliver them to the MD.

The final visited is Quinte Design, who was founded in 1989. Company structure is general manager with marketing and chief designer, ID group, and MD department. The total staff is about 9 persons.

### Type of Product Design

Every design consultant has been designing computer, communication and electronic consumer products and even design consultants located in the north, middle or south of Taiwan, find these products are very important for design business. Only Conser design have no experience in Gift & stationary products. Only 50% of design consultants have designed toy, furniture and toilet & bathroom products. Transport and machinery products have been designed by 60% of design consultants. (Table 3.9)

Table 3.9: Design Company Basic Information

Company	Company Found	Which kind of products[has] your company been designing											
		Computer	Communication	Consumer	Toy	Gift & Stationary	Furniture	Transport	Medical	Toilet & Bathroom	Machine	Aerospace	Other
Center	1983	*	*	*		*		*	*	*	*		
Conser	1989	*	*	*					*		*		
I+U	1995	*	*	*		*		*	*	*	*		
JIK	1985	*	*	*	*	*	*	*	*	*	*		
Moreal	1994	*	*	*		*	*						
Nova	1988	*	*	*	*	*	*	*	*	*	*		
Quinte	1989	*	*	*	*	*		*	*				
Sekond	1990	*	*	*	*	*	*						
Sumwell	1990	*	*	*		*		*			*		
Wen's	1990	*	*	*	*	*	*		*	*			
Total		10	10	10	5	9	5	6	7	5	6	0	0
%		100%	100%	100%	50%	90%	50%	60%	70%	50%	60%	0%	0%

### Staff of Design Consultant

Design consultants who offer a model making service are Center, Nova and Sekond design. Most design consultants co-operate with several model makers. Nova and Moreal have computer personnel for helping designers to build the 3D model. Center, Conser, Nova and Sumwell have marketing personnel for contacting clients. 60% of design consultants have graphic designers but only I+U and Nova have more than one designer in this department. (Table 3.10)



Table 3.10: The Main Staff

Company	Staff	Main Staff							
		ID	MD	Model Maker	Marketing	Management	Computer	Graphic Design	Other (Financial)
Center	17	5	4	3	1	2		1	1
Conser	20	10	7		1	1			1
I+U	31	14	8			4		4	1
JIK	9	3	3					1	2
Moreal	11	4	3				3	1	
Nova	22	6	4	2	1	2	4	3	
Quinte	11	7	2					1	1
Sekond	10	3	5	1					1
Sumwell	13	4	5		1	1			2
Wen's	5	2	1					1	1

### 3.2.1 Design Processes

The 10 design consultants design process are described in follows sections, The frist, Center Design, in 70% of approaches to the idea generation stage, Center Design uses A4 paper to sketch, then chose three design sketches to make a rendering by hand with a PU model. The following stage is for the designer to do the detailed design from the client's chosen concept. The next stage is to use the Master CAM to build a CAM model and make the mock up. 30% of approaches add the 3D computer modelling render for the client to evaluate the concept. The third approach depends on the design charge, the process lacks the PU and 3D computer modelling render. (Table 3.11)

In reverse engineering, such as, in mouse and transport products, which are from concepts, models for presentation are made by hand.

Table 3.11: Center Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	(30%)	*	*	(A4)	3 hand-made (A3)	3 (PU)	1 (Pro. E/ Ideas)	1 (Master CAM)	1
2	Standard (70%)	*	*	(A4)		3 (PU)		1 (Master CAM)	1
3		*	*	(A4)	3 hand-made (A3)			1 (Master CAM)	1
4	Reverse Engineering (Mouse)	*	*			3 (PU, Clay) Hand made		1 (Master CAM)	1

Conser Design Approach show in Table 3.12. In the idea sketch stage, Conser Design uses A3 size paper for free hand drawing. The 2D software used is CorelDraw. For 3D modelling, Conser use Pro. Engineering and Alias and CTRD (Pro. Designer). In the second approach, many clients increasingly want to jump the 3D computer modelling images to the mock up.

Table 3.12: Conser Design Approach

No		Brief	Marketing	Idea Sketch (Pieces)	2Drendering (Pieces)	Soft Model (Sets)	3D/ Presentation	3D / CAM	Mock Up
1	25%	*	*	10-15	3 Direction (CorelDraw)	GA Drawing/3			
2	70%	*	*	10-15			3 (Alias, CTRS)	3 (Pro. E.)	1-2
3	5% Reverse Engineering	*	*			3 (PU)		3 (Pro. E.)	

Then shows the I+U Design Approach. The I+U standard process is that image maps are produced from marketing information, and at the same time, the design brief also needs to be written down. 70% of the approaches use A4 paper for the idea generation stage to sketch and brainstorm. The following stage is that from the client’s chosen concept, the designer does the detailed design and builds up the 3D computer modelling by Alias. The next stage is to make the mock up. (Table 3.13)

Table 3.13: I+U Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	Standard (70%)	*	*	Brain Storming 50-100 (A4)		PU / 2D GA	3 (Alias)	1 (Pro. E.)	1 PU/ ABS
2	Reverse Engineering	*	*			PU/Plastic		1 (Pro. E.)	1 PU/ ABS

The Table 3.14 shows JIK Design Approach. In the idea sketch stage, JIK Design use A4 size paper for free hand drawing. The 2D Auto-CAD is rendered by hand. JIK Design uses Solid work for 3D modelling. In the second approach, many clients

increasingly want to jump the soft model stage to 3-D computer modelling and to make the mock up. Finally, reverse engineering is used on the soft model to create a 3-D computer model.

Table 3.14: JIK Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering (Pieces)	Soft Model (Sets)	3D/ Presentation	3D / CAM	Mock Up
1	Standard (80%)	*	*	*	4-6 Direction (hand made)	PU	1 (Solid work)	1 (Solid work)	1
2	(15%)	*	*	*	4-6 Direction (hand made)		1 (Solid work)	1 (Solid work)	1
3	5% Reverse Engineering	*	*	*		2-3 (PU)	1 (Solid work)	1 (Solid work)	

Moreal Design Approach, in the idea sketch stage, Moreal design use A4 size paper for free hand drawing. CorelDraw is used for 2D rendering, and Moreal Design uses Pro. E and Alias for 3D modelling. In the second approach, many clients increasingly want to jump the soft model stage to 3-D computer modelling and to make the mock up. Finally, reverse engineering is used on the soft model to create a 3-D computer model. (See Table 3.15)

Table 3.15: Moreal Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering (Pieces)	Soft Model (Sets)	3D/ Presentation	3D / CAM	Mock Up
1	Standard (computer)	*	*	*	3 Direction (CorelDraw)	PU	Pro. E.		1
2		*	*	*	3 Direction (CorelDraw)		3 (Alias, Pro. E.)	3 (Pro. E.)	1
3	(Time, price)	*	*	*	3 Direction (CorelDraw)				1
4	5% Reverse Engineering	*	*	*		3 (PU)		3 (Pro. E.)	

Nova Design Approach, in the idea sketch stage, A4 size paper is used for free hand drawing or the idea is drawn direct into computer software. The 2D software used is CorelDraw. Pro. Engineering, Alias and CTRD (Pro. Designer) are used for 3D modelling. In another approach, many clients increasingly want to jump the 3D computer modelling images to the PU soft model, and then go back to the 2D stage, and then to the 3D computer modelling image.

The standard process comes from marketing information, which clients are asked to offer. At the same time, it is necessary to write down the design brief, and have it checked by both designer and clients. The image scale and image board depends on the idea of their product position. The company’s proposal strategy for clients is that if they want leading designs, then the designer can accord this strategy to design the product. The idea generation stage uses A4 paper to sketch, then three design sketches are chosen, so that the CAID department can build a rough concept by Alias. The following stage is to make a detailed design from the client’s chosen concept. The appearance of the control drawing is offered for clients to approve in 2D AutoCAD software. The next stage uses Alias to build a CAM model and make the mock up.

In reverse engineering, products, such as, a mouse or transport, which are from concepts, models are made by hand for presentation. (See Table 3.16)

Table 3.16: Nova Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	Standard	*	*	(A4)			3 ( Alias)	1 ( Alias)	1
2	Reverse Engineering (Mouse)	*	*			3-5 (PU, Clay) Hand made		1 (Alias)	1

Then shows Sekond Design Approach, whose standard process is that from marketing information, image maps are produced. At the same time, the design brief also needs to be written down. 70% of approaches use A4 paper to sketch for the idea generation stage, then three-five orthographic project drawings are chosen to make an EK model. In the following stage, the designer does a detailed design and builds the 3D-computer model from the client’s chosen concept. The next stage is to make the mock up and then, to direct the making of the 1/1 scale to make a full size model. (See Table 3.17)

Table 3.17: Sekond Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	Standard (70%)	*	*	(A4)	AutoCAD 3 view drawing	EK / 2D GA	1		1
2		*	*			EK/Plastic			

Wen’s Design approach, whose standard process is that from marketing information, image maps are produced. At the same time, the design brief also needs to be written down. 70% of approaches use A4 paper to sketch for the idea generation stage, then three or five design sketches are chosen to make a PU model. The following stage is for the designer to do the detailed design from the client’s chosen concept. The next stage is to make the mock up. In furniture projects, the designer directs the drawing of the 1/1 scale orthographic project drawing, and in the next stage asks the furniture manufacturer to make a full sized model. The gift and stationery projects only use the sketch. The jewellery, which is from a concept sketch, has a PU model made by hand, before making it into a real model. (See Table 3.18)

Table 3.18: Wen’s Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	(70%)	*	*	3-5 (A3) PU	CorelDraw, PhotoShop	2D GA (AutoCAD)	1 PU		1
2	Furniture	*	*	1/1 3 views					
3	Gift	*	*	3-5 (A3)					
4	Reverse Engineering Jewellery	*	*	3-5 (A4)		Scale PU			1

The follows present is Quinte Design Approach. In the idea sketch stage, Quinte Design use A3 size paper for free hand drawing. CorelDraw and PhotoShop are used for 2D rendering. Quinte Design uses Pro. E and Alias for 3D modelling. In the second approach, many clients increasingly want to jump the 2-D rendering to 3-D computer modelling and make the mock up. Finally, reverse engineering is used on the soft model to create a 3-D computer model. (Table 3.19)

Table 3.19: Quinte Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	(30%)	*	Image scale	15-45 (A3)	CorelDraw, PhotoShop	3 (PU) 2D GA			1
2	Standard (70%)	*	Image scale	15-45 (A3)		3 (PU)	1 (Alias /Pro. E)	1	1
3	Reverse Engineering (Mouse)	*	Image scale			3 (PU, Clay) Hand made			1

The final presented is Suivwell Design approach (See Table 3.20). The standard process is that the product style could be changed, if the product size is very large or the design time is too short, then 2D rendering by hand is used for presentation. After the idea sketch stage of the small sized product, 3D rendering is always employed to present the design work. The reverse engineering product, which focuses on ergonomics and hand hold positions, needs to have three to five soft models made, which are then reversed to a concept drawing to modify the design.

Table 3.20: Suivwell Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	Standard	*	Basic ID analysis	30-40 (A4, A3)	3-5 Concept Drawings (Time Limited, price)	1-3	1 (Pro. E., Pro. Designer)		1
2	Electronic (3C products)	*	Basic ID analysis	30-40 (A4, A3)		1-3	3or 6-9 (Pro. E., Pro. Designer)	3 (Pro. E., Pro. Designer)	1-2 ( RP)
3	Reverse Engineering (Transport)	*	Basic ID analysis			3-5 (PU, Clay) Hand made		3 (Pro. E.)	1

### 3.2.2 Design Brief

Most design briefs from the client are given by oral presentation and documented by the designer. 100% of design consultants respond to these two proposals by the PL (project leader) or design leader rewriting the client's design brief. (Table 3.21)

Table 3.21: Design Brief

Company	Client's Brief			Brief Contents	Brief Priority		
	Oral from client	Document by designer	Who deals with brief in design company		1	2	3
Center	Yes 90%	Yes	PL	<ul style="list-style-type: none"> <li>● Software, hardware, Design direction (by asking)</li> <li>● 30% clients clearly present how the future concept will look.</li> <li>● 70% clients use sample or catalogue to help present the future concept.</li> </ul>	Assembly Cost/ Plastic Structure, Maintenance	Style Position	
Conser	Yes	Yes	PL	<ul style="list-style-type: none"> <li>● Ask client to clearly write down the brief. Finally need clients approval and signature.</li> <li>● Clear product definition, product mission.</li> </ul>	Product Definition	Product Mission	
I+U	Yes	Yes	PL	<ul style="list-style-type: none"> <li>● Recording of clients clarification of product performance.</li> </ul>	Marketing	Company Culture	Product Definition , Mechanical Constraint
JIK	Yes	Yes	PL	<ul style="list-style-type: none"> <li>● Clear product definition, product mission.</li> </ul>	Specification	Design Direction	
Moreal	Yes	Yes	PL	<ul style="list-style-type: none"> <li>● Provide a check list for client to clarify design direction</li> </ul>	Interface	Specification	Marketing (Design Trend)
Nova	Yes	Yes	PL/ID	<ul style="list-style-type: none"> <li>● If client gives a clear design brief – the brief is not written down.</li> <li>● If client's design brief is not clear– it helps to write down the brief.</li> <li>● Hardware, soft ware and design strategy</li> <li>● ID also can contact client and report the brief to team leader for forming the design brief.</li> <li>● Name of key decision-maker</li> </ul>	Design Strategy (Marketing information)	Specification	Hardware Lay Out
Quinte	Yes	Yes	PL	<ul style="list-style-type: none"> <li>● Ask design direction, hardware, software data</li> <li>● The client offers photos and samples to describe design strategy.</li> <li>● The product cost shows the design performance</li> </ul>	Product Position	Product Cost	
Sekond	Yes	Yes	PL	<ul style="list-style-type: none"> <li>● Design brief is formed in product meeting</li> </ul>	Working Contents	Product Position	Price
Sumwell	Yes	Yes	ID/PL	<ul style="list-style-type: none"> <li>● To use graphics showing the design specification and for initial concept working draft (size limited, space tolerance).</li> <li>● To ask client to offer design direction.</li> <li>● To use photos from magazines or illustrated books for checking the design direction.</li> </ul>	Marketing Information	Competitor Position	
Wen's	Yes	Yes	PL	<ul style="list-style-type: none"> <li>● To ask client to offer design direction.</li> </ul>	Design Direction	Marketing Position	Cost

## **Brief Contents from Designer Viewpoint**

- Design brief is formed in first contact meeting and needs to be approved by clients.
- Ask clients to offer design direction. Quinte, Center and Sumwell Design use photo or product sample to define the future concepts.
- Clear product definition, product mission.
- Product hardware lay outs, software and design strategy.
- Provide a check list for client to clarify design direction
- ID also can contact client and report the brief to the team leader for forming the design brief.
- Name of key decision-maker
- The product cost shows the design performance.

## **Brief Priority**

The design brief priority: first 40% is focused on market information. Assembly cost, plastic structure, maintenance of product specification and working contents.

### **3.2.3 Adjective Word**

Few clients use adjective words to describe the future concepts. 20%-30% of clients can offer adjective words. Conser Design ask clients to offer a clear design brief in the first design meeting. Both image scale and marketing maps are critical tools for describing the future concepts.

- To describe the product position.
- Most clients do not mention adjective words but utilise the related product to describe the design direction.
- To use marketing maps to highlight the scope of ideas.
- Many clients do not use the adjective word, but use oral communication to describe the future concept.
- The adjective is too abstract, thus Moreal Design use photo or product to define the future concept.
- I+U Design wishes clients to offer large picture adjective words, not directly



describing what the product looks like. Clients want I+U Design to produce excellent design, and believe that to use adjective words could limit the design development. (See Table 3.22)

Table 3.22: Adjective Word

Adjective Word				
Company	Adjective Word	Who deals with	Adjective Word Come From	Assisting tool for describing the future concept
Center	Yes, but few		<ul style="list-style-type: none"> <li>To describe the product position.</li> <li>To use marketing maps to highlight the scope of ideas.</li> </ul>	Marketing Maps
Conser	To ask clients		<ul style="list-style-type: none"> <li>70% clients not sure of the products mission.</li> <li>30% clients quite sure of product mission and do not change [their] mind.</li> <li>Design leader ought to ask clients to provide adjective word.</li> </ul>	
I+U	Yes, only 30% clients		<ul style="list-style-type: none"> <li>To wish clients to offer large picture adjective words, not directly describing what the product looks like.</li> <li>Clients want designer to produce excellent design, and believe that to use adjective words could limit the design development.</li> </ul>	
JIK	Few, clients use it		<ul style="list-style-type: none"> <li>Most clients do not mention adjective words but utilise the related product to describe the design direction.</li> </ul>	Related Product
Moreal	Few, clients use it		<ul style="list-style-type: none"> <li>Many clients do not use the adjective word, but use oral communication to describe the future concept.</li> <li>The adjective is too abstract, thus Moreal use photo or product to define the future concept.</li> <li>To use semantics creates a gap between designer and clients.</li> </ul>	Photo or Product
Nova	Yes		<ul style="list-style-type: none"> <li>Do not believe client can use exactly the right adjective word.</li> <li>To use marketing maps to highlight the scope of ideas.</li> </ul>	Marketing Maps
Quinte	Yes		<ul style="list-style-type: none"> <li>Ask clients to use adjective words to describe product position.</li> </ul>	
Sekond	Yes, only 20% clients		<ul style="list-style-type: none"> <li>Ask clients to describe product position and design direction.</li> </ul>	
Sumwell	Yes		<ul style="list-style-type: none"> <li>To offer the image scale with marketing data to describe concept.</li> <li>Some long term relationship clients, use adjective words only</li> </ul>	Images Scale
Wen's	Yes		<ul style="list-style-type: none"> <li>Clients ask design company to use adjective words for describing the concept.</li> </ul>	

### 3.2.4 How to Satisfy the Client

First priority of how to satisfy the client: 50% is in the presentation quality or design quality and 20% is in the service. (Table 3.23)

- To offer a total service for the client, from idea to model.
- If the client cannot read 3-view orthographic project drawings, the design approach will be to add the soft model, but reading drawings is an important skill for clients.
- According to client's needs, propose a suitable design for clients.
- To offer detailed service for clients, if clients request it. To solve the client's problem.

- To offer high quality 2D and 3D images for presentation.
- In ID style, 100% of clients are satisfied because Nova uses Alias to make 3D models in the first idea presentation. (In three design directions)

Table 3.23: How to Satisfy the Client

Company	How to satisfy client	Priority		
		1	2	3
Center	<ul style="list-style-type: none"> <li>● To offer a total service for client, from idea to model.</li> <li>● Design quality includes 2D rendering, PU soft model, 3D computer modelling.</li> <li>● 3D computer rendering always attracts the clients.</li> </ul>	Service	Timing	Design Quality
Conser	<ul style="list-style-type: none"> <li>● If client cannot read 3-view orthographic project drawing, the design approach will [be to add] the soft model, but reading drawings is important skill for clients.</li> </ul>	Design Quality	Timing	Service Charge
I+U	<ul style="list-style-type: none"> <li>● Clients can understand design results, such as product style, product and cost.</li> <li>● Designer needs to insist on the design. insisting on a good design means not being modified by clients)</li> </ul>	Recognise design results	Design Insistence	Communication
JIK	<ul style="list-style-type: none"> <li>● Offer one design concept that meets client's needs and wants.</li> <li>● To use image scale to communicate to clients.</li> </ul>	Presentation Quality		
Moreal	<ul style="list-style-type: none"> <li>● To offer high quality 2D and 3D images for presentation.</li> <li>● According to client's needs propose a suitable design for clients.</li> <li>● To record the design meeting and check the client feedback time schedule.</li> </ul>	Presentation Quality		
Nova	<ul style="list-style-type: none"> <li>● To solve the client's problem.</li> <li>● In ID style, 100% of clients are satisfied because Nova uses Alias to make 3D models in first idea presentation.</li> </ul>	Presentation Quality	Timing	Response
Quinte	<ul style="list-style-type: none"> <li>● To offer detailed service for client, if client asked.</li> </ul>	Service	Response	
Sekond	<ul style="list-style-type: none"> <li>● Ask client to be involved in design process and direct communication. It could delay the project, but is useful for satisfying the clients.</li> </ul>	Co-design	Communication	
Sumwell	<ul style="list-style-type: none"> <li>● To offer high quality 2D and 3D images for presentation.</li> </ul>	Design Quality	Total Service	
Wen's	<ul style="list-style-type: none"> <li>● To use sketch for communicating with client</li> </ul>	Sketch		

### 3.2.5 Design Quality

To control design quality, 80% of PL (Project Leaders) or team leaders control design results. 50% of PL's use oral control and 20% both oral and photo, and 20% use team discussion. (See Table 3.24)

- To utilise team meeting devoted to the idea concept.
- To ask designer to attend client meeting to understand the client's wish.
- The design quality through the team discussion.
- The project leader will highlight the style by photo and keep an eye on the design team to check the design result.
- To use the image board (Competitor product, product position, and life style) and design experience to achieve the client needs.
- PL plays the client's viewpoint to help the designer to achieve the client needs. The

team discussion is also important.

- According to the design strategy, check design quality.

Table 3.24: Design Quality

			Design Quality
Company	Who deals with design quality	How is it done	
Center	PL	Oral	<ul style="list-style-type: none"> <li>● To utilise team meeting devoted to the idea concept.</li> <li>● To ask designer to attend client meeting to understand the clients wish.</li> </ul>
Conser	PL/Team Leader	Team Discussion	<ul style="list-style-type: none"> <li>● The design quality through the team discussion.</li> <li>● The project leader will highlight the style by photo and keep an eye on design team to check the design result.</li> </ul>
I+U	PL	NA	<ul style="list-style-type: none"> <li>● The company culture, which is experience and design, discusses with the designer how it can be improved by him.</li> </ul>
JIK	Team Leader	Oral / Photo	<ul style="list-style-type: none"> <li>● The ID team leader and MD leader use oral control and photo to check design concept.</li> </ul>
Moreal	Team Leader	Oral / Photo	<ul style="list-style-type: none"> <li>● Team discussion, the team leader uses oral control and photo to check the design concept.</li> </ul>
Nova	PL	Oral	<ul style="list-style-type: none"> <li>● According to the design strategy, check design quality.</li> </ul>
Quinte	General Manager	Oral	<ul style="list-style-type: none"> <li>● To use the image board (Competitor product, product position, and life style) and design experience to achieve the client needs.</li> </ul>
Sekond	General Manager	Oral	<ul style="list-style-type: none"> <li>● To modify orally the design direction.</li> </ul>
Sumwell	PL	Team Discussion	<ul style="list-style-type: none"> <li>● PL plays the client's viewpoint to help the designer to achieve the client needs. The team discussion is also important.</li> </ul>
Wen's	PL	Oral	<ul style="list-style-type: none"> <li>● To modify orally the design direction.</li> </ul>

### 3.2.6 Idea Presentation Approach

90% of PL's deal with the idea presentation approach and use image boards to identify client's requirement. I+U do not use PL's to handle design concepts because designers are trained well. (Table 3.25)

Table 3.25: Idea Presentation Approach

			Idea Presentation Approach
Company	Who deals with design approach	How is it done	
Center	PL	Image Board	<ul style="list-style-type: none"> <li>● To offer three concepts to client.</li> </ul>
Conser	PL		<ul style="list-style-type: none"> <li>● To understand client preference.</li> <li>● To pick up six to seven idea concepts from defined scope.</li> </ul>
I+U	NA	NA	<ul style="list-style-type: none"> <li>● PL does not offer any ideas, because designer already has a good training.</li> <li>● Some projects use devoted staff to chose the idea concepts.</li> </ul>
JIK	PL		<ul style="list-style-type: none"> <li>● PL lays out concepts from client's opinion.</li> </ul>
Moreal	PL	Sketch / Computer	<ul style="list-style-type: none"> <li>● To offer three concepts to client. One is similar to existing product, other two are more advanced design.</li> </ul>
Nova	PL	Image Scale	<ul style="list-style-type: none"> <li>● To offer three concepts to client.</li> <li>● To find out the semantic put into the axis of image scale.</li> </ul>
Quinte	PL	Image Board	<ul style="list-style-type: none"> <li>● From 15 to 45 ideas, 3 to 5 ideas are chosen..</li> <li>● To use sketch to modify the concepts.</li> </ul>
Sekond	PL		<ul style="list-style-type: none"> <li>● To offer five concepts to client.</li> </ul>
Sumwell	PL		<ul style="list-style-type: none"> <li>● Firstly, total new concept, secondly, higher existing product, thirdly, similar existing product.</li> </ul>
Wen's	PL		<ul style="list-style-type: none"> <li>● Firstly, similar existing product, secondly, five years advanced design concept, thirdly, total new design concept.</li> </ul>

- To offer three concepts from defined scope to client. One is similar to existing product, other two are more advanced in design.
- To understand client preference.
- Some projects use devoted staff to chose the idea concepts.
- PL lays out concepts from client's opinion.
- To use sketch to modify the concepts.

### 3.2.7 Design Sense

90% of design consultants argue that design sense for decision-makers is important. 50% of design consultants argue that engineering skill for decision-makers is important. 30% of design consultants argue that engineering skill for decision-makers is not very important. An attribute of design sense is first priority: 70% is marketing ability, 20% is style and 10% for design trend. (Table 3.26)

Table 3.26: Design Sense

Company	Design Sense for Decision-maker	Engineering Skill	Design Sense	Attribute of Design Sense		
				1	2	3
Center	Important	Not very important	<ul style="list-style-type: none"> <li>Client needs to know what is good design sense.</li> </ul>	Marketing information	User culture	colour
Conser	Important		<ul style="list-style-type: none"> <li>Design sense makes an impact on the design process, and quality of clients' decision</li> <li>Many clients, through international viewpoint and attendance at exhibitions, enhance their design sense.</li> </ul>	Marketing Ability	Design Trend	Ergonomic colour
I+U	Important but not first priority	Not necessary	<ul style="list-style-type: none"> <li>Some clients have long term NPD experience, or design background, or have been employed as a designer, thus they have a good design sense.</li> <li>Design sense is based on respect oreach other.</li> </ul>	Marketing (product position)	Company culture	Aesthetic ability
JIK		Very important	<ul style="list-style-type: none"> <li>The key decision-maker needs to understand the ID design process.</li> <li>Designer needs to inform clients of design trend.</li> <li>From an educational background to check the engineering skill.</li> </ul>	Marketing	Style	Cost
Moreal	Important	Very important	<ul style="list-style-type: none"> <li>The product and manufacturing knowledge is anj engineering skill.</li> <li>If the client has good design sense, then they will contribute more than usual.</li> <li>Having design sense is useful for design process.</li> <li>No design sense leads to bad communication</li> </ul>	Marketing	Design Trend	Culture
Nova	Important	Very important	<ul style="list-style-type: none"> <li>Very strong confidence if possesses design sense.</li> <li>Nova does not like clients to have good design sense.</li> <li>Engineering skill includes reading 2D drawings and plastic technology.</li> </ul>	Style	Marketing Ability	Design Trend
Quinte	Important	Not necessary	<ul style="list-style-type: none"> <li>If client has no engineering skill, Quinte will offer the PU soft model.</li> <li>The clients do not need to have aesthetic ability, but need to understand the future product's appearance..</li> </ul>	Marketing (User, product position)	User culture	Colour
Sekond	Important		<ul style="list-style-type: none"> <li>The client has design sense, therefore they like to criticise the design</li> </ul>	Marketing (User, product position)	Product Ability	
Sumwell	Important	Necessary	<ul style="list-style-type: none"> <li></li> </ul>	Shape	Marketing	Ergonomic colour
Wen's	Important	Necessary	<ul style="list-style-type: none"> <li>No design sense, client will respect designer</li> <li>Possess design sense, then they will contribute more.</li> <li>No engineering skill, Wen's will offer PU model.</li> </ul>	Design Trend	Manufacture Knowledge	Aesthetic Ability

### Contents of Design Sense:

- Client needs to know what is good design sense.
  - Design sense makes an impact on the design process, and quality of clients' decision.
  - Some clients have long term NPD experience, or design background, or have been employed as a designer, thus they have a good design sense.
  - The key decision-maker needs to understand the ID design process.
  - Designer needs to inform clients of design trend.
  - If client has good design sense, they will contribute more. Moreal and Nova Design do not like clients to have good design sense.
  - Having design sense is useful for design process.
  - No design sense leads to bad communication.
  - Very strong confidence if possesses design sense.
  - The client has design sense, therefore they like to criticise the design.
  - No design sense, client will respect designer
- 
- Engineering skill includes reading 2D drawings and plastic technology.
  - From an educational background, to check the engineering skill.
  - If client has no engineering skill, Quinte Design will offer the PU soft model.

### 3.2.8 Design Trend

Attribute of design trend first priority: 70% competition maps, benchmarking and cost. Second priority, 40% style and colour, 30% semantic and material. Third priority, 50% benchmarking. (See Table 3.27)

The contents of design trend shows as follows:

- For vehicle, or fashion, design concept comes from design consultant or bigger Brand Company's concept.
- Marketing is design trend, product trend and technology trend.
- Without design trend, product can easily fail in marketing.

- 80% of clients use me-too method
- If client has design trend knowledge, they have good design communication tools.
- Many clients attend exhibitions, thus they have good design trend ability
- Suggest clients read magazines to understand design trend.

Table 3.27: Design Trend

Company	Design trend	Attribute of Design trend		
		1	2	3
Center	<ul style="list-style-type: none"> <li>● For vehicle, or fashion, design concept comes from design consultant or bigger brand company's concept.</li> </ul>	Design Position Competitor	Semantic	Benchmarking
Conser	<ul style="list-style-type: none"> <li>● To use simple language to explain the design trend.</li> </ul>	Competition Maps, Product Position	Style, Colour	
I+U	<ul style="list-style-type: none"> <li>● Marketing is design trend, product trend and technology trend.</li> </ul>			
JIK	<ul style="list-style-type: none"> <li>● Marketing data is one of the design trends.</li> <li>● 80% clients use me-too method</li> </ul>	Competition Maps, Product Position	Style, Colour	Benchmarking
Moreal	<ul style="list-style-type: none"> <li>● Without design trend, product can easily fail the market.</li> <li>● Computer products have strong main stream.</li> </ul>	Competition Maps, Product Position	Style, Colour	Benchmarking
Nova	<ul style="list-style-type: none"> <li>● If client has design trend knowledge, they have good design communication tools.</li> </ul>	Benchmarking		
Quinte	<ul style="list-style-type: none"> <li>●</li> </ul>	Design Position Competition Maps	Semantic	
Sekond	<ul style="list-style-type: none"> <li>● Many clients attend exhibitions, thus they have good design trend ability</li> </ul>	Cost	Material	Benchmarking
Sumwell	<ul style="list-style-type: none"> <li>● Suggest clients read magazines to understand design trend.</li> </ul>	Competition Maps	Semantic	
Wen's	<ul style="list-style-type: none"> <li>● Design trend is world trend.</li> </ul>	Competition Maps, Product Position	Style, Colour	Benchmarking

### 3.2.9 Dissatisfaction with Design Concept

80% of design consultants try doing another presentation and 20% switch to the next design stage. (Table 3.28)

The contents of satisfied clients:

- To discuss with client what is dissatisfying them. Clients need to offer their reasons. Many clients do not know the reason.
- To offer broader idea concepts.
- Designer self-criticism.
- Design direction is wrong, need re-communication.

Table 3.28: When Client is Dissatisfied

Company	Presentation	When client is dissatisfied	
			How to correct
Center	Switch to next stage	●	To discuss with client what is dissatisfying them.
Conser	Try to do another presentation	●	Client needs to offer reason for being dissatisfied.
I+U	Try to do another presentation	●	To offer broaderidea concepts.
JIK	Try to do another presentation	●	Designer will offer self criticism
Moreal	Try to do another presentation	●	Client needs to offer reason for being dissatisfied.
Nova	Switch to next stage	●	To discuss with client what is dissatisfying them.
Quinte	Try to do another presentation	●	Client needs to offer reason for being dissatisfied. ● Many clients do not know the reason.
Sekond	Try to do another presentation	●	To offer broader idea concepts.
Sumwell	Try to do another presentation	●	Design direction is wrong, needs re-communication. ● Design direction is correct but needs modifying.
Wen's	Try to do another presentation	●	To offer broader idea concepts.

### 3.2.10 How NPD Members Evaluate the Concept

There are three ways to evaluate the design concept. Firstly, discussion (100%). Secondly, devoted (100%). Thirdly, one key decision (40%). During idea presentation, there are three types of NPD members. Firstly, those who criticise, secondly, those who follow, and thirdly, those who listen, such as engineering, who do not like design concepts, and have no design sense, and no power.

NPD Members: 100% of design consultants state that the R& D manager, marketing manager and key decision-maker are involved as NPD members. (Table 3.29)

Table 3.29: How NPD Members Evaluate the Concept

Company	Who are involved as NPD Members					How NPD Members Evaluate Concepts			Response During Presentation		
	R& D Manager	Marketing Manager	Product Manager	Key decision-maker	EE, MD	Discussion	Devoted	One Key Decision	Criticise	Following	Listen
Center	*	*		*		*	*		*		Engineering
Conser	*	*		*		*	*	*	*		
I+U	*	*		*		*	*				
JIK	*	*		*		*	*	*	*		*
Moreal	*	*		*		*	*	*	*		* Not like idea
Nova	*	*		*	*	*	*		*		* No sense
Quinte	*	*		*		*	*		*		* No power
Sekond	*	*		*		*	*		*		*
Sumwell	*	*		*		*	*	*			
Wen's	*	*		*							



## **Chapter 4 Design Communication**

There are a lot of buyers coming from all over the world who want to sort out Taiwan's best competitive products because Taiwan has excellent manufacturing and redesign ability. This means that, upon the basis of the technology of the developed countries, Taiwan is able to produce and sell much cheaper products in the global market. However, most of the buyers who want to place an order with Taiwan's companies desire that the products should be produced as soon as possible. During the limited time schedule, a rapid product development, therefore, is badly needed.

In this chapter, there is focus on both design brief and visual communication skill. Firstly, in the early stage of product development, it is very important to get the key messages for the design brief, because an explicit design brief is the very thing that a successful product development cannot do without. Secondly, in the computer age, so many traditional tools and illustration drawings have been replaced by computer software. In the Industrial Design area, especially, drawings are used to communicate between the client, colleague, and design leader to transmit the designer's ideas. However high quality output drawing produced by 3 D modelling software will probably change the communication process. But in some design cases, 2D computer rendering is still needed for design communication between design leader and his clients.

### **4.1 Design Brief**

When the clients and designers get together, they need to communicate with each other. These messages are fundamental; some of which ought to be informed to the designer by the client and some of which designers might need to ask of the buyer. Among this data, some of it is useful while other details may be of no use. In the early phase of a product development project, a design brief model can help work out the communication process. The client, therefore, should express his or her idea to the designer, and the designer can capture critical information such as the expectation or special requirement from the client. If both the client and the designer can fully

communicate with each other through the design brief, design projects can be easily defined in the very initial stage of development procedures. By doing this, both the client and the designer can trust each other, which will upgrade the degree of satisfaction of both the client and the designer.

A proper format for design brief will help the designer quickly understand what the client wants. Hence, it is very important that the designer can collect the critical information upon which the design proposal can be offered at the early design stages. Otherwise, designers might misunderstand the client's needs and the design proposal could go wrong.

In the following sections, emphasis was placed on the key elements of the design brief. A framework of design brief model was proposed. The types of failures in the design brief and the elements that need to be decoded were discussed.

#### **4.1.1 Vertical Design Communication Interface**

Shannon 1949 stated that the model of communication process in management is composed of six parts: (1) Communication source, (2) Encoding, (3) Message, (4) Channel; (5) Decoding, and (6) Communication receiver. Differently put, a concise model of communication should include the following four parts: (1) sender; (2) message/media; (3) feedback, and (4) receiver. From these two models, the communication direction can be divided into two ways: (1) Vertical communication, downward and upward, and (2) Horizontal communication. The messages in the communication model can include texts, tables, specific design drawings, and photographs, and the output documents can be made of paper, drawings, photographs, and digital data. In this chapter, the authors concentrated only in the upward and downward design communication, that is, communication between client, design leader and designer. To sum up the above, in design brief process, the client is a sender, the design leader is a receiver and sender, and the designer is a receiver. But in the idea presentation phase, the process is in reverse. The important role is the design leader, who needs to act as both encoder and decoder. During the design communication, the design leader is the key person in getting the right product to market and also to satisfy

the client requirement. The horizontal communication, which is the communication between design team members who share design experience or suggestions, will be discussed in the styling planning chapter.

#### **4.1.2 Communication Interface**

Both an in-house designer and a design consultant cares more about the design schedule, but the design consultant usually charges for design service by the hour. Hence, it is important that a concise and accurate design brief be prepared so that the project leader or chief designer can present a proposal for the target product. Beckman 1993 noted that there are five major functions of high-tech electronics industrial companies in the viewpoint of design management. They are: (1) Strategic alignment; (2) Customer and user needs assessment; (3) Competitive analysis; (4) Analysis of regulatory issues, and (5) Technology assessment. These key elements are based upon marketing, technology research and regulatory standards. One thing worthy of being mentioned is that they belong to the upper level of design management. On the contrary, the design communication between the design leader (Design manager or chief designer) and team member will be defined as another sort of communication of the lower level. Cooper 1995 argued that there are four foundations in team organisation for the new product development, which include: (1) Understanding: other members' function in the team, but not only the individual designer's own role; (2) Awareness: each member needs to be aware of and responsible for a certain thing; (3) Communication: there should be good communication in the frequency and content between any two functions, and (4) Commitment: each member must bear respect and understanding to other team workers. Although most senior and junior designers' working experience is less than that of the design leader, they should be given the same charge. That is to say, each team member should be highly aware of the design leader so that they can communicate with each other and with the client. By doing so, the initial design concept time schedule will be reasonably shortened.

#### **4.1.3 Design Brief Model**

It is important that the design brief be used for one of the design management strategies because if the communication process can be controlled, then the design brief message

can also be decoded. It goes without saying that a design brief will proceed through many cycles during the product development process. For example, it should fit in after the product idea development, product planning, and feasibility study processes. A design may be produced by the buyer or by the design department, or even by other design consultants. The point is that a design brief should be explicit so that it can clearly present the product information. At the first stage in the design brief model, the client will communicate with the design leader; at the same time, the design leader will receive the message of the design brief orally or by a formal document from the client. In some other cases, it may be proposed by the design leader during a presentation meeting. After the meeting, the design leader needs to organise the message and revise the design brief for a new version for the client. Because the design brief needs to be approved by the client, a place for signature is necessary. As has been mentioned earlier, the design brief will be adjusted several times by the client; therefore, the project leader should renew the content and inform the designer of the updated items of the new version whenever there is a change. More importantly, the design leader should double check the design brief in every presentation of the design team, in that it is often the case that designers will forget the part of the design brief that has been already changed.

At the next stage of the model, the design leader needs to decode the brief message into common design language, such as easy to use, a message involving ergonomics research. By doing so, the decoded message will, and should point out the direction of the design project. The format of a decoded design brief can be of paper documents, photographs, or verbal descriptions. If the designer still has questions about the design brief, he or she can ask the design leader or confirm their views by direct talk to the client.

To make most of the design brief during practical design practice, the design leader should employ the design brief as the benchmark for the assessment of the quality of the design outcome. Furthermore, designers of the design team can share each other's style of designing activity so as to build up a company's design strategy. The design brief in the design communication model shows as follows in Figure 4.1.

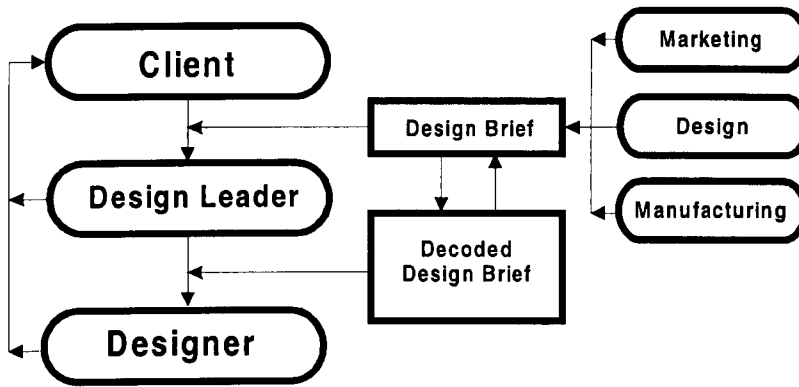


Figure 4.1: The Design Brief in the Design Communication Model

#### 4.1.4 Types of Failures in Design Brief

In most cases, the design brief is often very short and it is hard to explicitly express the concept of a product design at the early stage of design process. This is part of the reason that there are so many design projects going astray after the design leader has the first meeting with the client. Constable 1996 explained that the phenomenon is due to three possible reasons. First of all, the designer may misunderstand the requirement from the design brief. Secondly, the leader, due to some particular reason, may give a wrong instruction. Finally, it may be due to the fact that the design solution fails to meet what the client or the design leader has within his or her own mind.

In this chapter, it is hypothesised that the design proposal is correct; thus if the design output is not right, the main fault goes to the bad communication between the client, the design leader (Design manager, chief designer), and designers. For example, it may happen when the junior, who lacks design experience, misunderstands what is on the design leader's mind. Namely, there is a recognition gap between the design team members. In these circumstances, the senior designer should give a hand to the junior designer. The design leader, on the other hand, should pay attention to the design process all the time to ensure that the design project is on the right track. Therefore, the project leader needs to decode the initial brief message for the downward communication.

#### **4.1.5 Decoded Messages**

The client will always use many professional and sensitive words to describe the target market in the context of a design brief, such as the user's life style, the end user or customer's characteristics. The design leader may receive only the key words from the client. Some of them may be hi-tech, professional, retro-trend, and new naturalism. The design brief is supposed to possess the key concept of the design proposal, so that the message from the client might cover a wider boundary. Moreover, because the client does not desire to place too many limitations upon the design, it may be very ambiguous so that it will not prevent other potential feasible design ideas. From the viewpoint of the design leader, however, the designer needs to work out as many design details as possible from the product concept message right after the first meeting. Consequently, several messages are indispensable and should be covered in the design brief:

- Professional and sensitive adjective words to describe the target market.
- Product trend, styling approach, product appearance, texture, colour, etc.
- Product position in future marketing, benchmarking products.
- Company's Corporate Identity System (CIS) and Product Identity (PI).
- Interface design, ergonomics.

#### **4.1.6 New Context in Design Brief**

In this research, most design projects belong to what is called the me-too products. The product interface, features, product specifications, and styling reference are already in the market place. This means that there are a lot of redesigning and re-styling projects with the design consultant in Taiwan. The marketing information and product design trends, therefore, are very important. Baxter 1996 noted that the styling planning contexts are styling context, product symbolisation, and product semantics. For the redesigning and re-styling cases, some properties should be covered in the existing design brief context. In chapter 3, investigation phase, marketing information is first priority, new context of brief is focused on user's life style, marketing position and adjective words for future concept. Others, such as styling planning context, needs to make a clear check list for client to comprehend his products. The context of a new design brief is as follows in Table 4.1.

Table 4.1: The New Context of A Design Brief

	Marketing	Design	Manufacturing
User/Buyer (Customer)	Life Style	User Position	
Product	Benchmarking Products	Adjective Word CIS/PI, Product Position Styling Approach	
Quality			
Standard/Legislation			
Cost			
Time Scale			

From the action research case studies, it is suggested that design leaders at the design consultant in Taiwan should understand the following issues. The first thing to pay attention to is the background research of the client's company, including the company policy, product strategy, and product lines. The background of the people who will make the decisions for the design proposal need to be further investigated. Their educational background, for example, their expertise may be related to design, engineering, or economics. From their backgrounds, the design leader will have a better understanding of the language they use in the design brief. Last but not least, the study of the product's life style, the life pattern and the consuming habits of the end user, the environment they live in, and the leisure trend they have cannot be overemphasised.

#### 4.2 Visual Communication

Utilising the best communication interface during the design process between the client, product leader and designers is vital for producing the “right” product. Although presentation drawing is one of the key communication tools, and it can represent all ideas that include the concept, styling, production, colour scheme, designers can use it to present the “right message” for presentation drawing. In the computer age, so many traditional tools and illustration drawings have been replaced by computer software, especially, in the Industrial Design area. Drawings are used to communicate between the client, colleague, and project leader to transmit the designer’s ideas. But the idea generation process does not change, the hand drawn idea sketch is still used. However, high quality output drawing produced by 3 D modelling software will probably change the communication process and the way of visual communication media.

### **4.2.1 Concept Design Process**

The concept development is called front-end process. Ulrich 1995 noted that Industrial Design process is: (1) Investigation of customer needs; (2) Conceptualisation; (3) Preliminary refinement; (4) Further refinement; (5) Control drawings, and (6) Co-ordination with engineering, manufacturing and vendors. In every design stage, the designer uses a sketch drawing and model to communicate with the clients. The design leader's mission is to understand the language for the marketing and manufacturing people for a client, and then transmit the data to the design team. The designers need to listen carefully to the design leader, as they have no contact with the client. At this stage, the leader needs to decode data, which includes company culture to policy, product planning, product strategy, etc. The design leader needs to translate the client's wants and needs into a design language, that is, a word or a drawing. Therefore, the design leader needs to be very attentive and give clear communication between both the client and the designer working for him.

During the conceptualisation, the Industrial Design Drawing is an idea sketch, and rough sketch. These sketches are a fast and inexpensive medium for expressing ideas and evaluating possibilities. In the preliminary refinement phase, a soft model is used for Industrial Designers, engineers, marketing people and focus groups for feeling and holding. Therefore, in the further refinement and final selection phase, 2D or 3D rendering shows the detail of the further product. At the same time, the soft model is modified to a wood or plastic or dense foam for final selection. The next phase is a general arrangement drawing for the final concept.

### **4.2.2 Design Process in Taiwanese Environment**

The design process depends on time and cost. A general manager is always asking when new generation products will be born, or how many budgets can be saved. The reason is that the OEM/ODM buyer is not given much time to design and produce a new product. In addition, Taiwanese firms offer the best low cost, the short timetable, and guarantee quality for the buyer, because they need to survive in the global competition environment. This situation is very common in Taiwan, thus very often design leaders squeeze the product development process. The design consultancies also attempt to



shorten and speed up the development to reduce charges to clients. Many projects are only redesigning with maybe the same functions but different appearance, or changing little functions and also needing a new appearance, or an existing product that needs to replace the inside of an old design with new technology.

Total new-to-the-world products are seldom designed by Taiwanese firms, so that during the product design process when a product is new or established, it is unnecessary for these products to go through every design process.

Hannon 1995 noted that drawing is an essential tool in the design process, because it records the visual thinking and creativity and it is also the fastest way to present a concept idea. During the early concept development, drawing is an enormously powerful tool for innovation and for evolution of ideas. In this stage, drawing also is a means of communication, a language. During the presentation, visual objects allow both designer and client to participate. The oral presentation assists in describing any unclear parts. The oral part of the presentation is still important, but visual objects are more significant, because all concept ideas on paper, photo, computer screen images, which are provided, other people can participate in. Tovey 1986 argued that the design drawing has three principle functions: (1) To facilitate the design process; (2) To externalise the process and thus to allow others to participate in it. (Such as other designers, project leader, or client), and (3) To communicate the completed design proposal to others (such as client, marketing manager, and engineers). To summarise the above, drawing is an important tool for communication between designers, clients and other designers.

There are four major types of process in Taiwanese consultants. Shown as follows in Table 4.2. The data has come from the investigation phase, chapter three.

Table 4.2: Types of Design Approach

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	Standard A	*	*	(A4, A3)	3 pieces hand-made 2D rendering/AutoCAD 2D CorelDraw, PhotoShop	3 pieces (PU, EK foam)	1 pieces (Pro. E., Ideas, Alias, Sold Work)	*	*
2	Standard B	*	*	(A4, A3)			1 pieces (Pro. E., Ideas, Alias, Sold Work)	*	*
3	Economic/ Time-limited	*	*	(A4, A3)	3 pieces hand-made 2D rendering/AutoCAD 2D CorelDraw, PhotoShop			*	*
4	Reverse Engineering	*	*			3 pieces (PU, Clay, EK foam, Plastic model)		*	*

Source from: Chapter three – investigation phase

There are many design approaches in Taiwanese design consultants. Each approach has many different design results such as, idea sketch, 2D (Orthographic projection, Perspective) rendering by hand, 2D computer (CorelDraw, PhotoShop) rendering, 3D computer rendering and Soft Model (PU, EK foam) and Mock Up Model. During the design process, each design stage has a relationship. Between each design stage, the different viewpoint from client and designer needs to be focused. Bruce & Docherty 1993 noted that a long-term client and designer relationship uses a common language. When the clients' decision-maker can speak design language, they will have a similar design viewpoint and a problem of misunderstanding might not happen very often. One language is to read 2D visual communication drawing, which will be discussed in the following section.

#### 4.2.3 2D Visual Communication

In the investigation phase chapter, 2D rendering by hand and 2D computer rendering is still useful in design process. Even the 3D-computer image is increasingly important, but due to both the design schedule and design service charge, it is limited, Those two design stages are still very important for the design consultant. Table 4.3 uses a matrix to review all the types of visual tools for design communication. The \*\*\* represent a very strong relationship, \*\* a strong relationship and \* a weak relationship. The idea sketch has a very strong relationship with 2D rendering, 2D computer rendering and 3D computer rendering, this means, most clients are surprised that the final mock up is

different to the rendering or sketch. Many debates come from different types of paper drawing images, such as, idea sketch/2D rendering, idea sketch/2D computer rendering and idea sketch/3D computer rendering. There are many clients who cannot speak the design language, and then misunderstandings happen.

Table 4.3: The Relationship between Design Stages.

	Idea sketch	2D rendering	2D computer rendering	3D computer rendering	Soft model	Mock up model
Idea sketch		***	***	***	*	*
2D rendering				***	***	**
2D computer rendering				**	***	***
3D computer rendering					***	***
Soft model						**
Mock up model						

\*\*\* Very strong    \*\* strong    \* weak

Tovey 1986 has listed the purpose of 2D visual communication as being: (1) Diagrammatic drawing - abstract schematic; (2) Representational drawing - idea sketch, concept drawing; (3) Measured drawing - general arrangement, part drawing. The author has found the following visual problems in action research cases: (1) Although the hand drawing has a personal touch like an artist’s drawing, in some projects, showing the drawing gives a too strong impression that leads to the client misunderstanding the product’s appearance; (2) The clients cannot rebuild three 2D views from a rough sketch or rendering to a 3D image. The reason is many clients do not have an engineering background, so they find it difficult to imagine 3D images from three 2D drawings, and (3) A gap between the idea sketch and three 2D views rough sketch.

#### 4.2.4 CAID Design and New Approach

The 3D modelling package software can provide (1) 3D/2D-wire frame computer model; (2) 3D/2D orthographic projection rendering image, and (3) Rapid prototype file. The 2D visual, only abstract schematic and idea sketch can not instead of by the 3D

modelling package software. Comparing the working hours, to build the computer 3D model will take longer than the 2D orthographic projection rendering by 2D software such as PhotoShop, Corel Draw. Some products use 3D software rather than 2D software, but some products utilise 2D software more easily than 3D software. However, employing 3D computer images for design communication is like a real product. In design process, the 3D-computer model is the new design approach, but many kinds of drawing still have a critical design position. The model of design approach is shown as follows in Table 4.4.

Table 4.4: The Model of Design Approach

Design Stages	Design Contents	Design Performance & Results	
		Design Consultant / Design manager internal performance and prepare presentation	Presentation for Client
Prepare	Design proposal	To understand: *Client background *Decision-maker design sense, experience *Decision-maker alternate to rework conditions *New product design. redesign, re-styling	*Design pre-brief: by document, verbal Decisions interpreting the trigger launching support.
Pre-design		*Design brief	*Design brief
	Product planning & investigation Product Analyse	*Product planning *Styling planning	Present product planning and styling planning
	Product Definition	*Modify design brief	*Final design brief
Concept Generation	Idea generation: *Recording sketch *Development sketch *Refine sketch *Presentation sketch	*Idea sketch	*Present 3D perspective idea sketch: for making sure of the direction of design
Design Development	*Idea development *Clarify concept *Prediction idea scope *Scale proportion concept	*2D or 3D sketch: develop and modify *Rapid soft model: for checking interface *Prediction method: design scope *3D hand drawing perspective rough sketch *2D computer outline drawing: checked *2D hand drawing/ 2D computer drawing	*3D hand drawing perspective rough sketch *2D computer outline drawing: checked *2D hand drawing/ 2D computer drawing
	Client check concept	*2D hand drawing rendering/ 2D computer rendering/ 3D computer rendering *2D computer outline drawing: modify	*Present 2D hand or computer drawing *Present 2D computer outline drawing/2D hand drawing rendering/ 2D computer rendering/ 3D computer rendering *2D computer outline drawing: modify
	Client approved concept	*2D hand drawing rendering/ 2D computer rendering/ 3D computer model (visualise ) *3D soft model: EK foam, PU, clay, form core, paper models. * 3D computer model: To make CAM mock	*2D hand drawing rendering/ 2D computer rendering/ 3D computer model image (visualise) *3D soft model: EK foam, PU, Clay model
Specification	Visualise, specification evaluation	*3D prototype *2D GA control drawing	*Present 3D prototype * hand out of 2D GA control drawing

The model design approach is for the design leader to propose a suitable design process and design results for his client (Top manager, key decision-maker). Due to this study

focusing on Industrial Design phase, which does not include engineering design, plastic structure design and other design tasks in the product design area, the output of design results are simpler, but the industrial design phase involves many unsure consumer appeal factors. In this area, between both designers and decision-makers, there is still a big gap, and it needs a design leader to manage and decide the activities.

As shown in the model of design approach, there are many kinds of visual communication drawings in every stage. Between different visual communication drawings, an engineering skill is needed to decode the idea concepts. In the following section, an experiment is attempted to prove the finding from action research case studies that training is necessary to recognise the difference between the idea sketch, 2D rendering, and 3D computer rendering.

### **4.3 Experiment**

To evaluate the design approaches used by Taiwanese design consultants in a controlled and standard environment. A concise experiment was carried out.

#### **4.3.1 Aim**

An effective design depends on effective communication (Walton 1995). The aim of this experiment is to review the communication of design information between the clients, design leader and designers. When using paper based illustrations and models, it is possible for clients to misunderstand drawings on paper because they are only in two dimensions during the design process.

#### **4.3.2 Objective**

To analyse the design practice during the conceptual phase, to propose the problem, to design and run the experiment, evaluating four approaches to the problem (Figure 4.2).

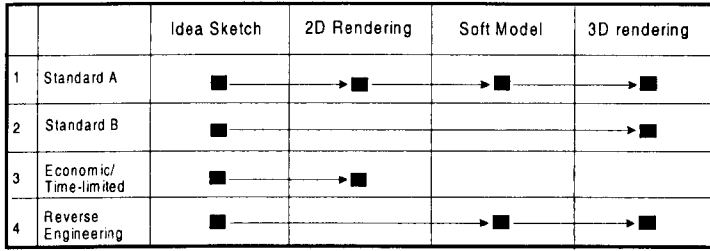


Figure 4.2: Four Design Visual Communication Approaches

### 4.3.3 Protocol

#### The Hypotheses

The hypotheses were formulated, as follows:

Hypothesis 1: The 2D rough sketch or rendering is difficult to rebuild as a 3D mental image.

Hypothesis 2: Between the 2D orthographic projection rough sketch or rendering and idea sketch, there is a recognition problem.

Hypothesis 3: 3D computer model images are easier to understand than an idea sketch or 2D rendering.

In order to investigate the best approach for presenting design information, a brief experiment was carried out using undergraduate design students. The proposal was to see which approach would convey the most information using drawings, photographs and models. A product model was shown to students who were required to mark a checklist showing which drawing represented the product model. Each student was presented with a set of photographs and a model, then answered ten questions, which were marked by a tester.

#### Subject and Procedures

There were 37 subjects (27 males, 10 females; average age 22.5 years old), 16 subjects were students at the Department of Industrial Design of Huaan University and 21 subjects were students at the department of Industrial Design of Taipei Technology University. (See Table 4.5)

Table 4.5: Subjects Information

Huafan University	Taipei Technology University
16 subjects	21 subjects
Total: 37 subjects (Male 27subjects and Female 10 subjects)	

Each student took an average of 7 minutes for the test. The Questionnaire and test material contained a 4”x 6” photo. The stage of research shows as follows in Table 4.6. The results were recorded by checklist. For detailed information, please see appendix-III and III-a.

Table 4.6: The Stage of Research

	Stage
Purpose	To explore visual drawing and how it affects communication
Time limited	No
Material	Questionnaire with 4”x 6” photo
Analytical tool	Expert analysis

### Experiment Result

Q6 is to choose a collected model from a 2D orthographic projection rendering. 62%, 23 samples are correct, and 38%, 14 samples are incorrect. These results do not support the proposition 1: the 2D rough sketch or rendering is difficult to rebuild as a 3D mental image. Because of the photo image, it is too simple to choose the correct answer. But, even 14% of the design students have made a mistake, this means that if clients have no engineering background, it will be more difficult to decide which design is the correct answer.

Q 4 is to choose a collected idea sketch from a three view 2D rendering. 32%, 12 samples are correct, but 68%, 25 samples are incorrect. These results support proposition 2: there is a recognition problem between the 2D orthographic projection rough sketch or rendering and the idea sketch.

Q1 is to choose a collected idea sketch from a 3D computer model image. 62%, 23 samples are correct, and 38%, 14 samples are incorrect. These results explain the

proposition 3: 3D computer-model images are easier to understand than an idea sketch or 2D rendering.

### **Experiment Discussion and Conclusion**

The experiment shows that there are many problems during the 2D orthographic projected rough sketch or rendering. The CAD tools seem that they can replace the rough sketch and rendered hand drawing to avoid the rebuilding of the 3D image process. Even design students still find it difficult to rebuild the 3D images, and many clients also find it difficult to speak design language. Hence, it is very important for the design leader to decide when, for whom, and where to use 2D orthographic project rendering. But in the rapid design process, time-limited and low design free, the 2D orthographic projection rough sketch or rendering is still existing in the design process. The client's engineering skill is very important during the decision processes.

### **4.4 Discussion and Recommendation**

It is evident that it will take the designer and the client quite a long period of time if there is much to be presented in a design brief. From the action research case studies, it was found that the sequence of the objects in a design brief is the most important thing to be considered. For different types of design service, different kinds of design briefs will be needed. Typical design projects are the new interface design cases, redesign projects, and re-styling projects. Marketing information, and adjective words are important in the design brief. From the experiment it shows that training is needed to read the 2D orthographic projected rough sketch. If the client wishes to participate in the design process effectively, an engineering skill is necessary to be able to read the 2D orthographic projected rough sketch.

Sometimes it may be a short project, which needs only a few modifications of the product design, which was not delineated in the research. The priority contexts of a design brief and the checklist of a design brief for different design services, need to be further investigated. Finally, it is suggested that the issue of how to decode the design brief message into the common design language has a lot to be desired.



## **Chapter 5 Styling Planning**

The marketing data is not only for making business decisions but also for producing a design strategy. If the design management level attempts to achieve the company policy and strategy, the details of styling planning are important tools giving form specific for right styling to the market. However, most young designers have good design skills, but lack precepts of the key styling meaning of high competition products. They can design excellent products but could be not for the market and also be difficult to match the company wishes and needs. But, in the other hand, a good experienced designer uses a back-box process to digest the market products data which is becoming a useful design reference of information from which the designer generates a suitable design result for the target users.

A successful product is the result of many factors. This chapter is based on the Industrial Design process used to explore the redesign of a product and what data is important and useful to the designer during the process. The redesign of projects is done by most companies and is repeated every year and is done to generate new world products, however it is not every company that specializes in this task. Some companies specialize in new technology research, but most companies are keen to utilize existing technology to produce universal merchandise for sale on the world market. Thus, most New Product Development (NPD) is to add or modify features, reposition the product within known market areas or target specific users. Therefore, re-styling of a product has become a critical part of the NPD process. The styling planning must support the re-styling task as it has become increasingly important.

### **5.1 Style Planning Specification**

Kotler 1996 mentioned that new products could include parts from an original product, improved product, refined product and new brand. The "me-too" product could be said to include all kinds of NPD products that copy the feature of a successful competitor's product. The "me-too" products need a different appearance and styling than the item they copy, for them to take over the market. Although, the product's features, price and

customer are the same as the benchmarking product, the styling becomes a critical subject.

The aim of product planning is to collect background information on the proposed product. In relation to product styling, this information will be used to construct a framework of design visual images. This means that the design manager will understand the clients' needs and will be able to propose future products that match those needs.

### 5.1.1 The Consequence of the Styling Planning

The information provided in the literature review on styling specification was summarized on Table 5.1. Teng 1994 noted that “the specific person (who may be the design manager) possessing knowledge of both design and marketing is able to play the three roles of design communicator namely (1), Liaison; (2), Transmitter, and (3), Coordinator.” The style planning between design leader, client and designer consists of, firstly, where to go (Design direction) which involves corporation strategy, product strategy and marketing trend, such as product position and user position, product metaphor etc. Design direction is combined with the company top level manager's viewpoint and consultation with the design leader's idea. Secondly, why should it be done (Product value) which includes product symbol, for example, life style, mood board, and theme board etc. Thirdly, how to do (Product semantic) which focuses on design trend such as competitor product and relative product semantic and topological data. The design leader needs to communicate to top level (client) and down level (designer), not only transmitting but also filtering the messages.

Table 5.1: The Level of Styling Planning

Aim	Style specification	Visual tools of management	Who deal with
1. Where to go (Design Direction)	Product , Corporation Strategy	<ul style="list-style-type: none"> <li>● Product Position Maps</li> <li>● User Position Maps</li> <li>● Metaphor Maps</li> </ul>	Client/ Design Leader
2. Why should it be done (Social Value)	Product Symbol	Image board : <ul style="list-style-type: none"> <li>● Life Style Board</li> <li>● Mood Board</li> <li>● Theme Board</li> </ul>	Design Leader /Designer
3. How to do (Product Semantic)	Design Trend	<ul style="list-style-type: none"> <li>● Competitor and Relative Product Semantic Maps</li> <li>● Topological</li> </ul>	Design Leader /Designer

Baxter 1995 argued that the styling specification is as follows:

- Researching the styling context.
- Exploring the product semantics and product symbolism.
- Collecting together a documented record of these planning activities and their conclusions and using these as the styling specification for the remainder of product development.

## 5.2 Styling Planning in Communication Approach

Bruce & cooper 1997 pointed out that: between designers and marketing there are two different worlds. From education, thinking style, behavior and culture, both designers and marketing need to establish a working partnership”. Thus, from the design consultant viewpoint, the company organization (or client) has a NPD team group that includes decisions-markers, marketing, R&D, and production department. Due to most projects being redesign or "me-too" products, many organizations (or clients) are keen on restyling. The design leader needs to understand the company structure, awareness and the communication carried out by the designer in order to manage the tools and control the design results.

Table 5.2: Design Leader Communication Approach

Aim	Communication Objects	Methods	The Types of Design Leader Tools for Communicating Designer		
			Oral	Documents	Images
<b>Business Level:</b> ● Product Predecessors ● Competing Products ● Design Strategy	Company Level	Corporation Identity System (CIS)	*	*	
		Product Identity (PI)	*	*	
	Designer Level	Product Position	*	*	
		User Position	*	*	
		Product Line (Typology)	*	*	
<b>Design level:</b> ● Product Symbolism ● Product Semantics ● Style Benchmarking	Designer Level	Life Style Board	*	*	
		Mood Board	*	*	
		Theme Board	*	*	
		Design Trend	*	*	*
		Style Benchmarking	*	*	*

\* Mark is represented the tools is used

According to action research case studies, the communication approach is shown on Table 5.2. It is common, at the beginning of a project for most design leaders to be in contact with the client obtaining oral data, documentation and company information on which to build future intangible product images. In general, most clients only have a brief idea of what they want, so that design leaders usually need to request more data from the client for designer reference. This may typically be, for example, items such as company corporation identity system, product identity, competing products, company strategy, and target users. After considering and analysing this data, it is often possible for the design manager to develop future product images. Therefore, the designer can by collecting and mapping related photos provide very useful image boards. At the same time, some of the metaphors may be quite blurred. Therefore, the design leader will try to make a more tangible visual image and may modify the image board which was made by the designer for the team members.

During the idea generation phase of the design process, the visual management tools are shared between the design leader wishes and designer wants. Bruce & Cooper 1997 noted from Roy and Potter's study that a successful project in design management includes:

- Clear project objective
- Comprehensive design briefs
- Regular communication with the designer
- Top-level commitment
- Sourcing of appropriate design skills
- Integration of the design with other corporate activities

The clear project objective is just like a team in computer software development, Joint Application Design (JAD), the researcher August 1991 mentioned that one of JAD disciplines was making the design tangible through “ Visual aids”. Many designers prefer sticking photos on a partition that include products, people, cars, cartoons and any thing they like. In the same way, the design leader can show the visual maps in the

workshop. Becker & Steele 1995 has same argument that in the design workplace: “Display thinking by making the daily activities of the organization more visible, communication among employees, and awareness of what is going on in the organization will naturally increase generating energy and interest throughout the firm.”

### **5.3 New Visual Maps Tool**

The design leader especially from a design consultant needs to establish the outstanding design characteristic and good reputation to increase higher competition in the design consultant market. Each design project is performance of the design leader’s personal design philosophy. The design leader also is a monitor that needs to do the quality control for each design project. Visual maps tools offer an opportunity for the design leader who needs to communicate to top level (client) and down level (designer), not only transmitting but also filtering the messages.

The detail of the visual maps tool for design management is shown as following (See Figure 5.1). The visual maps tool data is listed from the action research case studies, design projects from June 1995 to June 1998, and thirty-nine design projects. This figure is recorded in the evolution of the visual maps tools.

In Figure 5.1, the No. A and B figures, are created by the author as a new styling format file for describing the design direction. The cordless telephone project is the first design project utilizing the new generation styling format in June 1995 (As described in Section 5.4). The No. C figure is product semantic maps, the author creates a new format file for describing the design semantic. The timer project is the first project utilizing the new generation format in January 1997. (As described in Section 5.5)

The other four figures on the right side are idea position and idea strategy which are presented in chapter 6-concept approach.

# Styling Planning Evolution

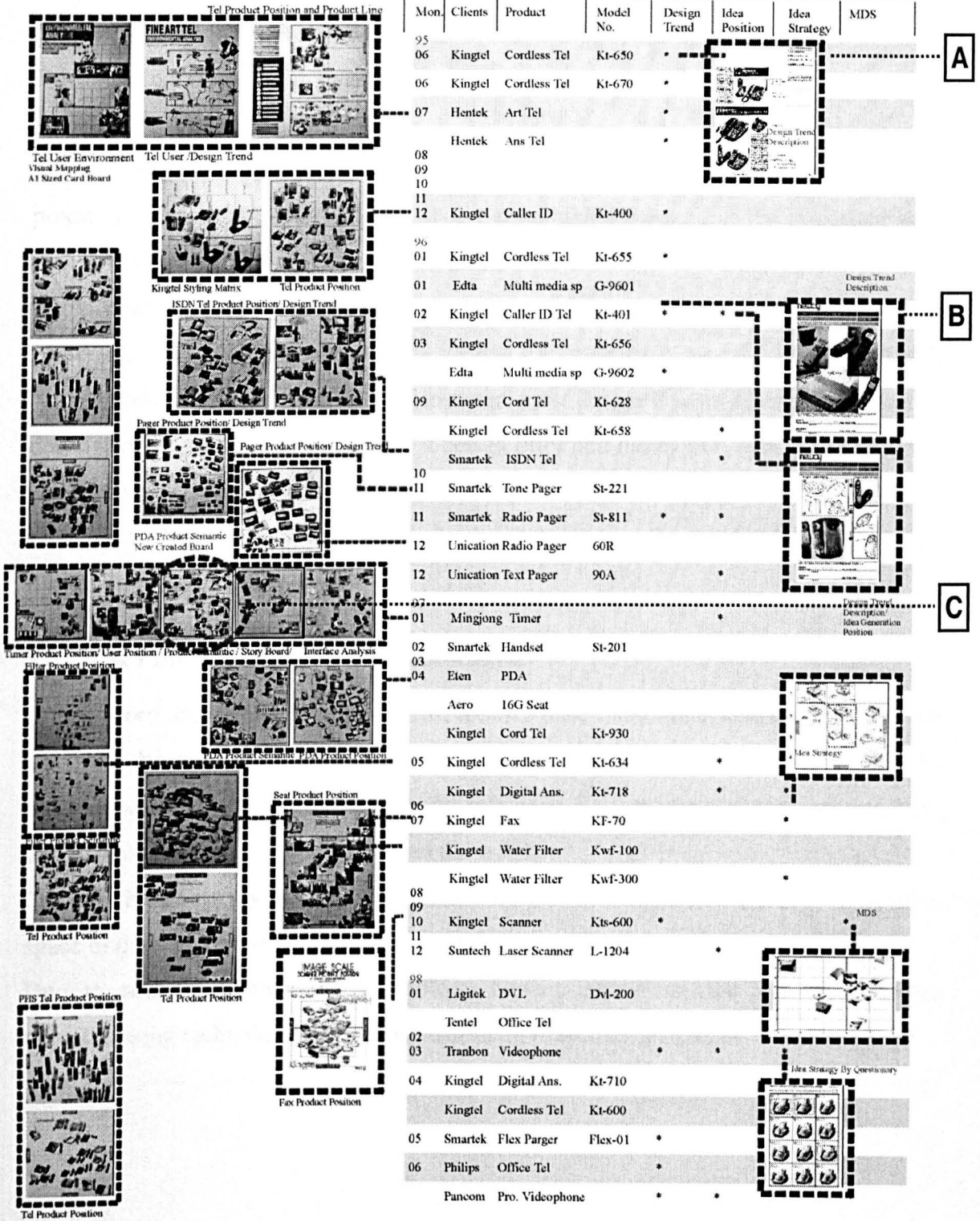


Figure 5.1: The Evolution of the Visual Tools

## **5.4 Design Trend - The Cordless Telephone Project**

The cordless telephone project is for the Kingtel company who wish to develop a series of new generation cordless telephones to take over the market leader position in the Taiwanese communication market, and also wish reposition in globe market.

The design brief of this project used “me-too” strategy, the same as others competitor products’ features and interface. This is a typical style project, thus the important work is that key benchmarking products are needed for defining. The same as before in the action research projects’ style planning process, the design leader utilizes the market position maps, related product maps, user’s life style map etc. to define the future concept orientation and style detail. However, most design leaders always given an oral description perceived from his client’s design brief and the market data to the designer, but some times this is not enough to describe the idea concept. Therefore, the design manager will prepare the relative product’s photo images or real product to show the design orientation and approach.

### **5.4.1 The Problem of Design Communication**

(1) A word and a sentence are a useful tool for describing the concept orientation, but designers have different cognitive means. Thus, designers could generate different results if without any image of photos for reference. So that, the photo images and hand drawing sketches are needed more than the words.

(2) The hardware lay out needs to utilize the hand drawing sketch to show the relative space or component positions.

Due to some manufacturing technology having impact on the style design, the manufacturing technology also needs addressing in the design format.

### 5.4.2 Defined Styling Format

There are two parts the define the future concept design. Firstly, collecting relative product’s photo images showing the design orientation and style detail approach. Secondly, the words describe the design brief in which are the attractive elements parts, style of curve, fillet radius, and material etc. (Show as Figure 5.2)

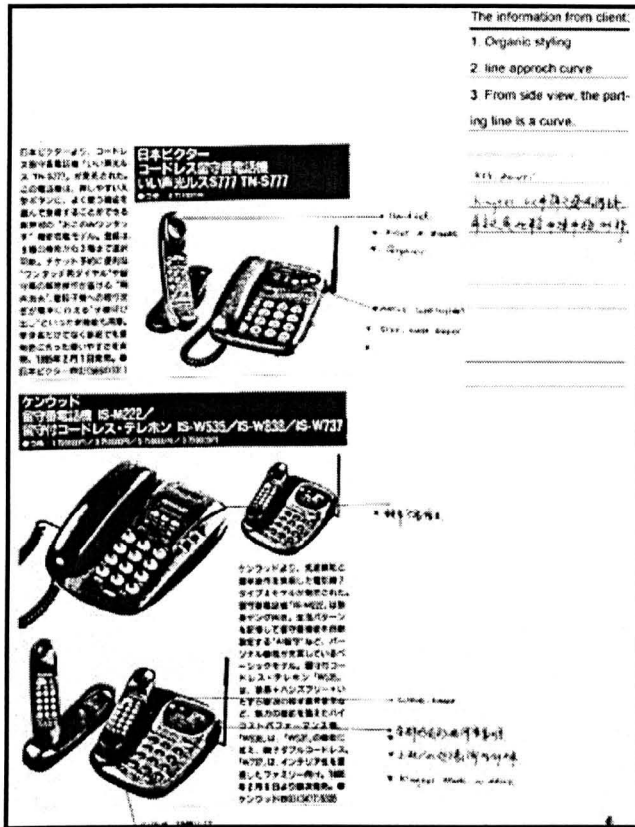


Figure 5.2: Defined Design Format

The design format is used for a vertical communication, to remind the designer how the future client’s concept will look. The design format needs handing out in internal meetings and at the same time, the design leader also needs to describe the detail of the format. After concept presentation, the design results also can use this format feed back to the designer.



### 5.4.3 The Evolution of the Styling Format

The new design format (Figure 5.3) is similar to the original one. The difference is use of colour photo that is collected by design leader or designer, but the design leader defines the design format. So far, the photos of the design format use a scanner and colour printer which print on paper or overhead projector (OHP). The paper design format is for designer reference, and the colour OHP for styling planning presentation that is presented to clients.

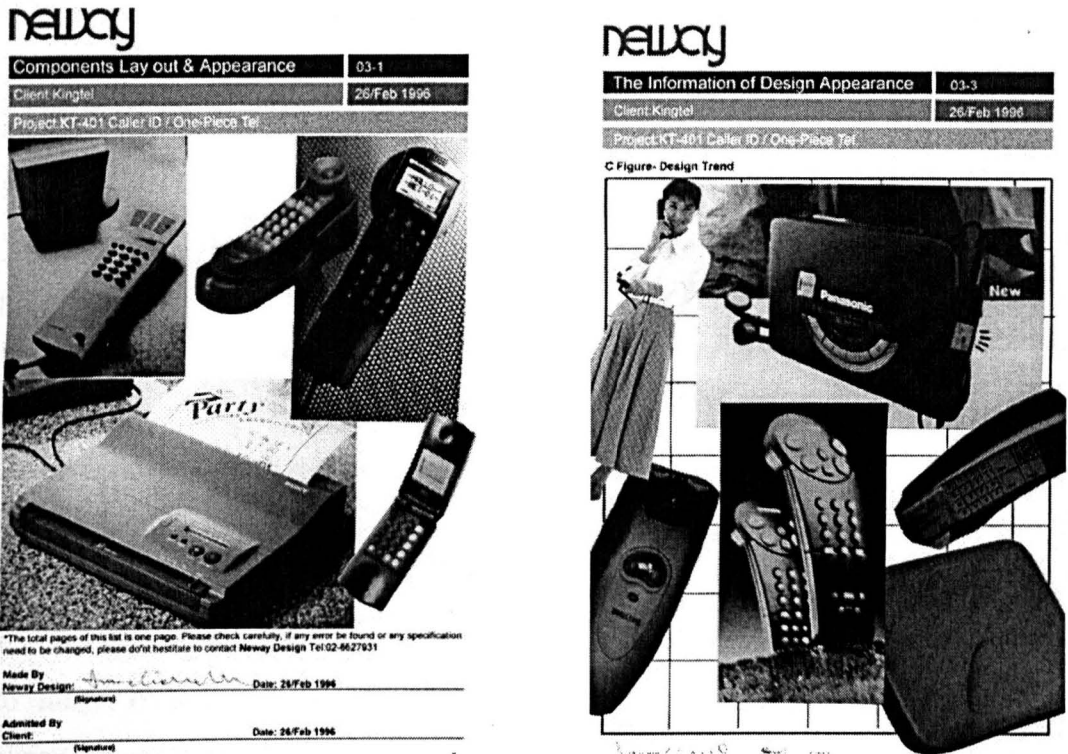


Figure 5.3: The New Colorful Design Format

The initial Design Format is the design leader's design experience which addresses the leader's view of the design project and detail of design. The design format lacks a rigid structure. The second stage of design format is similar with a meeting recorded after presentation. The client has a different NPD experience, thus, the design leader needs to decode the information which is the feed back from clients.

During the idea concept approach, design format was concluded:

- The design format is a lower level of design management tools, which is defined by

design leader's personal experience.

- The design format can help the designer define the style orientation and detail of design.
- Design process becomes effective because the designer understands the design leader is needs.
- Design manager needs to take time to prepare the design format.

## **5.5 Design Semantic Format - the Timer Project**

The timer project is for the Ming-jong company who wish to develop a series of new generation timers for the USA market.

The design brief of this project used “me-too” strategy in style but new mechanical design interface. This is a new product design project, thus the important work is that the key customer's needs a defined in planning the new product segmentation. The market position maps, related product maps, user's life style map etc. are used to define the future concept orientation and style detail. Baxter 1995 noted that elements of style planning, in which the product semantic is different are not yet proposed as a visual tool. However, most designers always use design magazines or design books to generate a design concept. Thus, the design manager could prepare the useful relative product's photo images by different semantics. This could influence designers thinking, therefore, the client's needs could be rapidly achieved.

### **5.5.1 Product Semantic Different Format**

The timer has five main parts that have a different function and different product semantic. (See the Figure 5.4) The center of the mapping is the timer housing, auto override, time dial, tripper and 2-prong outlet. The related products or similar product images link with different semantics. According to the semantic mapping, the designers can scan all the images and generate the idea concept that the design manager wishes. Thus, the generated idea concepts might be influenced by the design leader.

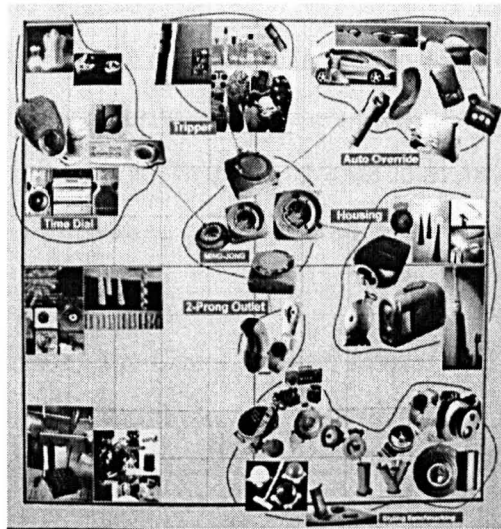


Figure 5.4: Timer Semantic Different Format

However, to employ semantic maps, the designer can easily understand the design manager's style approach but the design leader might take time to collect the useful images for designer reference. If the design leader is too busy the semantic maps could be changed to photos or adjective words.

During the design approach, the semantic maps were concluded:

- The semantic map is a lower level of design management tool, which defined the design leader's personal thinking.
- The semantic map can help design by narrowing down the style orientation.
- Design process becomes effective because the designer understands the design leader's needs.
- Design leader needs to take time to prepare the semantic map.

## 5.6 Front-end Industrial Design Process

The purpose of this paper is to consider the relationship between clients and design consultants; the front-end of the design process: which is from the design brief, styling planning to the concept phase. (Show as Table 5.3)

Many researchers mention design brief as being from the background of the company,

corporation strategy, and a design problem – attributed to definition consumer and market information. (Bruce & Cooper 1997& Cooper & Press 1995) Many clients utilize the adjective word for describing the future products and type of target customers. The design leader uses adjective word to decide the product position and styling boundary, thus, decoded information can be submitted to the designer.

Table 5.3: Interactions among the Client, Design Leader and Designer, Who Carry Out the Activities During the Front-end Industrial Design Process.

Front-end Industrial Design process		Client	Design Leader	Designer
Design Brief	Function specific & limited	*		*
	Interface design		*	*
	Adjective word	*	*	
	Customer position			*
Styling Planning	Product position			*
	Product predecessors			*
	CIS & PI			*
	Product symbol & value		*	*
	Competing product design trend		*	*
	Relating product design trend		*	*
	Styling benchmarking		*	
	Target customer life styling			*
Concept	Client preference		*	
	Apply the semantic of design trend			*
	Predict future product images		*	*
	Quantity of concept drawing			*
	Evaluating concept & concept strategy		*	
	Concept presentation quality			*

Mark \* represents who needs to carry out activity

The styling planning involves firstly, the business level that is the product position, product predecessors, CIS & PI, and styling benchmarking. Secondly, design level, that is product symbol and value, competing product design trend, related product design trend, and target customer life styling. The design leader needs to decipher any product symbols and values and convey these as styling benchmarking to the designer. The design trend might be produced by the designer himself but the design leader needs to highlight the key factors of the design trend.

Due to the design leader being responsible for quality control monitoring during the

concept phase, the design leader must ensure that his personal opinions are not expressed through the concepts developed. The design leader needs a clear understanding of the clients preferences and must evaluate the concepts against the design brief and other business. The critical task is to organize the initial concept maps and also arrange the concept strategy against the client's needs and wants.

According to action research case studies, the author (design leader) observed the interaction between client and designer, and marked who needs to deal with the design process. The finding was that the designer needs to take care of each design process except (1), Adjective word; (2) Styling benchmarking; (3), Client preference and (4), Evaluating idea concept. The client only needs to focus on the product specification, and adjective word to explain what the future concept looks. Final, the design leader transmits the client's requirement and highlights the critical information in the designer's work.

## **5.7 Visual Maps Experiment**

The purpose of this research is to consider the relationship between clients and design consultants; the front-end of the design process which is from the design brief, styling planning to the concept phase. The common sense that the existing visual mapping influences on the designer during the front-end Industrial Design process, specially, focuses on the idea generation phase and how it affects the designer and effective design processes.

### **5.7.1 The Hypothesis**

The hypothesis were formulated as follows:

Hypothesis 1: Designer using visual map for idea generation has better design results than one not using an image maps in the idea generation phase.

Hypothesis 2: Comparing the idea sketch, utilizing the visual maps' the designer's idea sketch easily matches the client requirement.

### **5.7.2 Methodology**

Use Japanese cordless telephone marketing position, design trend, and product semantic

map on A4 color copy for subjects reference, at the same time, ask subjects to design a family type cordless telephone. The sketch uses A4 size paper. The questionnaire is also prepared for the subject.

### 5.7.3 Subject

There were two subject groups: the control group are third year Industrial Design students of Taipei Technology University and the experiment group are third year Industrial Design students of Huafan University.

### 5.7.4 Front-end Industrial Design Process

The questionnaire is focused on three design phases: (1), Design Brief; (2), Styling planning, and (3), Concept. (See as Table 5.4 and the detail showed in Section 5.6)

Table 5.4: Front-end Industrial Design Process

Front-end Industrial Design Process	
Design Brief	Q09. Function Specific & limited
	Q10. Interface design
	Q11. Adjective word
	Q12. Customer position
Styling Planning	Q13. Product position
	Q14. Product predecessors
	Q15. CIS & PI
	Q16. Product symbol & value
	Q17. Competing product design trend
	Q18. Relating product design trend
	Q19. Styling benchmarking
	Q20. Target customer life styling
Concept	Q21. Client preference
	Q22. Apply the semantic of design trend
	Q23. Predict future product images
	Q24. Quantity of concept drawing
	Q25. Evaluating concept & concept strategy
	Q27. Concept presentation quality

### 5.7.5 Experiment Procedures and Results

This study attempted to explore how designers utilize visual tools during the concept phase. Each stage has different subjects and all subjects are summarized in Table 5.5.

There are four stages of experiment, and the detail of each stage is explained as follows.

Table 5.5: The Stage of Research

	Stage 1	Stage 2	Stage 3	Stage 4
	Idea generation ability			Likert Scale test
Purpose	Compare stage 2,3	Compare stage 3	To explore visual map how affect concept design	To explore visual map how affect concept design
Subject: control group	20 subjects	38 subjects	38 subjects	30 subjects: 23 male/ 7 female
Subject: experiment group	40 subjects	38 subjects	38 subjects	30 subjects: 21 male/ 9 female
Time limited	15 minutes	50 minutes	50 minutes	no
Material	Cordless phone	Cordless phone	Leading brand cordless phone	Questionnaires
Task	Creative evaluate	Creative evaluate	Creative evaluate	Likert Scale
Analytical tool	Expert analysis	Expert analysis	Expert analysis	One Way ANOVA

In stage 1, the control group had 20 subjects, and the experiment group 40 subjects. All subjects were asked to do an idea generation task on a home based cordless telephone project, with the time limited to fifteen minutes. Design subjects are asked to use their experience in order to create an idea generation.

Next in stage 2, all subjects are asked to do an idea generation on a home based cordless telephone. The same idea development object, but time is increased to fifty minutes. The details of objects were told to the subjects: family use, parents and two children, living room or bed room type of cordless telephone, which has a simple base center and handset.

In the next stage 3, after one week, the experiment group was asked for the same object but was provided with three visual maps which were Japanese cordless telephone market maps, Japanese mobile phone market maps and design trends of cordless telephone for design reference. At the same time, the subjects were told that the design was for a leading company, which meant that fit should it' with the entire companies products. The control group lacked the three visual maps; all the other conditions were the same as the experiment group. The testing for both groups was fifty minutes. All

sketches were to be in B3 format without any color rendering.

The assessment of the concept sketches was carried out by four experts from an R&D department of a telephone manufacturer and by one design consultant. All of the experts had working experience of between one year to ten years in an Industrial Design background. The sketches were copied from original B3 to A4 size in black and white only. All experts were asked to choose carefully selecting excellent interface and good quality style from the sketches. The results of the assessment are shown on Table 5.6. In all three stages, the control group design results are better than the experiment group. Therefore, utilizing the visual images prove effective design quality in this experiment is not successful. But, the control group results were from  $0.26 > 0.246 > 0.1657$  and the experiment group were also from  $0.2 > 0.174 > 0.1278$ , this means that as the design brief becomes more specific, the design quality, in the view of the industrial experts, became worse.

Table 5.6: Expert Selected the Idea Concepts.

	Experiment Group - Huafan University		Control Group - Taipei Technology University	
	Frequency	Frequency/subjects	Frequency	Frequency/subjects
Stage 1	7.6/ 39 subjects	0.2	5.2/ 20 subjects	0.26
Stage 2	6.8/ 39 subjects	0.174	9.6/ 39 subjects	0.246
Stage 3	4.6/ 36 subjects	0.1278	5.8/ 35 subjects	0.1657

The final stage 4 – the questionnaire, two subject groups were required to complete a questionnaire. This questionnaire uses the Likert Scale method to explore the visual maps and how they influence experiment. The questionnaire answers are on a 5-point scale, 5 points represent the strongest concern, and 1 point represents no concern. The questionnaires results are shown on table 3 – the front-end Industrial Design processes.

The raw data of concern scores were analyzed by one-way ANOVA to check if there existed significant differences between two groups. Shown in the Table 5.7. This raw data of concern scores is to check between two groups after stage 2. The result of subjects are significantly different in Q2, client preference, ( $P = 0.027 < 0.05$ ) and Q3, apply semantic of design trend, ( $P = 0.002 < 0.05$ ) and Q6, quantity of concept drawing,



(P = 0.02<0.05).

Table 5.7: The Key Factors among Control and Experiment Group Were Who Carried Out the Front-end Industrial Design Concept Process.

Front-end Industrial Design process		Experiment Group Huafan University		Control Group Taipei Technology University		Probability
		Mean	STD	Mean	STD	P
Concept Phase	Q02. Client preference	3.37	1.1	2.67	1.24	0.27*
	Q03. Apply the semantic of design trend	4	0.74	3.4	0.86	0.02*
	Q04. Predict future product images	3.8	0.89	3.4	0.93	1.53
	Q05. Quantity of concept drawing	2.98	0.98	3	0.98	0.695
	Q06. Quality of concept drawing	3.8	0.89	3.3	0.99	0.02*
	Q07. Evaluating concept & concept strategy	3.37	0.85	3	1.02	0.071
	Q08. Concept presentation quality	3.57	0.63	3.33	0.88	0.119

\*P<0.05

The Table 5.7 shows the average of the concern scores relating that there is a difference between Huafan University (experiment group) and Taipei Technology University (control group) assessing both concern attitude during the concept stage. Figure 5.5 shows the experiment group better than the control group in the concept phases. Thus, the visual maps are influencing the designer during the concept phase.

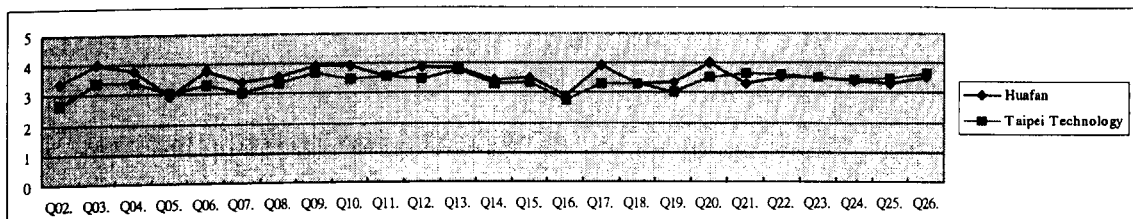


Figure 5.5: The image profile of concerns score

The raw data of concern scores were analyzed by one way ANOVA to check if there exists any significant difference between the two groups (Table 5.8). The result of Q10, product interface, (P = 0.026<0.05) show the two groups are different, and the experiment group concern scores are higher than the control group (mean 3.37>2.67).

Another significant difference is Q17, competitor product semantic and design trend ( $P = 0.023 < 0.05$ ). Due to being shown three image maps, the experiment group appears to be more concerned about design trends than the control group.

Table 5.8: The Key Factors among Control and Experiment Group Who Carry Out the Subjects During The Front-end Industrial Design Process.

Front-end Industrial Design process		Control Group Huafan University		Experiment Group Taipei Technology University		Probability
		Mean	STD	Mean	STD	P
Design Brief	Q09. Function Specific & limited	3.9	0.92	3.7	0.92	3.43
	Q10. Interface design	3.9	0.8	3.47	0.73	0.026*
	Q11. Adjective word	3.57	0.82	3.57	1.01	0.869
	Q12. Customer position	3.87	0.94	3.47	0.97	0.095
Styling Planning	Q13. Product position	3.83	0.87	3.8	0.89	0.859
	Q14. Product predecessors	3.43	1.19	3.27	1.34	0.798
	Q15. CIS & PI	3.53	1.11	3.33	1.35	0.55
	Q16. Product symbol & value	2.87	0.97	2.77	1.17	0.698
	Q17. Competing product design trend	3.9	0.92	3.27	1.17	0.023*
	Q18. Relating product design trend	3.27	1.11	3.3	1.15	0.913
	Q19. Styling benchmarking	3.33	0.96	3	1.2	0.236
	Q20. Target customer life styling	4	1.05	3.5	1.11	0.07
Concept	Q21. Client preference	3.27	1.23	3.63	0.93	0.377
	Q22. Apply the semantic of design trend	3.53	0.94	3.6	1.04	0.455
	Q23. Predict future product images	3.53	1.07	3.5	1.01	0.334
	Q24. Quantity of concept drawing	3.4	0.89	3.43	0.94	0.639
	Q25. Evaluating concept & concept strategy	3.27	1.05	3.47	0.97	0.682
	Q27. Concept presentation quality	3.5	0.9	3.36	1	0.708

\* $P < 0.05$

### 5.7.7 Recommendations and Conclusions

The experimental research was to deduce the critical visual management tools and also, to utilize the concept sketches and questionnaires to show that images are additional useful tools.

The experiment demonstrated that visual maps have an impact the on designer during the front end Industrial Design process. Many elements could be influencing the experiment results. Firstly, the design students may be lacking in practical design experience. Secondly, the experiment and control groups have different design

backgrounds and lecturers and possibly different levels of design ability. However, it was possible from the experimental results, to indicate the effect of reference images on idea generation. It is intended that future work will improve this result and provide a clear indication of the effect.

The critical finding is tested by the sketch:

- At all stages, the sketches lack a use of design approach following existing design trends, even the experiment group was introduced to the design trend, and the product position is as also the same.
- Young design students lack commercial awareness, and misunderstand the manufacturer's design brief or are unconcerned about the key task during the design processes.
- The design brief, design specification might block young designer's ability to produce results during idea generation.

The important finding in the maps questionnaire:

- The visual map which was controlled by the design leader may influence the designer.

The styling planning is important in most redesign projects. This research qualifies the specification of styling planning and type of visual maps. The quality of communication in design management could be improved and the gap in perception between the different levels involved in the process may disappear.

## **5.8 Summary**

This project used a literature research and experimental research to deduce the critical visual maps tool and also, utilized the concept sketches and questionnaires to show that images are additional useful tools. However, because many kinds of visual maps have already applied into design process, these have become a "common sense" through out the industry.

From company/client aspect, during the styling planning phase, companies need quality

marketing information and need to identify the target customer. Thus, the design manager can have a clear design brief to understand the company needs and requirements. (Figure 5.6)

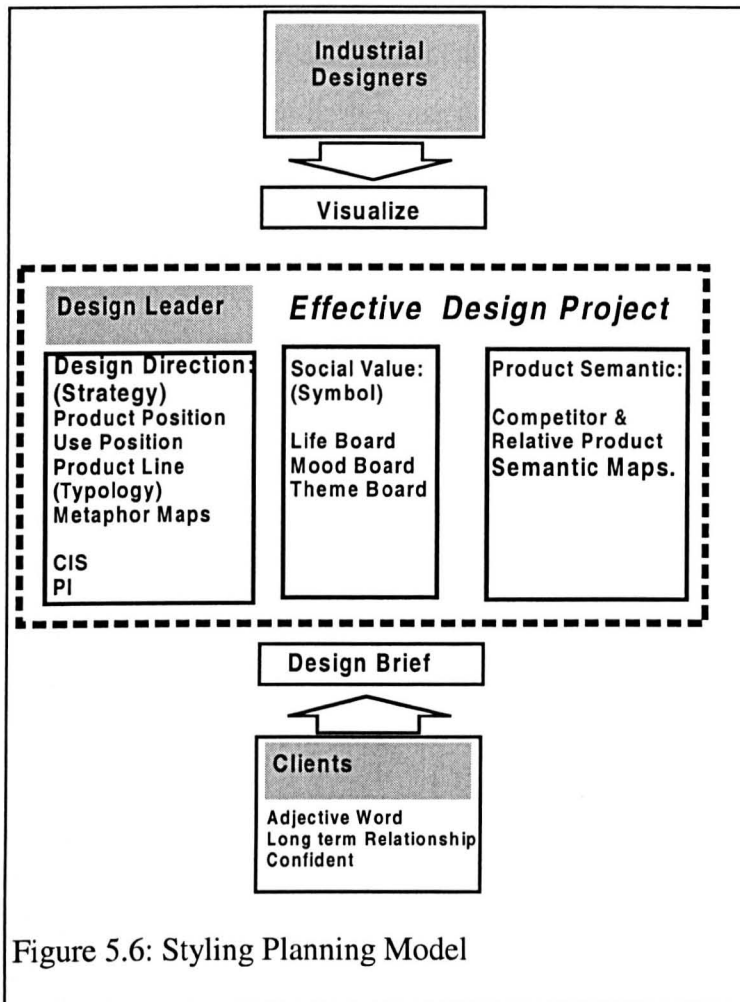


Figure 5.6: Styling Planning Model

From the design management aspect, during the styling planning phase, the manager should use the suitable tools for improving the design quality and satisfying clients. The following activities are suggested:

- Different communication levels need different visual added tools. Companies need product strategy maps, and the designer needs the detail of design maps.
- The consequence of styling planning from (1), product and corporation strategy to; (2), product symbol, and (3), design trend.
- Design leaders need to define who deals with the maps and when there is a need to

use visual maps.

- The visual map is one of the design strategy tools that was controlled by the design leader.

From the designer aspect during the styling-planning phase, both junior and senior designers need different levels of visual maps. The following is suggested:

- Senior designers have greater design experience of design strategy, which may include the direction a company wishes to go and the symbol of product information.
- Junior designers tend to always feel that company wishes are unclear. All kinds of visual maps are useful for design reference, but design strategy that includes the direction of company wishes and design trend is important.

The styling planning is important in most redesign projects. This chapter qualifies the specification of styling planning and type of visual added maps. The quality of communication in design management could be improved and the gap in perception between the different levels involved in the process may disappear.

## **Chapter 6 Concept Approach**

A good relationship between the design consultant and the client needs to be established in order for them to build and have confidence in each other. However, this confidence is mostly dependent on design consultant design ability. An effective design consultant can accurately predict clients' needs and requirements from initial idea concepts to final model. An effective design consultant will receive a high appraisal by his clients. When a design project fails, it is often due to the final result not matching the client expectations and this can result in the project needing to be reworked many times. Such an activity wastes resources and time and also loses client confidence. Furthermore, when this happens clients tend to become increasingly critical of any idea concepts presented during the early stages of new product development by design consultants.

A major part of the design management process is when the design team (which includes design leader, project leader or chief designer) try and build an ideal concept strategy for their clients. This means developing and choosing the best concept. This is carried out by interpreting the design brief, marketing information, and understanding the types of clients' characteristics, and design preferences. This research is combined and sorted in an attempt to build a process strategy model to help with effective ideas presentation that is right for the client and also right for the market.

### **6.1 Action Research Project in Concept Approach**

The four design projects used in this project belong to two clients who are communication product manufacturers. There are two famous Taiwanese brands, Kingtel and Romeo. Projects 1-3 belong to Kingtel and project 4 belongs to Romeo.

The Kingtel Company is a telephone products maker, a medium sized company in Taiwan. The educational background of Kingtel's key decision-maker is electronic engineering, he is president and general manager and has a high level of experience and success in new product development and marketing. The Tranbon Company, is also a medium sized company, The education background of Tranbon's key decision-maker

is sociology and he also is president of the Tranbon Company. He has extensive experience of success in new product development. Kingtel's decision-maker is more interested in industrial design projects, and he has been involved in NPD and marketing for nearly twenty years. Both clients have many critiques and suggestions during the concept presentation as well as many ideas to ask about the modification of the design project. Neither of them are from a design back ground, but NPD trained both key decision-makers to have an excellent design sense.

### **6.1.1 Design Process**

These four projects are to redesign the product styling. The design process will include, styling planning, idea sketch, idea presentation, rendering, soft model, to controlled appearance drawing, which appears to be typical of the design project process. Before the first idea presentation, the detail of design context is shown as following:

- (1) To review product styles in competitor market and to build the market mapping. (Designer)
- (2) To review the related product or collect new images of product design trend in published design books, periodical articles and product catalogues. (Designer)
- (3) To decide product position which the buyer or client needs and wants. (Design leader)
- (4) To indicate which design trend could be useful for new concept generation. (Design leader)
- (5) To check idea generation in internal presentation, therefor, the three types of idea concepts are selected by the design leader. (Design leader)

### **6.1.2 The Cognitive Gap between Designers and Design Leaders**

During idea generation, due to different design experience and different backgrounds, most junior designers have several problems:

- (1) Which marketing map position and orientation can match client needs and wants?
- (2) What kinds of idea concept innovation generation are suitable for client?
- (3) What kind of images would the client like?
- (4) Which kind of design trend can be used with new design project? Can it compete with other existing products in the market?

However, when designers finish a project, they will have gained experience and knowledge. Thus, the cognitive gap between design leader and designer may become smaller.

In the above situation, the hypothesis is that designers who understand the design brief, but junior designer misunderstanding because of the cognitive gap between than. Due to the design brief having been mentioned in the design brief chapter, thus this factor is ignored in this chapter.

There are four action researcher case studies that represent the author is evolution of concept approach. Firstly, the author generates a new format file for idea concept. The caller identity telephone project (caller ID telephone) is the first project which utilizes the new generation format in Feb. 1996. Secondly, the author created a concept matrix to help designers check that all idea concepts are covered using all approaches. This matrix can also help the designer to chose a suitable idea concept for exterior idea concept presentation in May 1997. This concept-matrix also helps design leader to define the orientation of concepts, the next sequence, to fill the three concepts in concept identity format, which prepares for the first idea concept presentation. Thirdly, in October 1997, the author used the MDS method to help designers understand the client scanner preference. The MDS established a precise market mapping, which could illustrate a client viewpoint and map factors for design reference. Both designers and clients must always try to understand each other's position, MDS offers this chance. Finally, the author used a questionnaire to explore idea concepts in March 1998. The videophone project was the first project to utilize the questionnaire approach to get proper concepts to match the client needs and wants.



## **6.2 Initial Concept Approach - Caller ID Telephone Project**

The caller ID telephone is an electronic device, which can show the caller telephone number as well as name on display. This product has already existed in the USA market for a few years, now the USA buyer needs a low price caller ID telephone built in one piece. The buyer argues that the control button and LCD display was designed on the backside of the handset. This would make it easier to watch the LCD display when the telephone is ringing.

The design brief for this project used a “me-too” strategy, copying a competitor product, features and interface, and having a low price product position. The key argument from the client prospective is to design a different appearance but attractive product image for sale in the universal market. Therefore, this product is mainly an appearance changing design project.

### **6.2.1 Restyling Design Approach**

This Caller ID Telephone is a typical styling or appearance design project. Before the first idea presentation, design leaders and designers consultants need to go through the design process, stage by stage. The requirements of the Caller ID Telephone design context is summarised in the following points:

- (1) To review caller ID telephone styles in competitor market and to build the market mapping.

Designers collect similar caller ID telephone styles and decide the adjective words for the X/Y-axis. After sorting out all the caller ID telephone styles, more than two designers utilize a marketing people analysis method to finish the competitor mapping.

- (2) To review the related products or collect new images of product design trends in published design books, periodical articles and product catalogues.

Then designers collect similar products at the same time, reviews such as IF annual book and International Design Magazine’s (ID) annual award issue in which, many advanced designs could influence to design concept.

(3) To decide marketing position which is the buyer or clients specification.

Design manager needs to review the competitor mapping and make a decision for new products position which, may match client specification.

(4) To indicate which design trend could be useful for new concept generation.

The design leader designs the appearance pages and attaches the collected image photos that have been chosen. Each image photo has a critical semantic or new created style; the design leader must highlight the useful relative parts to these project designers.

(5) To check idea generation in internal presentation, therefore, the three types of idea concepts are selected by the design leader.

This is very common during the design process in design consultants, but the stage 4 and 5 need a format file instead of oral critique information.

Two methods were used to produce the format file. Firstly, due to most junior designers experiences of carrying out searches and deciding on the design direction, the design leader utilize this format to identify the design trend and initial concepts' direction before the idea generation. Secondly, when designers do the internal idea presentation, the design leader picks up the three types of idea concepts to prepare external concept presentation.

### **6.2.2 Concept Identity Format**

There are two parts to the concept identity format. (Figure 6.1) Firstly, Part A – the detail of style, there are four spaces (It can extend to more space if required) for attaching the collected images, photos or sketches. This task is done by designers or the design leader, because through this task being carried out by both the designer and design leader they can share their initial ideas. However, it is communication work: The design manager will recommend the associate image style and designers will share his personal preference for image style.

Secondly, part B – the design orientation, there are three vertical spaces, which include up, middle and down orientation. It is used to show the new product orientation within currently available products. The down orientation is almost an existing marketing product and the middle orientation is further away than the down orientation. The up orientation is still further from the existing market. Most design consultants present three idea

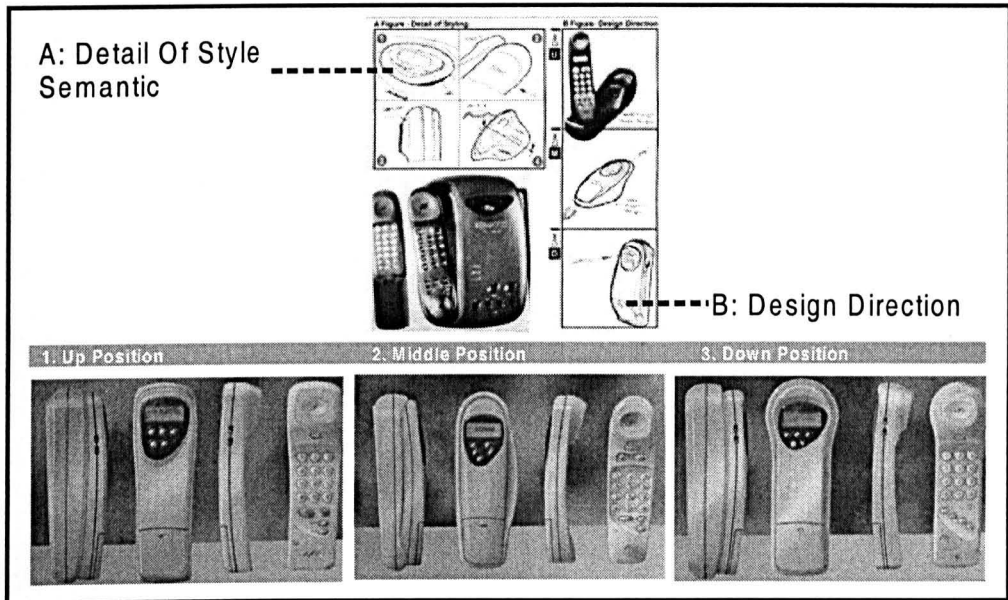


Figure 6.1: Concept Identity Format

concepts for their client. If more than three concepts were presented, it may often confuse the client. By presenting three orientation concepts, it is easier to identify among each range where most junior designers lack this skill. To utilize this format, the design leader can record chosen idea concepts in order to be able to remind designers and also employees of this format to predict the concept generation orientation for design reference.

### 6.3 Concept Matrix Method - Digital Answering Machine Project

The digital answering machine is part of the computer era of modern products. The traditional answering machine has used micro tape to record or play the voice message. Now, the microchip has replaced the tape function producing a digital message which increases the effectiveness for operation. The first digital answering machine announced was produced by AT&T in USA, however, now many Taiwanese OEM companies produce this product. After a few years, Kingtel wished to produce this kind of product, although many competitors already existed in the global market. However, the digital answering machine is still a new area in the answering machine market.



Figure 6.2: Kt-718 Digital Answering Machine Project

The design brief of this project uses the “me-too” strategy to copy the benchmarking product, its features and interface. The key specification from the client is that the product must have a compact image and horizontal style. The new digital answering machine is shown as above Figure 6.2.

#### 6.3.1 Design Process

The digital answering machine is also a restyling project, but the focus of this project was on concept strategy. The tasks to be done before the first idea presentation were the following:

- (1) To review digital answering machine product styles in competitor market and to build the market mapping.

- (2) To review the related product or collect new images of product design trend.
- (3) To decide product position which the buyer or client needs and wants.
- (4) To indicate which design trend could be useful for new concept generation.

Stages 1 to 4 are the same as those used in the Caller ID Telephone project design process. Stage 5, is a new method chosen by the client.

- (5) To map idea concepts as market mapping by designer and design leader in internal presentation, both designer and design leader according to the concept matrix for deciding the three types of idea concepts for the next design presentation.

### **6.3.2 Concept Matrix**

Most designers should always have an open mind to scan any possible idea and develop idea concepts. However, sometimes designers can be too free to generate idea concepts, which may go in directions which are not in the areas of the clients orientation. Hence, the concept matrix can be used when designers present the idea concepts to the design manager for checking the design orientation. In addition, the design leader can request designers to map the idea concepts as market mapping. Moreover, the concept matrix X, Y-axis still follows the same path as market mapping adjective words and uses personal cognitive ability to lay out the concept matrix. In action research, the author and one junior designer work together to complete an idea generation, but, unfortunately the author checks the results of the young designer's idea which appears not to match the client's wish. Hence, only the author's idea concepts built up the concept matrix.

The 8 chosen concepts are show in the mapping, the 3x4 matrix is designed for the concept matrix. (See the Figure 6.3) Some of the space is empty, because no idea sketches were deemed suitable to fill the relevant space. According to the design brief, the client needs a new image of digital answering machine thus they need to select an idea concept approach from the innovation style zone. The idea concepts for the first idea

presentation were completed. When showing the first idea generation concepts to the client, the key decision-maker chose to middle orientation concepts for this project style.

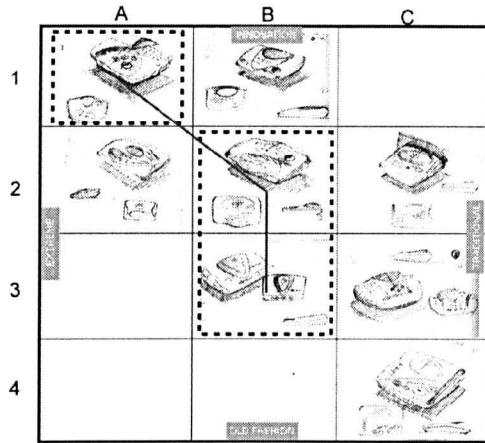


Figure 6.3: Concept Approach

Thus, the concept matrix can be said to be successful and useful.

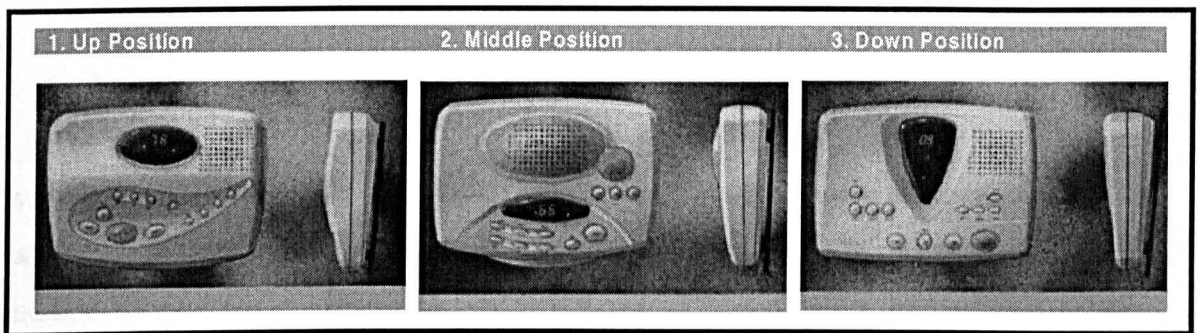


Figure 6.4: The selected Concept Design in Three Directions

The concept matrix permits the following to be achieved. Firstly the designer can check his idea concepts by total direction not only by similar orientation. In addition, the design manager can also check quality and quantity of idea concepts. This is regarded as an important process for design quality control. Secondly by having three-direction (Show Figure 6.4) concepts it is easier to decide the concept matrix, which shows an overview of the whole big picture, so that the design leader can easily make a decision. Thirdly, the idea concept matrix gives the opportunity for a concept strategy, which according to the client is design sense can chose suitable concepts for presentation.

## 6.4 Multidimensional Scale (MDS) - A4 Size Scanner Project

The A4 scanner is increasing by becoming one of Taiwan's top export products. Because of this, the expertise of companies in Taiwan in producing the scanners, both in hardware and software, is developing and increasing. Hence, the world famous brands such as HP, Fuji, Epson and Agfa are ODM by Taiwanese companies. At the same time scanners are becoming an increasingly important facility with the computer, which

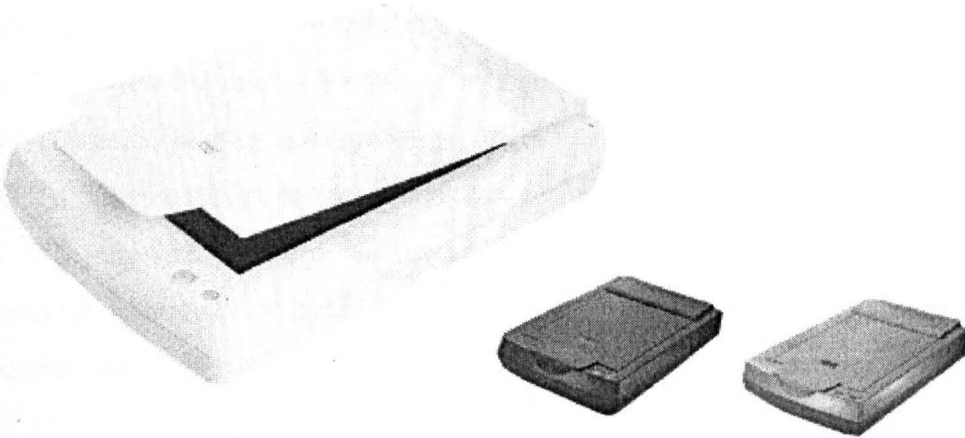


Figure 6.5: Kts-600 A4 Size Scanner Project

is an already crowded market. Even in Taiwan, there are big named manufacturers, such as Microtech, Umax, Lumax and also many other manufactures in this high competitive market. Kingtel are attempting to establish a market in computers, and see the scanner as a critical chance to move into this area.

The design brief for the scanner project required it to be focused on a middle level of scanner, which is 600-dpi high-speed scanner. The scanner was to include a copying feature, that is a new idea in this kind of product. The structure of the scanner needed to be low cost in consideration. To describe the future concept an uptodate fashion style was required and also the Kingtel successful company images in the communication field were to be kept. The kts-600 A4 Size Scanner Project is shows as above Figure 6.5.

### 6.4.1 Design Process

The scanner was also a restyling project, but for this project the focus was on concept

strategy. The detail of design process before the first idea presentation was shown as follows:

- (1) To review scanner product styles in competitor market and to produce a market map.
- (2) To establish both clients and designers' precept map by means of MDS method.

The Stage two used a different design approach from the other design projects. The MDS approach is at the centre of this design project.

- (3) To review the related product or collect new images of product design trend.
- (4) To decide product position which the buyer or client needs and wants.
- (5) To indicate which design trends could be useful for new concept generation.
- (6) To map idea concepts as market mapping by designer and design manager in internal presentation, both designer and design leader. Then to using the concept matrix to decide the three types of idea concepts for next design presentation.

#### 6.4.2 A4 Scanner's Feature Space - MDS Approach

To use Semantic Different (SD) procedures the designer needs to collect peoples perception. Therefore, to utilize the MDS analysis, the stimulating objects are properly laid out in to feature axis map.

#### The stage of research

This research employs the SD method to evaluate clients and designer perception of product form. The research was arranged into two stages and is described in Table 6.1.

Table 6.1: The Stage of Research

	Stage 1	Stage 2
	<b>Semi-Structure Questionnaire</b>	<b>Semantic Differential Test</b>
<b>Purpose</b>	To chose representative sample and adjective	To study client and designer preference and to build up their conceptual
<b>subject</b>	Client: 6 Designer:1	Client: 6 Designer:2
<b>Material</b>	Questionnaires with 54 samples	Questionnaires with 12 samples and 6 adjectives
<b>Task</b>		SD evaluation
<b>Analytical tool</b>		MDS analysis



**The materials**

The design concepts used in the study were selected from a 1997 consumer electric show in Hannover, Germany. Subjects were presented with copies of photographs taken from books, catalogues and magazines. At the same time, concepts were photographed to produce a 4” x 6” picture. Final, 12 photographs were selected by 7 subjects (6 clients and 1 designer). Figure 6.6 shows total concepts shown in marketing mapping.

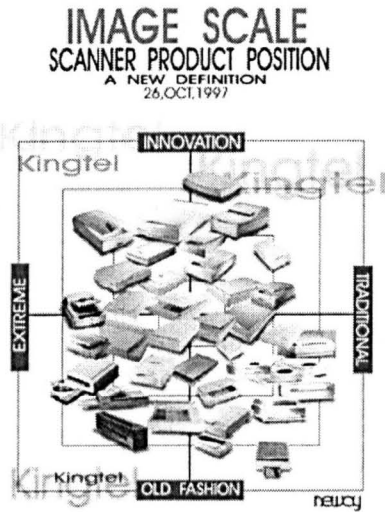


Figure 6.6: Total Concepts Show in Marketing Mapping

**The attitude scale**

The elements on scale consisted of adjectives. Each adjective also needed to cover semantic space. Initially, 6 adjectives were selected. This research used 9-point scale. The subjects can judge from a pair of adjectives in order to chose the concept approach. (An example follows)

	1	2	3	4	5	6	7	8	9	
Modern	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Traditional

Subjects had to assign a score to each sample concept according to the degree to which they considered it important on the scale. In the example, the subject considered the design concept to be a 5 on the Modern - Traditional scale. The scale is divided into

three sections, for the low in the range of 1 to 3 points; medium degree 4 to 6 points, and high degree 7 to 9 points.

### The subjects

The subject samples in the semi-structure questionnaire were 6 clients and 1 designer, the SD test, had 6 clients and 2 designers. The clients included manager engineers and marketing people. The subject samples are shown in Table 6.2.

Table 6.2: The Subject Profile for Design Attribute Indication

Subject profile	Clients (6)	Design consultants (2)
Sex	Male (4) Female (2)	Male 2) Female (0)
Age	21-30 (1) 31-40 (2) above 40 (3)	21-30 (1) 31-40 (1) above 40 (0)
Job title	President (0) General manager(0) Manager (2) Chief designer (1) Engineer (1) Other staff (2)	President (0) General manager(0) Manager (0) Chief designer (1) Engineer (1) Other staff (0)

### Procedure

#### The stage 1: pilot test.

Questionnaires with 54 sample concepts asked subjects to chose 12 preference samples, at the same time, they were also asked to write down adjectives which they considered described the scanner images. The 12chosen samples are shown as follows in Figure 6.7.

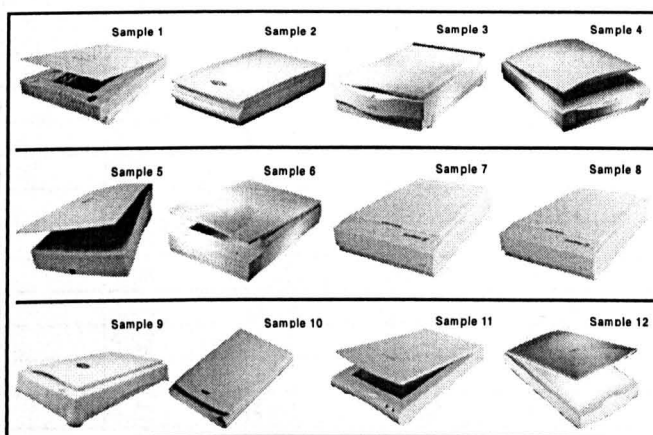


Figure 6.7: The 12 Chosen Samples

## The stage 2: SD test.

Having piloted the method and ensured that any problems were removed or minimized, stage 2, the SD test was carried out. A questionnaire with 12 samples and 6 adjectives was presented to the client subjects.

The summary of 6 adjectives is shown as follows:

- (1) Traditional - Extreme      (2) Old Fashion – Innovation      (3) Complex - Simple  
 (4) Conservation – Fashion      (5) Steady - Frivolous      (6) Sharp - Mellow

## Results

The average and Std row data are shown in Table 6.3

Table 6.3: Scanner SD Row Data

		Adj1	Adj2	Adj3	Adj4	Adj5	Adj6
S1	Avg.	4.63	5.5	5.63	5.63	3.75	3.75
	Std	2.33	2.07	2.26	1.41	1.98	2.82
S2	Avg.	4.88	5.38	4.38	5.5	5.13	5.25
	Std	2.03	2.33	2.00	2.27	1.96	1.58
S3	Avg.	4.88	5	4.88	6.25	4.25	4.75
	Std	1.73	2.20	1.36	2.05	2.38	1.67
S4	Avg.	5.88	4.63	3.75	5	3.88	4.5
	Std	1.64	1.92	2.05	1.69	2.59	1.51
S5	Avg.	3.5	4.13	7.88	4.5	2.38	6
	Std	1.85	1.89	1.55	2.45	1.51	2.00
S6	Avg.	3.5	4.25	6.38	4.5	3.38	3.88
	Std	1.60	2.25	1.85	2.14	1.51	1.73
S7	Avg.	6.63	6.75	5.5	8	3	4.13
	Std	1.85	2.49	1.77	0.76	2.00	2.47
S8	Avg.	2	3.25	7.5	2.13	4.5	4.25
	Std	0.93	2.19	1.20	1.13	2.14	1.67
S9	Avg.	6	7	4.88	6.88	5.63	5.25
	Std	2.07	2.20	2.64	1.89	2.26	3.11
S10	Avg.	4.88	4.88	6.38	4.38	6.5	6.25
	Std	2.03	2.70	0.92	2.56	1.77	1.83
S11	Avg.	5.88	5.63	5.38	6.13	6.75	6.25
	Std	1.55	1.51	1.92	2.53	2.43	1.49
S12	Avg.	4.25	4.63	7.38	4.38	3.38	6.63
	Std	1.04	1.77	1.41	1.77	1.69	1.69

The perceptual distance (di) is different evaluation score of subjects.

$$d_i (S_1-S_2) = \sqrt{s}$$

$$S = ((X_{11}-X_{21})^2 + (X_{12}-X_{22})^2 + \dots + (X_{16}-X_{26})^2) / 6$$

The difference between sample perceptual distance is shown as a table. The data utilizes SPSS /MDS for analysis and generates a feature space map. Please see Table 6.4.

Table 6.4: Scanner MDS Feature Space

	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12
s1	0											
s2	0.98	0										
s3	0.65	0.57	0									
s4	1.08	0.85	0.83	0								
s5	1.65	2.03	1.82	2.15	0							
s6	0.9	1.48	1.24	1.51	1.14	0						
s7	1.41	1.74	1.39	1.73	2.53	2.21	0					
s8	2.09	2.07	2.19	2.09	2.15	1.52	3.45	0				
s9	1.42	1.02	1.14	1.53	2.59	2.19	1.31	3.03	0			
s10	1.65	1.18	1.48	1.75	1.9	1.72	1.72	2.14	1.63	0		
s11	1.69	1.01	1.3	1.64	2.45	2.17	2.17	2.79	0.91	0.97	0	
s12	1.53	1.64	1.56	1.87	0.64	1.24	1.24	2.13	2.17	1.39	1.92	0

The 12 A4 scanner samples are shown along the x-y axis space, (reference Figure 6.8) which offer between 6 clients and 2 designers' percept space. The x-axis was defined as traditional / extreme and y-axis as simple / complex, two pairs of adjectives instead of others adjectives. The next stage was by means of an MDS map. Each subject was asked in which direction is the future concept approach, and to mark each position, this offered a reference position for designer development idea concept.

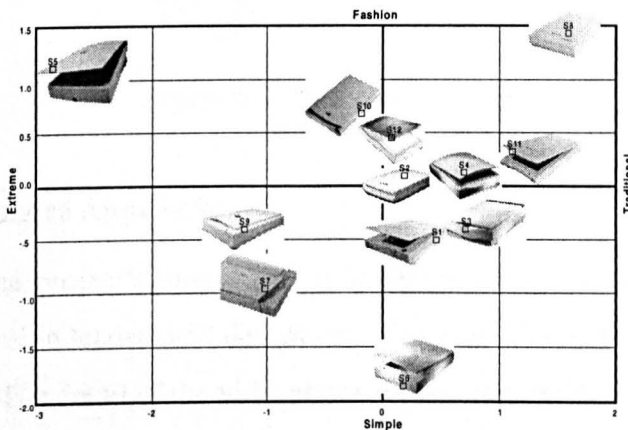


Figure 6.8: The Scanner MDS Map

## 6.5 Questionnaire of Idea Concepts - Videophone Project

The videophone project was designing a communications product, which offered both still images and voice communication between the users, although similar products already exist in the global market, especially in the USA, Europe and Japan. This kind of product is normally used with normal telephone cable to transfer data for people who need images during communication.

The Tranbon company already produces communication products, such as: pager, modern telephone. They are one of the leading brands in the Taiwanese and Chinese market. The Tranbon design brief of this project was to utilize a "me-too" strategy. In so doing produce a design, similar to other competitor products and with similar features and interface, as well as a low priced product position. The key requirement from the client was that the design should be sufficiently different in appearance and yet still attractive enough to fit it for sale in a universal market. Nonetheless, it must be remembered that, it was also an appearance design project. The new videophone is shown as follows in Figure 6.9.



Figure 6.9: Videophone Project

### 6.5.1 Questionnaire Approach

This videophone project's appearance is a typical design project. Before the first idea presentation, design leaders and design consultant need to go through the design process stage by stage. The detail of the videophone design context was as follows:

- (1) To review videophone styles in the competitor market and to build the market mapping.
- (2) To review the related product or collect new images of product design trend in published design books, periodical articles and product catalogues.
- (3) To decide product position which the buyer or client needs and wants.
- (4) To indicate which design trend could be useful for new concept generation.
- (5) To check idea generation in internal presentation, therefore, the three types of idea concepts are selected by the design leader.

The stages 1 to 5 are similar to the previously mentioned 3 design projects.

- (6) To ask a questionnaire of idea concepts to approve the concept strategy.

This last stage, number 6, is new for this design process. The proposal is to try to identify the client's likely responses before the idea concept presentation. In addition, to also attempt to modify the concept strategy model.

### 6.5.2 The Questionnaire of Idea Concepts

After the idea matrix, the idea concepts are designed to A4 size, on paper, using black and white pictures (See Figure 6.10). Each member completed an idea concept

Trancon video-phone project - Idea generation strategy 07/04/2004

Please mark the three idea sketches which you recommend for Trancon video-phone project.

1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4 <input type="checkbox"/>	5 <input type="checkbox"/>	6 <input type="checkbox"/>
7 <input type="checkbox"/>	8 <input type="checkbox"/>	9 <input type="checkbox"/>
10 <input type="checkbox"/>	11 <input type="checkbox"/>	12 <input type="checkbox"/>

Figure 6.10: The Questionnaire of Idea Concepts

questionnaire which needs 3 idea concepts to be selected. In addition, there are nine

members who attended the NPD committee meeting, who included president, chairman of NPD committee and key decision-maker, other members are is marketing, R&D, and produce managers. Due to the long term relationship with Tranbon, the key decision-maker needs to keep an eye on the idea strategy, if it matches the key decision-maker's needs and wants, he will persuade other member to accept his choice.

### Raw data

The result of the raw data of the questionnaire is shown in Table 6.5. The rank of selected concepts, the first ranked concept was number 10 which was chosen 5 times, second ranked concept was number 12 which was chosen 3 times, and third ranked was concept number 11 which was chosen 3 times.

Table 6.5: Raw Data of Videophone Concept Questionnaire

	S1 President	S 2 vice-president	S3	S4	S5	S6	S7	S8	S9	Total	Rank
Concept 1	0	0	0	0	1	0	0	0	0	1	
Concept 2	0	0	0	0	0	0	0	0	1	1	
Concept 3	0	1	1	1	0	0	0	0	0	3	3
Concept 4	0	0	0	0	0	0	0	1	0	1	
Concept 5	0	0	1	1	0	0	0	0	0	2	
Concept 6	0	0	0	0	1	0	0	1	0	2	
Concept 7	0	1	0	0	0	1	0	0	0	2	
Concept 8	1	0	0	0	0	0	1	0	0	2	
Concept 9	0	0	0	0	0	0	0	0	1	1	
Concept 10	1	1	0	1	1	0	1	0	0	5	1
Concept 11	0	0	1	0	0	1	0	0	1	3	3
Concept 12	1	0	0	0	0	1	1	1	0	4	2

### Concept Approach

The author (who is also the design leader) decided on the concept strategy, the down position which was concept 12. The reason for this choice was that the key decision-maker mention in the design brief that the style needed to relate to the existing market products and not be new for the market. In other words, the new videophone was to be focused on the existing telephone user, not for the hi-tech user. Thus, the down position

concepts approach the existing product but new are for the video-phone style. Moreover, the middle position, needs to chose the approach concept 7,8,9 which is near the down position because the key decision-maker has a traditional style approach, and wants a conservative approach in this new investment project. In addition, the up position selects concept 1 which is a new semantic in the concept matrix. In this case, if key the decision-maker wishes to approach a new innovation style, the concept 1 is like this description. The result is to chose the middle and down concepts to modify, and the idea presentation is successfully predicted by the idea concept matrix. The concept strategy is referred to in Table 6.6 and the concept approach shown in Figure 6.11.

Table 6.6: Concept Approach Position

	S1 President	Total	Rank	Concept strategy
Concept 1	0	1		Up position
Concept 2	0	1		
Concept 3	0	3	3	
Concept 4	0	1		
Concept 5	0	2		
Concept 6	0	2		
Concept 7	0	2		Middle position
Concept 8	1	2		
Concept 9	0	1		
Concept 10	1	5	1	
Concept 11	0	3	3	
Concept 12	1	4	2	Down position

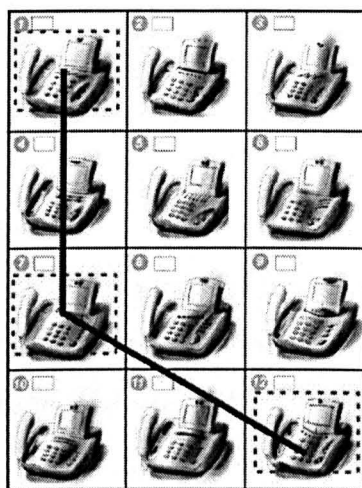


Figure 6.11: Concept Approach



## **6.6 New Idea Concept Approach**

During the idea generation phase, critical marketing information, decision-maker attitudes and design sense can influence the design position, orientation and consequently the design results. It is an important function of the design management process to match current company policy and strategy. Furthermore they need to also try to satisfy both clients and designers during the product development. The concept strategy became increasingly important tools in giving products the best styling position in the increasingly competing market.

### **6.6.1 The Process of Idea Concept Approach**

Noorderhaven 1995 presented a normative-rational model of strategy making. Firstly, setting managerial goals, secondly, SWOT analysis, thirdly, generating strategic options, and finally, implementation. Certo & Peter 1990 mentioned that the strategy management is a continuous and interactive process, from keeping an organization matching the analysis to building up the company direction, as well as forming the implementation of the strategy. However, the design manager process is similar to others management processes. This chapter summarises the idea concept strategy.

#### **(1) Setting the Manager Goals**

The third design project, the A4 scanner utilized the MDS method and a small number of subjects which included the clients and design leaders to generate the marketing map. From the marketing position it is possible map to understand the client needs and wants. At the same time, the design leader needs to ask the key decision-maker, what the future concept will look like, then the design leader can easily identify the design approach.

#### **(2) Company SWOT Analysis**

The first design project, caller ID project generates the Concept Identity Format, which helps the designer and design manager (or design leader) to effectively to define the concept generation orientation. The Concept Identity Format has two parts, part A – the detail of style and part B – the design orientation. The second design project, the digital answering machine project created a concept matrix to help the idea concepts

generation.

The analysis stages are with concerned the three factors of idea concepts generation and presentation and these are product, market, and design sense of key decision-maker.

### (3) Generating Approach Option

Dyson 1990 noted that the strategic planning process is to ensure generation and formulation of the strategic option.” He also argued that strategic planning is difficult to reverse, thus options need to be carefully evaluated before action is taken. The idea concept strategy matrix offers eight options, which are divided into three groups. Group one had three options which attacked the approach, Group two had two options which defended the approach. Option three was half-attacking and half defending the approach. This method also offers a tool for the design leader according to the key decision-makers wish and expectations.

### (4) Implementation

The final action research is the videophone project, whose concept matrix is for initial contact with the clients for testing idea concept approach. Jauch & Gluek 1989 argued that an effective decision-maker needs a combination of analytical-rational and intuitive-emotional skills in order to make complex, unstructured decisions. In addition he also mentioned political-behavioral for feasibility of the decision.

The videophone project utilized a questionnaire approach to get proper concepts for matching client needs and wants. At this stage, if the design leader utilizes the idea concept strategy, the results can help the design leader to modify a suitable idea concept for the next presentation.

## **6.6.2 The Factors of Idea Concept Approach**

The purpose of the idea concept strategy is to satisfy both clients and design consultants as soon as possible. But, most young designers lack the perception and key styling position ability, which is a key factor in high competition restyling products. They can design an excellent product, but it may not be for the right market for the client needs

and requirements.

### 6.6.3 The Design Problems in Idea Concept Generation Process

During the four action research projects, the designers have encountered many common problems, from not understanding the design brief to misunderstanding the comments from key decision-makers. The design problems in idea concept generation process are shown in the following Table 6.7.

Table 6.7: The Problems of Design Interaction between Client and Designer During Idea Concept Generation Process.

	Design Consultant / Designer	Company / Client
Design Brief Phase	<ul style="list-style-type: none"> <li>● How To Identity Design Orientation</li> <li>● How To Identity Adjective Words</li> <li>● How To Identity Styling</li> <li>● How To Identity Product Dimension</li> </ul>	<ul style="list-style-type: none"> <li>● What is Design Orientation</li> <li>● How To Describe the Style by Adjective Words</li> <li>● Which Styling Approach</li> </ul>
Data Analysis Phase	<ul style="list-style-type: none"> <li>● How To Identity Product Semantic</li> <li>● How To Identity Product Trend</li> <li>● How To Identity Design trend</li> </ul>	<ul style="list-style-type: none"> <li>● How To Identity Product Semantic</li> <li>● How To Identity Product Trend</li> <li>● How To Cognitive Design trend</li> </ul>
Idea Generation Phase	<ul style="list-style-type: none"> <li>● What Orientation and Range of Creation</li> <li>● How To Chose Idea Concepts</li> <li>● How To Apply Semantic</li> </ul>	
Idea Presentation Phase	<ul style="list-style-type: none"> <li>● Misunderstand Feed Back Information</li> <li>● Understand Feed Back Information but How to Modify It.</li> </ul>	<ul style="list-style-type: none"> <li>● Which Styles are Suitable for Company</li> </ul>

### 6.6.4 The Factors of Idea Concept Presentation

The main elements which influence how to chose the idea concepts can be divided into three levels, firstly, the product it self, secondly, the marketing environment, thirdly, the decision-maker. (See the Table 6.8)

Table 6.8: The Factors of Idea Concept Presentation

	Product	Marketing	Decision-maker's Design Sense
Factors	<ul style="list-style-type: none"> <li>● Product Life Cycle</li> <li>● Company Product Line</li> </ul>	<ul style="list-style-type: none"> <li>● Product Position</li> </ul>	<ul style="list-style-type: none"> <li>● Adjective Words</li> <li>● Design Approach Attitude</li> </ul>

In the Product factor, when the design leader or the designer proposes the idea concepts,

the product life cycle and company product line that are two critical factors, which have impact on the idea concept strategy.

(1) Product life cycle:

Marketing defines the product life cycle from growth, maturity, and decline. The “me-too” product is not new to the world, but is new to the company. The design leader needs to consider the product market situation and must choose a suitable strategy, which is a style innovation approach. The style concept strategy is in a growth and maturity situation and needs style innovation to be considered higher than in the market decline situation.

(2) Company product line:

If the product is new to the company, only the basic style needs to be considered, because the initial company product starts from a standard type. But if the product is designed as an extension to existing product line, then various styles might be needed.

In the marketing factor, when using the “me-too” approach the product market positions and segmentation are more important. For example, the user, function, and price position, are all very important for the style concept. When the designer and the design leader decide before the idea concept generation they need to listen very carefully to their clients requirements.

In the Decision-maker’s Design Sense factor, the author’s action research case studies and investigation phase studies, which initially sorted out the clients, found three kinds of design sense; firstly, good design senses, secondly, design senses still developing, thirdly, bad design sense. The three types of client key decision-makers may influence the idea concept development and decision making. (Shown in Table 6.9)

Table 6.9: The Idea Concept Approach Factors of Key Decision-Maker

	Personal Attitude	Adjective Description	NPD/ID Experience	Defined Design direction
Good Design Sense	<ul style="list-style-type: none"> <li>● Confident of Design Sense</li> <li>● Strong Confidant in Pervious Experience</li> </ul>	<ul style="list-style-type: none"> <li>● Used Adjective Word</li> </ul>	Yes	<ul style="list-style-type: none"> <li>● Clear Defined by Clients</li> </ul>
Design Sense Developing	<ul style="list-style-type: none"> <li>● Confident of Design Sense</li> </ul>	<ul style="list-style-type: none"> <li>● Used Adjective Word</li> </ul>	Yes	<ul style="list-style-type: none"> <li>● Clear Defined by Clients</li> <li>● No Clear Defined Which Design Manager Need Ask Client Product Approach by Relative Images</li> </ul>
Worse Design Sense	<ul style="list-style-type: none"> <li>● Unconfident of Design Sense</li> <li>● Uncertain the Buyer Needs and Wants</li> </ul>	<ul style="list-style-type: none"> <li>● Lacking Use Adjective Word</li> </ul>	Not much	<ul style="list-style-type: none"> <li>● No Clear Defined Which Design Manager Need Ask Client Product Approach by Relative Images</li> </ul>

Whittington 1993 argued that classic leadership approach offers an inspirational message, so the business world demands an unwavering commitment to mechanism for such change; providing the ideals shape the strategy. He also noted that “leadership can give employees their sense of purpose and transform their work into play.” The design leader also needs to be able to decode the information for the other designers. Freeze 1998 also mentioned that the design leader and designer are supported from the top-level manager, thus the design process may be an effective activity.

(1) Personal attitude and design approach attitude

Key decision-makers are confident of their design sense because they have many successful previous experiences. This kind of key decision-maker can describe in detail the difference between products which look alike. A lot of clients do not want to offer a clear sheet in the design approach for design consultants, because they wish the designer to propose a different design approach which is unexpected. Nevertheless, some clients have understanding of styles for future products, they may also wish the design consultant to present an excellent design approach therefore they can evaluate and make decisions. But some of the clients offer clear information for the designer, because they wish the design consultant to start at the right point which they expect. Those expected attitudes affect the designer in their idea concept proposal; the clear brief offers designers a precise range, but a vague brief results in the designers proposing a big

range of idea concepts to ensure they can match the client needs and wants.

## (2) Adjective word – defined style approach tools

Preddy, (1992) mentioned that a good client is one who knows what he or she is trying to achieve.” He also noted that good design will almost always lead back to a good client.” In general, many clients understand how to develop the new product by feature, specification, price, and position, but how the products will look like, most clients do not understand. The design consultant needs very carefully to ask the key decision-maker the wishes of the new product style approach during the design brief. The critical information from the key decision-maker is presented by oral adjective words. The style can be defined very clear by or still be vague and uncertain.

## (3) NPD and Industrial Design (ID) experience

Understanding the process of the NPD is an important aspect for the key decision-maker, especially, as many key decision-makers are the company owner who need to make decisions during the NPD process. From learning the NPD process, the key decision-maker’s experiences can accumulate for the next project. However, the Industrial Design (ID) process includes product appearance, aesthetics and human interface design. Any decisions are becoming increasingly complex and uncertain. If key decision-maker’s design sense is aware or developing, the client key decision-maker can clearly perceive and turn the aesthetes’ information in to design. The client key decision-maker’s design sense is not developing, there are two situations. The first is that the client respects the design consultant who will accept the results. The second situations is that the client will not respect and will doubt the design consultant who will produce unsatisfactory results. If the second situation occurs, the design projects tend to become more complex and filled with uncertainty. But, at the same time, they still can learn experience of the appearance of aesthetes from the design consultant during the ID process.

## (4) Defined design direction

The three kinds of idea design directions are described (Show Figure 6.12); Key

decision-maker who has a good design sense, and already has the product image, which may be unclear but the design direction is clear. They chose the idea concept strategy that needs focus as mentioned, such as scope A. Moreover, the key decision-maker with no design sense, does not know product image and design direction which may be indistinct and uncertain. Thus, the design leader needs to take more patience in asking the client how design direction may relate to future product images. Therefore, the design leader choosing the idea concept strategy needs a bigger range such as scope C. Final, the key decision-maker whose design sense is still developing, has a little understanding of future product images which may be vague but the design orientation is clear. They chose the idea concept strategy which needs a middle range size between the two above mentioned kinds of key decision-maker design senses, such as scope B.

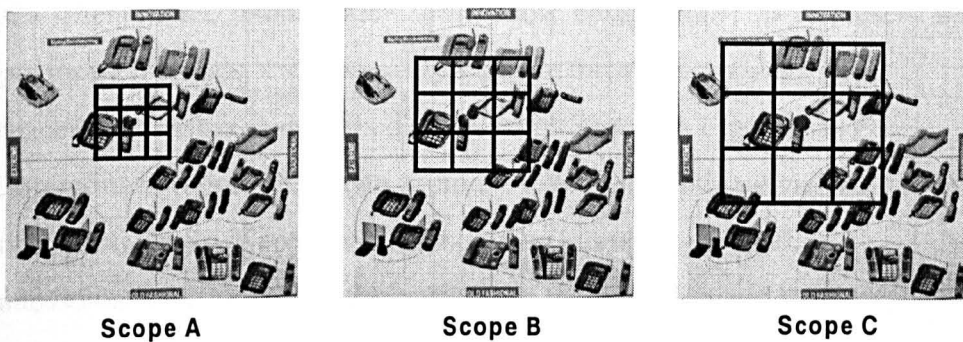


Figure 6.12: The Three Types of Idea Concept Scope

## **6.7 The Idea Concept Matrix**

The concept matrix helps the designer and the design leader to effectively define the concept generation orientation. From the digital answering machine action research project, it can be seen that using the concept matrix to forecast the client needs and wants is a useful tool. By combining market mapping and concept matrix, it offers a clear image for both the designer and the design leader and helps with understanding the market position and how to propose future concept products.

### **6.7.1 The Detail of Idea Concept Matrix**

The concept matrix, x-axis adjective word is extreme style to traditional style and y-axis adjective word is innovation style to contemporary style. The idea concept matrix is 3 x 3 square; the total matrix has 9 spaces. The center space is the focus point which is the position of the idea concept matrix location on the marketing mapping and also is one of the three orientations, middle orientation. Most design consultants present three idea concepts for their clients, and also easily evaluate three orientations.

Each space in the matrix is described as follows: (Shown in Figure 6.13)

- (1) Extreme-innovation (EI): Style approach to extreme and innovation.
- (2) Innovation (I): Style approach to innovation but not traditional.
- (1) Innovation-traditional (IT): Style approach to innovation and traditional.
- (2) Extreme (E): Style approach to extreme.
- (3) Focus point: Style approach to middle of x-axis and middle of y-axis.
- (4) Traditional (T): Style approach to traditional.
- (5) Extreme- Contemporary (EC): Style approach to extreme and contemporary.
- (6) Contemporary (C): Style approach to contemporary.
- (7) Contemporary-Traditional (CT): Style approach to contemporary and traditional



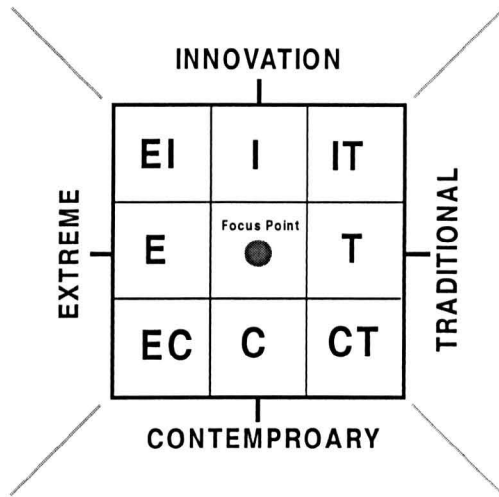


Figure 6.13: The Idea Concept Matrix

### 6.7.2 Idea Concept Approach

To chose the idea concepts by three orientations there are 20 different approaches. But, if the two orientations are excluded at the same level, this means, the up, middle, and down orientations, one or two are not in the same vertical level. In other words, each idea concept has a minimum of different styles. The 8 type of strategy attempts to describe as following (See Figure 6.14): Hax & Majluf 1990 noted that Rothschild 1980 model, (Show Figure 6.15) he used matrix to show consistent investment priorities, higher than expected and lower than expected. Thus the idea concepts according to the aggressive classic level are the attack, defense, and Conservative method. (Figure 6.16)

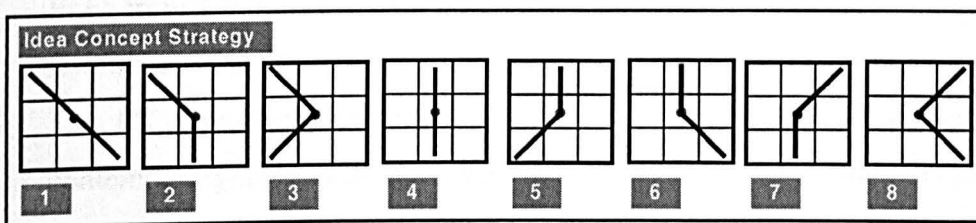


Figure 6.14: The Idea Concept Strategy

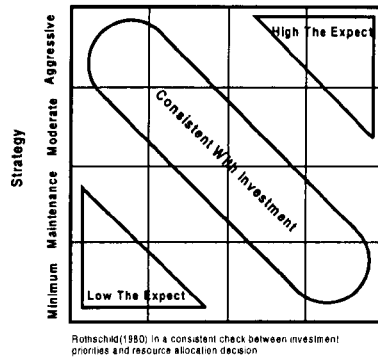


Figure 6.15: Rothschild 1980 Model

- Attack method

- (1) The standard approach: The three idea concepts are each located in a different vertical level. The up concept (EI) and down concept (CT) laid out become a 45 degree line.
- (2) The advance approach: The idea concept is a more advanced style, because of the up concept approach EI (Extreme-Innovation). The down concept approach is contemporary (C) but not too traditional.
- (3) The fast forward concept approach: Up and down concept approach is to extreme-Innovation (EI) and extreme-contemporary (EC).

- Conservative method

- (1) The middle approach: The three idea concepts are linked by a vertical line, which links from I to C. This style up concept approach is to I (innovation) but not too traditional. The down concept approach to contemporary but not too traditional.
- (2) The CT (contemporary-traditional) approaches: The down concept approaches contemporary-traditional (CT) and up concept approach innovation styles (I) not too traditional.
- (3) The down extreme-contemporary approach: Down concept approach is to extreme-contemporary (EC) and up concept approach to innovation not much to traditional style (I).

- Defense method

- (1) The conservative approach: The idea concept appears conservative character, because the up concept approaches to IT (Innovation-Traditional). The down concept approach to contemporary (C) but not too traditional.
- (2) The fast back ward approach: Up and down concept approach to innovation-traditional style and contemporary-traditional (CT).

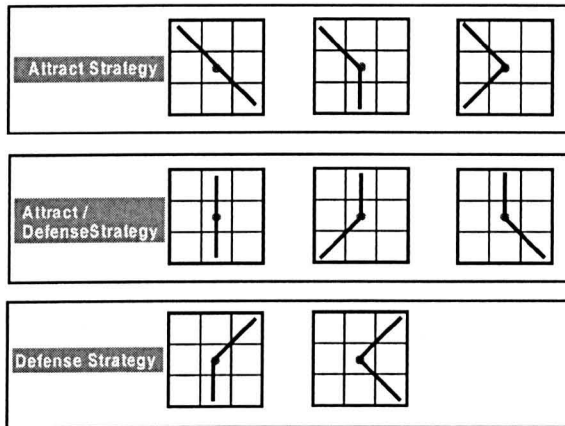


Figure 6.16: The Three Types of Idea Concept Strategy

## 6.8 Discussion and Recommendation

Firstly, in Section 6.2 the initial concept approach, to identify part A, detail of style; using photographs can waste lots of time, the suggestion is to use sketches and copies of the reference images for communication between the designer and the design leader.

If the design leader allows the designer to carry out design orientation before idea generation, it could limit designer's creation ability. But, on the other hand, if without design direction description, the designers may generate idea concepts in the wrong direction from the initial stage. The suggestion in this situation is to utilize design orientation description for junior designers. So that when the deadline approaches, the design leader feels there is no time to broaden the idea concept. The design orientation description may be useful to identify the right point at which to target the product.

Secondly, in the Section 6.3 concept matrix the designer needs to use their perceptual abilities to lay out the matrix. Thus several different matrix layouts could occur, each

with different ideas because it is the result of the designer subjective judgement. The recommended lay out for the concept matrix, if more than one designer is employed, is to use a corporate employee to map the concept matrix, thus the result of matrix may be more correct and objective. Furthermore, how the design leader compares the idea concepts against the design brief to decide the best idea concepts, is not a clear logical process and is a suggested topic for future research.

Thirdly, in Section 6.4, this is the first time MDS has been utilized to show clients' precept information for the design leader and designers. The design direction and position are clearly displayed on the MDS map, but more precisely using the marketing product map. But, using the MDS, even with only 12 product concept samples and 8 test subjects requires a lot of time. However, this experiment took two weeks to run each stage. When carrying out research it seems simple, but during a design project it is too time consuming, especially when design consultants charge for their services by time. However, if a design consultant has a long-term relationship with clients, then the suggestion is to renew the market map regularly by means of MDS in every 4 months.

Fourthly, in Section 6.4, the idea concepts were selected before the idea concept presentation consequently, the videophone idea concepts questionnaire results were tested after the concept strategy which is seen to be upside-down. But, from this action research, it can be seen that because of the results of the questionnaire, the initial concept strategy is modified for the next formal idea concept presentation. If the design leader needs to test and modify the concept strategy in each project, it could be a waste of time and money. But, on the other hand, some of the projects are seen as quite difficult or design leader is unfamiliar with the key decision-maker. Thus, using idea sketches to build a questionnaire in turn prepares for the next idea concept presentation, and with these results can match more precisely the client needs and wants.

In Section 6.7, the concept approach is an important tool in giving products the best styling position in a highly competitive market. However, most young designers lack the perception of key styling factors and product positioning ability. These are key factors

for high competition restyling products. Most young designers can design an excellent product, but it may not be for the right market matching the client requirements. But if the designer is a senior designer, who has enough design experience, the concept strategy may result in too many limitations in idea generation phase. The limitations could be influencing the idea results or idea generation process. The purpose of this study is to explore the role of design management in controlling product styling strategy. The limited idea generation of senior designers is a recommendation for future research.

Moreover, in the new concept approach, the different design sense of the decision-maker has a different focus and the size of range is also very difficult to define. Thus when the design leader meets with designers to evaluate the idea concepts, it is important to use precise words to describe and define the concept for the designer to understand. This part is a recommendation for future research.

## **6.9 Summary**

Firstly, section 6.2 concludes that initial concept identity format activity helps the designer and design leader to define the concept generation orientation. The advantages and disadvantages of this task are as following;

### **Advantage**

- To communicate with other designers and design leaders.
- To make sure the concepts associate with design trend product images.
- To identify the design orientation and market position.
- To understand how to propose different styles than other concepts.
- To record the chosen idea concepts for designer concept development.

### **Disadvantage**

- Design orientation description could limit designer's creative ability.
- The idea concepts show design leader's wishes not the designer's hope.

Secondly, section 6.3 concludes that the concept matrix tool helps both the designer and the design leader to effectively define the concept generation direction. The action

research method predicts that many design projects when using concept matrix to forecast the client needs and wants is useful a tool. Combining both market mapping and concept matrix, this offers a clear image for either designer or design leader and helps with understanding the market position in future concept products.

Thirdly, Section 6.4 MDS map concludes the advantage that the MDS map offers, which is a quantifying research method in which, the design manager becomes more confident when using an MDS map to predict the client needs and wants. Furthermore, the designers have a clear image for understanding client product perception to design the concepts. The disadvantage is it takes a long time during the design project.

Fourthly, Section 6.5 concept questionnaire, is to understand the clients needs and wants before the idea concept presentation, by means of idea sketches questionnaire to build up the concept matrix and ask the client which concept orientation approaches the company strategy. The out come of results can help the design leader to propose a suitable idea concept for his clients and the result is more precise than the design leader's prediction.

The idea concept matrix has three approaches (1), Attack method; (2), Defense and (3), Conservative method. According to product life cycle and company product line and product marketing position the suitable approach method is chosen. More detail will be discussed in the general discussion chapter.

## **Chapter 7 Decision Makers whose Design Sense**

The effective design result is based on a number of elements. One of the key elements is decision peoples' design sense. If decision people can't understand the design process, the background to design purpose and the output of design results, it could make a significant delay in the design schedule or result in the project failing. Hence, the design leader, especially in the design consultant company who service a lot of different types of organization, having a properly structured and effective design process for each clients requirements will have a a significant result during the design development phase.

Although, most of Taiwanese companies are small and middle sized business, those company product strategies have been "follower" or "me-too". Hence, most companies are only concerned with how to design and produce a popular product and sell it more cheaply in the global market. Thus, that design department may lack an industrial designer who has to create new products. If companies' decision-makers have design sense or design engineering skill, the product design process could be more effective and easier to make the right product to target the market.

This chapter describes the following aspects of design process: research from both decision maker and design consultant, exploring the interaction between decision maker and design leader in the design team.

### **7.1 Design Ability and Engineering Skill**

A key role of decision-maker in product design phase is to make any critical decisions, which will affect the design result in each phase of the design. If a decision-maker has design sense, he can use design language to communicate with designers. But unfortunately, most decision-makers do not have this ability. So both proper design process and results need experienced types of decision-maker. They need to understand and have design sense and have the following skill: Designer due to their long term design training, he must have a sense of design and some of peoples have design sense

but without any design training. Hence, design sense does not have to come only formal design training, it can be inherited from a parent and can be self taught or training in NPD process.

Bruce & Cooper 1996 pointed out: Design consciousness needs to develop, and through trial and error gained from many design projects. The design sense normally also needs a long time development. To explore the content of design sense, it is instructive to look at and understanding the design education. ICSID (International Council of Societies of Industrial Design) 1990 recommended that the design education should include six objectives: artistic, cultural, scientific, technical, marketing, and management. The evaluation mark from 1-5 point, the artistic and technical has 5 point. Feer 1980 summarized the skills of the industrial design student skills gained from design education as being, engineer, human factors, and marketing area. Bruce 1996 also mentioned that: a designer needs a number of competencies, such as driving the process, design, business orientation, perspective and framework, interpersonal competency. Design competency needed in objective creativity, technical, color and conceptual ability. From the above researchers it can be summarized that artistic is the first key design ability. The second key design ability is engineering skill. Bruce 1993 noted that client and designer need understand each other's language. Author in chapter 4 point out: many clients are not from an engineer background, so they are difficult to understanding 3D image from 2D orthographic projection drawing and no color soft model. However, if decision-makers have design technical skill, they can read design drawings (include computer drawing) and soft model without seeing a real product. Therefore they can use same language and communication with other design team numbers to produce a share understanding of the ideas product.

## **7.2 Design Evaluation**

Some of research mentioned that design is an important tool in marketing tactics to achieve the consumer appeal and repeat purchase. Design also contributes to price competitiveness and non-price competitiveness those points were stated by (Loosschilder 1994). Taiwan manufacturers produce many "me-too" products where product innovation is not very important in function area. Hence, product re-styling has



become one of key tasks for in Taiwan manufacturers. Also, product planning is already decided by buyer, therefore industrial designer's main role is in creating an attractive looking product for the world market.

Another researcher Ts'ai 1995 point out in this research that the evaluation of design has following functions: (1), The meaning of form; (2), Detail design; (3), Color harmony, and (4), Total form considering. He makes the conclusion that product design is styling activity. Any company can use these four elements to evaluate design project in product design phase. Su 1997 pointed that good design system is shown as follow (Figure 7.1). Firstly, art is product styling. Secondly, technology is function, user friendly, ergonomics. Thirdly, economic consideration, marketing, production. The final is social function that is green design and culture. The other key evaluation element is design trend of fashion, if design cannot match or catch up the fashion, the product is unlikely to be competitive in the market.

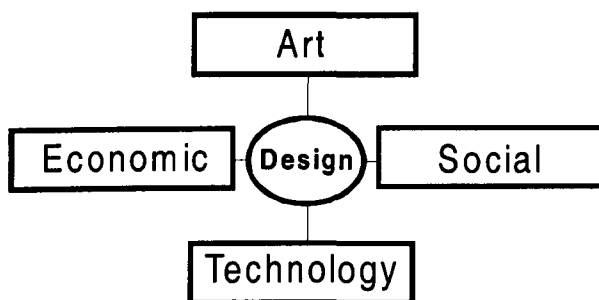


Figure 7.1: Good Design Evaluation System

### 7.3 Action Research for Design Project

This research is to explore design decision between interaction design ability, sense in Taiwan's consumer product environment. The author who handles those design projects as a design consultant utilizes the samples. All the projects details are carefully recorded and involve as follows, the project design proposal, design brief, schedule, cost of design charge, styling planning, and design meeting addresses. From June 1995 to May 1998, there were 39 design projects and the author designed all, or with other junior designers, together becoming a design team for completing the product. All projects

came from 14 companies, which are consumer product manufacturers, except the airplane 16G-passenger seat project, which comes from the Industrial Technology Research Institute.

Three medium-sized companies have more than 500 employees and also have manufacturing in Mainland China. One company provides high quality telephones, cordless telephones, fax machines, and another company produce pager, telephone modem the Final one produces timers to sell to the world. The other eleven companies are all small manufacturers, and the employees are not more than 200 people. One is a classic telephone manufacturer, Hentak, another an ISDN (Integration System Digital Network) telephone, pager, and cordless telephone manufacturer, Smartek. Only one company, Unication, produces one product line, which is a pager, Three companies are involved in computer ware products, one in multi-media speakers whose office is in Taipei, and is only marketing, with R&D people in Taiwan, but has manufacturing in Mainland China. Another is a laser scanner maker. The final computer Software Company, Eten, is a famous software maker in Taiwan, who produces PDA (Personal Digital Assistant). Only one company, Ligitek, produces electronic consumer products on the Taiwanese market, this is a Lease Disk decoder. Finally, the airplane 16G-passenger seat projects, which comes from the Industrial Technology Research Institute, CAST (Center for Aviation & Space Technology, Industrial Technology Research Institute). Three companies involve office communication, one is produce office telephone, Tentel Company, another is selling the office telephone to Asia, Philips Company, her is an international company. The final one is Panacom, new organization who produces videophone.

### **7.3.1 Taxonomy of Design Management Expertise**

The taxonomy shows as follows, results from the action research. Although, in design evaluation, and designer training, the design sense involves aesthetics (style, color, design trend) and marketability and culture. the design ability includes engineering skill and decoding of any kinds of visual result. Effective design from defining the problems set up from the brief to design ability, sense, design results, types of design decision, to styling planning create six levels. The following attempts to explain the categories in the

taxonomy.

(1) Design Brief:

This category tries to describe the company who is attempting, by means of a design consultant, to develop the products. Whatever the brief is, written or verbal, the design brief is devised to produce a specific, market position and future concept images. It should be clear and get right to the point. Lawson & Loke 1997 noted that word, and verbal description are better than pictures in expressing early design idea is their ability to sustain a range of interpretation. Thus if the Client uses many sensitive (adjective) words to attempt to describe the future product style, this client may have well design sense.

(2) Design Approach:

Design approach in normal projects is stage by stage defining the final design concept. From previous research, decision-makers were found not to have engineering skills and not a good drawing decoder ability, they need more 3D perspective drawing for showing the future products styling. In some cases, the decision-makers have a strong design sense, and they could be influenced on how to arrange the design approach.

(3) The Types of Decision Committee:

Company may have a new product development committee, it could be decision only by one key person, or key person with key related managers, or a key person could become chairman of the committee, or a non-key person committee. The types of design decisions represent the top-level management attempting to control design quality.

(4) Engineering skill:

Engineering skill is one of design ability that includes a skill to decode any kinds of visual results. Effective design from people with a decision-maker background of education could understand, but if the background of education came from engineering training, the engineer's skill would be better. If there are none of these kinds of background, the decision people could be trained by design project experience. Before

the initial design project, to attempt to understand the design engineer's skill is difficult, but the second project experience could be useful to organize the suitable design approach and type of hand out design results.

(5) Design Ability:

Design sense involves aesthetics and marketability. The aesthetics involved for decision-makers are (1), Styling: customer needs and wants basically come from styling; (2), Color: color represents product character and company CIS (Corporation Identity System); (3), Design trend: products are changed by the trend every year, or month. The trend is representative of most designers, and customers are willing and cognitive, and (4), Culture: culture awareness is a basic knowledge of designers and customers when a product attempts to sell in a special area.

### **7.3.2 To Classify the Design Projects**

All the design projects used the section 7.3.1 taxonomy to outline the type of clients. However, all commitments are proposed by the author himself following the design meeting record and observation results. How to generate commitments is shown as follows.

Firstly, the design brief needs classifying by two criteria, that is, product specification and adjective word. Most clients will offer a document specification or just explain the specification orally, but both approaches are given a yes mark, this means, they offer the specification. In addition, when the client directly uses adjective words to explain the future concept, that is given a yes mark. On the other hand, when the design leader asks the key decision-maker to use an adjective word without any response, then the author may give a no mark to the design brief.

Secondly, design approaches, that is, the design process during the front-end-industrial design process. The list of design approaches are proposed for clients design projects. Different clients have different approaches, the suitability of which the chief designer decides on according to the clients' budgets and time limit, and whether the project is

simple or complicated. The \* mark means these subjects have been presented to the client. For example, sketches of many ideas are given no mark, because they are only presented to design consultants for checking the design direction.

Thirdly, types of decision committee. When the client has a formal NPD committee, the author places the \* mark under the C (Committee), when the client only uses a key decision-maker to evaluate design, the \* mark is put under K (Key decision-maker). Some types consist of the key decision-maker and related department manager, then the \* mark is under K+M (Key decision-maker and managers). The final type is K+C (Key decision-maker and NPD committee).

Fourthly, engineering skill, when the client has related engineering background, or can read 2D orthographic project drawing, the client is given a yes to engineering skill. When the client cannot read 2D orthographic project drawing or does not read it very carefully, the author may mark no to engineering skill.

Finally, design ability includes aesthetic and marketing ability. Aesthetic includes styling, colour and design trend. Marketing includes market research and culture. This investigation is based on communication with clients during every design stage. From observing interaction between designer and client, their design sense could be uncovered. When clients criticise design from the styling aspect and can explain which kind of design style is used by the company, then the author gives a \* mark in styling. The colour is comparable with styling. When the client can explain the design semantic or product symbol or the main stream of design, the author gives a \* mark in design trend. Most clients are familiar with marketing and use cultural information in action research case studies. In addition, when the client can explain the target market and market survey information, the author gives a \* mark in market research. Moreover, when the client mentions the user's life style and target market preference, the author gives a \* mark in culture.

Table 7.1: Design Projects Information

Clients				Design Brief		Design process approach						Decision K – Key Decision M - Manager C - Committee			
Start data	Company	Product	Model No	Spec.	Adj.	Idea sketch	2D rough sketch	2D computer rendering	3D computer modeling	Soft model	Dummy Model	K	K + M	K + C	C
June'95	Kingtel	Cordless	kt-670	yes	yes		*				*	*			
June'95	Kingtel	Cordless	kt-650	yes	yes		*				*	*			
June'95	Kingtel	ct2	kt-	yes	yes		*					*			
July'95	Hentak	Tel./Ans.	art	yes	yes		*		*				*		
July'95	Hentak	Tel./Ans.	classic	yes	yes		*		*				*		
Dec'95	Kingtel	Call ID	kt-400	yes	yes		*			*	*	*			
Dec'95	Kingtel	Cordless	kt-655	yes	yes		*			*	*	*			
Feb.'96	Edta	Speaker	G-9601	yes	yes		*		*	*			*		
Feb.'96	Kingtel	Caller ID	kt-401	yes	yes		*			*	*	*			
Feb.'96	Kingtel	Cordless	kt-656a	yes	yes		*			*	*	*			
Mar.'96	Edta	Speaker	G-9602	yes	yes		*			*	*		*		
Sep.'96	Smartek	ISDN Tel		yes	yes		*		*	*	*				*
Sep.'96	Kingtel	Tel.	kt-628	yes	yes		*		*	*	*	*			
Sep.'96	Kingtel	Cordless	kt-658	yes	yes		*		*	*	*	*			
Nov.'96	Smartek	Pager	St-221	yes	no				*	*	*				*
Nov.'96	Smartek	Pager	St-811	yes	no				*	*	*				*
Dec.'96	Unication	Pager	60R	yes	yes				*	*	*			*	
Dec.'96	Unication	Pager	90a	yes	yes		*		*	*				*	
Jan.'97	Ming-jong	Timer		yes	no				*	*	*			*	
Feb.'97	Smartek	Cordless	St-201	yes	no		*			*					*
Apr.'97	Eten	PDA		yes	no		*		*	*	*			*	
Apr.'97	CAST	16G seat	A Project	no	no	*			*	*	*				*
Apr.'97	Kingtel	Tel	Kt-932	yes	yes		*			*	*	*			
May'97	Kingtel	Cordless	Kt-634	yes	yes		*			*	*	*			
May'97	Kingtel	Caller ID	Kt-718	yes	yes	*	*			*	*	*			
July'97	Kingtel	Fax	Ktf-70	yes	yes	*	*			*		*			
July'97	Kingtel	Water Filter	Ktf-100	yes	yes		*			*		*			
July'97	Kingtel	Water Filter	Ktf-300	yes	yes	*	*			*		*			
Oct.'97	Kingtel	Scanner	Kts-600	yes	yes	*	*			*	*		*		
Dec.'97	CAST	16G seat	B Project	no	no					*	*				*
Dec.'97	Syntech	Laser S		yes	no	*				*	*			*	
Jan.'98	Ligitek	Decoder	Dvl-200	yes	yes		*				*		*		
Feb.'98	Tentel	Key Tel.		yes	no				*	*	*		*		
Feb.'98	Philips	Key Tel.		yes	no				*				*		
Mar.'98	Tranbon	Videophone Tel.		no	yes				*		*			*	
Apr.'98	Panacom	Videophone Tel.		no	yes				*	*	*		*		
Apr.'98	Kingtel	Dig. Ans.	Kt-701	no	no				*		*	*			
Apr.'98	Kingtel	Mimi Cordless	Kt-600	no	no	*			*		*	*			
Apr.'98	Smartek	Pager	Flex01/2	yes	yes				*		*		*		

Table 7.2 shows the design sense data. Engineering skill and design ability become design sense. Design ability includes aesthetic ability which is from styling to culture and each item has one point, the total is five points. If two and under the two point is lacking (no) design ability. On the other hand, in engineering skill ability, according to the engineering skill (Yes or no) and Design ability (Yes or no), the client's decision-maker is divided into four zones.

Table 7.2: Design Sense Factors

Client		Design brief		Key decision makers' design sense			Design ability : Aesthetic and marketing ability					
Company	Product	Specific	Adjective	a. Engineering Skill	b. Design ability	a and b matrix	1. Styling	2. Color	3. Design Trend	4. market Research	5. Culture	1-5 Total
Kingtel	Cordless Tel.	yes	yes	yes	yes	4	*	*	*	*	*	5
Hentak	Tel./Ans.	yes	yes	no	yes	3	*	*	*	*	*	5
Edta*	Speaker	yes	yes	no	no	1				*	*	2
Smartek	ISDN Tel.	yes	yes	yes	no	2				*	*	2
Unication*	Pager	yes	yes	yes	yes	4	*	*		*	*	4
Ming-jong	Timer	yes	no	yes	no	2				*	*	2
Eten*	PDA	yes	no	no	no	1				*	*	2
CAST	16G seat	no	no	yes	no	2						0
Syntech	Laser Scan.	yes	no	yes	yes	4	*	*		*	*	4
Ligitek	Decoder	yes	yes	no	yes	3	*	*	*	*	*	5
Tentel	Key Tel.	yes	no	yes	no	2				*	*	2
Philips	Key Tel.	yes	no	no	no	1				*	*	2
Tranbon	Video Tel.	yes	yes	yes	yes	4	*	*	*	*	*	5
Panacom	Video Tel.	yes	yes	yes	no	2				*	*	2

#### 7.4 Key Decision Maker Whose Between Design Sense and No Design Sense

Engineering skill and design aesthetic ability are defined the design sense. Engineering skill (Y-axis) helps the decision people to achieve better design communication ability, and also can use the design language to share their viewpoint. Design ability (X-axis) involves styling, color worth, design trend, market research, and culture. This case study's author defined both engineering skill axis and design aesthetic ability axis as the design sense. Figure 7.2 shows as following:

<b>Engineer Skill</b>	High	<b>Low Design Ability</b> High Engineer Skill (2)	<b>High Design Ability</b> High Engineer Skill (4)
	Low	<b>Low Design Ability</b> Low Engineer Skill (1)	<b>High Design Ability</b> Low Engineer Skill (3)
		Low	High

**Design Ability**

Figure 7.2: Design Ability and Engineering Skill Matrix

### 7.4.1 Zone 1: Low Engineering Skill and Low Design Ability

Table 7.3: Zone 1 Clients

Client		Design Brief		Design Sense			Design ability : aesthetic and marketing ability					
Company	Product	Specific	Adjective	a. Engineering Skill	b. Design ability	A / b. matrix	1. Styling	2. Color	3. Design Trend	4. market Research	5. Culture	1-5 Total
Edta*	Speaker	yes	yes	no	no	1				*	*	2
Eten*	PDA	yes	no	no	no	1				*	*	2
Philips	Key Tel.	yes	no	no	no	1				*	*	2

Three companies are in zone 1 (Show Table 7.3), Edta, Eten and Philips, the final is a failure project. The Edta is not satisfied with styling, because its buyer did not choose the prototype. The background of Edta's key decision-maker is in economics of agriculture and general management, and has experience of success in new product development and marketing. The Eten is also not happy with styling, because after the computer show, the market feed back information showed the organic styling approach to be better. The background of Eten's key decision-maker is Electric Engineer (EE) and head of R&D department, who have experience of success in new product development. Both are low in engineering skill, not much suggestion from initial contact and not much idea during the concept presentation. So, in the design aesthetic, only two items, marketing research and culture, have a \* mark. Edta's decision-maker are also involved in market research, they understand buyers' needs and wants. Thus they use many adjective words in attempting to describe to their client the market location and styling



preference. This only can explain that Edta quite understands the market. The Philips project is divided from Tentel's office telephones. The key decision-maker whose background is EE. He has excellent marketing sense but only for business level. This office telephone was designed for China market and he must know the local user. The key decision-maker lack styling, color and design trend information, because of not much mention this subjects.

### 7.4.2 Zone 2: High Engineering Skill and Low Design Ability

Table 7.4: Zone 2 Clients

Client		Design Brief		Design Sense			Design ability : Aesthetic and marketing ability					
Company	Product	Specific	Adjective	a. Engineering Skill	b. Design ability	a./b. matrix	1. Styling	2. Color	3. Design Trend	4. market Research	5. Culture	1-5 Total
Smartek	ISDN Tel	yes	yes	yes	no	2				*	*	2
Ming-jong	Timer	yes	no	yes	no	2				*	*	2
CAST	16G seat	no	no	yes	no	2						0
Tentel	Key Tel	yes	no	yes	no	2				*	*	2
Panacom	Video Tel	yes	yes	yes	no	2				*	*	2

Five companies, Ming-jong, Smartek, CAST, Tentel and Panacom are in zone 2 (Table 7.4). These are successful projects. The Ming-jong Company is a timer maker, a medium sized company. The background of Ming-jong's key decision-maker is Mechanical Engineering (ME) and general management. They have experience of success in new product development and marketing. The Smartek Company, a small sized company, makes ISDN & cordless telephones and pagers. The background of Smartek's key decision-maker, general management, is ME and he has experience of success in NPD. The CAST (Center for Aviation & Space Technology, Industrial Technology Research Institute), a medium sized company, is a research center. The background of CAST key decision-maker is ME and head of aero structure department, and they have experience of success in new product development. Three key decision-makers have high engineering skills, but not much suggestion from initial contact and not much idea during the concept presentation. So, in the design ability, only two items, marketing research and culture, have a mark. Smartek's decision-maker is also involved

in market research. Thus they use many adjective words in attempting to describe to their client, such as, European styling, and also chose a benchmarking product. This could explain that Smartek quite understands the market. The CAST's decision-maker, from initial contact and during the concept presentation, does not have much idea and do not offer marketing information for design reference. So, CAST has no mark in the design aesthetic subject. Tentel and Panacom decision-maker also is EE background, but have long term NPD experience. Both have good read drawing ability thus the engineer skill was mark yes. The zone 2 clients have same condition that is lack description the future concept by word. The means is more respect designer and trust design consultant ability.

### 7.4.3 Zone 3: Low Engineering Skill and High Design Ability

Table 7.5: Zone 3 Clients

Client		Design Brief		Design Sense			Design ability : Aesthetic and marketing ability					
Company	Product	Specific	Adjective	a. Engineering Skill	b. Design ability	a./b. matrix	1. Styling	2. Color	3. Design Trend	4. market Research	5. Culture	1-5 Total
Hentak	Tel./Ans.	yes	yes	no	yes	3	*	*	*	*	*	5
Ligitek	Decoder	yes	yes	no	yes	3	*	*	*	*	*	5

Two companies, Hentak and Ligitek are in zone 3 (Show Table 7.5), and both are successful projects. The Hentak Company is a classic telephone maker, a small sized company. The background of Hentak's key decision-maker is graphic design and general management. They have experience of success in new product development and marketing. The Ligitek Company, a small sized company, is a DVD decoder maker. The background of Ligitek's key decision-maker is EE and Head of R&D department, and they have experience of success in new product development. Hentak's decision-maker has a lower engineering skill, but quite a lot of suggestions from initial contact and many ideas during the concept presentation. So, in the design aesthetic, three items – styling, color and design trend have mark. In addition, Ligitek's decision maker are also involved in market research, thus they use many adjective words in attempting to describe to their client, such as, European styling, and also chose a benchmarking

product. This could explain that Ligitek quite understands the market and user culture.

#### 7.4.4 Zone 4: High Engineering Skill and High Design Ability

Table 7.6: Zone 4 Clients

Client		Design Brief		Design Sense			Design ability : Aesthetic and marketing ability					
Company	Product	Specific	Adjective	a. Engineering Skill	b. Design ability	A ./ b. matrix	1. Styling	2. Color	3. Design Trend	4. market Research	5. Culture	1-5 Total
Kingtel	Cordless	yes	yes	yes	yes	4	*	*	*	*	*	5
Unication*	Pager	yes	yes	yes	yes	4	*	*		*	*	4
Syntech	Laser Scan.	yes	no	yes	yes	4	*	*		*	*	4
Tranbon	Video Tel.	yes	yes	yes	yes	4	*	*	*	*	*	5

Four companies, Kingtel, Unication, Syntech and Tranbone are in zone 4 (Table 7.6), and these are successful projects. The Kingtel Company is a telephone maker, a medium sized company. The background of Kingtel’s key decision-maker is EE, president / general manager and they have excellent experience of success in new product development and marketing. The Unication Company, a small sized company, makes pagers. The background of Unication’s key decision people is architecture and president, and they have experience of success in new product development. The Syntech, a small sized company, is a laser scanner maker. The background of Syntech’s key decision-maker is EE and vice general manager / project manager, and they have experience of success in new product development and marketing ability. Three key decision-maker have high engineering skills, Kingtel’s decision maker are more interested in industrial design, so they have been involved in nearly twenty years experience of successful new product development and marketing. They have many suggestions from initial contact and many ideas during the concept presentation and many modifications until the design is perfect. So, in the design aesthetic, they have fulfilled five marks. Unication’s decision maker do not use many adjective words in advance but attempt to chose a benchmarking product or similar product to explain their idea. This could explain how Unication quite understands the market needs and wants, and also could be due to architecture education being the same as design training. Thus the key decision-maker have a good quality design sense. The Syntech key decision-maker from initial contact and during the

concept presentation has many ideas and offer marketing information for design reference. So, in the design aesthetic, Syntech have four marks. Moreover, Tranbon Company is pager, cordless telephone and modem phone producer. The key decision-maker, no engineer background but have long term NPD experiences, has good engineer ability. He has excellent marketing sense, especially he has good sense for suitable style, color and trend in concept product. Tranbon has fulfilled five marks.

### 7.5 The Design Sense Model

Four zones were gave a name, which is based on both engineering skill and design ability. See the Figure 7.3: design sense model and the summary of four zones of design sense show as follows Table 7.7.

<b>Engineering Skill</b>	<b>High</b>	Low Design Ability High Engineer Skill (Zone 2) <b>Engineer sense</b> Smartek, Ming-jong, CAST, Tentel, Panacom	High Design Ability High Engineer Skill (Zone 4) <b>Designer Sense</b> Kingtel, Unication, Syntech, Tranbon
	<b>Low</b>	Low Design Ability Low Engineer Skill (Zone 1) <b>Senseless</b> Edta, Eten, Philips	High Design Ability Low Engineer Skill (Zone 3) <b>Artist sense</b> Hentak, Ligitek
		<b>Low</b>	<b>High</b>

Figure 7.3: Design Sense Matrix

Zone 1 was gave a name that is “Senseless”. It is both low design ability and engineer skill. These three key decision-makers are no mechanical engineer background, and reading the 2D orthographic projection drawing g skill is worse. Those decision-makers were asked to describe the future product by verb. The same as results that is fewer verbs to describe and also can not use the adjective words to construct the concept. Only Edta can use adjective word, but Edta project is fail because of design consultant can not satisfy his buyer. Eten project also is fail, the reason is key decision-maker unsatisfied the final style. However, the three of key decision-makers have experience in NPD but no clear image in his mind. The zone 1 decision-makers need to develop the both

engineer skill and design ability.

Table 7.7: The Summary of Four Zones of Design Sense

Client		Design brief		Key decision makers' design sense			Design ability : Aesthetic and marketing ability					
Company	Product	Specific	Adjective	a. Engineering Skill	b. Design ability	a and b matrix	1. Styling	2. Color	3. Design Trend	4. market Research	5. Culture	1-5 Total
Edta*	Speaker	yes	yes	no	no	Zone 1				*	*	2
Eten*	PDA	yes	no	no	no	Zone 1				*	*	2
Philips	Key Tel.	yes	no	no	no	Zone 1				*	*	2
Smartek	ISDN Tel.	yes	yes	yes	no	Zone 2				*	*	2
Ming-jong	Timer	yes	no	yes	no	Zone 2				*	*	2
CAST	16G seat	no	no	yes	no	Zone 2						0
Tentel	Key Tel.	yes	no	yes	no	Zone 2				*	*	2
Panacom	Video Tel.	yes	yes	yes	no	Zone 2				*	*	2
Hentak	Tel./Ans.	yes	yes	no	yes	Zone 3	*	*	*	*	*	5
Ligitek	Decoder	yes	yes	no	yes	Zone 3	*	*	*	*	*	5
Kingtel	Cordless	yes	yes	yes	yes	Zone 4	*	*	*	*	*	5
Unication*	Pager	yes	yes	yes	yes	Zone 4	*	*		*	*	4
Syntech	Laser Scan.	yes	no	yes	yes	Zone 4	*	*		*	*	4
Tranbon	Video Tel.	yes	yes	yes	yes	Zone 4	*	*	*	*	*	5

Then, zone 2 was given a name that is “Engineer Sense”. It is one low design ability another is high engineer skill. The five key decision-makers only Tentel and Panacom do not have mechanical engineer background but both have long NPD experience thus reading 2D orthographic projection drawing skill is well. Those people were asked to describe the future product by verb. The same as results that is fewer verbs to describe and also can not use the adjective words to construct the concept. However, the three of key decision-makers have experience in NPD so they understand the marketing and target customer, but no clear image in his mind. The zone 2 key decision-makers need to develop design aesthetic ability. The Zone 2 only Ming-jong project is fail, which is mechanical design. The project fail is not on styling stage.

The next, zone 3 was given a name that is “Artist Sense”. It is one high design ability another is low engineer skill. The two key decision-makers do not have ME background and reading the 2D orthographic projection drawing skill is not well. Those people were asked to describe the future product by verb. The same as results that is used many verbs to describe and also utilized the adjective words to construct the future concept.

However, the two of key decision-makers have long experience in NPD so they understand the marketing and target customer. There is an interesting in this zone key decision-makers. One company producing the class telephone whose decision-maker is graphic designer. She understands the buyers need and want, but, in this project, she no clears image in his mind. The reason is that she uncertain his subject looks alike. Therefore, repeat many times in initial concept design phase. Having design background, the key decision-maker might be rework and rework if the concept do match his need. Another companies who produce DVD (Digital videodisk) decoder. This kind of product needs compatible with DVD player. The key decision has good experience in this field thus he know the design trend, style, color and market information. The zone 3 decision-makers need to develop engineer skill to improve the decoding drawing skill. Zone 2 projects all successful.

The finial, zone 4 was gave a name that is "Design Sense". It is one high design ability another is high engineer skill. The four key decision-makers no one have ME background but have long NPD experience thus reading the 3 views drawing skill is well. Those people were asked to describe the future product by verb. The same as results that is used many verbs to describe and also can not use the adjective words to construct the concept. The same condition is all key decision has confidence in design sense. However, the four key decision-makers have excellent experience in NPD so they understand the marketing and target customer. In the same time, they have a clear image in his mind for the future concept design. The zone 4 decision-makers only need to enhance design ability. Zone 4 only Unication project is fail, which the styling was not match the key decision-maker. The entire zone 4 project also has same situation that is modify and modify again. The reason is much confidence in past NPD experience thus they believe his sense.

## 7.6 The Identify the Different Characteristics among the Four Zones Key Decision-makers

From Table 7.8, recording the detail of projects. Bruce & Cooper 1996 noted that design consultant characteristic have long term (familiarity, stability, continuity) and short term relationship.

Table 7.8: The Identify the Different Characteristics among the Four Zones Key Decision-makers

Client information		Client and designer relationship				Project		Project rework			Zone
Company	Product	Long term	Short term	Repurchase client	NPD /years	Failure	Debate	Total rework	Redo part of works	When get right point	
Edta*	Speaker		*		5	*	*	*		3	Zone 1 Senseless
Eten*	PDA		*		1	*	*			1	
Philips	Key Tel		*		2					1	
Smartek	ISDN Tel	*			3					1	Zone 2 Engineer Sense
Ming-jong	Timer		*		2	*	*	*	*	3	
CAST	16G seat	*			1					1	
Tentel	Key Tel	*		*	1					1	
Panacom	Video Tel		*		3					1	
Hentak	Tel./ans.		*		3		*	*		3	Zone 3 Artist Sense
Ligitek	Decoder	*		*	1					1	
Kingtel	cordless	*		*	10			*	*	1 or 3 or more	Zone 4 Designer Sense
Unication*	Pager		*		3	*	*			3	
Syntech	Laser S		*		2					1	
Tranbone	Video Tel	*		*	5		*	*		1 or 3	

From repurchase clients information showing that only zone 1 is none. Each zone 2 and zone 3 have one repurchase client, and two repurchase clients in zone 4. This repurchase client means that before the June 1995 case studies is used clients. Some of clients do not develop new product each year or some reason to stop investigation in NPD or been employees others design consultant.

The quality of NPD in each year also influences the relationship between designer consultant and client. The NPD per year means that client releases design projects to outsource design consultant in each year. Design management characteristic among four zones key decision-makers show as follow Table 7.9.

Table 7.9: Design Management Characteristic among Four Zones Key Decision-Makers

Zone	Characteristic
Zone 1 Senseless	<ul style="list-style-type: none"> <li>● Short term relationship</li> <li>● Lacking use adjective word</li> <li>● Less Engineer skill</li> <li>● Unconfident of design sense ( Engineer skill and Aesthetic ability)</li> <li>● Less argue of aesthetic factors</li> <li>● Uncertain the buyer needs and wants</li> </ul>
Zone 2 Engineer Sense	<ul style="list-style-type: none"> <li>● To access the relationship</li> <li>● Less argue of aesthetic factors</li> <li>● Lacking use adjective word</li> </ul>
Zone 3 Artist Sense	<ul style="list-style-type: none"> <li>● Developing Long term relationship</li> <li>● Confident of design sense ( Engineer skill and Aesthetic ability)</li> <li>● Used adjective word</li> </ul>
Zone 4 Designer Sense	<ul style="list-style-type: none"> <li>● Long term relationship ( familiarity, stability, continuity)</li> <li>● Strong confident in pervious experience.</li> <li>● Confident of design sense ( Engineer skill and Aesthetic ability)</li> <li>● Used adjective word</li> <li>● Rework the design work because of not match the client wants</li> <li>● More argue of aesthetic factors</li> <li>● The NPD per year are more than two projects</li> </ul>

### 7.7 Summary

Due to this chapter utilize quality research and the subject only author design project. The personal characteristic and interpersonal could impact the conclusion. The suggestion in next experiment firstly, if use the quantify research input more design consultants factors could be better. Secondly, engineer skill ability needs a tool to access. The conclusion as following:

- The key decision maker has “Designer Sense” characteristic who has strong confident of previous work and design sense that include engineer skill and aesthetic ability. The important factors, which have more, rework and argue. It is could be develop became a long-term relationship.
- The key decision-maker has “Artist Sense” characteristic that also has confident of design sense. He also uses many adjectives to describe the future product.
- The key decision-maker has “Engineer Sense” characteristic that has unconfident of design sense. He seldom argues to modify the styling
- The key decision-maker has “Senseless” characteristic who also has unconfident of design sense. He less uses adjective word to describe the future product and less argue of aesthetic factors. In the other hand, he might uncertain the buyer requirement.



## **Chapter 8 Experimentation**

There are two experiments in this chapter, one using an SD test to sort out the types of design sense of key decision-makers, and the other used Lego basic components to test engineering skill.

### **8.1 Design Sense of Key Decision-makers**

The decision-makers' design sense affects the design result during the NPD process. If decision-makers can not understand the design process, the background to the design purpose and the output of design results, it could significantly delay the design schedule or result in a failed project. Hence, the design manager, especially in a design consultancy company who service many different types of organization, needs a properly structured and effective design process tailored to each clients requirements which will have significant benefits during the design development phase.

The design sense model developed showed that decision-makers have different levels of design sense for evaluating the new product concepts and style. The relationship of the client and design consultant is also influenced by design sense. If the designer can understand the kind of design sense which belongs to the clients, the product design process could be more effective in making the right product for the target market.

This chapter describes three aspects of the design process: Firstly, research from both decision-maker and design consultant. Secondly, exploring the interaction between decision-maker and design manager in the design team. Thirdly, the design sense model.

#### **8.1.1 Research Methodology**

To investigate the user perceptions of product form, the semantic differential method (SD) Osgood et al. 1957 is one of the most frequently used methods. This research employed SD method to establish a perception of space (or design sense) between key decision-makers and the design leader, and compares the different approaches of those people through the resultant finding.

The SD method is composed of three elements which are evaluated; concept, scale, and subject. The selected scales are included by semantic space, which are evaluation, potency and activity. The amount of dimension (as each item in a semantic differential scale is called) required 10 to 30, and the number of points on the scale is usually 5, 7 or 9 point.

### 8.1.2 Experimental Method

#### The Stages of Research

This research employs the SD method to evaluate clients and designer perception of product form. The research was arranged into two stages. As showed in Table 8.1.

Table 8.1: The Stages of Research

	Stage 1	Stage 2
	Pilot test	Semantic differential test
Purpose	To chose the representative sample and adjectives	To study client's and designer's preference and to build up their conceptual model
subject	Senior designers: 4	Clients:33 Designers:43
Material	Questionnaires with 19 samples and 16 adjectives	Questionnaires with 13 samples and 11 adjectives
Task	SD evaluation	SD evaluation
Analytical tool	Cluster analysis	Factor analysis

#### The Materials

Product concepts were selected from The IF (Industrie Forum Design Hannover) award 1998, International Design 43/annual 1997 award and Japan G-mark 1995 award. Concepts were used for computers, communication, and electronic consumer products. The tested design and client subjects produce those kind of products. Photographs of the product concepts selected for tests were copied from books and magazines. At the same time, the objective was to provide 4" x 6" photographs for the author and one senior designer to chose. Finally, 19 photos were selected and scanned to a computer image format. The backgrounds of photos were cut out and each one colour printed on A4 sized paper.

## The Attitude Scale

The elements of the scale consisted of adjectives, which cover the semantic space. Initially, sixteen adjectives were selected. Using a 9-point scale, the subjects can judge from a pair of adjectives in order to indicate their rating as follows:

	1	2	3	4	5	6	7	8	9	
Modern	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Traditional

Subject assigns a score to each sample according to their impression and personal evaluation by placing a check mark along the scale. For the low degree sector, evaluation scale should fall in the range of 1 to 3 points; median degree sector 4 to 6 points, and high degree sector 7 to 9 points.

## The Subjects

The subject samples employed at stage 1 (pilot test) comprised 4 senior designers, two of whom have more to 15 years design experience, one has more than 10 years design experience and the other has 5 years experience as a designer.

The subject samples employed at stage 2 (SD test) comprised 33 clients including key decision-makers and managers and 43 consultant designers which included design leaders and designers.

The 13 companies were those for whom the author carried out design consultancy work. Thirty-nine design projects were carried out for these client companies from June/1995 to July 1998. The 13 companies are mostly located in the Taipei area and one from Hsinchu (in north Taiwan). Most of the companies produce electronic products such as computer and communication products, audio-video products, consumer products and 16G passenger aircraft seat product.

The 11 design consultants design leaders are chosen from CIDA (China Industrial Design Association) published book, and also by reference to the design consultants invited by CIDA 40<sup>th</sup> annual exhibition. Most participating design consultants operate in Taipei (North Taiwan), and two design consultants in Taichung (Middle Taiwan), one

design consultant in Tainan (South Taiwan). The subject samples and further analysis are shown in Table 8.2 below.

Table 8.2: The Subject Profile for Design Attribute Indication

Subject profile	Clients (33)	Design consultants (43)
Sex	Male (28) Female (5)	Male (35) Female (8)
Age	31-40 (15) above 40 (18)	21-30 (21) 31-40 (17) above 40 (5)
Job title	President (6) General manager(8) Manager (15) Chief designer (3) Engineer (1)	President (2) General manager(5) Manager (4) Chief designer (15) Engineer (15) Other staff (2)
Design education background	Industrial Designer (2) Graphic Designer (2) Interior designer (0) Multimedia Designer(0) Other designer (3)	Industrial Designer (40) Graphic Designer (2) Interior designer (1) Multimedia Designer (1) Other designer (3)
Design Background	Design (7) No design (26)	Design (41) No design (1)
Key task	Key decision-maker (13)	Design leader (11)

### Procedure

The stage 1 pilot test resulted from questionnaires with 19 samples and 16 adjectives. The 4 senior designer participated in the pilot test. They entered scores on 16 pages with concept photographs and a SD scale. The concept photographs and the scale were explained before the test to ensure that each designer understood the purpose of the exercise.

The stage 2: SD test. Again before answering the questionnaires with 13 product concept samples and 11 adjectives, the client subjects were given an explanation of concepts and the adjectives by the design consultant. Because the thirteen key decision-makers are all very busy business executives, more patience and time and clear explanation were needed. In total 76 subjects from 24 companies complete the survey.

### 8.1.3 Results and Discussions

#### Stage 1: Pilot Test

The result was then coded for cluster analysis. 11 adjective pairs and 13 concept samples were picked for the final SD test by using cluster analysis. All the selected concept samples are referred to in the appendix.

The initial collected adjective pairs relating to design sense include style, colour, marketing, design trend, and culture. The 16 adjective pairs are shown as follows:

- |  |  |
|--|--|
| (1) Traditional style-Modern style     | (2) Nostalgic style –Futuristic style        |
| (3) Masculine style –Feminine style    | (4) Plagiaristic style -Creative style       |
| (5) Popular style -Personality style   | (6) Hard style - Soft style                  |
| (7) Coarse style -Delicate style       | (8) Conservative colour-fashion colour       |
| (9) Modern colour-Futuristic colour    | (10) Harmony colour-Contrast colour          |
| (11) Frivolous colour- Steady colour   | (12) Comfortable colour-Uncomfortable colour |
| (13) Japanese Style-European style     | (14) Local style-Universal style             |
| (15) My taste style-others taste style | (16) Like style-dislike style                |

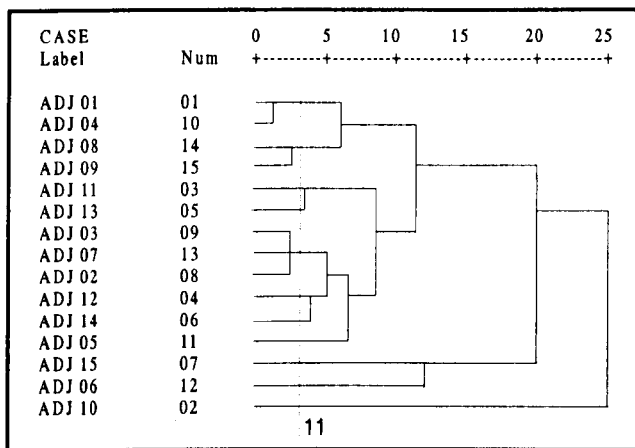


Figure 8.1: Adjective Cluster Analysis

The 11 adjective pairs extracted for SD test is as follows: (Figure 8.1)

- |                                      |                                     |
|--------------------------------------|-------------------------------------|
| (1) Traditional style-Modern style   | (2) Masculine style –Feminine style |
| (3) Popular style -Personality style | (4) Hard style - Soft style         |

(5) Modern colour-Futuristic colour

(6) Harmony colour-Contrast colour

(7) Comfortable colour-Uncomfortable colour

(8) Japanese Style-European style

(9) Local style-Universal style

(10) My taste style-Others taste style

(11) Like style-Dislike style

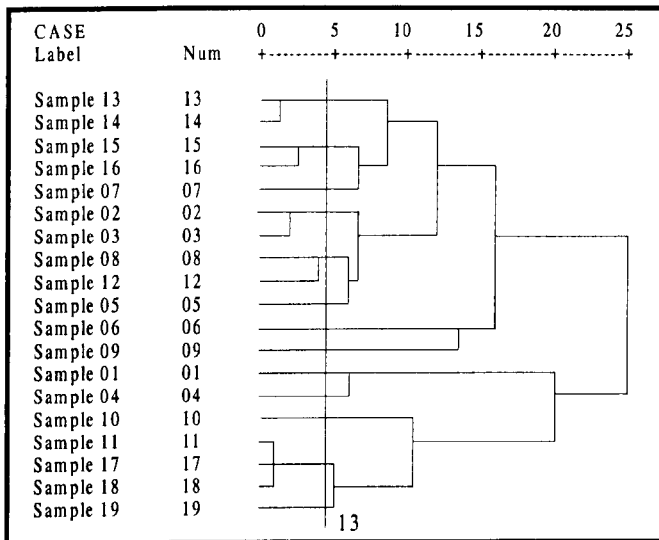


Figure 8.2: Material Cluster Analysis

Figure 8.2 shows how the 19 product concepts using the SD test became 13 material.

(Figure 8.3) Please refer to appendices to see the selected product samples.

Sense Model concept sample

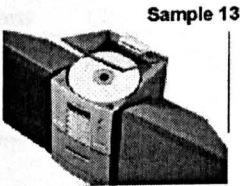
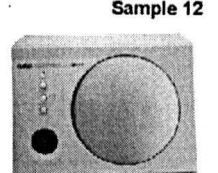
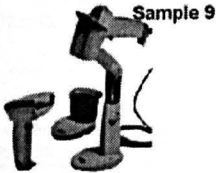
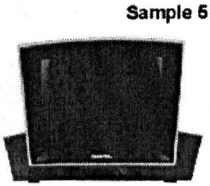
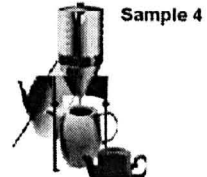
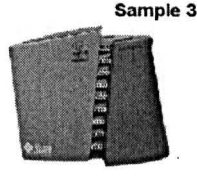
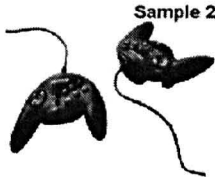
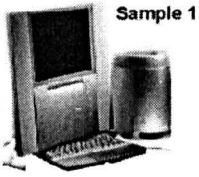


Figure 8.3: The 13 Material Samples

## Stage 2: The SD Test

### The Preference Distribution

The preference score is used to show the potential attractive elements of the product concepts to the consumer. The ranking of the most and least preferred concept samples are shown in Table 8.3 below:

Table 8.3: Preference Score Rank

Preference rank		1	2	3	4	5	6	7	8	9	10	11	12	13
Clients	Sample	S11	S3	S9	S13	S1	S4	S12	S8	S2	S10	S7	S5	S6
	Avg.	6.24	6.27	6.09	6.06	5.7	5.67	5.27	5.15	4.67	4.42	4.36	4.06	3.91
	Std.	1.64	2.21	1.6	2.11	1.94	1.81	2.07	2.10	1.99	1.36	1.99	2.32	1.86
Design consultants	Sample	S3	S1	S13	S2	S9	S12	S4	S11	S8	S10	S5	S7	S6
	Avg.	6.91	6.72	6.49	6.12	5.56	5.44	5.04	5.37	5.35	4.88	4.16	3.30	3.28
	Std.	2.06	2.14	2.38	1.73	1.71	2.04	2.04	2.09	2.13	1.93	2.67	1.68	1.89

Preference rank		1	2	3	4	5	6	7	8	9	10	11	12	13
Key decision-makers	Sample	S11	S1	S3	S4	S13	S9	S7	S2	S12	S10	S8	S6	S5
	Avg.	6.23	5.92	5.62	5.38	5.38	5.31	4.77	4.69	4.62	4.54	4.23	3.77	2.92
	Std.	2.01	1.75	2.57	2.06	1.66	1.75	2.05	2.18	2.22	1.20	2.13	1.59	2.14
Design leader	Sample	S13	S12	S1	S3	S2	S9	S11	S10	S8	S4	S6	S5	S7
	Avg.	6.28	6.64	6.55	6.55	6.09	5.82	5.73	5.55	5.45	5.09	3.45	3.36	3.27
	Std.	1.54	1.75	2.42	2.16	2.12	1.83	1.90	1.63	1.97	1.81	1.97	2.06	1.79

The Table 8.4 shows results for both design consultants (leaders) and clients. Only the S3 sample (Sun working station) is the same as most the preferred concept. This means modern style of computer product is seen as acceptable to all subjects. The least preferred concepts S5 (TV), S6 (Radio) and S7 (Camera) closely match within the two groups.

Table 8.4: The Most and Least Preferred Concept Samples between Clients and Design Consultant

	Most preferred concept	Least preferred concept
Clients	S11, S3, S9	S5, S7, S6
Design consultants	S3, S1, S13	S7, S5, S6

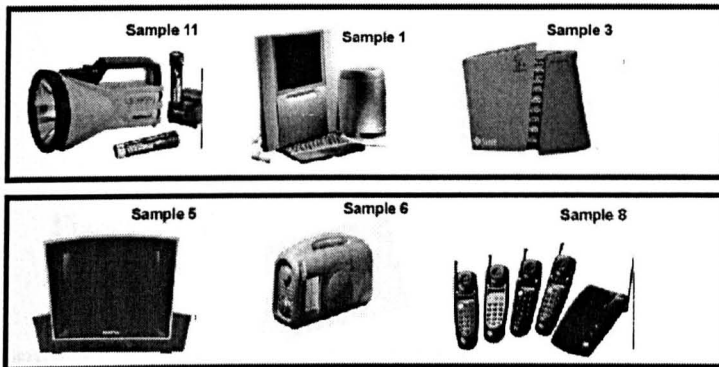


The rank of the most and least preferred concept samples, between key decision-makers and designer leader subjects are shown in the Table 8.5 below. Only the S1 sample (Apple multi media computer) is the same as the most preferred concept. This means modern style of computer product is seen as acceptable to most subjects; the least preferred concepts S5 (TV) and S6 (Radio) is the same for both two groups.

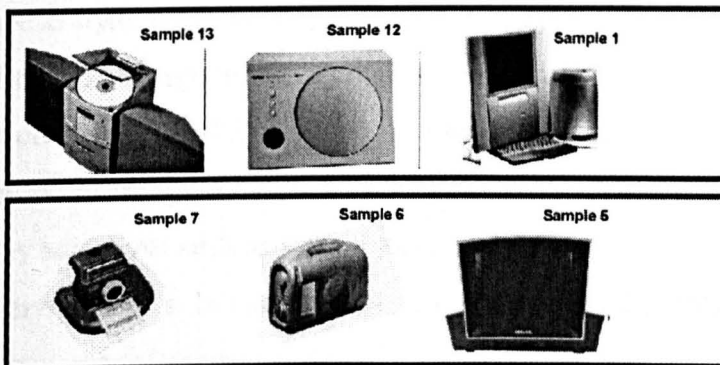
Table 8.5: The Most and Least Preferred Concept Samples between Key Decision-Makers and Design Leaders

	Most preferred concept	Least preferred concept
Key decision-makers	S11, S1, S3	S8, S6, S5
Designer leaders	S13, S12, S1	S6, S5, S7

From the summary it can be seen that for clients/design consultants and key decision-makers/designer leaders the least preferred concepts are similar. But, the two groups most preferred concepts are different. (Show Figure 8.4) The design leaders seem to prefer simpler styles than the key decision-makers. The Apple multi media computer (S1 sample) is preferred by both design leaders and key decision-makers.



The most and least preferred concept sample of key decision-makers



The most and least preferred concept sample of design leaders

Figure 8.4: The Most and Least Preferred Concept Sample

## The Principal Component of The Key Decision-Makers', Design Leaders' and The And Designers' Perceptual Space

A factor analysis was performed on the numerical scores assigned to the ten evaluation adjectives. Osgood et al. 1957 argued that people's perception of the product can be divided into three factors, evaluation, shape (potency), and activity factors. That according to the factor scree plot factor 3 is a pivot and factor 4 whose factor loading is less than 1 is eliminated, leaving 3 factors to describe the subjects. (Figure 8.5)

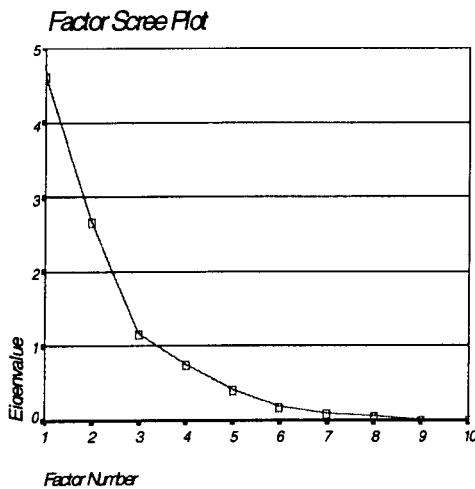


Figure 8.5: Factor Scree Plot

For all test samples, key decision-makers, design leaders and the And designers, the first factor is represented by such adjectives as modern style, popular style, and modern colour, Japanese style and thus can be defined as evaluation factors. In design sense, it may be defined as design trend ability. The second factor is represented by such adjectives as comfortable colour, universal style, and 'my taste' style that can be defined as shape factors. In design sense, it may be defined as style ability. The third factor is represented by adjectives such as masculine style, hard style, harmony colour that can be defined as activity factors. In design sense, it may be defined as marketing ability. Table 8.6 and 8.7 show rotated factor matrices.

Table 8.6: Three Principle Factors

Factors	Typical descriptive adjectives	Pct of Var	Design sense factors
Factor 1/ evaluation	Modern style, Popular style, Modern color, Japanese style	46.2%	Design trend
Factor 2/ shape (potency)	Comfortable color, Universal style, My taste style, Harmony color	26.7%	Marketing, Culture
Factor 3/activity	Masculine style, Hard style,	11.6%	Style

Table 8.7: Rotated Factor Matrices

		Factors 1	Factors 2	Factors 3
Adj3	Popular style - Personality style	0.92845		-0.28807
Adj5	Modern colour - Futuristic colour	0.92201	-0.17856	-0.14776
Adj1	Modern style - Modern style	0.87013	0.28635	-0.24156
Adj8	Japanese style - European Style	0.62781		-0.56506
Adj7	Comfortable colour - Uncomfortable colour	0.14575	0.95151	-0.13611
Adj9	Universal style - Local style	-0.45291	0.79976	0.15234
Adj10	My taste style - Others taste style	0.32655	0.77694	-0.44209
Adj6	Harmony colour - Contrast colour		-0.64654	-0.17076
Adj4	Hard style - Soft style	-0.20580		0.95912
Adj2	Masculine style - Feminine style	-0.28248		0.88755
Eigenvalue		4.62443	2.67307	1.15993
Pct of Var %		46.2	26.7	11.6
Cum Pct %		46.2	73	84.6

## The Key Decision-makers' and Designer Leaders' Entire Perceptual Space

The key decision-makers and designer leaders are divided into three groups. The first group of decision-makers comprises Eten, Syntech, Panacom, and Smartek decision-makers and the second group of decision-makers comprises Hentak, Ming-Jong, Tranbon, and CAST and Kingtel decision-makers. The third group of decision-makers comprises Tentel, Ligitek and Unication. The author is design leader for And Design, from the 13 key decision-makers, those from Eten, Syntech, Panacom, and Smartek score close to the And design leader. This means, they have similar design sense. (Table 8.8)

Table 8.8: Rotated factor matrix of total adjective

	Company	Role	Name	Factors 1	Factors 2	Factors 3
L56	Conser Design	Design leader	Mr. Fang	0.88650		0.37764
L2	Moreal Design	Design leader	Mr. Tseng	0.80773		0.25737
K26	Syntech Company	Key decision-maker	Mr. Wang	0.78792	0.58149	
L7	Quinte Design	Design leader	Mr. Chiou	0.78972	0.25732	0.33178
A69	And Design	Designer	Ms. Ali	0.78879	0.15559	-0.12856
A72	And Design	Designer	Mr. Lee	0.73094	0.19342	-0.16503
K32	Panacom Company	Key decision-maker	Mr. Wu	0.72049	-0.10767	0.31890
K40	Eten Company	Key decision-maker	Mr. Ma	0.71307	-0.44394	0.32102
K64	Smartek	Key decision-maker	Mr. Lee	0.67934		0.24618
L60	JIK Design	Design leader	Mr. Chung	0.60329	0.36776	0.39680
L71	And Design	Design leader	Mr. Wu	0.58933	0.55962	0.23103
L22	Nova design	Design leader	Mr. Lin	0.56208	0.45383	0.39272
L35	Center Design	Design leader	Mr. Tung	-0.53803	0.46741	0.50742
L41	Sekond Design	Design leader	Mr. Lin	0.24406	-0.84131	0.17442
A76	And Design	Designer	Mr. Con		0.83951	
L45	I+U Design	Design leader	Mr. koo		0.78914	0.14829
K73	Ming-jong Company	Key decision-maker	Mr. Chen	0.30918	0.72698	0.25264
K15	Hentak Company	Key decision-maker	Mrs. Tung	0.42343	0.72397	0.35560
L18	Sumwell Design	Design leader	Mr. Tang	0.36269	0.69176	0.32317
K49	Tranbon Company	Key decision-maker	Mr. Chen	0.16452	0.66638	0.14586
K29	CAST Company	Key decision-maker	Mr. Cheng	0.10835	0.55005	-0.12561
K70	Kingtel Company	Key decision-maker	Mr. Wu	0.50378	0.51005	0.39225
L4	Wen's Design	Design leader	Mr. Wen	0.17732		0.95981
K52	Tentel Company	Key decision-maker	Mr. Lin		0.21268	0.83814
K13	Philips Company	Key decision-maker	Mr. Chen	0.54004		0.75225
A75	And Design	Designer	Ms. Chen	0.31232	0.37309	0.73968
K16	Unication Company	Key decision-maker	Mr. Lu	0.51588	0.34247	0.66068
K31	Ligitek Company	Key decision-maker	Mr. Wei	0.23278	0.15885	0.63963
A1	And Design	Designer	Mr. Yei		0.25678	0.63145
Eigenvalue				12.3	4.99	3.16
Pct of Var %				42.4	17.2	10.9
Cum Pct %				42.4	59.6	70.5

## **Identify the Different Characteristics among the Three Group of Key Decision-makers**

Table 9 data was collated according to the And design leader's (Author) action research from June 1995 to Aug. 1998. And design leader handled the entire design projects and he also is a designer. The action research comprise 13 clients and 37 design projects, which were recorded the in detail.

### **Company Profile**

According to Bruce & Morris 1995 noted that the design consultant develops long term and short term relationships. Long term relationship has the characteristic of familiarity, stability and continuity.

Some 'repurchase' clients were known to the design consultant before the June 1995 action research studies. Some of clients do not develop a new product each year or for some reason cease investigation into NPD or been other design consultants.

The design brief focuses on which kinds of adjective are used to describe the future concepts. To describe the product form is 'style adjective', and to describe the action an 'activity adjective' and how to use the product is 'interface adjective'.

For key decision-makers' education background, it is necessary to understand the key decision-makers minimum decodes NPD drawing skill.

How many NPD projects undertaken in each year will also influence the relationship between designers consultants and clients. The NPD per year means the number of projects that the client releases to outsource design consultants in each year.

The project fails when client and/or his buyer disagree with the concepts presented or nothing is produced.

Debate between key decision-makers and design leaders is where they fight each other over the interpretation of the concept. Sometimes Design leaders can not agree with the

key decision-makers viewpoint, and sometimes it is key decision-makers who can not accept the design concepts.

Total rework is when clients are unhappy with the design concepts from the design consultant. Mostly it is because concept direction is wrong, however, the clients can insist that the design consultant does another concept presentation. In some cases, clients argue that one of the concepts must be modified to approach benchmarking. This means part of project is reworked.

Thus when the design consultant presents concepts design, some clients chose a design concept at first presentation, whilst some clients are satisfied at the second or third presentation.

### The Group Is Divided by Factors of Their Entire Perceptual Space

According to factor analysis, the three types of clients are divided and their profiles shown in Table 8.9 below:

Table 8.9: The Company Profile

Client information		Client and designer relationship			Design brief / adjective			Project									Group
Company	product	Long term	Short term	Repurchase client	Style	Activity	Interface	Eng.	Edu.	Key boss	NPD /years	Fail	Debate	Total rework	Redo part of works	When chosen concept	
Eten	PDA		*					4	EE		1	*	*			1	Group 1 Developing Sense
Syntech	Laser S		*			*	*	3	EE	*	2					1	
Panacom	Video tel.		*		*	*	*	4	MBA		3					1	
Smartek	ISDN tel.	*			*			4	ME	*	3					1	
Hentak	Tel./Ans.		*		*	*		3	Design	*	3		*	*		3	Group 2 Design Sense
Ming-jong	Timer		*					4	ME	*	2	*	*	*	*	3	
Tranbon	Video tel.	*		*	*			4	Social	*	5		*	*		1 or 3	
CAST	16G seat	*						4	ME		1					1	
Kingtel	Cordless tel.	*		*	*			4	EE	*	10			*	*	1 or 3 or more	
Tentel	Key tel.	*		*				4	Chem.		1					1	Group 3 No Design Sense
Philips	Key tel.		*					2	EE		2					1	
Ligitek	Decoder	*		*				4	EE	*	1					1	
Unication	Pager		*		*	*		4	EE	*	3	*	*			3	

Factor 1 included Eten, Syntech, Panacom and the Smartek Company: this means, that

their total adjective perceptual space is similar. The And design leader (Author) is also in group 1. Therefore in this group there is no reworking during the project. The first presentation was thus successful and matched the client's need. They share the same conditions in that they employ many adjectives to describe the future concepts. Since their mental space is similar to the And design leader, the future concept might also be similar. However, whilst this group has design sense, all the companies are new customers for the And design leader, thus their design sense is still under developed. This Group is therefore named the "developing sense group"

Factor 2 has Hentak, Ming-jong, Tranbon, CAST and the Kingtel Companies, sharing similar perceptual space. Therefore this group has much debate during the project and entire reworks or part reworks. In this group, Hentak's whose key decision-maker has a background in graphic design. The Tranbon, Kingtel and Hentak Companies also attempt to employ many adjectives for describing the future concepts. Another interesting finding is that only this group argued for rework. Thus, they all have good design sense and have the ability to argue with the design consultant to modify the future concepts. The Group 2 is named the "design sense group".

Factor 3 has Tentel, Philips, Ligitek, and Unication Companies: this means, that these companies have similar perceptual space. The finding from this group is that during the project, only one company used adjectives to describe the future concept. In other words, these clients may lack design sense since they seldom attempt use adjectives and they all accept the first presentation. The Group 2 is named "no design sense developing" group.

The Factor 1-2 and factor 2-3 Plot Rotated Space

The three factors show the factor 1-2 plot and 2-3 plot are shown in Figure 8.6 below.

These three factors are applied to x, y and z-axis, divided into eight quadrants.

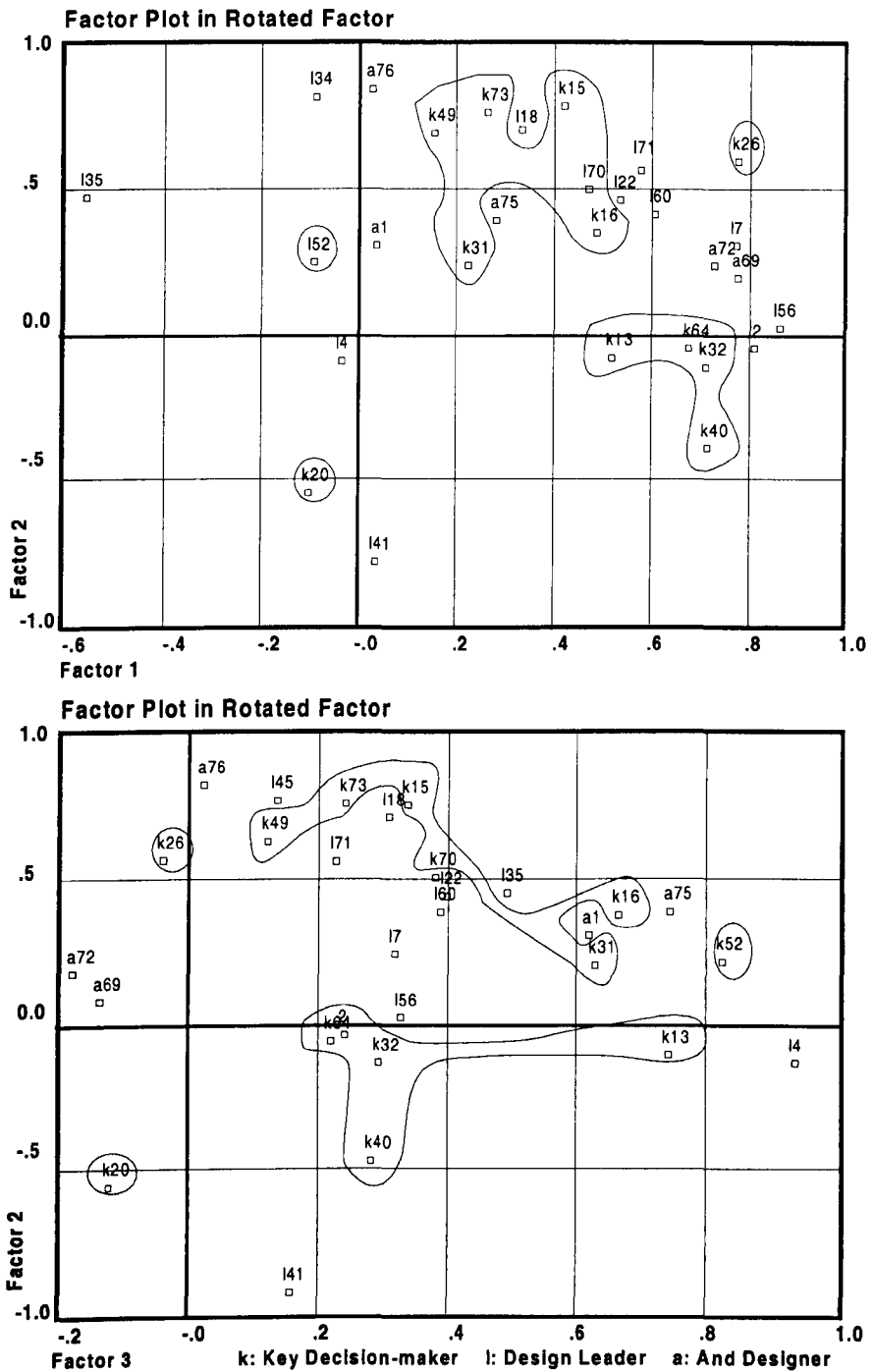


Figure 8.6: Factor 1-2 and 2-3 Plot in Rotated Factor Space



Figure 8.7 show the entire perceptual space and divides the key decision-makers and the And designers into their appropriate quadrant. Quadrant 1 has Tranbon, Kingtel, Ligitek, Hentak, Ming-jong, Unication, the And design leader and three of the And designers. Quadrant 2 has Syntech and two of the And designers. Quadrant 4 has only Tentel. Quadrant 5 has Philips, Smartek, Panacom and Eten, and quadrant 6 has only CAST. There is no key decision-maker in numbers 3, 7 and 8 quadrant.

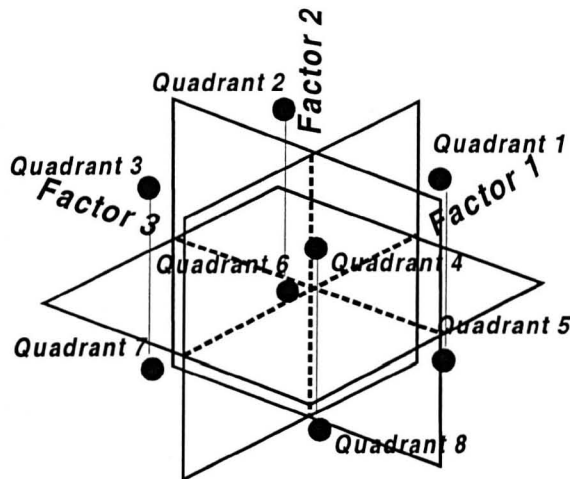


Figure 8.7: The 1-8 Quadrant

Table 8.10: The Divided Five Space of Company Profile

Client information		Client and designer relationship			Design brief / adjective			Project								Group	
Company	product	Long term	Short term	Repurchase client	Style	Activity	Interface	Eng.	Education	Key boss	NPD /years	Fail	Debate	Total rework	Redo part of works	When chosen concept	
Tranbon	Video tel.	*		*	*			4	Social	*	5		*	*		1 or 3	Quadrant 1
Hentak	Tel./ans.		*		*	*		3	Design	*	3		*	*		3	
Kingtel	Cordless Tel.	*		*	*			4	EE	*	10			*	*	1 or 3 or more	
Ligitek	Decoder	*		*				4	EE	*	1					1	
Ming-jong	Timer		*					4	ME	*	2	*	*	*	*	3	
Unication	Pager		*		*	*		4	EE	*	3	*	*			3	
Syntech	Laser S		*			*	*	3	EE	*	2					1	Quadrant 2
Tentel	Key tel.	*		*				4	Chem.		1					1	Quadrant 4
Eten	PDA		*					4	EE		1	*	*			1	Quadrant 5
Philips	Key tel.		*					2	EE		2					1	
Panacom	Video tel.		*		*	*	*	4	MBA		3					1	
Smartek	ISDN tel.	*			*			4	ME	*	3					1	
CAST	16G seat	*						4	ME		1					1	Quadrant 6

There are five quadrants explain as follow:

In quadrant 1 of the perceptual space represents higher evaluation, higher activity and higher shape attributes. Key decision-makers in this space comprise Tranbon, Kingtel, Ligitek, Hentak, Ming-Jong and Unication. It is important to note that the And design leader (Author) is also in this space, plus two senior designers and one junior designer. In this space, Tranbon and Kingtel are very important clients, not only because they are established clients but also because they have many design projects per year. In additional, Hentak, a small manufacturer, produces a classic telephone, which is made of wood. The key decision-maker is a designer, and most company products are proposed by this key decision-maker who also is president. Unication, produce a pager and together with Tranbon, Hentak and Kingtel they use adjectives to describe the future concept. Since they can describe the future concept, they display strong confidence in styling, thus they have similar attitude in debating and reworking to modify the concept, and seldom accept the concept design at the first presentation. (Table 8.10)

There are 6 designer leaders in quadrant 1, two design leaders in quadrant 4 and 3 design leaders in quadrant 5. The important finding is that the key decision-makers and most designer leaders share the same quadrant, which means those key decision-makers who have a similar perceptual space have better design sense than others' key decision-makers.

Then in quadrant 2 of the perceptual space represents higher evaluation, higher shape and low activity. The key decision-maker in this space is from Syntech together with two junior And designers. In other words, space 2 shows high understanding of design trends, marketing and culture but a lack of style sense. However, the fact that the two junior designers lack marketing and culture sense seems correct but lower style sense seems wrong. It could be that even though they have three years working experience, it is still not enough style sense to handle the different type of clients.

From action research information shows that Syntech's key decision-makers are

concerned with interface adjective and activity adjective because they produce handy barcode scanner. It is an important product because the scanner is hi-tech knowledge and there are not so many producers all over the world. Syntech use “Me-too” strategy to design the product; thus key decision-makers might not take care with the style.

Therefore in quadrant 4 of the perceptual space shows lower evaluation, higher activity and higher shape attributes. The key decision-maker is only Tentel in this space. In this space there is a low sense of design trend. In action research case studies, Tentel is small office telephone producer, the key decision-maker lacks understanding of the style of design and has low confidence in relation to design sense. But they respect the expert and thus do not argue for reworking but rather express satisfaction with the design results.

The Following is quadrant 5 of the perceptual space represents higher evaluation, higher activity and lower shape. The key decision-makers in this space are Philips, Smartek, Panacom and Eten. These four clients are new for the And design leader (Author). In space 5, the key decision-makers have similar characteristics in lower marketing and culture sense, also they have no identifiable boss or leader to utilize adjectives to describe the future concept and they do not argue for reworking.

The final, quadrant 6 of the perceptual space is higher evaluation, lower activity and lower shape. The key decision-maker in the space is only CAST. In other words CAST's decision-maker has lower marketing, culture and style sense. Thus CAST key decision-maker might have lower design sense than other key decision-makers. Note there are no other designers in the same space.

## Key Decision-Makers' and Designer Leaders' Entire Perceptual Distance

Key decision-makers and design leaders loading factors are shown in Table 8.11 as follows. Using loading factors to check each distance, may help to show each subjects' viewpoint.

Table 8.11: Key Decision-Maker and Design Leader Factor Loading

		ADJ1	ADJ2	ADJ3	ADJ4	ADJ5	ADJ6	ADJ7	ADJ8	ADJ9	ADJ10	FAC1_1	FAC2_1	FAC3_1
A1	And designer	4.77	3.85	4.92	4.23	3.77	5.62	5.23	5.46	4.15	4.69	-.08790	-.85241	-.58384
A69	And designer	5.46	4.85	5.69	4.62	5.08	3.54	6.31	4.85	4.23	5.92	.77969	-.21328	-.87712
A72	And designer	6.54	5.23	6.38	5.23	3.54	4.23	5.08	5.77	5.31	5.38	.46163	-.02342	.53270
A75	And designer	4.85	4.62	5.00	4.38	5.08	4.85	5.77	5.62	5.08	5.08	-.02007	-.03087	-.16158
A76	And designer	4.46	5.92	3.00	3.69	2.08	3.77	5.54	6.00	5.46	5.31	-3.02915	.57713	1.31004
K13	Philips key decision	5.85	3.31	5.23	3.69	5.38	4.15	5.62	6.15	5.85	4.15	.43089	.07589	-1.10381
K15	Hentak key decision	5.31	4.31	3.62	4.69	3.54	3.46	6.46	6.31	6.15	4.92	-1.51918	1.24542	.17434
K16	Unication key decision	5.00	3.92	5.08	3.54	3.77	4.38	5.46	5.92	4.62	4.46	-.37391	-.27488	-.97702
K26	Syntech key decision	5.69	4.54	5.08	4.54	3.31	3.31	6.23	5.00	5.00	5.31	-.27049	.07048	-.63361
K29	CAST key decision	7.38	5.77	4.00	5.62	6.00	4.38	3.31	5.08	4.85	3.62	.41447	-3.03638	2.39817
K31	Ligitek key decision	5.69	3.92	4.08	4.77	5.23	4.92	5.38	5.62	5.92	5.23	-.07189	-.08843	.34488
K32	Panacom key decision	6.54	5.31	5.77	5.77	5.54	5.23	5.85	6.46	5.08	5.54	.90605	.46107	.95368
K40	Eten key decision	6.54	4.08	6.00	5.62	6.08	5.00	5.62	5.69	5.23	5.69	1.72514	-.06145	-.09818
K49	Tranbon key decision	5.15	4.62	4.23	5.92	4.54	4.85	6.00	5.31	5.31	5.15	-.27177	-.02448	.63280
K52	Tentel key decision	3.62	3.46	4.15	3.77	4.31	4.77	5.38	5.54	3.92	3.23	-.71361	-1.28103	-1.27572
K64	Smartek key decision	6.23	5.08	5.23	4.92	5.08	5.00	5.77	5.15	4.92	5.00	.60848	-.62142	.38866
K70	Kingtel key decision	5.08	3.46	5.69	4.62	2.46	4.15	6.00	6.00	5.46	3.85	-.44172	.45939	-1.18960
K73	Ming-jong key decision	4.62	4.08	2.92	4.00	2.69	3.54	4.85	5.31	4.23	4.46	-1.85221	-1.18146	-.07094
L18	Sumwell Design Leader	4.31	4.15	4.85	4.31	4.08	4.08	5.62	5.15	5.77	5.00	-.58558	.08199	-.54456
L2	Moreal Design Leader	5.85	4.31	6.62	4.77	5.15	4.54	6.00	5.38	5.54	5.38	1.26906	.28915	-.78000
L22	Nova Design Leader	5.31	4.38	4.31	3.92	4.31	3.69	7.23	5.38	4.00	4.62	-.35390	.04475	-1.23537
L35	Center Design Leader	6.46	6.69	5.69	6.08	6.00	7.54	6.85	6.92	7.08	6.31	.37445	2.30002	2.77362
L4	Wen's Design Leader	5.08	4.23	4.77	4.31	5.23	5.00	5.23	5.54	5.08	4.46	.08815	-.70785	-.14224
L41	Sekond Design Leader	6.69	5.23	5.62	5.08	6.23	5.69	4.92	5.38	4.92	5.31	1.36015	-1.06352	.95751
L45	I+U Design Leader	4.23	4.92	4.54	5.23	3.85	5.38	6.92	4.92	4.69	5.08	-.56672	.20735	-.07096
L56	Conser Design Leader	6.31	4.62	6.08	5.54	5.54	4.38	6.15	6.38	5.54	5.38	1.02985	.83694	.02995
L60	JIK Design Leader	5.62	4.00	4.69	4.23	4.23	4.54	5.54	5.54	4.85	5.92	-.00686	-.03251	-.38075
L7	Quinte Design Leader	5.85	4.62	6.77	5.08	5.46	4.15	7.08	6.38	6.00	5.69	1.07260	1.85475	-.72848
L71	And design leader	5.54	4.62	4.62	5.46	4.77	3.69	6.23	6.08	6.08	5.31	-.35564	.98907	.35741

The perceptual distance ( $d_i$ ) is the different evaluation score of each factor. If the perceptual distance score is lower it means that two subjects are very similar. If the perceptual distance score is higher it means that two subjects are distant.

$$d_i = \sqrt{s}$$

$$S = \sum (x_i - x')^2 + (y_i - y')^2 + (z_i - z')^2$$

$$\Delta x_i = \text{factor 1}$$

$$\Delta y_i = \text{factor 2}$$

$$\Delta z_i = \text{factor 3}$$

### **The Perceptual Distance between And Design Leader and And Designers**

A1 designer has only a half-year of working experience, the gap of perceptual distance is 2.09. The working experience directly with the design leader might impact on the perceptual distance. The others A75 and A76 designers who are chief executive of And design both have working experience of more than 10 years. Entire perceptual distance between design leader and designers is shown in Table 8.12.

Table 8.12: The Perceptual Distance between Design Leader and And Designers

	A1/Mr.Yei	A69/Ms. Cho	A72/Mr.Lee	A75/Ms.Cheng	A76/ Mr. Con
Work experience/years	0.5	3	3	17	10
L71 And Design Leader	2.09	2.06	1.31	1.19	0.87

### **The Perceptual Distance between The And Design Leader and Key Decision-Makers**

In measuring the perceptual distance between L71/And design leader (Author) and the key decision-makers, the scores ranked thus: K49<K31<K15<K26<K32<K70. Between the 13 key decision-makers, the K49/Tranbon key decision-makers is the shortest perceptual distance with the And design leader. This means that the two people have similar design sense. The And design leader has at least 8 years design consultancy experience with Tranbon thus they have established a similar design sense. The K31/Ligitek is similar to the Tranbon situation. The third shortest perceptual distance, K15/Hentak key decision-maker whose background is a graphic design, shows that she has design ability and also has design sense. The another key decision-maker, from K70/Kingtell is an important client and also has 6 years experience of consulting with the And design leader.

From the perceptual distances ranked 1 to 6 key decision-makers are shown to have similarities with the manner in which have key decision-makers utilize adjectives to describe the future concept as indicated in Table 8.13 and 814 below:

Table 8.13: The Rank of Perceptual Distance Between The And Design Leader and Key Decision-Makers

	K49/Tranbon	K31/Ligitek	K15/Hentak	K26/Syntech	K32/Panacom	K70/Kingtel	K16/Unation
L71/And Leader	1.054	1.113	1.2054	1.3534	1.492	1.6374	1.8381
Rank	1	2	3	4	5	6	7
Correlations	0.702*	0.639*	0.931***	0.733*			

	K64/Smartek	K13/Philips	K40/Eten	K73/Ming-Jong	K52/Tentel	K29/CAST
L71/And Leader	1.8773	1.8941	2.3754	2.671	2.8193	4.5785
Rank	8	9	10	11	12	13

Accordingly the rank of perceptual distance between the And design leader and key decision-makers and the company profile is indicated in Table 14. The action research information also shown in the following Table 14. It can be seen that in 9 to 13 rank lack used adjectives. Since they have no design sense they respect the design experts (leader) and thus accept the first presentation.

Table 8.14: The Rank of Perceptual Distance of Company Profile

Client information		Client and designer relationship			Design Brief /Adjective			project									Rank
Company	product	Long term	Short term	Repurchase client	Style	Activity	Interface	Eng.	Education	Key boss	NPD /years	Fail	Debate	Total rework	Redo part of works	When chosen concept	
Tranbon/K49	Video tel.	*		*	*			4	Social	*	5		*	*		1 or 3	1
Ligitek/K31	Decoder	*		*				4	EE	*	1					1	2
Hentak/K15	Tel. / ans.		*		*	*		3	Design	*	3		*	*		3	3
Syntech/K26	Laser S		*			*	*	3	EE	*	2					1	4
Panacom/K32	Video tel.		*		*	*	*	4	MBA		3					1	5
Kingtel/ K70	Cordless Tel.	*		*	*			4	EE	*	10			*	*	1 or 3or more	6
Unicatio/K16	Pager		*		*	*		4	EE	*	3	*	*			3	7
Smartek/K64	ISDN tel.	*			*			4	ME	*	3					1	8
Philips/K13	Key tel.		*					2	EE		2					1	9
Eten/K40	PDA		*					4	EE		1	*	*			1	10
Ming-jong /K73	Timer		*					4	ME	*	2	*	*	*	*	3	11
Tentel/K52	Key tel.	*		*				4	Chem.		1					1	12
CAST/K29	16G seat	*						4	ME		1					1	13

### Key Decision-makers' and Designer Leaders' Design Trend Perceptual Space

The key decision-makers and designer leaders are divided as three groups. The first group of key decision-makers comprises Tranbon, Philips, Ligitek, Hentak, Ming-jong and Panacom decision-makers and the second group of decision-makers is made up of Kingtel, Syntek, and Unication key decision-makers. The third group of key decision-makers includes Eten, Tentel, Smartek and CAST. These groups are shown in Table 8.15 below:

The author (And design leader) is among entire 13 key decision-makers that comprises group 1. This means, they have similar perceptual space in relation to the design trend.

Table 8.15: Rotated Factor Matrix of Design Trend

		Factors 1	Factors 2	Factors 3
K49	Tranbon key decision-maker	0.98952	0.13170	
L35		0.97876	0.11834	0.16743
K13	Philips key decision-maker	0.96946	0.218930	0.11055
L71	And design leader	0.95196	0.26710	0.14976
K31	Ligitek key decision-maker	0.93022	-0.28668	-0.22915
L22		0.91755	0.37885	-0.12069
K15	Hentak key decision-maker	0.91577	0.37692	0.013893
K73	Ming-jong key decision-maker	0.89989	0.43204	
L4		0.83719	-0.34505	0.42434
A76		0.81222	0.53661	0.22879
K32	Panacom key decision-maker	0.80893	0.54899	-0.21033
L60		0.76024	0.62383	-0.18127
A69		0.69202	0.49504	-0.52539
A72		0.10061	0.96925	-0.22457
K70	Kingtel key decision-maker	0.22036	0.95019	0.22043
K26	Syntek key decision-maker	0.27734	0.90912	-0.31077
L7		-0.26986	0.84685	0.45828
A1		0.40445	0.84453	0.35097
L56		0.53889	0.84236	
K16	Unication key decision-maker	0.47241	0.80372	0.36176
L2		-0.61626	0.77120	-0.15960
L45		0.32926	0.73955	0.58707
K40	Eten key decision-maker			-0.99898
L41			-0.32310	-0.94307
K52	Tentel key decision-maker	0.44142		0.89728
K64	Smartek key decision-maker	0.32039	0.34322	-0.88292
A75		0.52112		0.85339
K29	CAST key decision-maker	0.53504	-0.32062	-0.78163
L18		0.18191	0.69350	0.69711
Eigenvalue		15.33	7.27	6.4
Pct of Var %		52.3	25.1	22.1
Cum Pct %		52.3	77	100

From the action research information shown in the following table, It can be seen that in group 3 only the Smartek key decision-maker used adjectives, whilst other companies lacked adjective ability. Since they have no design sense they respect the design experts (leader) and thus accept the first presentation. (Table 8.16)

Table 8.16: Factors of the Design Trend

Client information		Client and designer relationship			Design Brief / Adjectives			Project									Group
Company	product	Long term	Short term	Repurchase client	Style	Activity	Interface	Eng.	Education	Key boss	NPD /years	Fail	Debate	Total rework	Redo part of works	When chosen concept	
Tranbon	Video tel.	*		*	*			4	Social	*	5		*	*		1 or 3	Group 1
Philips	Key tel		*					2	EE		2					1	
Ligitek	Decoder	*		*				4	EE	*	1					1	
Hentak	Tel./ans.		*		*	*		3	Design	*	3		*	*		3	
Ming-jong	Timer		*					4	ME	*	2	*	*	*	*	3	
Panacom	Video tel.		*		*	*	*	4	MBA		3					1	
Kingtel	Cordless tel.	*		*	*			4	EE	*	10			*	*	1 or 3or more	Group 2
Syntech	Laser S		*			*	*	3	EE	*	2					1	
Unication	Pager		*		*	*		4	EE	*	3	*	*			3	
Eten	PDA		*					4	EE		1	*	*			1	Group 3
Tentel	Key tel.	*		*				4	Chem.		1					1	
Smartek	ISDN tel	*			*			4	ME	*	3					1	
Aero	16G seat	*						4	ME		1					1	



## Key Decision-Makers' And Design Leaders' Marketing and Culture Perceptual Space

The key decision-makers and designer leaders are divided as three groups. The first group of decision-makers comprises Philips, Ligitek, Hentek, Ming-Jong and the Kingtel decision-makers and the second group of decision-makers include Smartek, Tentel, Unication Panacom and Tranbon. The third group of decision-makers are from Eten, CAST and Ming-Jong.

The author (And design leader) is among the 13 key decision-makers that comprises group 1. This means, they have similar perceptual space in relation to marketing and culture. (Table 8.17)

Table 8.17: Rotated Factor Matrix of Market and Culture.

		Factors 1	Factors 2	Factors 3
L18		0.97186	0.13165	0.19535
K31	Ligitek key decision-maker	0.96267	-0.24074	-0.12377
L41		-0.95939	-0.23568	-0.15499
K15	Hentak key decision-maker	0.92838	0.30810	0.20808
L71	And design leader	0.92140	0.20847	0.32797
K13	Philips key decision-maker	0.91386	0.29395	-0.28008
A76		0.84792		0.52324
L2		0.80026	0.41439	0.43343
L56		0.78178	0.44034	0.44149
A1		-0.77821	0.60615	-0.16423
L7		0.77413	0.47790	0.41513
K70	Kingtel key decision-maker	0.76058	0.59519	-0.25935
A72		0.74849	-0.23388	0.62053
K26	Syntech key decision-maker	0.67723	0.41909	0.60475
L45			0.98685	0.16161
K64	Smartek key decision-maker	0.20185	0.95654	0.21043
K52	Tentel key decision-maker		0.89123	0.44926
K16	Unication key decision-maker	0.47306	0.86859	0.14752
L22		0.32322	0.85949	0.39600
A75		0.48178	0.81633	0.31859
K32	Panacom key decision-maker		0.76146	0.64821
K49	Tranbon key decision-maker	0.62081	0.74071	0.25681
L60		0.16981	0.13809	0.97575
L35		-0.26318	0.12306	-0.95687
K40	Eten key decision-maker	0.30136	0.24913	0.92039
A69		0.29529	0.45506	0.84007
K29	CAST key decision-maker	0.14804	-0.64303	-0.75140
L4		0.36304	0.62212	-0.69366
K73	Ming-Jong key decision-maker	0.62321	0.43850	0.64755
Eigenvalue		17.84	6.00	5.16
Pct of Var %		61.5	20.7	17.8
Cum Pct %		61.5	82.2	100

Group 1, from the action research information, was found to consist of those companies where no project failed project and the projects also generated less debate. In group 3, there is a lack of adjectives to describe the future concept as shown in Table 8.18 below:

Table 8.18: The Group of Factors of Marketing and Culture

Client information		Client and designer relationship			Design Brief /Adjectives			Project									Group
Company	product	Long term	Short term	Repurchase client	Style	Activity	Interface	Eng.	Education	Key boss	NPD /years	Fail	Debate	Total rework	Redo part of works	When chose concept	
Ligitek	Decoder	*		*				4	EE	*	1					1	Group 1
Hentak	Tel./ans.		*		*	*		3	Design	*	3		*	*		3	
Philips	Key tel.		*					2	EE		2					1	
Kingtel	Cordless Tel.	*		*	*			4	EE	*	10			*	*	1 or 3or more	
Syntech	Laser S		*			*	*	3	EE	*	2					1	
Smartek	ISDN tel.	*			*			4	ME	*	3					1	Group 2
Tentel	Key tel.	*		*				4	Chem.		1					1	
Unication	Pager		*		*	*		4	EE	*	3	*	*			3	
Panacom	Video tel.		*		*	*	*	4	MBA		3					1	
Tranbon	Video tel.	*		*	*			4	Social	*	5		*	*		1 or 3	
Eten	PDA		*					4	EE		1	*	*			1	Group 3
CAST	16G seat	*						4	ME		1					1	
Ming-jong	Timer		*					4	ME	*	2	*	*	*	*	3	

### 8.1.4 Summary

In order to modify the existing design sense model of key decision-makers, the author found the engineering ability factor is a skill and not regarded as a sense. The engineering ability factor is how key decision-makers understand the design language. Since, this research is concerned with the perceptual space of key decision-makers Table 8.19 is prepared according to the plot rotated space of the entire adjective factor analysis.

Table 8.19: Design Management Characteristics among the Three Groups of Key Decision-makers

Group	Characteristic
<p>Group 2 Design Developing</p> <p>Syntech Panacom Smartek</p>	<ul style="list-style-type: none"> <li>● To build the relationship</li> <li>● Less debate of aesthetic factors</li> <li>● Developing long term relationship</li> <li>● Confidence of design sense</li> <li>● Use adjective words</li> <li>● Respect the expert</li> </ul>
<p>Group 3 Design aware</p> <p>Hentak* Ming-Jong Tranbon* Kingtel* Ligitek* Unication</p>	<ul style="list-style-type: none"> <li>● Long term relationship ( familiarity, stability, continuity)</li> <li>● Strong confidence in pervious experience.</li> <li>● Confidence of design sense</li> <li>● Use adjective words</li> <li>● Rework the design work to match the client needs</li> <li>● More debate of aesthetic factors</li> <li>● More debate of all issues</li> </ul>
<p>Group 1 No Design Sense Developing</p> <p>Tentel* Philips Eten CAST</p>	<ul style="list-style-type: none"> <li>● Lacking adjective words</li> <li>● Not confident of design sense</li> <li>● Less debate of aesthetic factors</li> <li>● Uncertain of buyer needs and wants</li> <li>● Respect the expert</li> </ul>

Repurchase clients (\*)

The key decision-makers have “Design Aware” characteristic if they have confidence in previous work and their design sense capability. The important factors relate to more and more reworking, argument and debate. But, if the perceptual distance is near to the design leader, the key decision-maker could develop a long-term relationship with the And design leader. (Figure 8.8)

The key decision-makers have “Design Developing” characteristics when he/she also has confidence of design sense. They also respect the design expert.

The key decision-makers have “No Design Sense Developing” characteristic when he/she has no confidence in relation to their own design sense. He/she uses less adjective words to describe the future product and argues less about the aesthetic factors. On the other hand, he/she might also be uncertain of the buyers needs and wants. They also respect design expert. Figure 8.8 shown the developing model derived from this research.

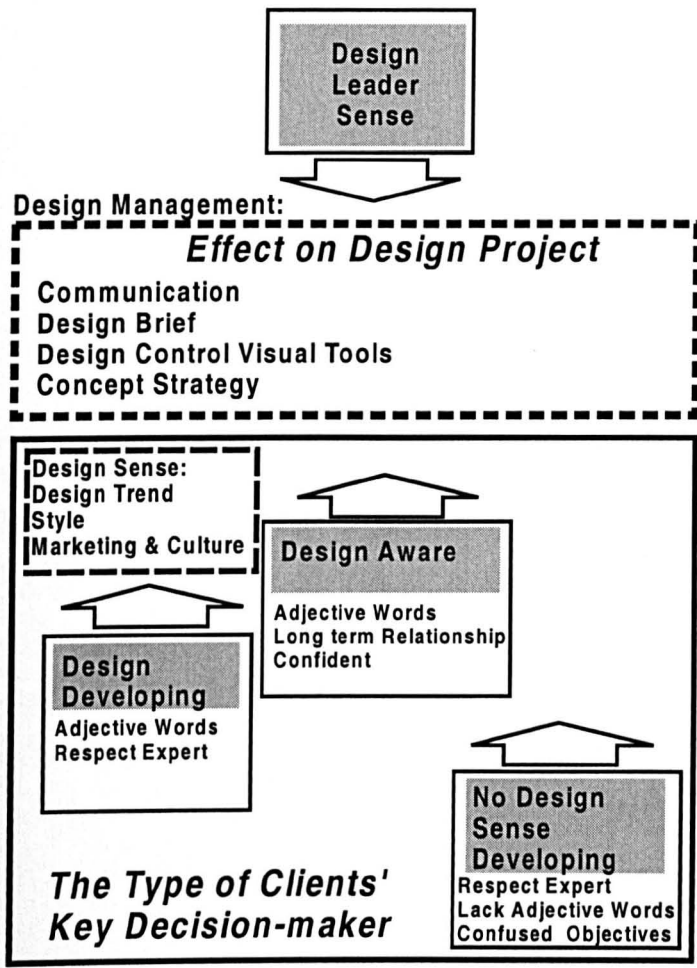


Figure 8.8: Design Sense Model

However, many cheaper follower (me-too) products are needed to be designed by design

consultants in Taiwan, using low cost of design services, rapid design development process, and good quality of product design. These all depend on being able to define and understand the requirements of the clients' design sense. This study is to extract the factors of design sense (Style, design trend, culture and marketability) and to offer a design sense model as well as a method for tested design sense for the design leader (manager) to understand the types of key decision-maker. Therefore design manager may integrate all this information to design the best design approach, to inform the setting of appropriate fee, and design strategy for satisfy the client and effective design approach to achieve a rapid design develop process.

## **8.2 Engineering Skill of Key Decision-maker**

French & Vierck 1987 noted that drawing is a language which can communicate with other people. However, decision-makers' engineering skill means that they can read the design language and use this language to communicate with designers. If decision-makers have a good engineering skill, they can effect design results during the NPD process. If decision-makers can't understand the design language, bad communication might happen. However, today, even powerful computer software packages can provide 3D computer modeling and rendering for decision-makers to evaluate future concepts. But during the NPD process, many decisions have the opportunity to evaluate by orthographic projection drawing (2D). If some decision-makers have a good engineering skill sense, they can utilize the design language to modify design results. The key decision-maker's engineering skill becomes a factor which has an impact on the NPD process.

### **8.2.1 Engineering Skill**

For designer's engineering skill, Cross 1996 argued that design appears to be an integral function which has a separate process, factory production, and division of labor, scientific management, mechanization and economies of scale. He also mentioned that "the drawing is a simple means of modeling the product design in advance of its production and use." Jones 1996 also mentions drawing is for the corporate designer's work, drawing before working and division of labor. In conclusion of the above viewpoint, design features utilize drawing to describe future product concepts and also integral mechanization function. This section is focused on engineering drawing because this is the basic communication tool. The key decision-maker wants to evaluate design concepts, the basic engineering skill – reading engineering drawings is needed. It is not just to read complex drawing, it is the ability to use different sides of product images to rebuild product concepts.

### **Between Industrial Designer and Mechanical Designer**

Due to the difference between the industrial designer and mechanical engineering designer. Viscount 1996 mentioned the design spectrum model, which describes the

Industrial Designer (ID) as aesthetics, ergonomics, the Mechanical Designer (MD), as structures, mechanics, the Electrical Engineering (EE) electromechanical and electronics system. Some product approaches to Industrial Design or Mechanical Design are equal. Thus an engineering drawing has a common language for communication between industrial designer, mechanical engineering and producer or related designer. The key decision-maker also is not a designer but he needs to make decisions, but if acting in mechanical engineering is difficult. Thus the key decision-maker finds it easier in industrial design easier than in mechanical engineering because industrial design focuses on product interface and aesthetics, which more approaches the user center design which is based on the user viewpoint.

### **Orthographic Projection Drawing**

There are many kinds of drawings for designers, one of these drawings makes use of orthographic projection showing each side of the concepts. Pipes 1990 noted that “orthographic projection, perfected by William Binns in 1857 and based on Durers method of 1525, is notoriously ambiguous, and hundreds of conventions have grown up to try to make sense of it.” The orthographic projection drawing is very common in the twentieth century, computer modeling still needs to use this method to display the different sides of the concept product. He also argued that drawing must convey information about complex three-dimensional shapes, endowing new products which can be unfamiliar to the consumer with personality and ease of use. He argued the product designer’s drawings have three critical functions, firstly, it is a means of externalizing thought and sorting out problems, secondly, it is a tool to sell the ideas to clients, and thirdly, it is a method for communication. In summary, the function of the drawing, which inverts the idea concepts, is for communication to other people for sharing or producing the product.

Designers offer many kinds of rendering to present the future product concept, in which the most popular approach is showing 3D perspective projection by hand sketch or computer modeling and rendering. Gill 1991 noted that “rendering drawing is a two-dimensional representation which conveys information to an observer in a form which can be understood, because it is based on principles that conform with what is seen.”

But unfortunately, not every product can use this approach.

Some situations need orthographic projection drawings to explain the concept.

- (1) **Product dimensions:** For example a pager, which is portable product whose dimensions are designed as small as possible. If the designer only shows the 3D perspective project drawing, the key decision-maker can easily catch the idea concept, but the detail of the image and dimensions could lose shape in perspective drawing. Utilizing both 3D perspective project drawing and orthographic projection drawing can reduce the chance of misunderstanding.
- (2) **The hardware lay out is needed for review:** As in the a videophone, the standard videophone is a telephone plus LCD display and camera. Only showing the 3D perspective projection drawing the reader can not really understand the dimensions of the product and also whether the hardware lay out has enough space.
- (3) **Interface design:** In airplane passenger seats, the seat adjective angle, head rest position, foot tray dimension, position and restoring angle all need orthographic projection offering detailed design explanation.

Industrial designers offering near reality product concept rendering considers that the key decision-maker is not familiar with orthographic projection, but according to the above reasons, the key decision-maker can use this skill for better communication with designers.

### **The Basic Orthographic Projection Drawing**

Earle 1990 argued that three views are usually adequate to describe an object, most utilize the orthographic projection to draw out the three-view drawing. French 1987 mentioned that orthographic projection provides a means of describing the exact shape. Thus, the engineering workers use this method and it becomes the basic approach and the three-view orthographic project drawing is needed. French & Vierck 1987 stated there are several principles in reading the three-view orthographic project drawing.

- (1) **The object related side view:** To different the main figure is the first step. The orthographic projection uses the projection method for viewing any side. The following figure shows the views projected onto their projection planes.
- (2) **The components of object position in different views of the projection plane:** The position of small parts or part of an object are shown in different views. The kinds



of line can describe the detail of the object in different views.

- (3) The complex or special feature: The inclined plane, which appears in the projection drawing is needed to check each side.

### 8.2.2 Orthographic Project Testing

A test of engineering skill, orthographic projecting, according to the orthographic projection test and using Lego basic components to rebuild the model. This test method for the subjects is not like traditional testing but like playing a game.

#### Experiment method: Material

The test is to show the five views of orthographic projecting, and asks the subject to use the Lego to build the model. The Figure 8.9 shows the first test drawing.

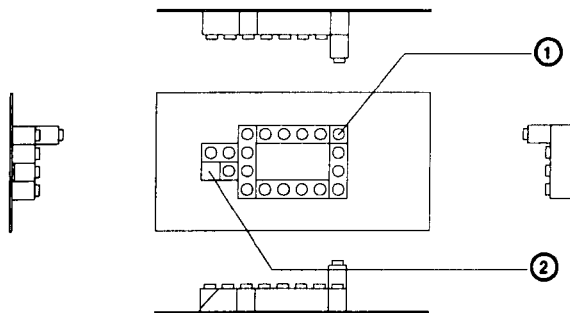


Figure 8.9: The Initial Engineering Skill Testing

Number one indicates the relative position, such as distance, location, and shape. Number two displays the inclined plane, which appears in projection drawings and is needed to check each side of view. It is very easy to confuse, if test subjects do not have engineering training.

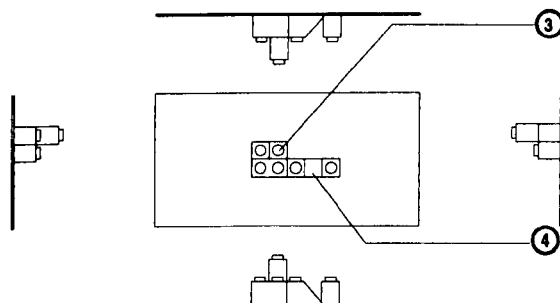


Figure 8.10: The Second Engineering Skill Testing

The second engineering skill test was shown in the Figure 8.10. The third and fourth repeat the first test but the model is simpler than the first model. However, the second test arranged for the subject was assembled correctly by chance. Thus the second test can make sure the sample is built as intended.

The Lego components are listed as follows on the Table 8.20. During each drawing test, the Lego components are designed to have more components than drawing components.

Table 8.20: The Components of Lego

No.	Lego dimension	First Drawing Q/T	Second Drawing Q/T	Total Q/T
1	1*1	1	2	3
2	1*2/included an inclined plane	1	1	2
3	1*2	1	2	5
4	1*3	0	0	2
5	1*4	4	0	4
6	12*8 Assemble plane	1	1	2

### The subjects

The 13 companies were those for whom the author carried out design consultancy work. Thirty-nine design projects were carried out for these client companies from June 1995 to July 1998. (Shown as Table 8.21)

Table 8.21: The Subject Profile

Subject profile	Client /Company (13) Testing subject (33)
Sex	Male (28) Female (5)
Job title	President (5) Vice President (3) General Manager (3) Vice General Manager (3) Manager Vice Manager (1) Chief Designer (1) Others (1)
Education background	Industrial Design (2) Electronic Engineering (10) Mechanical Engineering (3) Graphic Design (2) Others Engineering (6) Business (5) Related Liberal Art (4)
NPD Experience	1-5 years (10) 6-10 years (6) 11-15 years (9) 16-20 years (7) 21 years above (1)
Key task	Key decision-maker (13)

## **Procedure**

The test needed individual assembly testing and evaluation at the same time by a monitor. Each tested subject was only allowed to assemble the model once.

- (1) The test subject was told firstly the five views of the orthographic projection and to then rebuild the model. This had no time limit.
- (2) The monitor evaluated the results and gave the mark.
- (3) The same as the last stage, the test subject was asked to assemble the second drawing.
- (4) The monitor evaluated the results and gave the mark. At the same time, summed up the two test marks.

### 8.2.3 The Results and Discussion

There are 33-test subjects in 13 companies is shown in the follows Table 8.22.

Table 8.22: The Engineering Skill Testing Results

	Company	Name	Education background	Job title	NPD experience (years)	Engineering skill test				
						No.1	No.2	No.3	No.4	Total
K	Kingtel	Mr. Hu	Industrial Design	Manager	12	NA	NA	NA	NA	NA
K	Kingtel	Mr. Chiang	Industrial Design	Vice Manager	12	NA	NA	NA	NA	NA
PH-k	Philips/Communication/Taiwan	Mr. Cheng	Electronic Engineering (EE)	General Manager	13	×	×	•	•	2
PH	Philips	Ms. Hug	Liberal Art		0	×	×	×	•	1
Hen-k	Hentak	Mrs. Tung	Graphic Design	President	8	•	×	•	•	3
Un-k	Unication	Mr. Lu	EE	President	16	•	•	•	•	4
Un	Unication	Mr. Chen	EE	Manager	16	•	×	•	•	3
Sy-k	Syntech	Mr. Wang	Atomic Energy	Vice president	14	×	×	•	•	2
Sy	Syntech	Mr. Kung	Atomic Energy	Vice president	14	•	•	•	×	3
Sy	Syntech	Mr. Hung	EE	Manager	10	•	•	•	•	4
CAST-k	CAST	Mr. Cheng	Civil Engineering	Chief design	25	NA	NA	NA	NA	NA
CAST	CAST	Mr. Fan	Material Engineering	Manager	16	NA	NA	NA	NA	NA
Lig-k	Ligtech	Mr. Wei	EE	Manager	15	•	•	•	•	4
Pan-k	Panacom	Mr. Wu	Business	General Manger	0	•	•	•	•	4
Pan	Panacom	Mr. Cheng	EE	Vice GM	15	•	•	•	•	4
Pan	Panacom	Mr. Lee	IE	Vice GM	15	•	•	•	•	4
Et-da	Et-da	Mr. Cheng	physiology	Manager	3	•	•	•	•	4
Et-k	Eten	Mr. Ma	EE	Vice GM	6	•	•	•	•	4
Tr-k	Tranbon	Mr. Chen	Sociology	President	20	•	•	•	•	4
Tr	Tranbon	Ms. Kuo	Graphic Design	Manager	1.5	×	•	•	•	3
Tr	Tranbon	Mr. Kuo	Mass-communication	Manager	3.5	×	•	•	•	3
Ten-k	Tentel	Mr. Lin	Chemical	Manager	10	•	•	•	•	4
Ten	Tentel	Mr. Chang	EE	Manager	8	•	•	•	•	4
Ten	Tentel	Mr. Lu	Business	Manager	8	•	•	•	•	4
Ten	Tentel	Mr. Hung	Mold	Manager	8	•	•	•	•	4
Sm	Smartek	Mr. Lee	Mechanical	President	17	NA	NA	NA	NA	NA
Sm	Smartek	Mr. Lu	Business	Vice Pre.	0	×	•	•	•	3
Sm	Smartek	Mr. Shi	EE	Manager	12	•	•	•	•	4
Sm	Smartek	Ms. Lin	Business	Manager	3	×	×	×	×	0
Sm	Smartek	Ms. Tu	Mechanical	Manager	10	NA	NA	NA	NA	NA
K-k	Kingtel	Mr. Wu	EE	President	20	NA	NA	NA	NA	NA
Mig-k	Ming-jong	Mr. Chen	Mechanical	GM	20	NA	NA	NA	NA	NA
Mig	Ming-jong	Ms. Cheng	Business	Manager	10	NA	NA	NA	NA	NA

\*k: Key Decision-maker      NA: the sample without testing

The engineering skill test mark NA has two situations, first, the subject has related Mechanical Engineering or design background such as Industrial Design, Civil Engineering and Material Engineering. Second, the subject has long term NPD experience and also can read engineering drawings.

The engineering skill scores under four are shown in the Table 8.23 below. Smartek's Ms. Chen who is the marketing manager, has three years NPD experience, Philips's Ms. Hug's educational background is Liberal Art and no NPD experience, thus she only gets one score in the engineering skill test. Syntech's decision-maker's educational background is Atomic Energy, but he is the EE designer and his engineering skill test also is bad. Mr. Wang has fourteen years NPD experience, but in engineering testing only scores 2.

The first engineering skill test is more difficult than the second one, because there are 6 subject mistakes in No.1 (position) and also 6 subject mistakes in No.2 (inclined plane). By learning from the first engineering skill test, the second test has fewer mistakes. Only Philip's Ms. Hug and Smartek's Ms. Chen who do not have much NPD experience and no related engineering backgrounds, have lower marks. The Table 8.23 shows the 8 subjects under the scores of four, there are two subjects who are key decision-makers. This means, the other 11 key decision-makers have good engineering skill.

Table 8.23: The Engineering Skill Mark Under Four Scores Company Profile

	Company	Name	Education background	Job title	NPD experience (years)	Engineering skill test				
						No.1	No.2	No.3	No.4	Total
PH-k	Philips/Communication/ Taiwan	Mr. Cheng	Electronic Engineering (EE)	General Manager	13	×	×	•	•	2
PH	Philips	Ms. Hug	Liberal Art		0	×	×	×	•	1
Hen-k	Hentek	Mrs. Tung	Graphic Design	President	8	•	×	•	•	3
Un	Unication	Mr. Chen	EE	Manager	16	•	×	•	•	3
Sy-k	Syntech	Mr. Wang	Atomic Energy	Vice president	14	×	×	•	•	2
Sy	Syntech	Mr. Kung	Atomic Energy	Vice president	14	•	•	•	×	3
Tr	Tranbon	Ms. Kuo	Graphic Design	Manager	1.5	×	•	•	•	3
Tr	Tranbon	Mr. Kuo	Mass-communication	Manager	3.5	×	•	•	•	3
Sm	Smartek	Ms. Lin	Business	Manager	3	×	×	×	×	0

The Table 8.23 shows there are no subjects who have related Mechanical Engineering and Design Engineering background. Thus even on engineering testing, the educational background can be used to evaluate the engineering skill. According to sense model section 8.1.4 summary, the three types of clients are divided. A list of their company profile is shown in Table 8.24 below:

Table 8.24: The Company Profile

Client information		Client and designer relationship			Design brief / adjective			Project									Group
Company	product	Long term	Short term	Repurchase client	Style	Activity	Interface	Eng.	Edu.	Key boss	NPD /years	Fail	Debate	Total rework	Redo part of works	When chosen concept	
Syntech	Laser S		*			*	*	2	EE	*	2					1	Group 1 Developing Sense
Panacom	Video tel.		*		*	*	*	4	MBA		3					1	
Smartek	ISDN tel.	*			*			4	ME	*	3					1	
Hentek	Tel./ans.		*		*	*		3	Design	*	3		*	*		3	Group 2 Design Aware Sense
Ming-jong	Timer		*					4	ME	*	2	*	*	*	*	3	
Tranbon	Video tel.	*		*	*			4	Social	*	5		*	*		1 or 3	
Ligitek	Decoder	*		*				4	EE	*	1					1	
Unication	Pager		*		*	*		4	EE	*	3	*	*			3	
Kingtel	Cordless tel.	*		*	*			4	EE	*	10			*	*	1 or 3 or more	
Tentel	Key tel.	*		*				4	Chem.		1					1	
Philips	Key tel.		*					2	EE		2					1	Group 3 No Developing Sense
CAST	16G seat	*						4	ME		1					1	
Eten	PDA		*					4	EE		1	*	*			1	

Each group has one subject score under four, other key decision-makers all have four. The typological method is utilized to analyse the results as follows: Group 1 is named the “design developing” group and included Syntech, Panacom and the Smartek Company. However, whilst this group has design sense, all the companies are new customers for And’s design leader, thus their design sense is still under developed. The Syntech decision-maker’s educational background is Atomic Energy, but he acts as the EE designer which also is good. Mr. Wang has fourteen years NPD experience, but in engineering testing only scores 2. He can not carefully analyse the drawing and rebuild the model. The final subject, Panacom’s key decision-maker whose background is an MBA, with no NPD experience, but he got four marks. He could carefully analyse the drawing and rebuild the model. This is a special case.

Group 2 is named the “design aware” group, included Hentak, Ming-jong, Tranbon,

Unication, Ligitek and the Kingtel Companies, sharing similar perceptual space. Therefore this group had much debate during the project and entirely reworked or part reworked. In this group, Hentak's key decision-maker who has a background in graphic design, got a three score because graphic designers are not familiar with the 3D modeling. Thus, she lacks engineering skill. In group 2, they all have good design sense and have the ability to argue with the design consultant to modify the future concepts. Tranbon's key decision-maker's background is sociology, but he has 20 years NPD experience. Thus the NPD experience accumulated a useful engineering skill. Kingtel, Ligitek and Unication's key decision-makers also have EE background and long term NPD experience, thus they have good engineering skill.

Group 3 is named "no developing sense" group, and included Tentel, Philips and Eten Companies. In other words, these clients may lack design sense since they seldom attempt to use adjectives and they all accept the first presentation. In this group only Philips key decision-maker had two scores. His background is EE, and he also has long-term NPD experience but the engineering testing score was lower. Tentel and Eten's key decision-maker have no ME background, but they have long term NPD experience, thus they have good engineering skill.

#### 8.2.4 Suggestion and Recommendation

The engineering test uses the very simple model for testing the clients' ability to reading drawings. The advantage is that tested subjects can finish two tests in five minutes. The disadvantage is that many shapes, such as, curved surface are not components in basic Lego, and the organic shape can not be duplicated by a small quantity of Lego basic components.

Table 8.25: The Added Quantity of Lego Components

No.	Lego dimension	First Drawing Q/T	Second Drawing Q/T	Total Q/T
1	1*1	1	2	(3) 6
2	1*2/included an inclined plane	1	1	(2) 2
3	1*2	1	2	(5) 5
4	1*3	0	0	(2) 4
5	1*4	4	0	(4) 6
6	12*8 Assemble plane	1	1	(2) 2

\*() is original Lego quantity

The recommendation to adding circle base Lego and more of each Lego type in which the tested subjects may be confused by misreading the drawing and also misjudging the size of the Lego. The recommendation of adding Lego shows as follows in Table 8.25.

### **8.2.5 Summary**

The decision-maker has the engineering skill that he can use for design communication language. By utilizing Lego assembly to test the engineering skill, any consultant design manager can understand how key decision-makers read orthographic projections. Therefore they can set up a suitable design approach for each client. The conclusion is:

- (1) The engineering skill of decision-makers in each group appears not remarkable, each group has lower ability engineering skill subjects.
- (2) The educational background can first judge who has engineering skill, for example the ME, ID, related Mechanical Engineering. Those subjects do not need to be tested.
- (3) Long NPD experience is useful for training in engineering skill, such as Kingtel's key decision-maker whose background is EE but he has 25 years NPD experience, thus he has an excellent engineering skill.
- (4) When the client's engineering skill testing score is under four, the design manager needs to avoid using 2D orthographic projection and 2D rendering during the design presentation.



### 8.3 Matrix of Engineering Skill and Design Sense

Design sense is divided into three groups and engineering skill defined in two types. Engineering skill (Y-axis) helps the decision-maker to achieve a better design communication ability and also to use the design language to share their viewpoint. Design sense (X-axis), from the experiment result is divided into (1), Design aware; (2), Design developing and (3), No design developing groups. Two factors combine in a matrix for modifying section 7.5, design sense matrix, and shows as following Figure 8.11.

Engineer Skill	High Engineering Skill No Design Developing (Zone 2) <b>Engineering Sense</b> Tentel, Unication, CAST	High Engineering Skill Design Developing (Zone 4) <b>Pre-Designer Sense</b> Eten, Panacom, Smartek	High Engineering Skill Design Aware (Zone 6) <b>Designer Sense</b> Tranbon, Kingtel, Ming-jong, Ligitek
	Low Engineering Skill No Design Developing (Zone 1) <b>Senseless</b> Philips	Low Engineering Skill Design Developing (Zone 3) <b>Pre-Artist Sense</b> Syntech	Low Engineering Skill Aware Design (Zone 5) <b>Artist Sense</b> Hentak
	Design Sense		

Figure 8.11: Design Sense Matrix

The characteristic of each zone key decision-maker, shows as following in Table 8.26. The first zone is Philips. Philips Taiwan communication department’s key decision-maker is in this zone, and given the a name “Senseless”. He has low Engineering skill and no design development.

Tentel, Unication and CAST’s key decision-makers are in zone 2, and given the name “Engineering Sense”. One has a high Engineering skill another has no design development. This group’s key decision-makers have strong engineering characteristics, such as focus in plastic structure design, plastic injection skill, injection mold and production process. These kinds of key decision-maker are like being an engineer.

Syntech’s key decision-maker is in zone 3, given the name “Pre-Artist Sense”. One low engineering skill, another has design development. This kind of key decision-maker’s engineering skill is bad and development sense has an artist’s approach.

Eten, Panacom and Smartek’s key decision-maker’s are in zone 4, with the name “Pre-Design Sense”. One has high engineering skill and another has design development. This kind of key decision-maker’s engineering skill is good and development sense has a design approach.

Table 8.26: Design Management Characteristics among the Three Groups of Key Decision-Makers

Group	Design sense characteristic	Engineering skill	
Group 2 Design Developing	<ul style="list-style-type: none"> <li>● To build the relationship</li> <li>● Less debate of aesthetic factors</li> <li>● Developing long term relationship</li> <li>● Confidence of design sense</li> <li>● Use adjective words</li> <li>● Respect the expert</li> </ul>	High Engineering Skill	(Zone 4) Panacom, Smartek <b>Pre-Designer Sense</b>
		Low Engineering Skill	(Zone 3 )Syntech <b>Pr-Artist Sense</b>
Group 3 Design Aware	<ul style="list-style-type: none"> <li>● Long term relationship ( familiarity, stability, continuity)</li> <li>● Strong confidence in pervious experience.</li> <li>● Confidence of design sense</li> <li>● Use adjective words</li> <li>● Rework the design work to match the client needs</li> <li>● More debate of aesthetic factors</li> <li>● More debate of all issues</li> </ul>	High Engineering Skill	(Zone 6) Ming-jong, Tranbon, Kingtel, Ligitek, Unication <b>Designer Sense</b>
		Low Engineering Skill	(Zone 5) Hentak <b>Artist Sense</b>
Group 1 No Design Developing	<ul style="list-style-type: none"> <li>● Lacking adjective words</li> <li>● Not confident of design sense</li> <li>● Less debate of aesthetic factors</li> <li>● Uncertain of buyer needs and wants</li> <li>● Respect the expert</li> </ul>	High Engineering Skill	(Zone 2) Tentel, Eten, CAST <b>Engineering Sense</b>
		Low Engineering Skill	(Zone 1) Philips <b>Senseless</b>

Hentak’s key decision-maker is in zone 5, and given the name “Artist Sense”. One has low engineering skill, another is design aware. This kind of key decision-maker’s engineering skill is bad but design ability is good. It is like an artist who lacks engineering skill to design a product. The result may be a beautiful style but difficult to produce.

Ming-jong, Tranbon, Kingtel, and Ligitek's key decision-makers are in zone 6, and given the name "Designer Sense". One has high engineering skill, another is design aware. This kind of key decision-maker's engineering skill is excellent but design is good. These kind of key decision-makers have a strong feeling about wishing to play designer. Because he feels that he is a designer, thus he can modify the design consultant's design work over and over.

## **Chapter 9 Refined Design Sense Model**

This section describes the two new clients whose SD data was used as further input for the design sense model. It is divided into three parts. Firstly, how the data from the two new clients was used to sort out the type of design sense each group had. Secondly, the action research was used to check one existing client – Eten and also, the two new clients Tellus and CEMC. This included, the design sense character and the interaction with design approach and concept approach. Thirdly, the sense model was refined, by using the result of the character and symptom.

### **9.1 Research Methodology**

To investigate the user perception about product form, the semantic differential method (SD) was used. This research employs SD to establish a level of perceptual space (or design sense) between key decision-makers and the design leader and also, it compares the different approaches of those people through the resultant finding. The processes used are the same as those in section 8.1 Design Sense Model Methodology.

### **9.2 The Subjects**

The subject used for the SD test comprised of 15 client companies. The subjects within each company were the key decision-makers and managers and was made up of 10 consultant designers, 11 design leaders and 5 designers. The new companies from which subjects came were Tellus and CEMC key decision-makers.

### **9.3 Results and Discussions**

For all test samples, key decision-makers, design leaders and the And designers were used. The first factor investigated was represented by such adjectives as modern style, popular style, modern colour and Japanese style and were defined as evaluation factors. In design sense, it may be defined as design trend ability. The second factor is represented by such adjectives as comfortable colour, universal style, and 'my taste' style and were defined as shape factors. In design sense, it may be defined as style

ability. The third factor is represented by adjectives such as masculine style, hard style, harmony colour. These adjectives were defined as activity factors. Furthermore, in design sense, it may be defined as marketing ability. Table 9.1 and 9.2 show rotated factor matrices.

Table 9.1: Three Principle Factors

Factors	Typical descriptive adjectives	Pct of Var	Design sense factors
Factor 1/ evaluation	Modern style, Popular style, Modern color, Japanese style	45.7%	Design trend
Factor 2/ shape (potency)	Comfortable color, Universal style, My taste style, Harmony color	27.8%	Marketing, Culture
Factor 3/activity	Masculine style, Hard style,	12.6%	Style

Table 9.2: Rotated Factor Matrices

		Factors 1	Factors 2	Factors 3
Adj3	Popular style - Personality style	0.95032		-0.22200
Adj5	Modern colour - Futuristic colour	0.92749		-0.15516
Adj1	Modern style - Modern style	0.85377	0.32536	-0.21397
Adj8	Japanese style - European Style	0.65567		-0.54021
Adj7	Comfortable colour - Uncomfortable colour		0.96045	
Adj10	My taste style - Others taste style	0.29919	0.80706	-0.40531
Adj6	Harmony colour - Contrast colour	-0.11938	-0.78589	
Adj9	Universal style - Local style	-0.49924	-0.77514	0.15292
Adj4	Hard style - Soft style	-0.18726		0.96048
Adj2	Masculine style - Feminine style	-0.28248		0.89352
Eigenvalue		-0.26445		1.15993
Pct of Var %		45.7	27.8	12.6
Cum Pct %		45.7	63.5	76.1

### 9.3.1 The key Decision-makers' and Designer Leaders' Entire Perceptual Space

The key decision-makers and designer leaders were divided into three groups. The first group of decision-makers comprised of Eten, Syntech, Panacom, and Smartek decision-makers. The second group comprised of Hentek, Ming-Jong, Tranbon, CAST and Kingtel decision-makers. The third group comprised of Tentel, Ligitek and Unication (Table 9.3) Two new clients Tellus and CEMC were in group two and suggests that the two new clients possibly have excellent design sense.

Table 9.3: Rotated Factor Matrix of Total Adjective

	Company	Role	Name	Factors 1	Factors 2	Factors 3
L56	Conser Design	Design leader	Mr. Fang	0.90004	0.10584	0.30983
L2	Moreal Design	Design leader	Mr. Tseng	0.79913		0.26827
K40	Eten Company	Key decision-maker	Mr. Ma	0.76976	0.37589	0.26875
L7	Quinte Design	Design leader	Mr. Chiou	0.76389	0.31674	0.33392
K32	Panacom Company	Key decision-maker	Mr. Wu	0.74697		0.26917
A69	And Design	Designer	Ms. Ali	0.74462	0.19530	-0.11643
K26	Syntech Company	Key decision-maker	Mr. Wang	0.72716	0.65246	
K64	Smartek	Key decision-maker	Mr. Lee	0.70409		0.19197
A72	And Design	Designer	Mr. Lee	0.69262	0.27225	-0.16561
L60	JK Design	Design leader	Mr. Chung	0.57381	0.38959	0.40146
L35	Center Design	Design leader	Mr. Tung	-0.54428	0.41328	0.51800
L22	Nova design	Design leader	Mr. Lin	0.53279	0.47499	0.038194
A76	And Design	Designer	Mr. Con		0.83369	
L41	Sekond Design	Design leader	Mr. Lin	0.33742	-0.82045	0.11990
K15	Hentak Company	Key decision-maker	Mrs. Tung	0.38981	0.77043	0.31092
L45	I+U Design	Design leader	Mr. Koo	-0.14150	0.76186	0.20007
K73	Ming-Jong Company	Key decision-maker	Mr. Chen	0.26434	0.74562	0.22740
K77	Tellus Company	Key decision-maker	Mr. Weng	0.38054	0.73529	0.31276
L18	Sumwell Design	Design leader	Mr. Tang	0.33553	0.72285	0.34051
K49	Tranbon Company	Key decision-maker	Mr. Chen	0.13453	0.70182	
L71	And Design	Design leader	Mr. Wu	0.56732	0.62981	0.16775
K70	Kingtel Company	Key decision-maker	Mr. Wu	0.46541	0.56437	0.40384
K29	CAST Company	Key decision-maker	Mr. Cheng	0.19463	-0.49664	-0.24033
K80	CEMC Company	Key decision-maker	Mr. Shyr	0.11753	0.17571	-0.10787
L4	Wen's Design	Design leader	Mr. Wen	0.23751		0.92702
K52	Tentel Company	Key decision-maker	Mr. Lin		0.17525	0.85948
K13	Philips Company	Key decision-maker	Mr. Chen	0.29552	0.35499	0.76323
A75	And Design	Designer	Ms. Chen	0.58770		0.70348
K16	Unication Company	Key decision-maker	Mr. Lu		0.22229	0.69587
K31	Ligitek Company	Key decision-maker	Mr. Wei	0.49407	0.35634	0.68646
A1	And Design	Designer	Mr. Yei	0.27608	0.19271	0.56238
Eigenvalue				12.96854	5.09078	3.19273
Pct of Var %				41.8	16.4	10.3
Cum Pct %				41.8	58.3	68.6

### 9.3.2 The Group Is Divided by Factors of Their Entire Perceptual Space

According to factor analysis, the three types of clients were divided by their profiles which are shown in Table 9.4.

Table 9.4: The Company Profile

Client information		Client and designer relationship			Design brief / adjective			Project									Group
Company	product	Long term	Short term	Repurchase client	Style	Activity	Interface	Eng.	Edu.	Key boss	NPD /years	Fail	Debate	Total rework	Redo part of works	When chosen concept	
Eten	PDA		*					4	EE		1	*	*			1	Group 1 Developing
Syntech	Laser S		*			*	*	3	EE	*	2					1	
Panacom	Video tel.		*		*	*	*	4	MBA		3					1	
Smartek	ISDN tel.	*			*			4	ME	*	3					1	Design Sense
Hentak	Tel./Ans.		*		*	*		3	Design	*	3		*	*		3	
Ming-jong	Timer		*					4	ME	*	2	*	*	*	*	3	Group 2 Design Aware Sense
Tranbon	Video tel.	*		*	*			4	Social	*	5		*	*		1 or 3	
CAST	16G seat	*						4	ME		1					1	
Kingtel	Cordless tel.	*		*	*			4	EE	*	10			*	*	1 or 3 or more	
Tellus	Pager		*		*			4	EE	*						1	
CEMC	Speaker							3	Arch.	*	2						
Tentel	Key tel.	*		*				4	Chem.		1					1	Group 3 No Developing Design Sense
Philips	Key tel.		*					2	EE		2					1	
Ligitek	Decoder	*		*				4	EE	*	1					1	
Unication	Pager		*		*	*		4	EE	*	3	*	*			3	

Factor 2 has Hentak, Ming-Jong, Tranbon, CAST and the Kingtel Companies, sharing a similar perceptual space. Therefore, this group has holds many debates during the project and entire reworks or part reworks. In this group, Hentak's whose key decision-maker had a background in graphic design. The Tranbon, Kingtel and Hentak Companies also attempt to use many adjectives for describing the future concepts. A further interesting finding was that only this group argued for rework. Thus, it can be summarised that they all have a good design sense and also, have the ability to argue with the design consultant to modify the future concepts. The Group 2 was named the "design sense group". The Tellus and CEMC key decision-maker are located in factor 2 – design sense group. Tellus key decision-maker also attempted to use many adjectives for describing the future concepts. He had an EE (Electric Engineer) background but he argued style approach. CEMC's key decision-maker had an architecture background and due to this, has very little related product NPD experience. Thus he tended not to use adjectives for describing the future concepts.

### 9.3.3 The Factor 1-2 and Factor 2-3 Plot Rotated Space

The three factors show the factor 1-2 plot and 2-3 plot are shown in Figure 9.1 below. These three factors are applied to x, y, z-axis and divided into eight quadrants.

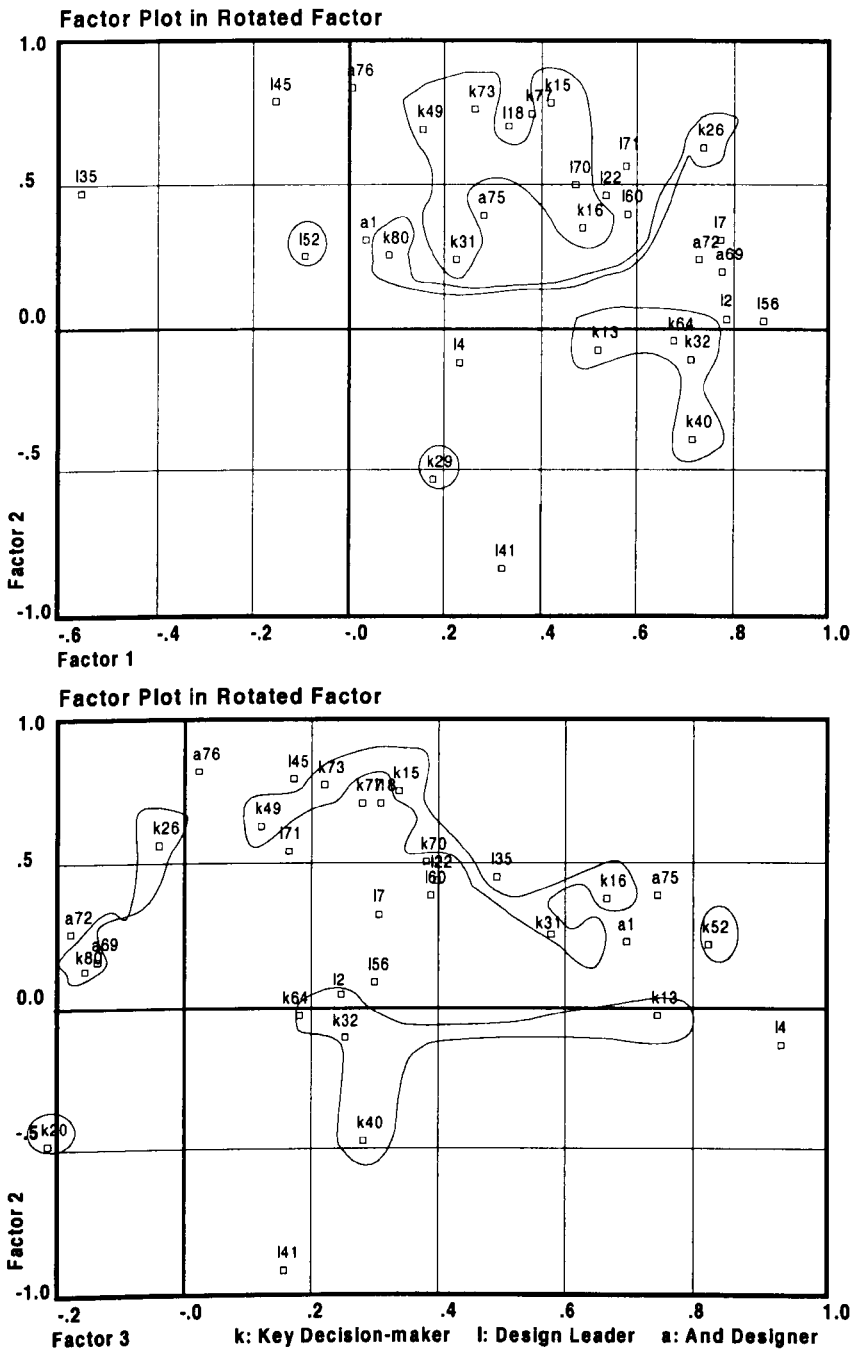


Figure 9.1: Factor 1-2 and 2-3 Plot in Rotated Factor Space



### 9.3.4 The Key Decision-makers and the And Designers into their Appropriate Quadrant.

Quadrant 1 contains Tranbon, Kingtel, Ligitek, Hentak, Ming-jong, Unication, the And design leader and three of the And designers. Quadrant 2 contains Syntech and two of the And designers. Quadrant 4 contains only Tentel. Quadrant 5 contains Philips, Smartek, Panacom and Eten, and quadrant 6 contains CAST. The new companies, Tellus (k77) were located in Quadrant 1 and CEMC (k80) in Quadrant 2. (Show Table 9.5). There were no key decision-makers in quadrants 3, 7 and 8.

Table 9.5: The Divided Five Space of Company Profile

Client information		Client and designer relationship			Design brief / adjective			Project									Group
Company	product	Long term	Short term	Repurchase client	Style	Activity	Interface	Eng.	Education Background	Key boss	NPD /years	Fail	Debate	Total rework	Redo part of works	When chosen concept	
K49 Tranbon	Video tel.	*		*	*			4	Social	*	5		*	*		1 or 3	Quadrant 1
K15 Hentak	Tel./ans.		*		*	*		3	Design	*	3		*	*		3	
K70 Kingtel	Cordless tel.	*		*	*			4	EE	*	10			*	*	1 or 3 or more	
K31 Ligitek	Decoder	*		*				4	EE	*	1					1	
K73 Ming-Jong	Timer		*					4	ME	*	2	*	*	*	*	3	
L16 Unication	Pager		*		*	*		4	EE	*	3	*	*			3	
K77 Tellus	Pager		*		*			4	EE	*						1	
K26 Syntech	Laser S		*			*	*	3	EE	*	2					1	Quadrant 2
K80 CEMC	Speaker							3	Arch.	*	2						
K52 Tentel	Key tel.	*		*				4	Chem.		1					1	Quadrant 4
K40 Eten	PDA		*					4	EE		1	*	*			1	Quadrant 5
K13 Philips	Key tel.		*					2	EE		2					1	
K32 Panacom	Video tel.		*		*	*	*	4	MBA		3					1	
K64 Smartek	ISDN tel.	*			*			4	ME	*	3					1	
K29 CAST	16G seat	*						4	ME		1					1	Quadrant 6

Quadrant 1 of the perceptual space table represents higher evaluation, higher activity and higher shape attributes. Key decision-makers in this space comprised of Tranbon, Kingtel, Ligitek, Hentak, Ming-jong and Unication. It is important to note that the And design leader is also in this space, plus two senior designers and one junior designer. In this space, Tranbon and Kingtel are very important clients, not just because they are

established clients but also, because they have many design projects every year. In addition, Hentak, a small manufacturer, produces a classic telephone, which is made of wood. The key decision-maker is a designer and most company products are proposed by this key decision-maker who is also the president. Unication, Tranbon, Hentak and Kingtel all use adjectives to describe the future concepts. It is assumed that since they can describe the future concept, they display strong confidence in styling. Thus, they have similar attitudes in debating and reworking and seldom accept the concept design at the first presentation.

There are 6 designer leaders in quadrant 1. Tellus' key decision-maker and other 5 key decision-makers who have a similar perceptual space and tend to have a better design sense than others' key decision-makers.

Quadrant 2 of the perceptual space represents higher evaluation, higher shape and low activity. The key decision-makers in this space are from Syntech and two junior And designers. Space 2 shows that these people have a high level of understanding of design trends, marketing and culture, but that they lack style sense. Nevertheless, the fact that the two junior designers lack marketing and culture sense seems correct, but the lower level of style sense seems wrong. It could be, that even though they have three years working experience, it is still not enough experience to be able to handle the many different types of clients.

The action research information shows that Syntech's key decision-makers are concerned with interface adjective and activity adjective. This is demonstrated by the design they produced for the handy barcode scanner. This was an important product as it required a knowledge of a new, high technology for which and there are currently few producers through-out the world. Syntech tend to use a "Me-too" strategy to design the products; thus their key decision-makers might not take so much care with the styling.

CEMC key decision-maker lies in space 2. CEMC has an architecture background. This is similar to the two young And designers, who inspite of some experience, have too low a level style sense in order to be able to handle the future concepts.

### 9.3.5 Key Decision-Makers' and Designer Leaders' Entire Perceptual Distance

Key decision-makers and design leaders loading factors are shown in Table 9.6. By using the loading factors to check the distance between people it is possible to show each subjects' viewpoint.

Table 9.6: Key Decision-Maker and Design Leader Factor Loading

		adj1	adj2	adj3	adj4	adj5	adj6	adj7	adj8	adj9	adj10	fac1	fac2	fac3
A1	And designer	4.77	3.85	4.92	4.23	3.77	5.62	5.23	5.46	4.15	4.69	0.01	-0.70	-0.96
A69	And designer	5.46	4.85	5.69	4.62	5.08	3.54	6.31	4.85	4.23	5.92	0.33	-0.08	-0.58
A72	And designer	6.54	5.23	6.38	5.23	3.54	4.23	5.08	5.77	5.31	5.38	0.66	0.07	0.21
A75	And designer	4.85	4.62	5.00	4.38	5.08	4.85	5.77	5.62	5.08	5.08	-0.03	0.01	-0.23
A76	And designer	4.46	5.92	3.00	3.69	2.08	3.77	5.54	6.00	5.46	5.31	-2.74	0.29	1.48
K13	Philips key decision	5.85	3.31	5.23	3.69	5.38	4.15	5.62	6.15	5.85	4.15	0.56	0.15	-1.51
K15	Hentek key decision	5.31	4.31	3.62	4.69	3.54	3.46	6.46	6.31	6.15	4.92	-1.52	1.02	0.45
K16	Unication key decision	5.00	3.92	5.08	3.54	3.77	4.38	5.46	5.92	4.62	4.46	-0.28	-0.16	-1.34
K26	Syntech key decision	5.69	4.54	5.08	4.54	3.31	3.31	6.23	5.00	5.00	5.31	-0.60	0.07	-0.28
K29	CAST key decision	7.38	5.77	4.00	5.62	6.00	4.38	3.31	5.08	4.85	3.62	1.16	-3.22	1.75
K31	Ligitek key decision	5.69	3.92	4.08	4.77	5.23	4.92	5.38	5.62	5.92	5.23	0.08	-0.14	0.20
K32	Panacom key decision	6.54	5.31	5.77	5.77	5.54	5.23	5.85	6.46	5.08	5.54	1.17	0.55	0.60
K40	Eten key decision	6.54	4.08	6.00	5.62	6.08	5.00	5.62	5.69	5.23	5.69	1.73	0.11	-0.39
K49	Tranbon key decision	5.15	4.62	4.23	5.92	4.54	4.85	6.00	5.31	5.31	5.15	-0.38	-0.14	0.93
K52	Tentel key decision	3.62	3.46	4.15	3.77	4.31	4.77	5.38	5.54	3.92	3.23	-0.72	-1.25	-1.50
K64	Smartek key decision	6.23	5.08	5.23	4.92	5.08	5.00	5.77	5.15	4.92	5.00	0.63	-0.58	0.34
K70	Kingtel key decision	5.08	3.46	5.69	4.62	2.46	4.15	6.00	6.00	5.46	3.85	-0.53	0.50	-1.26
K73	Ming-Jong key decision	4.62	4.08	2.92	4.00	2.69	3.54	4.85	5.31	4.23	4.46	-1.72	-1.32	-0.13
K77	Tellus key decision	5.15	4.31	5.46	5.00	3.54	4.69	6.15	5.54	6.00	4.92	-0.38	0.66	-0.05
K80	CMC key decision	5.77	5.31	4.00	6.15	5.77	4.38	6.08	4.69	6.08	3.92	-0.17	-1.05	1.81
L18	Sumwell	4.31	4.15	4.85	4.31	4.08	4.08	5.62	5.15	5.77	5.00	-0.78	0.04	-0.33
L2	Moreal	5.85	4.31	6.62	4.77	5.15	4.54	6.00	5.38	5.54	5.38	1.06	0.47	-0.83
L22	Nova	5.31	4.38	4.31	3.92	4.31	3.69	7.23	5.38	4.00	4.62	-0.75	0.07	-0.86
L35	Center	6.46	6.69	5.69	6.08	6.00	7.54	6.85	6.92	7.08	6.31	0.83	2.25	2.67
L4	Wen's	5.08	4.23	4.77	4.31	5.23	5.00	5.23	5.54	5.08	4.46	0.23	-0.68	-0.42
L41	Sekond	6.69	5.23	5.62	5.08	6.23	5.69	4.92	5.38	4.92	5.31	1.67	-0.93	0.46
L45	I+U	4.23	4.92	4.54	5.23	3.85	5.38	6.92	4.92	4.69	5.08	-0.97	0.16	0.52
L56	Conser	6.31	4.62	6.08	5.54	5.54	4.38	6.15	6.38	5.54	5.38	1.06	0.92	-0.15
L60	JK	5.62	4.00	4.69	4.23	4.23	4.54	5.54	5.54	4.85	5.92	0.00	0.07	-0.57
L7	Quinte	5.85	4.62	6.77	5.08	5.46	4.15	7.08	6.38	6.00	5.69	0.81	1.98	-0.61
L71	And design leader	5.54	4.62	4.62	5.46	4.77	3.69	6.23	6.08	6.08	5.31	-0.41	0.85	0.59

The perceptual distance ( $d_i$ ) is the different evaluation score of each factor. If the perceptual distance score is lower it means that two subjects are very similar. If the perceptual distance score is higher it means that two subjects are distant.

$$d_i = \sqrt{s}$$

$$S = \sum (\Delta x_i - x'_i)^2 + (\Delta y_i - y'_i)^2 + (\Delta z_i - z'_i)^2$$

$$\Delta x_i = \text{factor 1} \quad \Delta y_i = \text{factor 2} \quad \Delta z_i = \text{factor 3}$$

### 9.3.6 The Perceptual Distance between The And Design Leader and Key Decision-Makers

In measuring the perceptual distance between L71/And design leader and the key decision-makers, the score were ranked as follows: K77<K49<K15<K31<K26<K32<K70. Between the 15 key decision-makers, the K77/Tellus subjects had the shortest perceptual distance with the And design leader. K49/Tranbon decision-makers were the second shortest perceptual distance with the And design leader. This means that these two people have a similar design sense. The And design leader has at least 8 years design consultant experience with Tranbon thus they have established a similar design sense. The new client – Tellus might have a similar design sense. The K31/Ligitek is similar to the Tranbon situation. The forth shortest perceptual distance, K15/Hentak key decision-maker whose background is a graphic design, shows that she has a high level of both design ability and design sense. The key decision-maker from K70/Kingtel is an important client and has 6 years experience of consulting with the And design leader. CEMC key decision-maker whose background is an architecture, shows that he has a good level of design ability, but has a greater perceptual distance with the And design leader and so is 10 rank. The means, he needs to further increase his developing sense.

From the perceptual distances ranked 1 to 6, key decision-makers are shown to have similarities with the manner in which have key decision-makers utilize adjectives to describe the future concept as indicated in Table 9.7.

Table 9.7: The Rank of Perceptual Distance Between The And Design Leader and Key Decision-makers

	K77 Tellus	K49 Tranbon	K15 Hentak	K31 Ligitek	K26 Syntech	K32 Panacom	K64 Smartek	K70 Kingtel
L71/And Leader	0.668	1.047	1.131	1.171	1.183	1.608	1.785	1.886
Rank	1	2	3	4	5	6	7	8
	K16 Unication	K80 CEMC	K40 Eten	K73 Ming- Jong	K13 Philips	K52 Tentel	K29 CAST	
L71/And Leader	2.182	2.270	2.467	2.635	2.416	2.978	4.513	
Rank	9	10	11	12	13	14	15	

### 9.3.7 Summary

In order to determine which type of design sense the key decision-makers at Tellus and CEMC had, the following process was followed. Firstly from factor analysis, the Tellus and CEMC key decision-maker are located in factor 2 – the design sense group. Secondly, checking in which quadrant. The Tellus key decision-maker was in quadrant 1 – most designer leaders were located in this quadrant. CEMC was in quadrant 2, which was similar to the And designers, who had insufficient levels of style sense to be able to handle the future concept successfully. Thirdly, examination of their rank of perceptual distance between them and the And design leader. The Tellus key decision-maker is the shortest distance and thus Tellus was located in design sense group. But the CEMC key decision-maker ranked a distant of 10 and was in quadrant 2. Therefore, in summary, the CEMC key decision-maker in factor 2, that need modify to move factor 1, design developing sense group.

## **9.4 Tellus Design Project**

On September 1998, Tellus company asked author for help to develop a Chinese text pager, which was part of the Flex system. The general manager, Mr. Weng, meet the author in one of author's client company when he visited his friend.

Flex-pager is one a method of a high-speed, one-way, communication system. This pager design was for Taiwanese's market and the main target customers were students. Due to the amount of personal communication continually increasing, there are currently many communication companies in this crucial market. Every communication company needs to have the latest generation of products to promote in this new market. The manufacturer, Tellus, is located in Hsinchu Science Park (in north Taiwan). Tellus is hi-tech company and has previously developed CT2 communication and pager products.

The design brief of this project was to target a young style of flex-pager that would attract young students. This project required a new style design. The age of the intended customer would be between 18-25 years.

### **9.4.1 Tested Design Sense**

During the first client meeting, Mr. Weng was asked to do both the SD test and Engineering skill test. The author explained that the two tests were to measure the level of understanding between the key decision-maker design sense and design language ability and that, being able to understand each other well, was crucial to an effective design processes. Hence, Mr. Weng was pleased to complete the test. The SD test can be used as a factor analysis to determine the type of design sense. Engineering skill test employed Lego to test the client's engineer drawing ability. Therefore the design leader was able to compare the two tests to organised the best design approach and concept approach.

In previous chapter, Tellus was allocated into design sense aware group, and on the key decision-maker's engineering skill test obtained full marks (four marks). Therefore, by

applying the design sense model, Mr. Weng - the key decision-maker, has the “Design Aware” characteristic. He was confident about their previous work and design sense capability. The important factors relate to the requirement of more and more reworking, argument and debate. Mr. Weng’s perceptual distance is near to the author’s and he could develop a long-term relationship with the And design leader (author).

Table 9.8: Tellus’s Key Decision-Maker Design Sense Characteristic

Design aware Group	Design sense characteristic	Tellus’s key decision-maker
	● Long term relationship ( familiarity, stability, continuity)	NA
	● Strong confident in pervious experience.	NA
	● Confidence of design sense	NA
	● Use adjective words	Younger, fashion
	● Rework the design work to match the client needs	No
	● More debate of aesthetic factors	No
	● More debate of all issues	No

During the design presentation, Mr. Weng chaired the NPD meeting. He asked the NPD members present about their personal viewpoints for supporting his decision. He clearly understood the target market and the use of adjective words to describe the future concepts. Due to this being the first design project, both the design consultant and the client will still be kept at a distance. Thus, strong and confident from pervious experience and confidence of design sense is difficult to observation. Furthermore, Mr. Weng uses adjective words, such as younger, fashion in design, during the brief phase.

#### 9.4.2 New Styling Design Approach

The Author proposed a 2D computer rendering approach instead of 3D computer rendering approach. (Table 9.9) There were three reasons for this: firstly, Tellus’s key decision-maker was part of the design sense aware group and thus, he might argue to modify aesthetic factors to match his requirement. In addition, the 2D-computer rendering was easy to modify. Secondly, Tellus’s key decision-maker’s engineering skill test was full marks (four marks). Thus, he could use design language for to communication. Thirdly, developing a 2D render is comparatively easy and allows the same design approach method to be used from initial concepts to final presentation.

Table 9.9: Tellus Flex-Pager Design Project Design Approach

Standard Approach	Design Brief	Marketing Mapping (Pieces)	Idea Sketch (Pieces)	2D rendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
		Design trend A4x1	A4x20	Coral Draw A4x3 /GA drawing	NA	NA	NA	NA

Design leader presented three design concepts for meeting the design brief. These were: (1), Sport style; (2), Transparence material, and (3), Large piece of plastic cover. In this case, the client provided two concept adjectives younger and fashionable. Therefore, the design leader should be able to quickly defined which design direction to take to match the clients requirements. Such an approach can help young designers during the idea generation phase. (Show Figure 9.2)

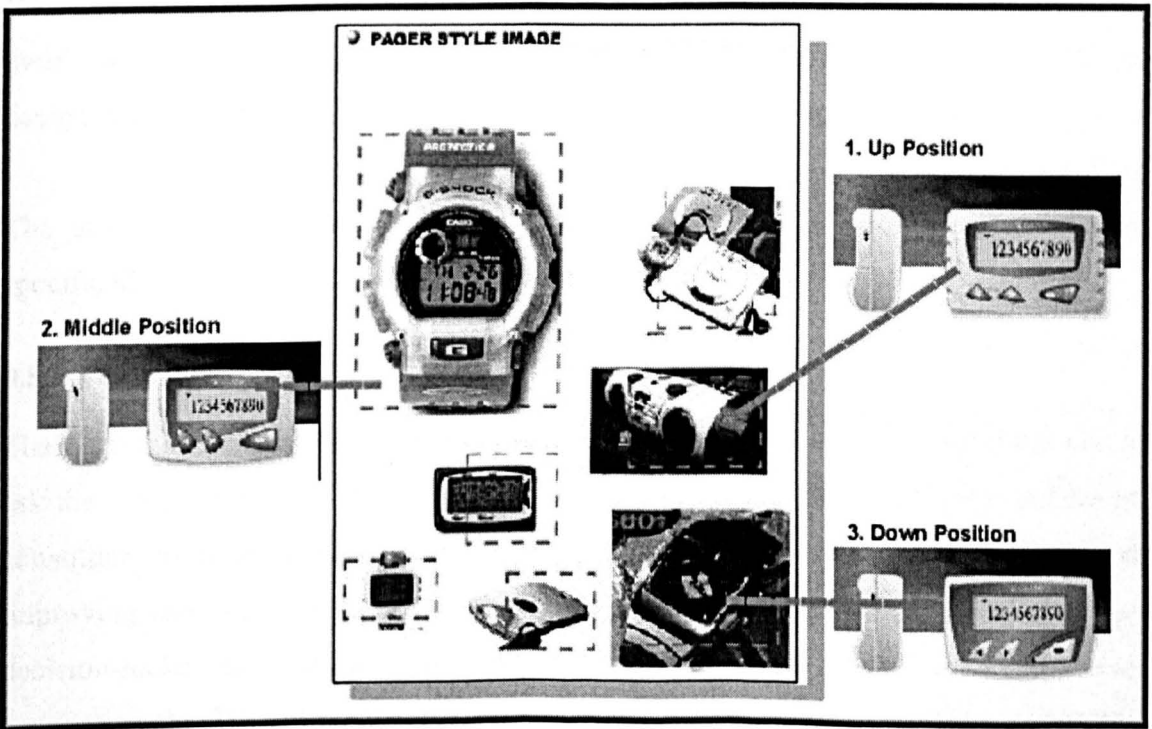


Figure 9.2: Design concept approach

In this instance it was very lucky that all three of idea concepts were attractive to the clients. Some of the NPD members preferred concept A and some prefer concept B. In general speaking, the first concept presentation is successful, and client did not argue for any modification of the design concept. Hence, after one month, client requested another design project, which was the flex-pager B. In this design project is no base on which to begin because it is a new product and a new concept. In this project, the clients



argued to modify the concept design more than three times. Furthermore, because of the problems during the design approach a 2D computer rendering was used. This allowed the work to be modified more easily and effectively.

## **9.5 CEMC Design Project**

During November 1998, the author was introduced to the China Electric MFG Co., Ltd. (CEMC), they wanted to develop a caller ID telephone (Caller Identity).

A Caller ID telephone is one where the caller's telephone number can be displayed in the LCD display. It is not a new product, but it is new for CEMC. CEMC have been speaker manufacturers since 1978. OEM speakers are main service for buyers, and they have 2 to 3 ODM projects each year. The company is located in Taipei City and their manufacturing facility is huge. Mr. Ma their marketing manager provided the design brief for the author.

The design brief of this project was developing a home type, caller ID telephone, specifically for sale in USA and European markets.

### **9.5.1 Tested Design Sense**

The Author visited CEMC twice. On the first occasion to clarify the design brief and to ask the company NPD if it was possible to carry out a test that would help the design consultant to understand the clients requirements. This would have the result of improving the design approach. Mr. Ma agreed to arrange for the company's key decision-maker to help with the testing. Secondly, the author spent one hour conducting the SD test and engineering skill test by CEMC's key decision-maker Mr. Shyr, Vice President. He took great care and patience to complete the test. He was not familiar with this caller ID telephone, so he was not able to offer any adjective words to help describe future concepts.

In section 9.3, CEMC's key decision-maker allocated to the design sense developing group. In their engineering skill test they achieved three marks. This meant that they had low engineering skill. Even though Mr. Shyr background was in architecture he had

nearly 15 years experience with CEMC and during that time had never done any architecture based projects. But by training he was an architecture engineer, one of design background he had a design sense ability.

### 9.5.2 Design Approach

The Author proposed using both 2D and 3D-computer rendering approach. (Table 9.10) For two reasons, firstly, CEMC’s key decision-maker was in design sense developing group. Thus, he might argue to modify aesthetic factors to match his personal requirements. Secondly, the caller ID telephone project used 2D-computer rendering that was easy to modify. Even though CEMC’s key decision-maker’s engineering skill test was three marks, he could not use design language to communication with the designer. In general terms, the design approach needed to use a 3D computer rendering in order to present three design concepts. Nevertheless, the author felt that CEMC can not pay too high a design fee, thus the proposal was to used 2D computer rendering instead of 3D-computer rendering. But after EK form model was completed, one 3D-computer rendering was developed in order to make sure of the details on the final design.

Table 9.10: CEMC Caller ID Telephone Design Project Design Approach

Standard Approach	Design Brief	Marketing Mapping	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
	*	Design trend and market mapping	A4x20	Coral Draw A4x3 /GA drawing	EK form	1 set	NA	NA

If the key decision-maker has no design sense, the design service fee includes no extra charges. However, if the key decision-maker has design sense, then developing the design service fee includes a 5% extra charge. If key decision-maker is aware design, the design service fee includes a 10 % extra charge. Due to CEMC’s key decision-maker being in the design sense developing group, the design fee included a 5% extra charge. Unfortunately this design approach and design free are not approved by CEMC. After few months, the Author contacted Mr. Ma, the marketing manager, to establish why the And design consultant was not awarded this design project. Mr. Ma, stated that the design fee was too high and did not match CEMC requirements.

## 9.6 Eten Design Project

On January 1999, the Eten Company asked the author for help to develop a new PDA (Personal Digital Assistant) and develop a pager system. The general manager, Mr. Ma, the key decision-maker, used to be R&D manager, and had been allocated to the no design sense group.

The PDA (Personal Digital Assistant) and pager system was Eten's main product and was mainly used for monitoring the stock market information. Eten was one of the high prestige Software Company. However, the product planning department now wanted to develop a product for younger user market. The design brief, target user was a student aged from 13-20. In addition, the LCD display was to be larger than first generated product by a  $\frac{1}{3}$ .

### 9.6.1 Test Design Sense

The Eten's key decision-maker was tested for design sense. (Table 9.11) The engineering skill test full marks were achieved (four marks) suggesting a high level of engineering skill. The first PDA design project, Eten's key decision-maker did not mention any adjective words to describe the future concepts and chosen one of the concepts to be modified for the final prototype during the first presentation. At the design meeting during design process, the key decision-maker did not debate of aesthetic factors of the product. Thus, from the action research it can be concluded that Eten's key decision-maker can be allocated to design sense group. For this project, the author only received 70% of the design fee, because Eten were not satisfied with the final mock up. This project was therefore regarded as a failed project. The author wanted a second project in order to modify the design sense model.

Table 9.11: Eten's Key Decision-Maker Design Sense Characteristic in First PDA Project

No Design Sense Developing Group	Design sense characteristic	Eten's key decision-maker
	● Respect the expert	yes
	● Not confidence of design sense	NA
	● Lacking use adjective word	NA
	● Uncertain of buyer needs and wants	NA
	● Less debate of aesthetic factors	yes
	● More debate of all issues	yes

### 9.6.2 New Styling Design Approach

The Author proposed a 2D computer rendering approach instead of 3D computer rendering approach. (Table 9.12) This was because during new PDA products developed using a 2D-computer rendering are easier to build, and Eten's key decision-maker's engineering skill test indicated an engineering skill ability, thus he can use design language to communication.

Table 9.12: Eten Second PDA Design Project Design Approach

Standard Approach	Design Brief	Marketing Mapping	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
	*	Design trend and marketing mapping	A4x10	Coral Draw A2x3 /GA drawing	NA	NA	NA	NA

Eten's key decision-maker had no design sense developing. Thus, the styling planning for Eten key decision-maker is education that why design consultant design this style, and communication the design trend and market position. (Figure 9.3)



Figure 9.3: PDA Styling Planning

He has no design sense developing skills and does not clearly know what he wants. Hence idea concepts needed to present a bigger range than he mentioned. And also means, that the design idea was too broad. Eten chose a conservative approach C, and it

was positioned is C3 idea. According to the Eten NPD meeting results the B1 idea was too new and B2 was too normal, and C3 matched Eten’s requirements. (Figure 9.4)

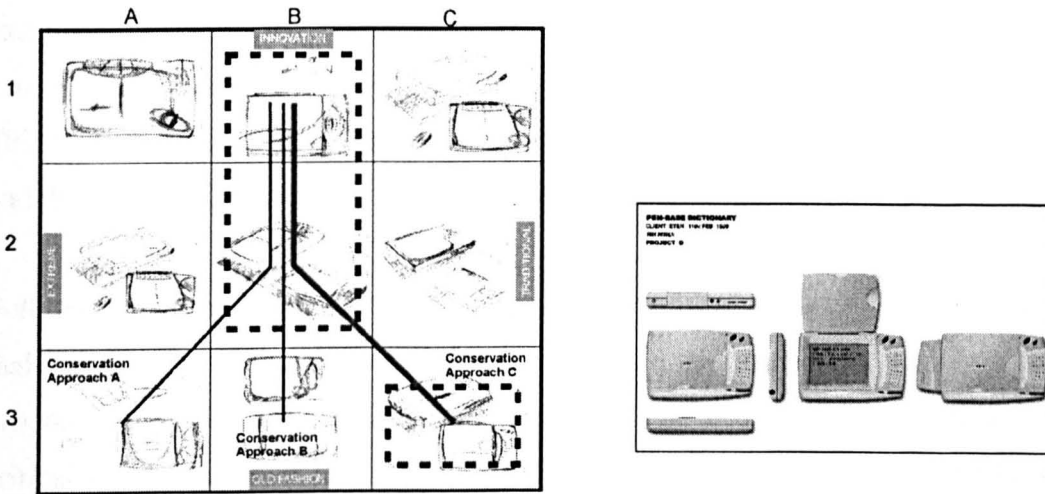


Figure 9.4: Design Concept Approach by Conservation Approach

Table 9.13: Eten’S Key Decision-maker Design Sense Characteristic in New PDA Project

No Design Sense Developing Group	Design sense characteristic	Eten’s key decision-maker
	● Respect the expert	yes
	● Not confidence of design sense	NA
	● Lacking use adjective word	No/ he uses vivid
	● Uncertain of buyer needs and wants	No/ he explain the target user
	● Less debate of aesthetic factors	No/ he argue modify the cover
	● More debate of all issues	yes

During the new PDA design project, Eten’s key decision-maker uses adjective word - vivid to describe the future concept. Although, he still respected the designer he had difficulty having confidence of design sense. In the design brief meeting, he explained the target user. However, during the concept presentation, he told the designer to modify the PDA cover twice. This would suggest some inconsistency in thinking by the key decision-maker (Table 9.13)

### 9.7 Conclusion

In section 9.2, Tellus’s key decision-maker had a good level of design aware sense, because of he could use adjective words to explain future concepts. In addition, he knew

what his company needed and what his buyers wanted. Furthermore, he was able to argue for modifications to the design concepts from his viewpoint. This resulted in him having confidence in both design sense and aesthetic factors. In second project, Tellus ordered two design concepts for his buyers. The Author, during a three months period, successfully developed three prototypes for Tellus company. Tellus's key decision-maker had design sense, and the And design could accept his reasons for modifying the design. This means, between Tellus's key decision-maker and And design consultant (Author) had the chance of developing a long term relationship.

Following on from section 9.3, when the author worked with CEMC's key decision-maker, who had similar levels of design sense and engineering skill and developed a proposal coupled with a design service charge. The level of service charge level is critical for design consultant and for first time contracts tends to be reduced to 5%. However, for second design projects, the design leader depending on the skills and experience of the key decision-maker at the client company needs decide how much % extra is suitable for this kind of client. If this is not done then the design approach needs to be modified to match this kind of client. Another critical finding is that design approach needs to consider whether products can easily be built from 3D computer renderings. It is important to establish the key decision-maker's engineering skill level to decide a suitable design approach.

In section 9.4, design projects were carried out with Eten. In this instance it was difficult to explain why in some cases, the key decision-maker was so willing to use adjective words to explain the future design concepts. A possible reason was that he was using the project to improve his design skills and learning as he went along.

In conclusion, this section used three subject company to refine the design sense model. In summary, the following issues were identified:

- Three subjects were willing to spend 15 min. for both SD test and Engineering test.
- The analysis SD data process:
  - (1), Factor analysis in rotated factor matrix of total adjective;
  - (2), Factor 1-2 and 2-3 plot in rotated space. (Quadrant)

(3), The perceptual distance between the design leader. Tellus's key decision-maker is in design aware group, and CEMC's decision-maker is in design developing group

- From carrying out the three design projects it was identified that, Tellus's decision-maker's skills and experience closely matched design aware group. That the CEMC's decision-maker's skills and experience although from an architecture background matched the design developing group. Eten's decision-maker was not in any design developing group, the previous design project did match the characteristics but during second design project they did not match the no design developing group characteristic.
- Engineering skill ability was not the only tools used to arrange the design process approach. Initial concept presentation used 2D computer rendering;
  - (1), Design aware, design developing group (two group key decision-maker more debate of aesthetic factors) with full mark (four mark) engineering skill;
  - (2), Product use 2D computer is easily to build rendering.
- When proposing design fees for design aware companies the design developing group needs to reduce the extra design fee from 10% to 5%.

## **Chapter 10 General Discussion**

The purpose of this chapter is to discuss and analyse the findings of each chapter. Subsequently it will be possible using the findings to develop a designer sense model to improve the design consultant-clients organisation interface and improve the effectiveness of the NPD design processes.

This chapter firstly, discusses the major findings of the investigation phase, the design communication (design brief, design visual tools). Secondly, it overviews the styling planning, and concept approach. Thirdly, it presents the design sense model by means of action research results.

### **10.1 Investigation Phase**

The investigation phase was conducted to determine the possible interaction relationship between a design consultant and a client organisation. Both chosen design consultants and action research's clients used interviews. The findings of the investigation phase were described in chapter three and were divided in two sections. The first section was based on interviews with thirteen clients. These focused on design sense within new product development process. The second section was based on interviews with ten design consultants who focused on understanding the design sense between design consultants and their clients.

The results of interviews with action research's clients are described in the first part consisting of the type of NPD, design brief, design sense and decision-maker. The results of interviews with design consultants are described in the second part consisting of design process and approach, design brief, design quality control, design sense and decision-maker.

#### **10.1.1 Clients Organisation**

There were three important pieces of information which came from each client organisation, firstly, redesign and restyling; secondly, the use of adjective words in the



design brief; thirdly, engineering skill. Each will be discussed in the following section.

### **(1) Redesign and Restyling**

The evidence gathered from the interviews illustrated that most of Taiwan's companies are small and medium sized businesses, most companies service their clients by ODM, OEM and OBM. Many new products in design are restyling, redesigning and also application of "me-to" projects. This approach to design is common because it results in a short design process, that quickly produces a new product to be added to the existing product line. Thus, the design process tends to focus on the "me-too" benchmarking product learning. Some companies change the features and specification and it is called redesign and another design is the same as a me-too product and that is called a restyle design. This tends to mean that design consultants use a simple approach.

### **(2) Adjective Word in Design Brief**

The adjective word is used to describe the product styling. It was a key factor for communication between client and designer. The use of semantic descriptions to describe future concepts is one of the best approaches. It also illustrates when a client has a good level of design sense ability.

### **(3) Engineering skill**

The design consultants and client companies agreed that engineering skill is one of the abilities that makes up design sense. However, many design consultants use a soft model approach to avoid this problem.

## **10.1.2 Design Consultant**

There are typically, four design processes in Taiwan's Design Consultants:

Design Process 1. This approach begins at the idea generation stage by using A4 or A3 paper to sketch, from these are then chosen three design directions which are made up in hand rendered (Auto CAD) or 2D computer rendering (CorelDraw, PhotoShop). In the 2D rendering stage, some design consultants sometimes use a PU model with a 2D

orthographic projection rendering to avoid difficulty or for clients who cannot speak in design language. During the following stage the designer modifies the detailed design from the client's chosen concept. The next stage is to use Pro. E., Ideas, Alias or Solid Works to build 3D computer models. Then, the 3D computer modeling digital file can be passed to the model workshop to be made into a model.

**Design Process 2.** This approach starts at the idea sketch and goes as far as the 3D modeling stages. Then the 3D computer modeling digital file can be passed to the model workshop to make a model. The approach provides a 3D rendered computer model for the client to evaluate for future concepts.

**Design Process 3.** This approach depends on the design charge, the process does not use the PU model nor the 3D computer modeling render. From the idea sketch there is only a 2D rendering, from which a model is made.

**Design Process 4.** This final approach uses reverse engineering, in such products as, the mouse and transport product, which are from concepts, and makes models by hand for presentation. The next stage is to use 3D software to build 3D computer models. Then, the 3D computer modeling digital file can be passed to the model workshop to be made into a model. (Table 10.1)

**Table 10.1: Types of Design Approach**

No.		Brief	Marketing	Idea Sketch (Pieces)	2Drendering / Presentation (Pieces)	Soft Model (Sets) for study	3D/ Rendering Presentation	3D / CAM	Mock Up
1	Standard A	*	*	(A4, A3)	3 pieces hand-made 2D Rendering/AutoCAD 2D CorelDraw, PhotoShop	3 pieces (PU, EK)	1 piece (Pro. E, Ideas, Alias, solid Works)	*	*
2	Standard B	*	*	(A4 A3)			1 piece (Pro. E, Ideas, Alias, solid Works)	*	*
3	Economic/ Time-limited	*	*	(A4 A3)	3 pieces hand-made 2D Rendering/AutoCAD 2D CorelDraw, PhotoShop			*	*
4	Reverse Engineering	*	*			3 pieces (PU, Clay, EK, Plastic Model)	1 piece (Pro. E, Ideas, Alias, solid Works)	*	*

### 10.1.3 Comparison

#### (1) Comparison of Design Brief between Designer and Client

Clients tend to focus on product hardware (Product specification, product feature). Designers tend to focus on software (What future product looks like). Both clients and designers discuss which marketing information is most important. But, clients are concerned with the specification of features in marketing. Designers are concerned with the interface and appearance of the competitor's products. With regard to design schedule, the client wishes this to be met as soon as possible, but designers sometimes request more time and extensions. (Show Table 10.2)

Table 10.2: Comparison of Design Brief between Designer and Client

	Client	Designer
Different viewpoint	<ul style="list-style-type: none"> <li>● Specification</li> <li>● Benchmarking</li> <li>● Schedule</li> <li>● Core benefit</li> <li>● Budget</li> <li>● Price</li> </ul>	<ul style="list-style-type: none"> <li>● Design direction</li> <li>● Design strategy</li> </ul>
Similar viewpoint	<ul style="list-style-type: none"> <li>● Marketing information</li> </ul>	<ul style="list-style-type: none"> <li>● Marketing information</li> </ul>

#### (2) Comparison of Adjective Words between the Designer and Client

The adjective words used for describing product concepts is an important tool for defining what the client wants the future concept to look like. Many designers want clients to develop a clear brief during the first meeting. Most clients seldom use the “Adjective Word” because they are not trained in design and for idea presentation. Some clients keep silent, because they feel the concept is obscure, or they have not decided on the style of product concept. Most clients describe orally their future concept but hand out the product specification, features and components. Then, the design leader translates the client's requirements, which become a document for client and designer. Table 10.3 shows a comparison of the adjective words which tend to be used by the designer and client.

Table 10.3: Comparison Adjective Word between Designer and Client

	Client	Designer
Adjective Word	<ul style="list-style-type: none"> <li>● Orally</li> <li>● Adjective Word (Style, active and interface)</li> <li>● Intuition</li> </ul>	<ul style="list-style-type: none"> <li>● Document</li> <li>● Adjective Word (Style; marketing position, Design appearance.)</li> <li>● Use photo to describe the concepts.</li> <li>● Clients' adjective word is too abstract.</li> <li>● Some designers want clients to offer large illustrations.</li> <li>● Some designers do not trust that clients can offer exact adjective words.</li> </ul>

**(3) Comparison of Design Sense between Designer and Client**

Clients that have a level of design sense, will tend to chose people to be a member of the NPD team that have a similar level of design sense as the design leader. Designers also prefer NPD members to have good design sense, because this greatly improves communication between them. When a client has a good level of design sense, they might argue for more reworking. However, Designers often do not like this kind of client, because they will delay the design schedule. However, due to modifying the design again and again, the final design quality might be dramatically improved. Both the designer and client think that design sense is useful for NPD process. Table 10.4 shows a comparison of design sense between designer and client.

Table 10.4: Comparison of Design Sense between Designer and Client

	Client	Designer
Different viewpoint		<ul style="list-style-type: none"> <li>● Client has good design sense, they might argue more.</li> <li>● Client has good design sense, they might criticize design.</li> <li>● No design sense leads to bad communication</li> </ul>
Similar viewpoint	<ul style="list-style-type: none"> <li>● Design is very important (Marketing, style)</li> <li>● Engineering skill also important</li> </ul>	<ul style="list-style-type: none"> <li>● Design is very important (Marketing, style)</li> <li>● 50% designers feel that Engineering skill also important</li> </ul>

From the findings of the investigation phase of this study, it seems appropriate to identify the major factors which have impact on the design sense model between designers and clients. (1), Redesign design and restyle styling projects tend to use one of four different types of design approach; (2), Adjective words; and (3), The design brief for design and design direction, for client is product specification.

## **10.2 Design Communication**

During the design process, the design brief will help the designers with their communication in the design project. It can save time and energy and especially, make it easier for designers to go through the design process. This is important since design consultants usually charge their fees by the hour. The design brief can help form a design strategy and bring forth a closer partnership between the small and medium-sized manufacturers and the design consultant with an aim at promoting MIT (Made in Taiwan) products throughout the world. Generally speaking, Taiwan's design consultants tend to be a department of a client firm, so there will be a close tie between these two parties. The most important thing is that the design consultants need to satisfy the clients and we need to bear in mind that the design brief is one of the most fundamental tools to prevent the design project from getting nowhere.

The critical finding of this study was that it is the key elements in the design brief that must be identified early. This applies both to the manufacturer and design consultant. Both parties want the design project to be right first time as this shortens the schedule of the design development process. In addition, another important finding was that 2D orthographic projections, rough sketches or rendering fill a gap when comparing the design results in design stages. Between client and designer, drawing communication skill is needed and allows the client to “speak” in design language and results in a more effective design process.

## **10.3 Styling Planning with Design Sense**

The findings from the literature search and experimental research allowed the identification of some of the critical visual management tools and also, utilized the concept sketches and questionnaires to show that images are additional useful tools. However, because many types of visual maps have already been applied into design process, these have become both “common sense” and “common place” through out the industry.

Design sense skill does not have a direct impact on the styling planning task, but does seem to effect the products direction and approach. In addition, it will have an effect on

all of the following areas: product position maps, user position maps and marketing segmentation. The social value and symbol, the Mood board, Life-Style board and Theme board. The product's semantic and design trend, and finally, the competitor's product semantic and relative product. This is illustrated in (Figure 10.1)

- (1) Key decision-maker whose design sense is aware: the style planning is for exchanging ideas which come from and confirm the design position.
- (2) Key decision-maker whose design sense is developing: The style planning is for presentation of the idea images.
- (3) Key decision-maker whose design senses is not developing: The style planning is to educate the clients.

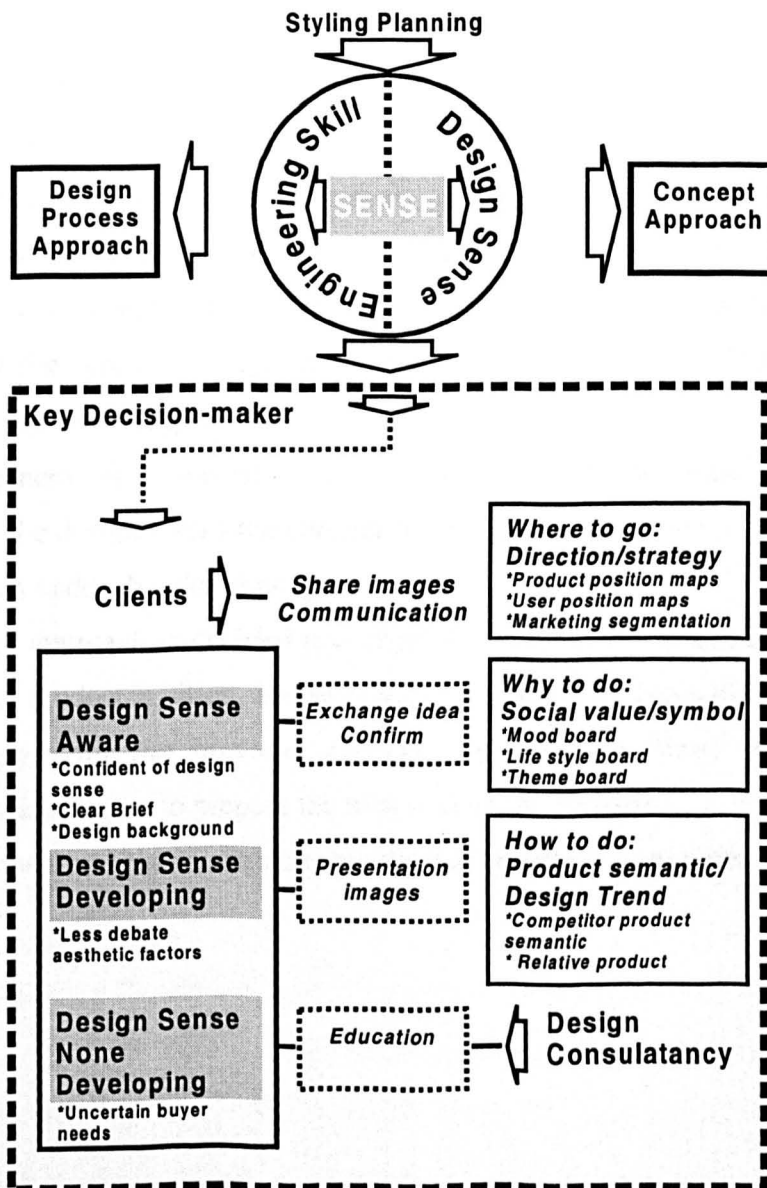


Figure 10.1: Design Sense with Styling Planning

## **10.4 Concept Approach with Design Sense**

During the idea generation phase of the product itself, critical marketing information and decision-maker attitude as well as design sense influences the design position, orientation and consequently the design results. It is an important part of the design management process to match current company policy and strategy with the product development. The concept strategy is an important tool in giving products the best styling position in a highly competitive market.

The concept strategy in the form-creation phase of the industrial design process is as following:

- (1) To understand the design brief from client, especially from the key decision-maker. The critical data includes design orientation, adjective word, styling approach, and product dimension.
- (2) To set up the product planning, which includes product trend, design trend, and product semantic. Design leader and designers need to analyse the competing market information, such as styling position, user position, and price position.
- (3) To make sure the client is design orientation is located in the marketing map.
- (4) To classify the types of design sense of the decision-maker. The focus range is defined by types of design sense.
- (5) The idea generation is according to the position and focus range. After the idea generation, the designer uses the concept matrix to make sure which orientation idea is lacking, and adds the idea concepts.
- (6) The concept approach is decided according to the product life cycle and company product line, product position, and key decision-maker's design sense.
- (7) In according with the previous concept approach, the three design concept orientations are chosen to prepare the idea concept presentation.
- (8) To modify the first idea presentation results and prepare the next idea presentation.

The concept approach is an important tool in giving products the best styling position in the highly competitive market. Design sense is defined by the focus size of the idea concept scope: (Figure 10.2)

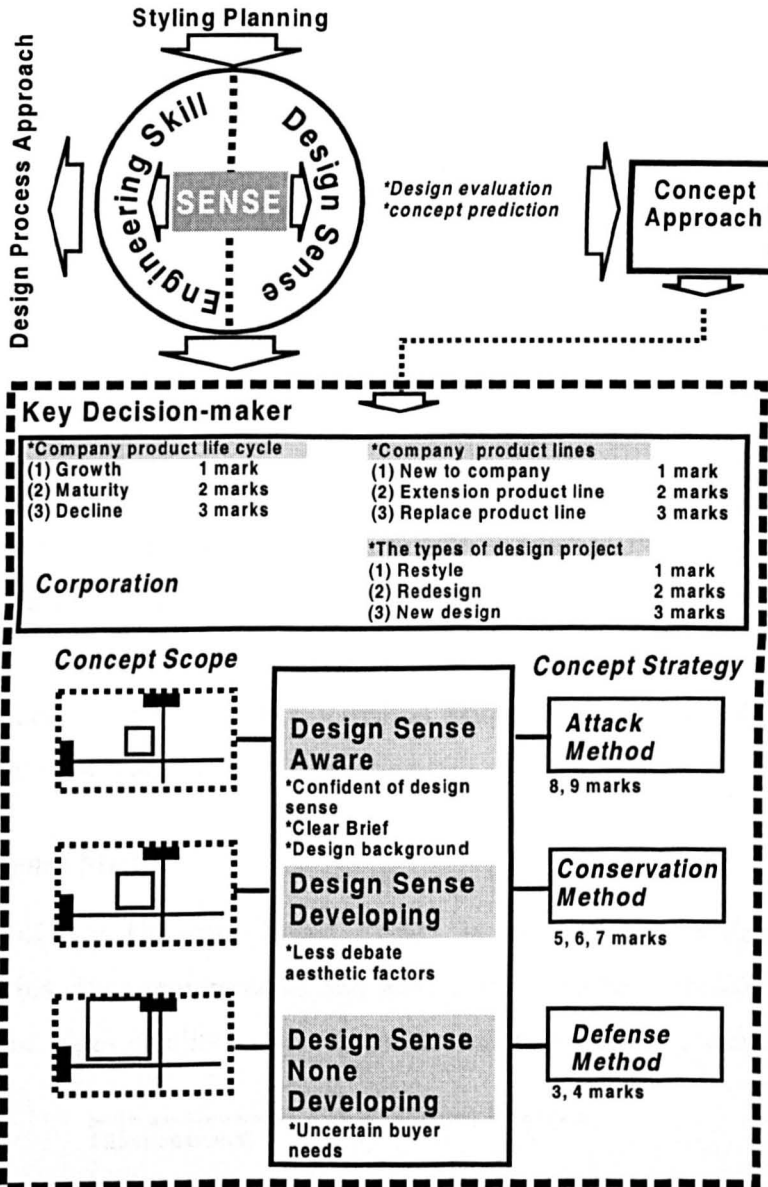


Figure 10.2: Design Sense with Concept Approach

- (1) Key decision-maker whose design sense is aware: This kind of key decision-maker is confident of their design sense, have clear briefs, a good level of NPD experience and clearly know what they want.
- (2) Key decision-maker whose design sense is unaware: This kind of key decision-maker is uncertain about the buyer's needs, the design leader chooses the idea concept approach from a much bigger range, and often forgets to mention



important concept information.

- (3) Key decision-maker whose design sense is developing: This kind of key decision-maker has less discussion on aesthetic factors. They tend to choose the idea concept approach from a middle size range between the above mentioned two kinds of key decision-maker's design sense.

There are three idea concept approaches, these are the attack, conservative, and defense methods. Each uses the idea concepts approach but with varying amounts of the three factors:

- (1) Company product life cycle; Product growth (1 Mark), product maturity (2 Marks), and product decline (3 Marks).
- (2) Company product lines; New to company (1 Mark), extension to product line (2 Mark), and replacing product line (3 Mark).
- (3) The types of design project; product restyle (1 Mark), product redesign (2 Mark), and new design (3 Mark).

Concept approach, Attack method (8, 9 marks), conservative method (5, 6, 7 marks) and defense method (3, 4 marks).

### 10.5 Design Sense Model

The purpose of the Designer Sense Model is to help the design consultant in understanding his client requirements and particularly with first contacts. In addition, to help sort out the types of client's sense that include both design sense and engineering

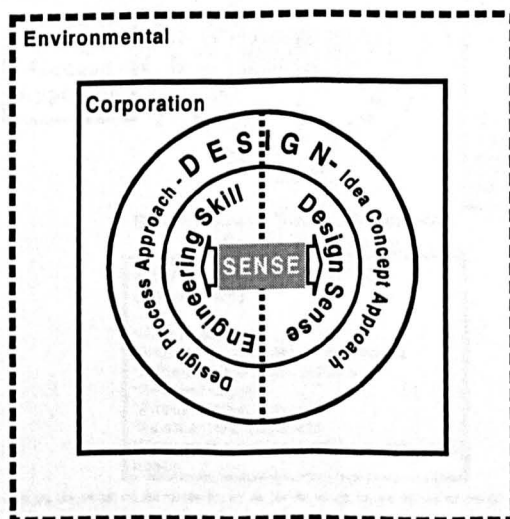


Figure 10.3: Design Sense and Environment

skill. There are three types of design sense discussed in this project; design sense awareness, design sense developing and design sense not developing, each type has different characters. Therefore, the design leader or manager may use this characteristic information to provide an effective design process, and successful concept approach to satisfy the clients' requirements and specification. (Figure 10.3)

### 10.5.1 The Big Picture of Design Sense

The environment can be focused on key factors which directly have impact the on design results. Typically these are: economic, manufacturing, green design, social elements etc. Furthermore, they are exclusive only to marketing trend, product symbol, design trend, product semantic and standard in which they may influence the product appearance, product position, user position. The impact that each of these has on the NPD results from outside is called environmental factors, but the inside impact on the

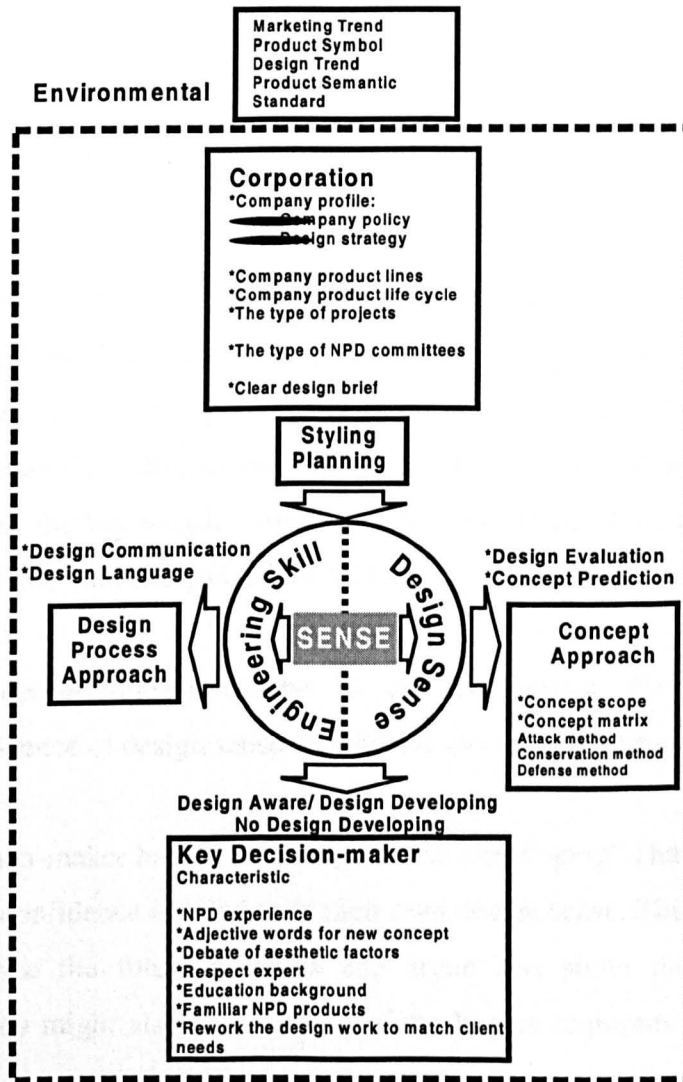


Figure 10.4: Design Sense with Detail Environment

organization NPD results is called corporation factor. The corporation factors include company policy and design strategy, those two factors are in the top levels of design management, and thus the design leader needs to be concerned with them. The clear design brief and the type of NPD committees the to basic information which can help the design processes be effective and successful.

The Design Sense Model interacts with other chapters (Show Figure 10.4)

- The level of design sense and engineering skill information will determine which design is the best design approach for the design leader to use and in setting the most appropriate free.
- Design sense also allows the design leader to decide the best concept scope and according to the corporation NPD strategy to chose the suitable concept approach method.
- Design sense can also let the design leader understand the condition of style planning meaning in different types of design sense clients.
- Design sense also provides some client's character information for the design leader when having face to face meetings with the client.

Overall, the important finding was that if the key decision-maker in a client company has the "Design Aware" characteristic they will be more confident from their previous work and their design sense capability. The important factors relate to more and more reworking, argument and discussion. However, if their perceptual distance is near to the design leader, the key decision-maker has the possibility of developing a long-term relationship with the And design leader (Author).

When the key decision-maker has the "Design Developing" characteristic they also have some confidence of design sense and also, respect the design expert.

If the key decision-maker has a "No Design Sense Developing" characteristic then they tend to have no confidence in relation to their own design sense. They use few adjective words to describe the future products and argue less about the aesthetic factors. Furthermore, they might also be uncertain of the buyers requirements. However, they

usually respect the design expert.

There are many cheaper, follower (me-too) products which need to be designed by design consultants in Taiwan, using low cost design services, rapid design development process, and good quality product design. These all depend on being able to define and understand the requirements of the clients' design sense. The objective of this study was to extract the factors of design sense (Style, design trend, culture and marketability) and to develop a design sense model as well as a method for testing design sense for the design leader (manager) to understand the types of key decision-maker. Therefore the design leader may integrate all this information to design the best design approach and to set the appropriate fees, determine the best design strategy and plan the most effective design approach to achieve a rapid design development process.

## **10.6 Engineer Skill**

The critical finding from the project was that if the decision-maker has a good level of engineering skill, he can use this for designer communication language. To utilize Lego assembly to test the engineering skill, any consultant design leader can understand how key decision-makers read orthographic projections. Therefore they can set up a suitable design approach for each client. The conclusion was the following:

- (1) The engineering skill of the decision-maker in each groups appears not remarkable, each group has lower ability engineering skill subjects.
- (2) It is possible to judge the likely amount of engineering skill that a decision-maker will have by investigating their educational background. For example the ME, ID, relates to Mechanical Engineering. Those subjects do not need to be tested.
- (3) Long NPD experience usually provides useful training in engineering skills, such as Kingtel's key decision-maker whose background is EE, but he has 25 years NPD experience, thus he has an excellent engineering skill.
- (4) When the client's engineering skill-testing score is under four, the design leader needs to avoid using 2D orthographic projection and 2D rendering during the design presentation.

### **10.6.1 Design Sense and Engineering Skill with Design Process Approach**

It is beneficial to NPD to identify the level of design sense and engineering skill that a client may have during the first stage of any project. In order to decide the best design approaches it is necessary to consider two elements; engineering skill and the amount of design sense.

The decision-maker has the engineering skill. Hence, he can use this for design communication language. According to the Lego test, the design leader can briefly understand how key decision-makers read orthographic projection level and engineering skill ability. According to different engineering skill ability, there are three approaches shown as follows: (See Figure 10.6)

- (1) Approach A: If the key decision-maker 's engineering skill test score was four and their design sense was not developing; The key decision-maker has one good design communication ability and rarely argues to modify the design style. The key decision-maker might decide the design approach from any design presentation results. In this situation, it will depend on which kind of product easily make a model, if it is easy to make a model, the presentation uses 3D model rendering. If not easy to make a model or time is limited, then concepts need to be produced from 2D rendering, then quickly approach 3D modeling rendering.
- (2) Approach B: If key the decision-maker 's engineering skill test score is four and his design sense is developing and he is design aware; The key decision-makers is one that has a good design communication ability and often argues to modify the design style. In this situation, the design leader might use 2D or 3D rendering for idea concept presentation. Therefore, this kind of key decision-maker will argue to modify the design concepts many times. Thus, using the 2D orthographic view drawing to modify the detail is more effective.
- (3) Approach C: If key decision-maker 's engineering skill test score is under four, and design sense is not developing; The key decision-maker has no design communication ability and rarely argues to modify the design style. Thus, the

design approach ought to leave out the 2D orthographic projection rendering and use the 3D modeling rendering to escape this condition.

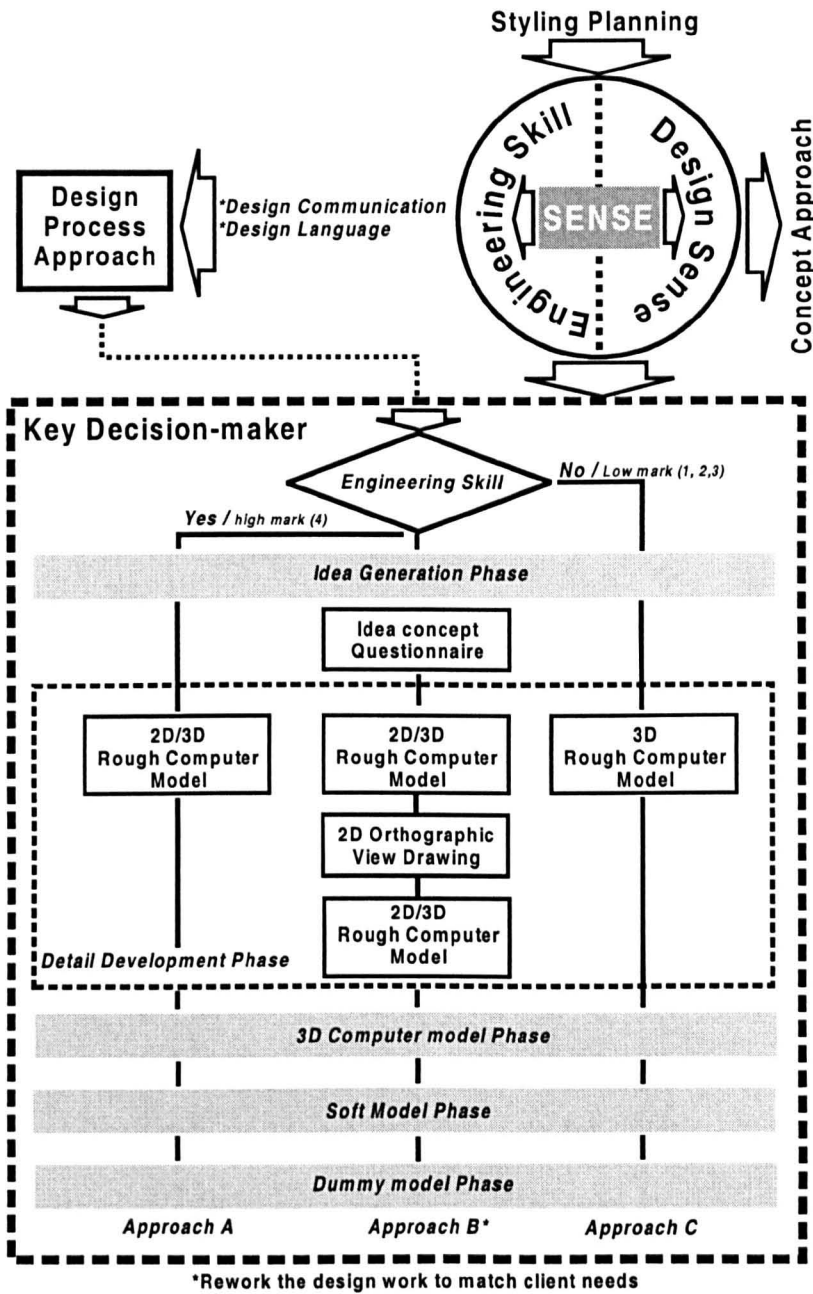


Figure 10.6: Design Sense with Design Process Approach

### 10.7 Refine Design Sense Model

By using the three subjects company to refine the design sense model, the following findings were made:

- The analysis of SD data process: (1), Factor analysis in rotated factor matrix of total adjective; (2), Factor 1-2 and 2-3 plot in rotated space (Quadrant); and (3), The perceptual distance between the design leader.
- The design sense can be learnt by carrying out more design cases.
- Engineering skill ability is not a critical factor when considering the best tools to arrange the design process approach. But there is two reasons why during the initial concept presentation 2D computer rendering needs to be used; (1), Design aware, design developing group (two group key decision-makers have more debate of aesthetic factors) with full mark (four mark) engineering skill; and (2), Product use 2D computer to build rendering easily.

## Chapter 11 Conclusion

### 11.1 Design Sense Model

This chapter attempts to describe the conclusion of the design sense model. The purpose of the Design Sense Model is to help the design consultant with understanding his client requirements during their first meeting. The objective of this project was to determine what type of client skills need to be included in the design sense model. There were three types of design sense; (1), Design aware sense; (2), Design developing sense; and (3), No design developing sense. Each type has a different set of characteristics. Therefore, the design leader may use the list of characteristics which comprise each skill to provide the most effective design processes and best concept approach in order to satisfy the clients' specification and requirements.

Critical conclusion included:

- (1) The development of a clear design brief and the type of people sitting on NPD committees are two basic pieces of information which can help make the design processes effective and successful.
- (2) SD method and factor analysis were critical tools for deciding what types of design sense a client had.
- (3) The Lego toys can act as a test tool for engineering skill ability testing. There are two levels of the engineering skill, (1), High engineering skill, and (2), Low engineering skill.
- (4) The scores achieved on the design sense and engineering skill assessments will have great impact on the design leaders choice of the best design approach to be used and the most appropriate amount of fee to set.
- (5) Design sense also provides help for the design leader to decide the best idea concept scope and according to the corporation NPD strategy to chose the most suitable concept approach. The idea concept approach depends on these three factors: (1), Company product life cycle; (2) Company product lines; and (3), The types of design project.



- (6) Concept approach: (1), Attack method; (2), Conservative method; and (3), Defense method.
- (7) Design sense also can help the design leader understand the condition of style planning meaning in different types of design sense clients: (1), Design aware sense - exchange the idea and confirm idea; (2), Design developing sense – presentation image, and (3), No design developing sense – education.
- (8) The amount of Design sense skill will also provide some character information for the design leader when dealing face to face with a client.

The study has identified and described three types of design sense and two types of engineering skill matrix. In addition there were six types of key decision-maker and these were divided as follows:

- (1) “Senseless” - low engineering skill and no design development. This group’s key decision-maker does not have strong confident characteristics, but believes in design expertise. When designers face this kind of client they will worry about who is actually responsible for the design quality because the client is not always willing to modify the design result.
- (2) “Engineering Sense” - high engineering skill another and no design developing. This group’s key decision-maker has a strong engineering characteristic, such as focus in plastic structure design, plastic injection skill, injection mold and production process. These kinds of key decision-maker would like to be engineers.
- (3) “Pre-Artist Sense” - low engineering skill and design development. This kind of key decision-maker’s engineering skill is bad and developing sense approaches that of an artist. The design sense is still developing, thus these clients still respect designers.
- (4) “Pre-Designer Sense” - high engineering skill and design development. This kind of key decision-maker’s engineering skill is well developed and has a developing sense approaching that of a designer. The design sense is still developing, thus clients do still respect designers.

- (5) “Artist Sense” - have a low level of engineering skill and design awareness. This kind of key decision-maker has low engineering skill but design ability is better. It is like asking an artist who lacks engineering skill to design a product. The product design result may be a beautiful style but be difficult to produce.
- (6) “Designer Sense”- have both high engineering skill and design awareness. This kind of key decision-maker’s engineering skill is excellent and they also design. This kind of key decision-maker has strong feelings about which way to play a designer. Because they feel that they are designers, they feel that they can modify the design consultant’s work many times. The final product often results in an excellent design.

## **11.2 Suggestions for Future Research**

It is anticipated that this research will be beneficial to the field of design management which may be improved by means of reinforcing the communication between industrial designers and clients. In addition, it is also hoped that this research has made practical contributions towards the enhancement of the understanding of design communication between designer and client. Furthermore, assisting the design leader to understand client’s design sense, in order to propose the best approach is an effective and efficient method of carrying out the work.

Due to the action research method being used it was not possible to choose the clients sample and the design sense was modeled on the author’s exclusive model. The design sense criteria or measurement of the effectiveness of design communication might be developed for future case studies, and this may enrich the present findings.

The design sense model can be used between the following parties:

- (1) Between the designer and the design leader.
- (2) Designer and client’s key decision-maker.
- (3) Client’s decision-maker and his manager.

The SD test used concept samples in the form of product sample photographs. This was

a time consuming process and it is possible that design trends change with time and result in the design semantic becoming different. Thus, the concept samples might need to be changed in the next few years and existing clients will need to be re-tested. The clients could also learn by being part of a NPD process. Their design sense could develop. Thus it is suggested that the SD is done again every few years.

Finally, it is suggested that to further uncover the client's learning processes that continual testing and examining be performed. This will allow modification of the models using new information and ensure that Design Sense theoretical models be continuously developed with time.

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**APPENDIX 1 EXCLUDED  
UNDER INSTRUCTION  
FROM THE UNIVERSITY**

## Appendix II:

A test questionnaire for interviewees to record organisation which is related design

# A Study of the Decision Maker's Design Sense in New Product Development Process

A research project by

Ph.D. student: Jun-Chieh Wu June 1998

Supervisor: Ray Holland

De Montfort University School of Design and Manufacture

## Aims of the investigation

1. To identify the major factors that are influential on design sense in new product development on Taiwanese manufacturers.
2. To increase understanding of decision maker's behaviour during new product development process.
3. To identify the modes of design sense between consultants and clients in new product development process
4. To develop an effective design management method for design consultants, clients and designers.

## The Interview of the Organisation

### Basic information

Company name:

Location:

Respondent name and position and main task:

Your job title: President, General (deputy) manager, Manager (deputy) or head of department (deputy), Chief designer (deputy), Project manager (leader),

Time / Date /Place:

Main product:

- |  |   |  |
|--|---|--|
| 1. <input type="checkbox"/> Computer products, | 2. <input type="checkbox"/> Communication products, | 3. <input type="checkbox"/> Consumer products,   |
| 4. <input type="checkbox"/> Toy products,      | 5. <input type="checkbox"/> Gift and stationary,    | 6. <input type="checkbox"/> Furniture,           |
| 7. <input type="checkbox"/> Transport          | 8. <input type="checkbox"/> Medical products,       | 9. <input type="checkbox"/> Toilet and bathroom, |
| 10. <input type="checkbox"/> Machinery,        | 11. <input type="checkbox"/> Aerospace products,    | 12. <input type="checkbox"/> Others,             |



Product types: 1. OEM 2. ODM 3. OBM 4. BTO

## **NPD**

1. Which kinds of NPD (New Product Development) does your company have?

1. New -to-the-world, 2. New product line, 3. Additions to existing product line, 4. Improvements in or revision of existing product, 5. Reposition, 6. Cost reduction,

2. Which kinds of NPD strategy are used in the company:

1.  Acquiring new product, 2. Reviving old product, 3.  Development "me-too" product,

3. Which kinds of NPD innovation are used in the company:

1. Added new functions, 2. Improved functions, 3. Reorganize functions, 4. Design appearance different,

## **Company brief**

4. Company brief and organisation structure and design structure.

## **Design brief**

5. Do you write down the design brief and design specifications and explain the contents of the brief and who is to carry it out?  
6. Do you attempt to use an adjective word to explain the NP?

## **How to buy design**

7. How are your design consultant chosen, and what percentage deals with design consultants?

## **Design sense**

8. Who chooses NPD numbers, and what is the organisation structure and type of NPD, and attitude towards NPD numbers?  
9. Design sense and the decision-maker. The attribute of design sense.  
10. What kinds of product attributes could be more important during product development process?  
11. How are NPD members evaluated from the idea presentation? Who is your main buyer?  
12. How is the niche marketing position decided?

## Appendix II-a:

A test questionnaire for interviewees to record

Design consultant which is related design

# A Study of the Decision Maker's Design Sense In New Product Development Process

A research project by

Ph.D. student: Jun-Chieh Wu June 1998

Supervisor: Ray Holland

De Montfort University School of Design and Manufacture

## Aims of the Investigation

1. To identify the major factors that are influential on design sense in new product development on Taiwanese manufacturers.
2. To increase understanding of decision maker's behaviour during new product development process.
3. To identify the modes of design sense between consultants and clients in new product development process
4. To develop an effective design management method for design consultants, clients and designers.

## The Interview of the Design Consultant

### Basic information

Company name:

Location:

Respondent name and position and main task:

Your job title: President, General (deputy) manager, Manager (deputy) or head of department (deputy), Chief designer (deputy), Project manager (leader),

Time / Date /Place:

1. Which kinds of product has your company been designing?

1. Computer products,
2. Communication products,
3. Consumer products,
4. Toy products,
5. Gift and stationary,
6. Furniture,

7. Transport                      8. Medical products                      9. Toilet and bathroom  
 10.Machinery,                      11.Aerospace products,                      12.Others\_\_\_\_\_

2. The main staff

1. ID\_\_persons,                      2. MD\_persons,                      3.Model maker\_\_persons,  
 4. Marketing persons,                      5. Management\_persons,                      6.Computer \_\_\_\_persons,  
 7. Graphic \_\_\_\_\_persons                      8.Others\_\_\_\_persons,

3. The company prospectus and company organisation structure.

**Design process**

4. What general design process and design presentation materials are used by your company and how many kinds of design approach are based on product, time schedule, price, and client.

No.	Name	Brief	Marketing	Idea Sketch (Pieces)	2DRendering (Pieces)	Soft Model (Sets)	3D/ Presentation	3D / CAM	Mock Up
1									
2									
3									

**Design brief**

5. Do you write down the design brief and explain the contents of the brief?  
 6. Does your client use an adjective word to explain his concept product?

**Design quality**

7. How do you satisfy your client? (Time schedule/presentation quality/ response?)  
 8. Who deals with design quality, and how is it achieved?  
 9. How is the idea presentation strategy arranged and who carries it out (product life cycle, market segments)

**Design sense**

10. Design sense and the decision-maker. The attribute of design sense.  
 11. What kinds of design trend could influence the product development process.  
 12. How do your clients evaluate the ideas, the approach and who is involved.  
 13. When the client is dissatisfied with the ideas, what is the procedure for the next stage?  
 14. How do the different types of clients respond during the ideas presentation?

# Appendix III:

A test questionnaire for interviews to record the design communication which is related design

Dear friend,

These research for help to understand the relationship between 2D hand-made rendering, EK foam model, mock up sample and 3D computer modeling image. The final results could be helped design manager to organize a suitable design process approach for design consultants.

All the information only for research reference. Thanks your help.

De Montfort University School of Design and Manufacture

Ph.D. Researcher: Jun-Chieh Wu

Supervise: Ray Holland

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## Personal information

Male  Female

Year 1  Year 2  Year 3  Year 4

Please check 3D modeling in five sec, therefore to find out a similar idea sketch.

Q 01, To chose a similar style of idea sketch with 3D computer modeling image.

Correct  Incorrect / Time:          Sec

Q 02, To chose a similar style of idea sketch with 3D computer modeling image.

Correct  Incorrect / Time:          Sec

Q 03 To chose a similar style of EK foam model with 3D computer modeling image.

1       2

Please check 2D hand-made rendering, therefore to collect the similar idea sketch.

Q 04 To chose a similar style of idea sketch with 2D hand-made rendering.

Correct  Incorrect / Time:          Sec

Q 05 To chose a similar style of EK foam with 2D hand-made rendering.

1       2       3

Q 06 To chose a similar style of mock up sample with 2D hand-made rendering.

1       2

Q 07 To chose a similar style of 2D hand-made rendering with 3D computer model image.

1       2       3

Q 08 To chose a similar style of mock up sample with 3D computer model image.

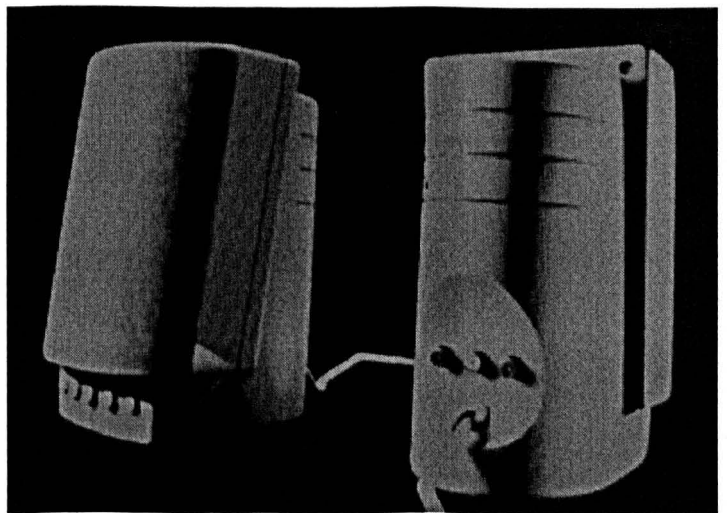
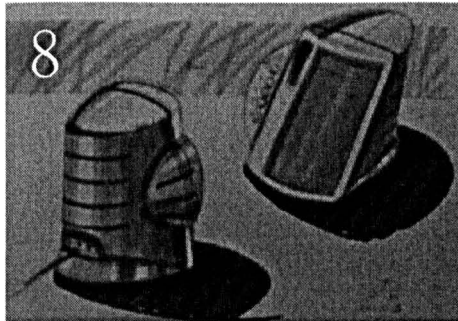
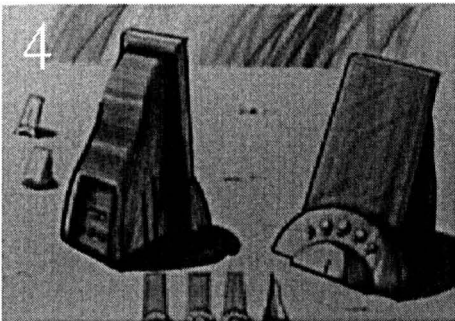
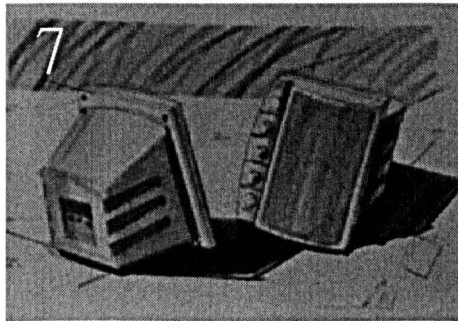
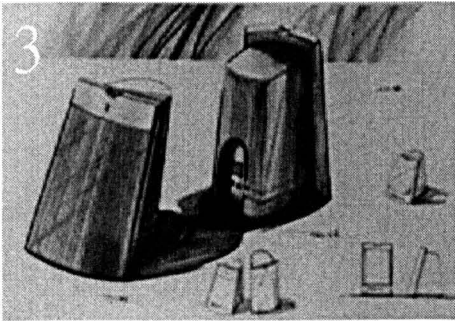
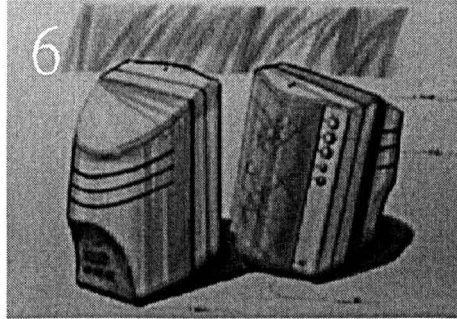
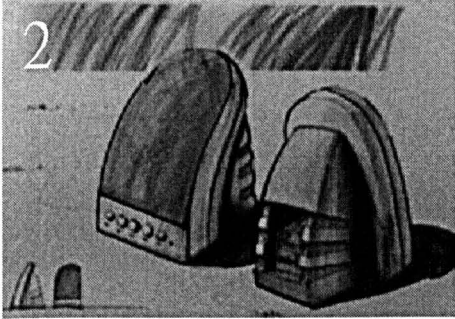
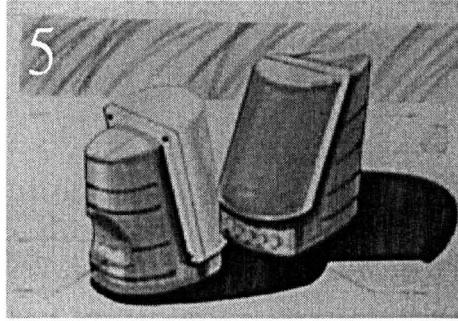
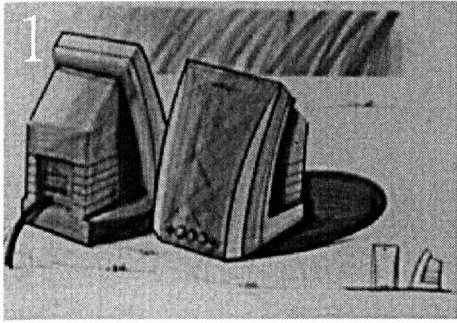
Q 09 To chose a similar style of EK foam model with Mock up sample.

Correct  Incorrect / Time:          Sec

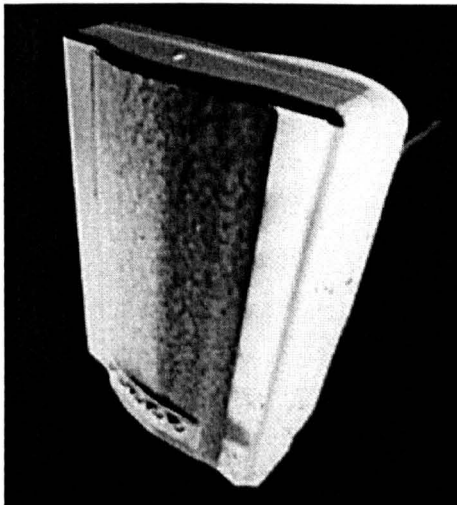
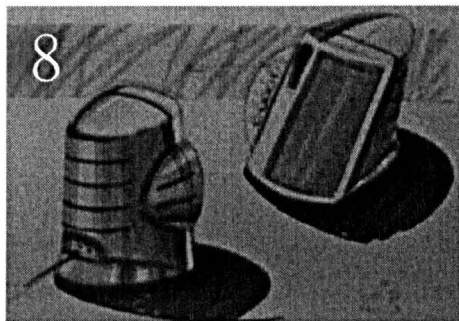
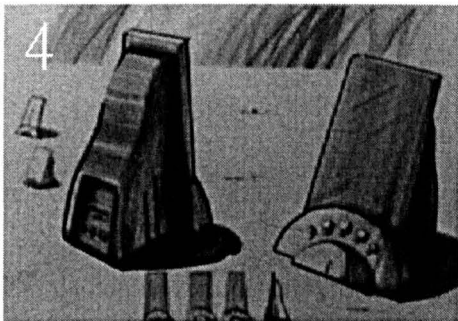
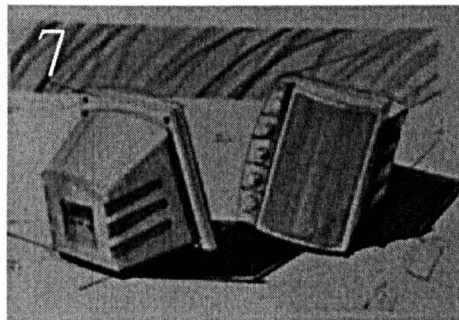
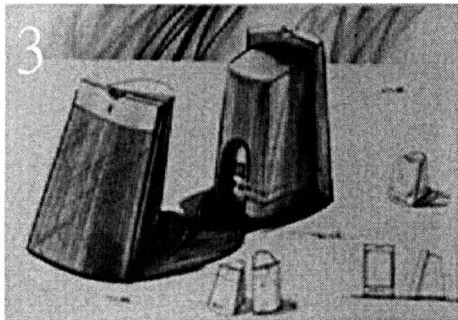
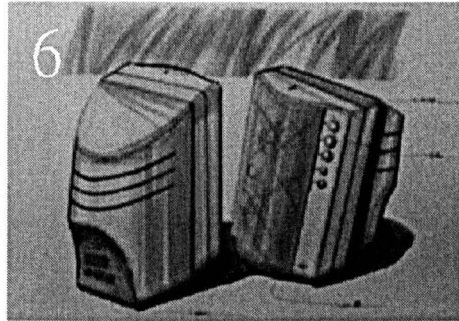
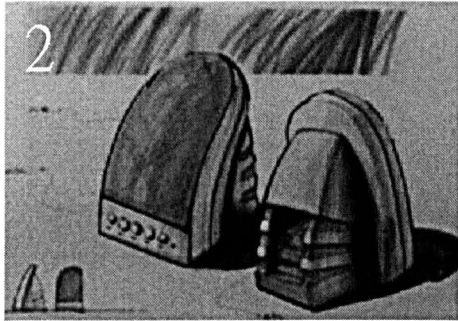
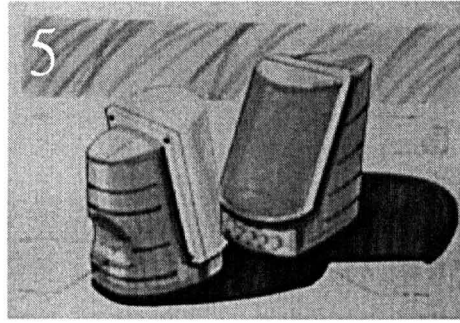
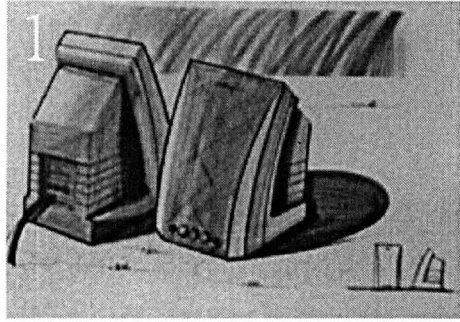
Q 10 To chose a similar style of 3D prospect hand-made rendering with 2D hand-made rendering.

1       2       3

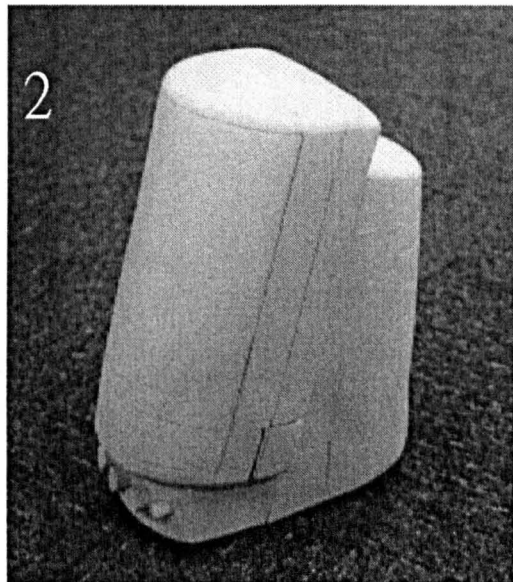
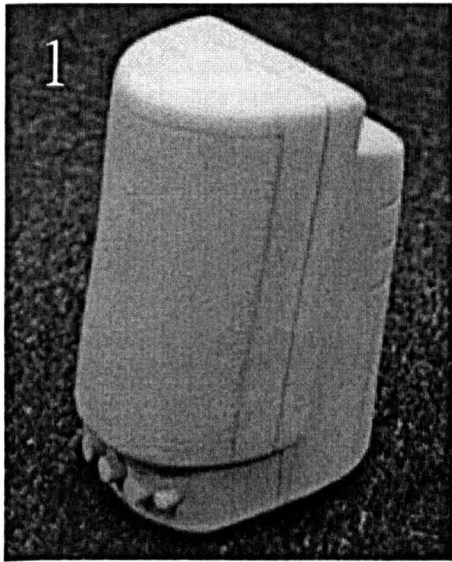
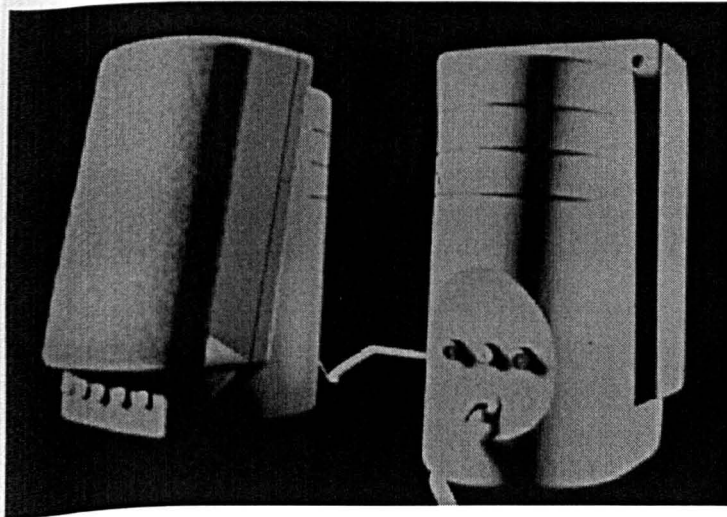
# Q 1, Idea Sketch Vs 3D Computer



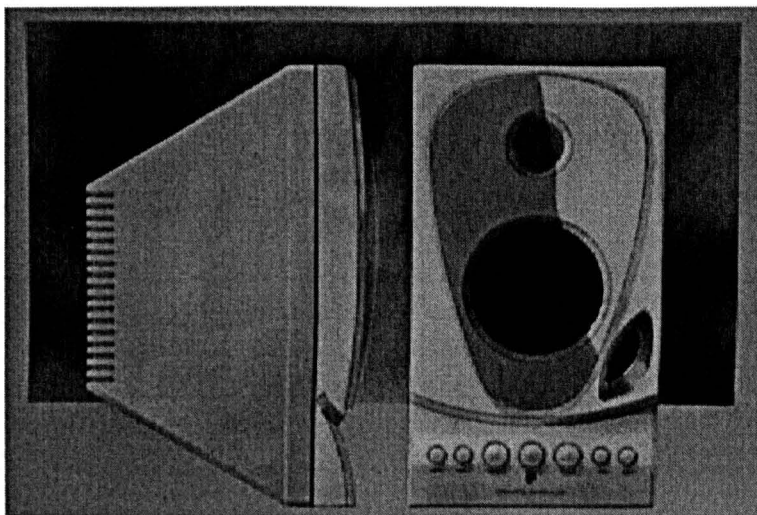
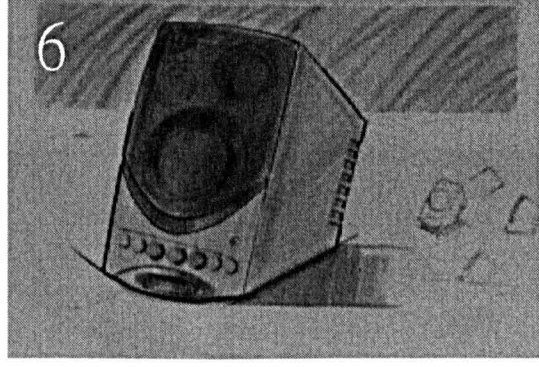
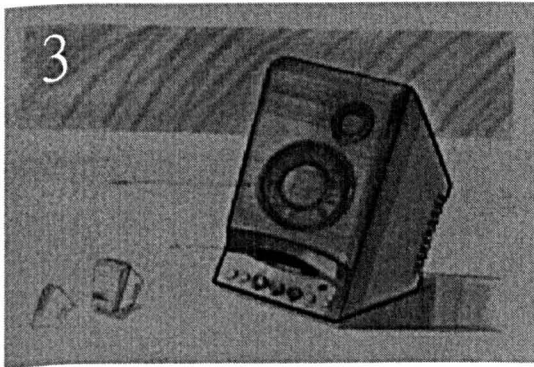
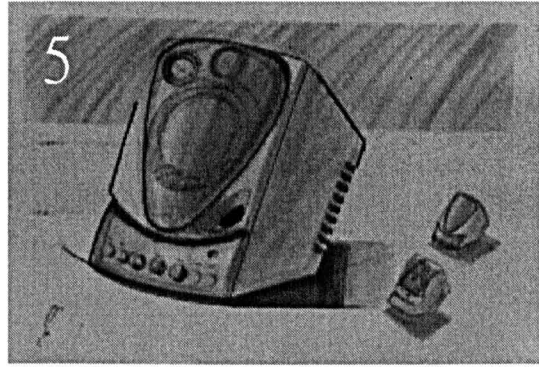
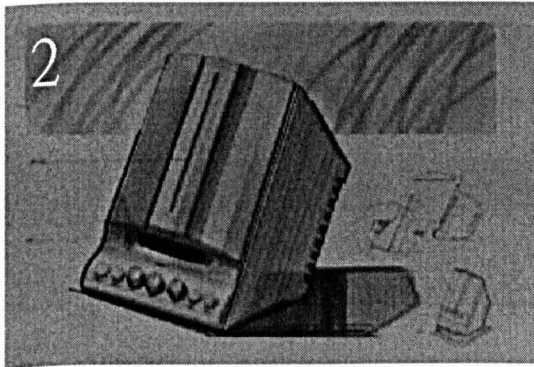
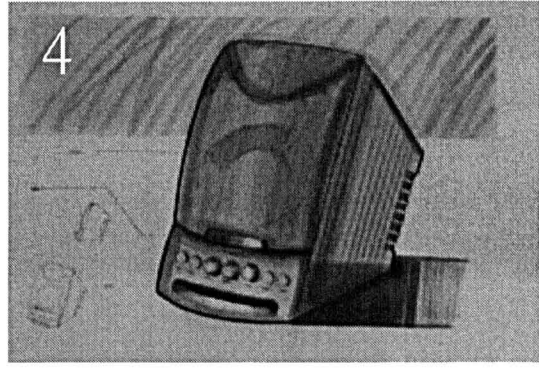
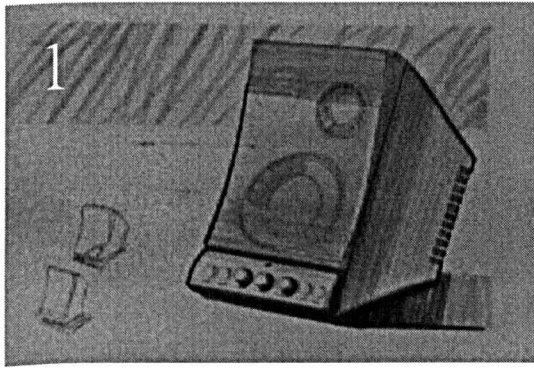
# Q 2, Idea Sketch Vs 3D Computer



# Q 3, 3D Computer Model Vs EK Foam Model

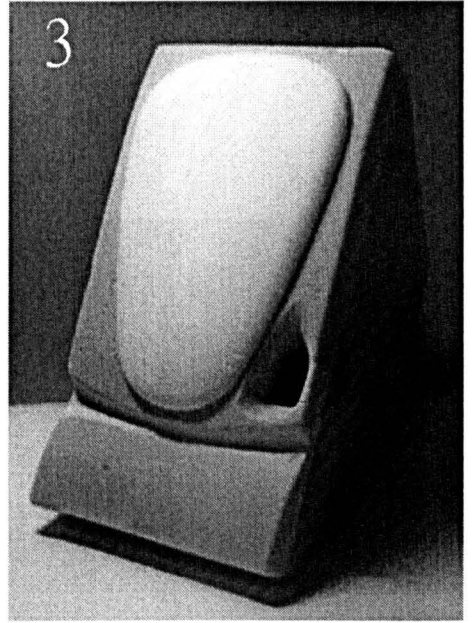
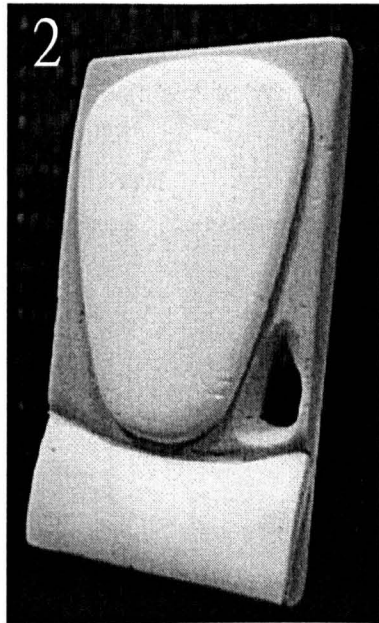
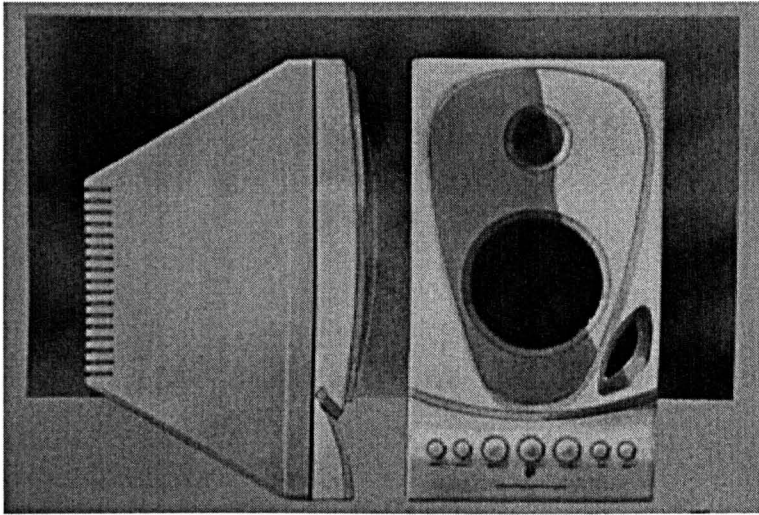


# Q 4, Idea Sketch Vs Rough Sketch

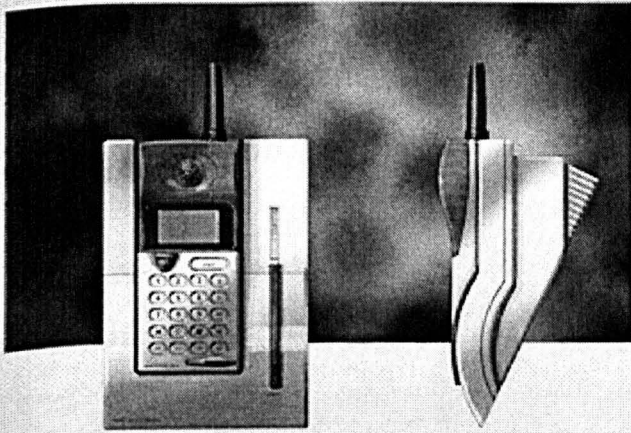
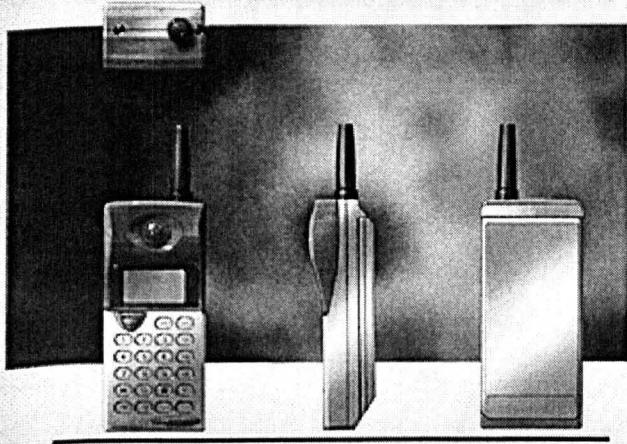




# Q 5, Rough Sketch Vs EK Foam Model



# Q 6, 2D Rough Sketch Vs ABS Mock Up



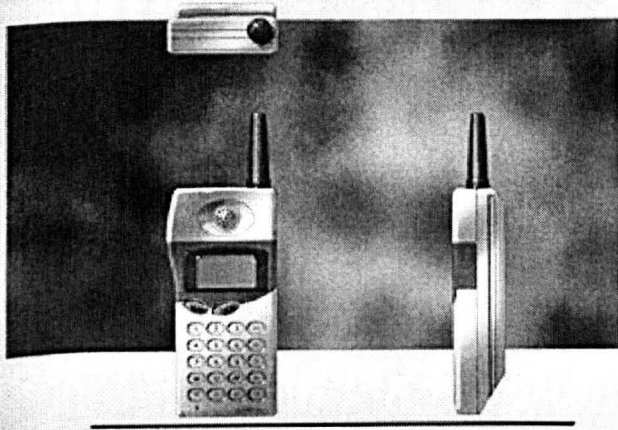
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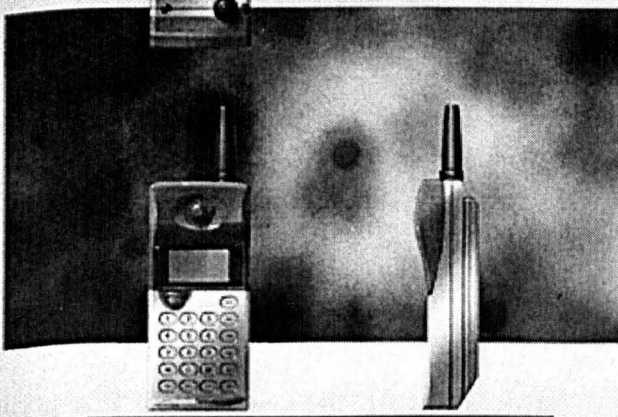
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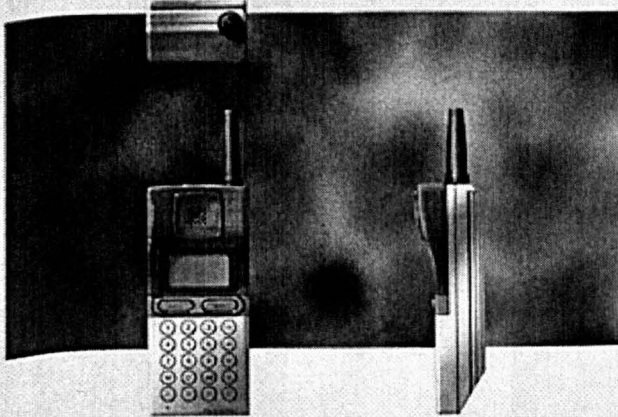
# Q 7, 2D Rough Sketch Vs 3D Computer Model



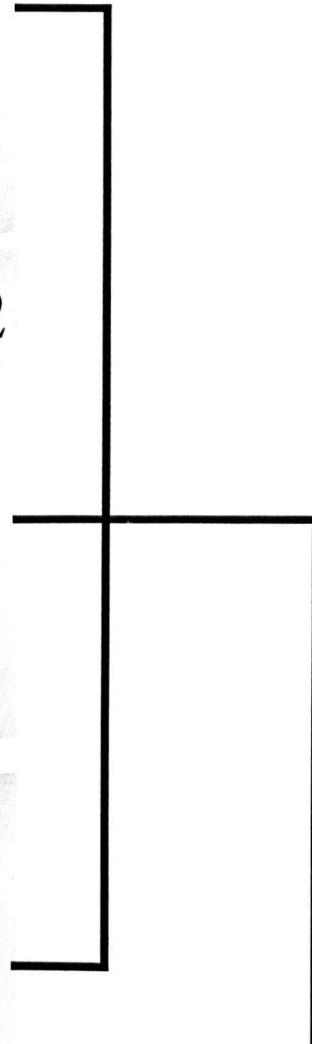
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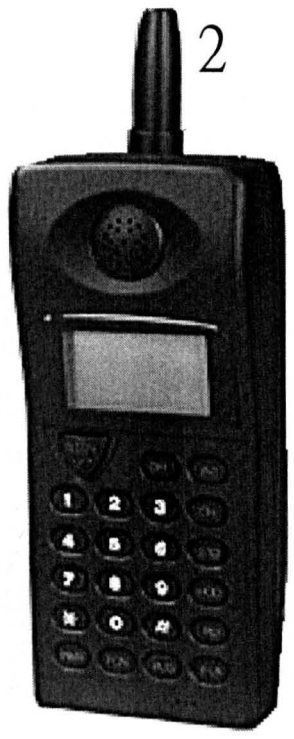
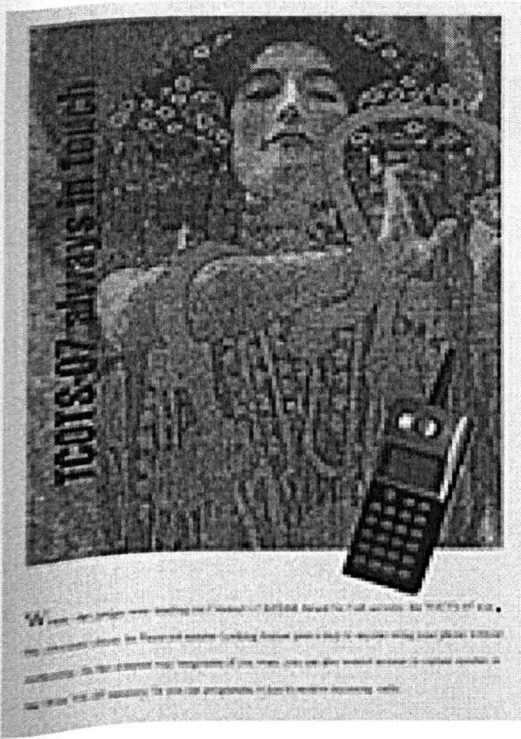
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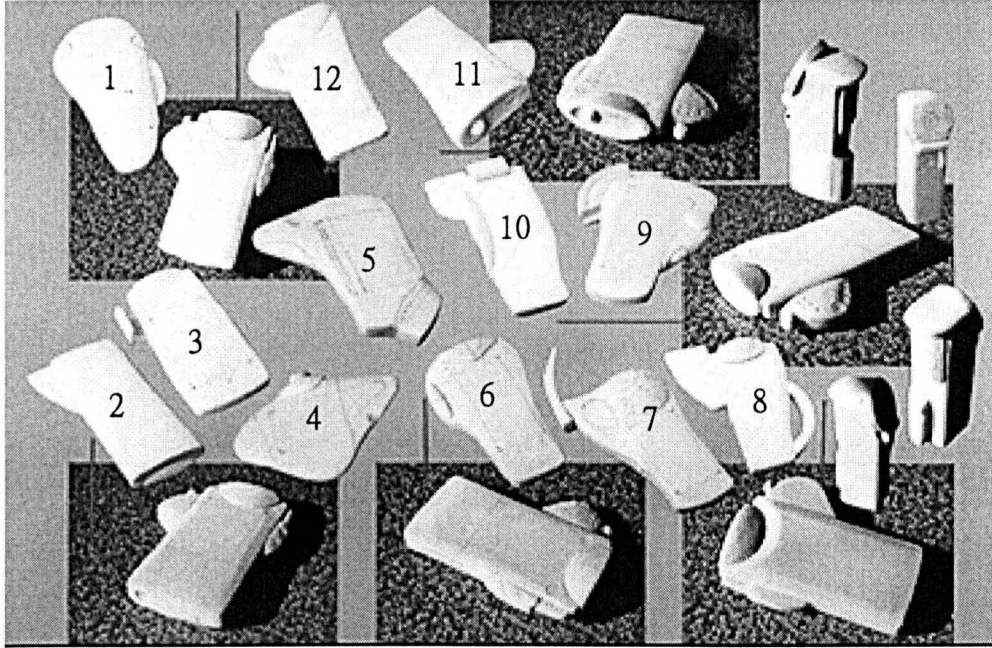
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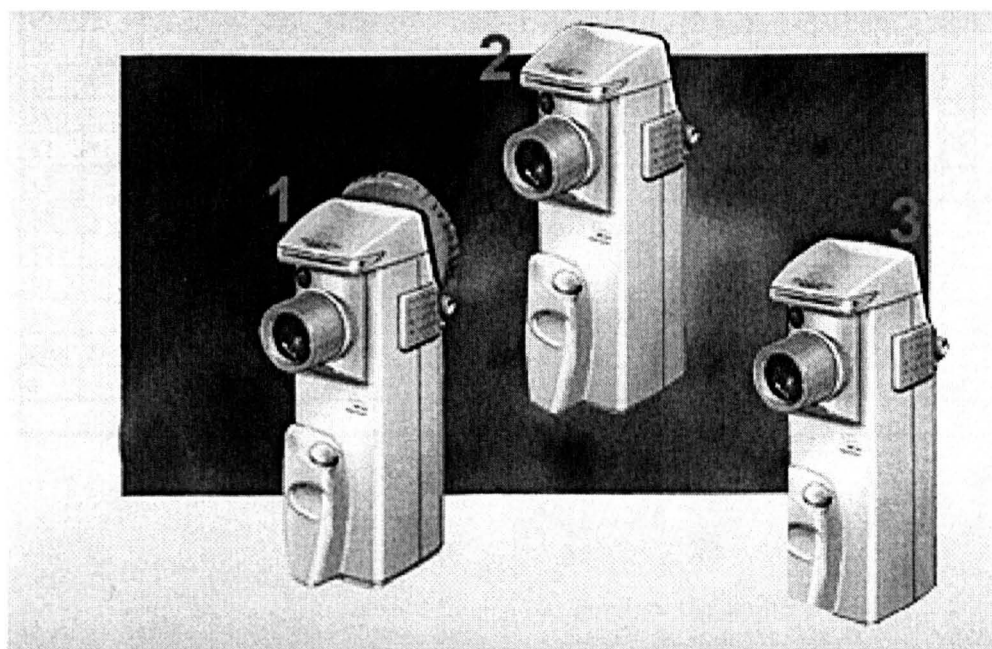
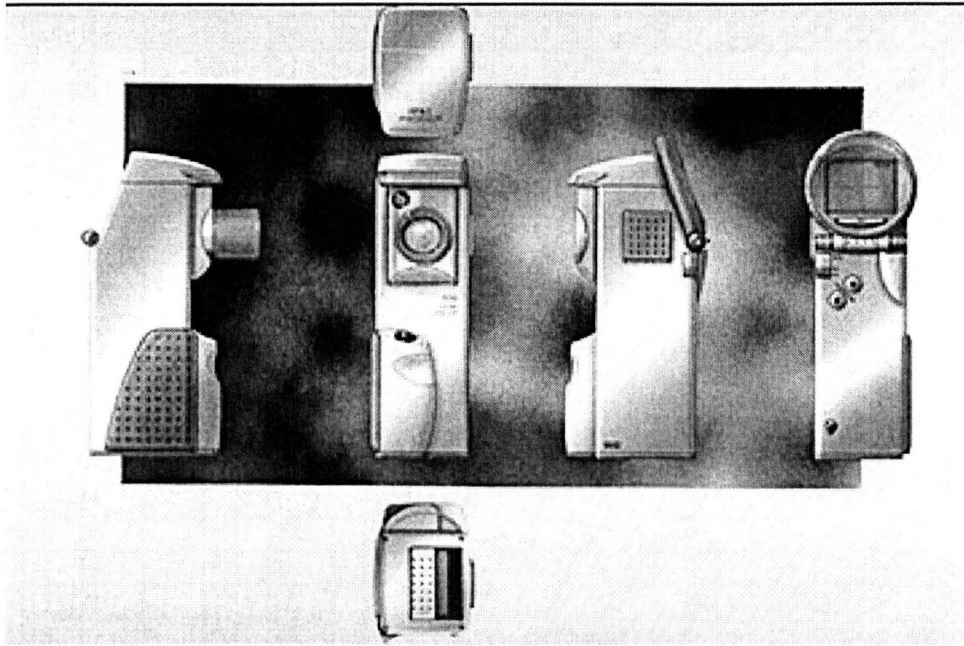
# Q 8, Computer Model Vs ABS Mock Up



# Q 9, EK Foam Model Vs ABS Mock Up



# Q 10, 2D Rendering Vs 3D Rendering



# Appendix III-a:

Experiment of Design Communication Raw Data

## Experiment of Design Communication Raw Data

Sub.	M	F	Q1			Q2			Q3		Q4			Q5			Q6		Q7			Q8			Q9			Q10		
			O	X	Sec	O	X	Sec	1	2	O	X	Sec/	1	2	3	1	2	1	2	3	1	2	3	O	X	Sec	1	2	3
1	*		*		21	*		11	*		*	5/3	*		*		*		*		*		*		*		7	*		
2	*		*		7	*		15	*		*	15/3	*		*	*		*		*		*		*		7	*			
3		*	*		11/2	*		10	*		*	4	*		*	*		*		*		*		*		6	*			
4	*		*		13/3	*		30/4	*		*	7/3	*		*	*		*		*		*		*		9	*			
5	*		*		5	*		7	*		*	7/4	*		*	*		*		*		*		*		1	*			
6		*	*		8/3	*		39/8	*	*	*	3	*		*	*		*		*		*		*		3	*			
7	*		*		9	*		30	*		*	7	*		*	*		*		*		*		*		5/2	*			
8	*		*		20/5	*		9/2	*	*	*	3	*		*	*		*		*		*		*		7	*			
9	*		*		60/6	*		5	*		*	19/3	*		*	*		*		*		*		*		3	*			
10	*		*		7	*		58/4	*		*	60/3	*		*	*		*		*		*		*		4	*			
11	*		*		5	*		10	*	*	*	11	*		*	*		*		*		*		*		3	*			
12		*	*		26/6	*		6	*		*	22/4	*		*	*		*		*		*		*		5	*			
13	*		*		5	*		29/8	*		*	9/24	*		*	*		*		*		*		*		2	*			
14	*		*		15/2	*		16/4	*		*	6	*		*	*		*		*		*		*		16/2	*			
15	*		*		3	*		7/2	*		*	8/2	*		*	*		*		*		*		*		5	*			
16	*		*		7	*		7	*		*	8	*		*	*		*		*		*		*		6	*			
17	*		*		8/2	*		7/3	*		*	5/2	*		*	*		*		*		*		*		4	*			
18		*	*		13	*		3	*		*	12/2	*		*	*		*		*		*		*		7	*			
19		*	*		3	*		4	*		*	9/2	*		*	*		*		*		*		*		7	*			
20	*		*		7	*		7	*		*	19/3	*		*	*		*		*		*		*		7	*			
21	*		*		17	*		5	*		*	51/5	*		*	*		*		*		*		*		21/2	*			
22	*		*		12/2	*		10	*		*	15/2	*		*	*		*		*		*		*		6	*			
23	*		*		5	*		14	*		*	21/3	*		*	*		*		*		*		*		7	*			
24	*		*		10	*		13/3	*	*	*	3	*		*	*		*		*		*		*		4	*			
25	*		*		11/2	*		43/6	*		*	50/6	*		*	*		*		*		*		*		11/3	*			
26	*		*		12/2	*		3	*		*	23/6	*		*	*		*		*		*		*		5	*			
27		*	*		8/3	*		99/8	*		*	10/3	*		*	*		*		*		*		*		8	*			
28	*		*		6	*		7	*		*	10/3	*		*	*		*		*		*		*		3	*			
29	*		*		7	*		37/5	*		*	7/3	*		*	*		*		*		*		*		9	*			
30	*		*		7	*		55/6	*		*	12/2	*		*	*		*		*		*		*		9	*			
31	*		*		7	*		7	*		*	22/3	*		*	*		*		*		*		*		6	*			
32	*		*		14	*		13/2	*	*	*	3	*	*	*	*		*		*		*		*		3	*			
33		*	*		23	*		12/2	*		*	28/4	*		*	*		*		*		*		*		3	*			
34	*		*		3	*		6/2	*		*	2	*		*	*		*		*		*		*		3	*			
35		*	*		17/3	*		12/4	*	*	*	4	*		*	*		*		*		*		*		8/3	*			
36		*	*		10	*		32/2	*		*	10	*		*	*		*		*		*		*		2	*			
37		*	*		9/2	*		3	*		*	7/2	*		*	*		*		*		*		*		20/2	*			
Total	27	10	23	14		17	20		19	28	12	25		0	33	4	14	23	2	33	2	13	17	7	32	5		28	8	1
%			62	32		46	34		51	49	32	68		0	90	10	38	62	5	90	5	35	45	20	86	14		76	22	2

# Appendix IV:

A test questionnaire for to record styling planning test

Dear friend,

These research for help to understand that designer concern situation with design brief, product position and design trend. Thanks you spend much time for this survey. The final results could be helped design manager to organize a suitable styling planning approach for industrial companies.

All the information only for research reference. Thanks your help.

De Montfort University School of Design and Manufacture

Ph.D. Researcher: Jun-Chieh Wu

Supervise: Ray Holland

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Personal information

Q 01,    Male     Female

## Stage 1

You are asked to design a home-type cordless telephone. During 50 min. idea generation phase, what is your concerned in front-end industrial design process.

		No Concern			Strong	
		1	2	3	4	5
<b>C, Initial Design Phase</b>						
Q 02,	Client's styling preference	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q 03,	Applied the semantic of design trend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q 04,	Predict future product images	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q 05,	Evaluating concept & concept strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q 06,	Concept presentation quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q 07,	Design concept evaluation, proposal and approach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q 08,	Technique of design presentation	1	2	3	4	5
		No Concern			Strong	



**Stage 2**

You are asked to design a home-type cordless telephone. The client's is Kingtel Company. During 50 min. second idea generation phase, what is your concerned in front-end industrial design process. Personal information

	No Concern					Strong
	1	2	3	4	5	
<b>A, Design brief</b>						
Q09,Function Specific & limited	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q10,Interface design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q11,Adjective word	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q12,Customer position	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

	No Concern					Strong
	1	2	3	4	5	
<b>B, Styling Planning</b>						
Q13, Product position	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q14, Product predecessors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q15, CIS & PI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q16, Product symbol & value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q17, Competing product design trend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q18, Relating product design trend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q19, Styling benchmarking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q20, Target customer life styling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

	No Concern					Strong
	1	2	3	4	5	
<b>C, Initial Design Phase</b>						
Q 02, Client's styling preference	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q 03, Applied the semantic of design trend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q 04, Predict future product images	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q 05, Evaluating concept & concept strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q 06, Concept presentation quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q 07, Design concept evaluation, proposal and approach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Q 08, Technique of design presentation	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	
	No Concern					Strong

# Appendix IV-a:

Huafan university raw data in styling planning test

## Styling Planning / Huafan University Raw Data

AQ1M:1 / F:0	1	0	1	1	1	1	1	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1			
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	AVG	STD
AQ2	4	5	1	4	2	4	3	3	4	4	3	4	2	4	4	2	4	4	2	3	3	4	3	4	2	5	5	4	1	4	3.37	1.10
AQ3	5	4	3	4	3	5	5	4	3	5	5	4	3	4	5	4	4	3	4	4	5	4	4	3	4	4	5	3	3	4	4.00	0.74
AQ4	3	5	3	3	4	3	5	5	3	5	3	4	4	3	3	3	4	4	4	3	5	3	5	5	2	5	4	4	3	4	3.80	0.89
AQ5	4	3	4	2	4	2	2	2	2	3	5	3	3	2	3	3	2	2	5	4	5	2	3	2	3	2	3	3	2	3	2.93	0.98
AQ6	5	4	3	4	4	4	3	3	3	2	5	4	3	3	4	5	3	5	5	3	5	3	4	2	4	5	4	4	4	4	3.80	0.89
AQ7	4	5	4	3	3	3	4	4	2	2	5	3	3	4	3	4	3	4	4	2	3	3	4	2	3	3	5	3	3	3	3.37	0.85
AQ8	3	3	4	3	4	3	3	3	3	4	5	3	3	4	5	3	4	3	3	4	4	4	4	4	3	4	4	3	3	4	3.57	0.63
Others(A:yes/B:no)	B	B	A	B	B	A	A	A	A	B	A	A	B	A	B	A	A	A	A	B	A	A	B	B	A	A	A	B	B			
BaQ9	4	4	3	4	5	4	5	2	4	2	3	4	2	5	3	4	5	5	4	4	5	4	4	3	4	4	5	3	4	5	3.90	0.92
BaQ10	4	4	2	3	5	4	4	4	3	4	4	4	3	4	4	4	4	4	4	5	5	5	5	2	3	3	5	4	4	4	3.90	0.80
BaQ11	5	4	2	3	4	3	3	5	2	5	3	3	3	3	5	3	3	3	4	3	4	4	3	4	3	4	4	4	4	4	3.57	0.82
BaQ12	5	4	4	2	2	5	2	5	3	3	5	4	4	3	3	4	4	4	5	4	4	5	4	5	3	4	4	5	4	3	3.87	0.94
BbQ13	5	4	4	4	3	4	5	4	3	2	4	3	2	5	5	4	3	4	5	4	5	3	4	4	3	4	5	4	3	3	3.83	0.87
BbQ14	5	5	4	4	2	2	4	3	2	4	3	4	1	4	4	4	3	5	4	4	3	4	2	2	2	4	5	5	1	4	3.43	1.19
BbQ15	4	5	3	4	5	3	5	3	3	4	4	4	1	2	4	4	2	5	3	4	4	4	4	3	2	3	5	4	1	4	3.53	1.11
BbQ16	3	2	2	2	1	3	4	4	1	5	3	2	2	2	3	4	3	3	4	3	4	3	2	2	3	3	4	3	2	4	2.87	0.97
BbQ17	5	4	3	3	5	4	2	5	4	5	3	4	2	4	4	5	4	5	4	4	4	2	4	3	4	4	4	5	3	5	3.90	0.92
BbQ18	4	5	2	4	2	4	2	4	2	3	3	4	1	4	3	5	4	4	4	3	4	3	3	2	3	2	4	5	1	4	3.27	1.11
BbQ19	4	5	3	3	3	4	3	3	3	4	4	4	2	1	5	4	2	3	4	3	5	3	4	2	2	4	3	3	3	4	3.33	0.96
BbQ20	4	5	3	3	5	5	3	4	2	5	5	4	3	1	5	5	4	4	5	5	5	4	5	3	3	4	5	4	3	4	4.00	1.05
BcQ21	0	4	2	4	3	3	5	3	4	2	3	4	2	4	5	2	3	4	4	3	5	3	3	5	2	4	5	3	1	3	3.27	1.23
BcQ22	0	4	3	4	4	4	4	4	2	4	4	4	3	4	4	3	3	4	4	2	4	4	4	4	3	3	5	4	3	4	3.53	0.94
BcQ23	0	4	2	3	4	5	3	5	3	4	4	4	3	3	3	4	4	3	5	4	4	3	5	3	2	3	4	5	3	4	3.53	1.07
BcQ24	0	4	3	3	4	4	3	3	3	3	3	4	3	3	4	3	4	3	3	5	5	3	3	3	4	4	4	4	3	4	3.40	0.89
BcQ25	0	5	3	3	2	3	4	4	2	3	5	3	3	3	3	3	3	4	4	4	4	2	4	3	4	3	5	4	2	3	3.27	1.05
BcQ26	0	3	3	3	4	3	4	4	2	4	4	3	3	3	4	4	4	4	4	4	5	3	4	4	4	3	4	4	3	4	3.50	0.90
Others(A:yes/B:no)	B	B	B	B	B	A	B	B	B	B	B	B	B	B	B	B	B	B	A	B	B	B	B	B	B	A	A	B	B	B		

# Styling Planning / Taipei Technology University Raw Data

AQIM.1/F0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1		
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	T31	T32	T33	T34	AVG	STD	
AQ2	4	4	4	4	2	4	5	3	2	3	3	3	2	4	2	4	2	3	1	5	1	1	2	1	1	2	2	1	3	2	4	2	4	2	2.67	1.24	
AQ3	4	5	3	4	3	3	2	5	3	4	4	4	3	3	4	4	3	5	4	4	3	3	3	2	3	2	2	3	3	4	3	3	3	3	3.40	0.86	
AQ4	2	4	4	5	3	4	4	5	4	3	4	2	4	2	2	3	4	4	5	4	3	3	2	3	3	3	2	4	3	4	4	4	3	5	3.40	0.93	
AQ5	3	1	3	3	4	3	3	4	3	3	3	5	2	4	4	2	4	3	3	3	5	1	2	3	3	2	4	2	2	3	3	4	2	4	3.00	0.98	
AQ6	2	1	3	2	3	2	3	4	4	4	4	4	4	4	4	5	4	4	5	3	4	4	3	3	3	2	3	2	4	2	2	3	4	2	3.30	0.99	
AQ7	3	4	2	2	3	3	2	4	3	3	3	3	4	4	1	4	2	4	5	3	4	4	1	4	3	2	2	2	4	2	2	3	3	2	3.00	1.02	
AQ8	3	5	3	3	4	3	3	4	4	4	4	3	4	3	2	4	5	3	3	3	5	4	3	3	3	2	2	2	4	2	3	3	3	2	3.33	0.88	
Others(A.yes/B.no)	B	B	B	B	B	B	B	B	B	B	B	B	A	B	B	B	B	B	A	B	B	B	B	A	A	B	B	B	B	B	B	B	A				
BaQ9	4	3	3	3	3	5	2	4	5	3	4	4	3	5	5	4	3	5	4	5	3	4	3	4	4	3	3	3	5	2	3	2	5	4	3.70	0.92	
BaQ10	4	4	4	3	3	4	2	4	4	3	4	3	2	3	4	4	5	5	4	3	4	3	3	3	3	3	3	4	3	3	4	3	4	3	4	3.47	0.73
BaQ11	3	5	2	4	2	4	4	5	3	5	3	5	2	3	4	4	4	4	5	4	4	5	3	3	3	3	3	2	4	2	3	4	3	3	3.57	1.01	
BaQ12	3	4	2	2	3	4	2	3	3	5	4	5	4	4	4	4	3	4	4	5	4	5	3	3	2	4	2	2	4	3	3	3	4	4	3.47	0.97	
BbQ13	4	4	2	4	3	4	4	4	4	5	3	5	4	4	4	5	5	4	4	5	5	4	3	3	3	3	4	2	4	2	3	4	5	3	3.80	0.89	
BbQ14	3	5	1	2	2	5	2	3	4	5	2	1	4	5	4	4	2	5	5	5	3	2	3	2	3	3	4	1	4	4	4	4	5	3	3.27	1.34	
BbQ15	4	5	1	2	1	5	3	3	4	5	5	5	4	4	1	5	2	3	4	5	3	4	2	2	3	3	3	1	4	4	3	3	4	4	3.33	1.35	
BbQ16	3	2	2	1	1	4	3	3	3	4	4	4	3	3	1	5	3	3	5	4	4	1	1	3	2	3	2	2	2	2	3	2	3	3	2.77	1.17	
BbQ17	3	2	3	3	3	4	2	5	3	4	4	4	4	3	1	4	4	5	5	4	5	4	3	2	2	3	4	1	3	1	3	1	4	5	3.27	1.17	
BbQ18	3	3	3	2	4	3	2	5	2	3	5	3	4	2	1	4	4	4	5	3	5	5	3	4	2	3	4	4	3	1	3	1	3	4	3.30	1.15	
BbQ19	2	3	2	1	4	3	4	4	2	3	3	1	3	2	1	5	1	4	5	2	4	3	4	5	3	2	3	3	4	4	3	1	3	5	3.00	1.20	
BbQ20	3	4	3	1	2	2	3	5	2	2	5	3	4	2	4	5	4	5	4	5	5	4	4	3	3	3	3	4	4	4	3	2	5	4	3.50	1.11	
BcQ21	4	4	1	3	3	4	4	4	3	5	4	5	4	4	2	4	3	5	4	5	4	4	3	3	3	4	4	2	4	3	2	3	4	4	3.63	0.93	
BcQ22	4	5	3	2	4	3	3	5	2	4	3	5	3	4	4	5	3	5	5	5	5	3	3	2	3	3	4	3	3	2	2	2	4	4	3.60	1.04	
BcQ23	3	4	5	4	3	4	4	5	3	3	4	2	4	2	1	4	4	4	5	4	5	3	3	2	3	4	4	4	3	2	3	2	4	4	3.50	1.01	
BcQ24	3	2	4	2	3	3	3	4	3	4	4	4	3	3	5	5	4	5	5	3	4	2	3	3	4	3	4	2	4	2	3	4	4	3	3.43	0.94	
BcQ25	3	4	2	3	2	4	3	5	2	4	3	5	4	4	1	5	4	5	4	3	4	4	3	4	4	3	3	3	3	3	3	4	4	5	3.47	0.97	
BcQ26	4	5	3	3	4	3	3	5	3	3	5	4	4	3	1	5	5	5	3	3	5	4	3	4	3	3	4	2	4	3	3	3	3	4	3.63	1.00	
Others(A.yes/B.no)	B	B	B	B	B	B	B	B	B	B	A	B	B	B	B	B	B	B	B	A	B	A	A	B	A	A	B	B	B	B	B	B	A	A			

# Appendix IV-b:

Expert chosen raw data in styling planning test

Taipei Technology University Stage A Raw Data

Taipei Technology University Stage A / 15 min.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg
Kingtel Vice Manager	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	1	0	0	6	6
Kingtel Manager	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	3	3	3
And Designer	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	4	4	4
Kingtel Engineer A	0	0	0	1	0	0	0	0	1	1	0	1	0	0	1	1	1	0	1	0	8	8
Kingtel Engineer B	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	1	0	5	5
																					5.2	0.26
Total	0	0	0	1	0	0	1	3	3	2	0	2	0	0	3	4	3	1	3	0	26	

Stage B Raw Data

Taipei Technology University Stage B / 50 Min.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Total	Avg	
Kingtel Vice Manager	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	5
Kingtel Manager	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	1	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1	1	1	1	1	1	0	0	1	15	15
And Designer	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	11	11
Kingtel Engineer A	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	0	1	0	12	12	
Kingtel Engineer B	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5	5	
																																									9.6	0.246
Total	2	1	0	1	0	0	2	2	4	2	0	0	1	1	0	5	3	1	1	1	2	0	0	1	2	0	0	4	2	0	0	2	1	1	1	2	0	1	2	48		

Taipei Technology University C Stages Raw Data

Taipei Technology University	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	Total	Avg		
Stage C/ 50 Min.																																							
Kingtel Vice Manager	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	
Kingtel Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5	5	
And Designer	1	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	10	10	
Kingtel Engineer A	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	7	7		
Kingtel Engineer B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2	
																																					5.8	0.165714	
Total	1	0	0	2	1	1	0	1	0	0	0	1	0	1	1	3	4	0	1	1	2	0	1	0	0	0	1	0	2	0	0	1	4	0	0	29			

Huafan University Stages A Raw Data

Huafan University	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Total				
StageA/ 15 Min.																																												
Kingtel Vice Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	
Kingtel Manager	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5	5	
And Designer	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	7	7	
Kingtel Engineer A	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	12	12		
Kingtel Engineer B	0	1	0	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	15	15		
																																										7.6	0.2	
Total	0	2	0	1	2	0	1	1	0	4	1	0	1	3	0	2	0	1	1	4	4	1	0	0	4	3	0	0	2	1	0	0	0	0	3	0	0	0	2	44				

39

Huafan University Stages B Raw Data

Huafan University 50	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39						
Stage B/ 50 Mi																																													
Kingtel Vice Manager	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	3	3			
Kingtel Manager	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	3	3			
And Designer	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	7	7			
Kingtel Engineer A	0	1	1	1	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	13	13				
Kingtel Engineer B	0	1	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	8	8				
																																										6.8	0.174		
Total	0	3	1	3	0	1	2	0	0	2	3	0	0	0	1	1	1	0	0	0	1	0	1	0	1	0	0	5	2	0	0	0	0	0	2	2	1	0	1	34					

### Huafan University C Stage Raw Data

Huafan University	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Total	Avg		
Stage C/50Min.																																								
Kingtel Vice Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kingtel Manager	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
And Designer	0	1	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8
Kingtel Engineer A	1	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	8	8	
Kingtel Engineer B	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
																																						4.6	0.1278	
Total	2	2	0	3	0	0	0	1	1	2	3	0	0	2	0	0	0	0	0	0	2	2	1	0	1	0	0	0	0	1	0	0	0	0	0	0	23			

### Expert Selected the Idea Concept

	Taipei Technology University		Huafan University	
Stage A	5.2 / 20 Subjects	0.26	7.6 / 39 subjects	0.2
Stage B	9.6 / 39 Subjects	0.246	6.8 / 39 Subjects	0.174
Stage C	5.8 / 35 Subjects	0.1657	4.6 / 36 Subjects	0.1278

# Appendix V:

A questionnaire for scanner MDS test

Dear friend,

These research for help both client and designer to better understands each other. Thanks you spend much time for this survey. The finial results could be helped design manager to organize a suitable approach for industrial companies.

All the information for research only. Thanks your help.

De Montfort University School of Design and Manufacture

Ph.D. researcher: Jun-Chieh Wu

Supervise: Ray Holland

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Personal information

1. Male  Female

2. Age below 20  21-30  31-40  above40

3. Your job title \_\_\_\_\_

What kind words would you choose if you were asked to describe of the future scanner images?

The format for semantic differentiation presents respondents first with the name or picture of an object or with the object itself, followed by a series of polar opposite terms: modern/traditional. For each par of terms, respondents are requested to indicate how the terms apply to the object on the basis of what the object mean to them.

Example:

	1	2	3	4	5	6	7	8	9	
Extreme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Traditional



Adj. 1	1	2	3	4	5	6	7	8	9
Extreme 極端									Traditional 傳統
Scanner 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5	6	7	8	9

Adj. 2	1	2	3	4	5	6	7	8	9
Old Fashion 老式									Innovation 創新
Scanner 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5	6	7	8	9

Adj. 3	1	2	3	4	5	6	7	8	9
Complex 複雜									Simple 簡捷
Scanner 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5	6	7	8	9

Adj. 4	1	2	3	4	5	6	7	8	9
Conservation 保守									Fashion 流行
Scanner 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5	6	7	8	9

Adj. 5

1 2 3 4 5 6 7 8 9

Frivolous 輕浮

Steady 穩重

Scanner 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5	6	7	8	9

Adj. 6

1 2 3 4 5 6 7 8 9

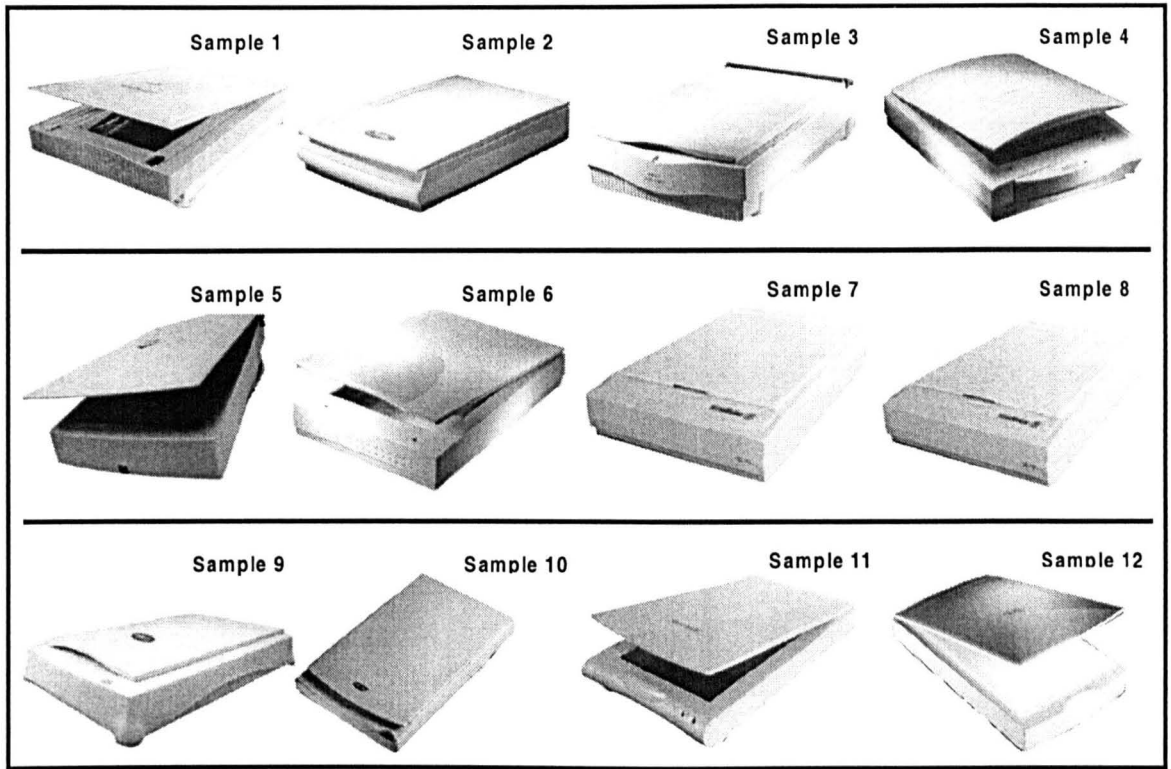
Sharp 尖銳

Mellow 圓潤

Scanner 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scanner 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5	6	7	8	9

# Appendix V-a:

12 scanner concept samples for SD test



# Appendix VI:













A test questionnaire for videophone idea generation approach

## Tranbon video-phone project - Idea generation strategy

07th April 1998

Please chose the three idea sketches which you recommend for Tranbon video-phone project



1 <input type="checkbox"/> 	2 <input type="checkbox"/> 	3 <input type="checkbox"/> 
4 <input type="checkbox"/> 	5 <input type="checkbox"/> 	6 <input type="checkbox"/> 
7 <input type="checkbox"/> 	8 <input type="checkbox"/> 	9 <input type="checkbox"/> 
10 <input type="checkbox"/> 	11 <input type="checkbox"/> 	12 <input type="checkbox"/> 

# Appendix VII:

A test questionnaire for design sense

Dear friend,

These researches for help both client and designer to better understand each other. Thanks you spend much time for this survey. The final results could be helped design manager to organize a suitable design approach for industrial companies.

All the information only for research reference. Thanks your help.

De Montfort University School of Design and Manufacture

Ph.D. Researcher: Jun-Chieh Wu

Supervise: Ray Holland

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## Personal information

1. Male  Female
2. Age: below20  21-30  31-40  above40
3. Your main job title: President  General (or vice) manager  Manager (or vice) OR head of department (or vice)  Chief designer (or vice)  Design engineer  normal staff  others
4. Do you have design background: Yes  No  (If you answer no, you do not need answer no.5)
5. Which design background you have: Industrial Design  Graphic and communication design  Interior design  Multi media design  Others designer  \_\_\_\_\_ (Multi chose)
6. Your are a: In house designer (公司的設計師)  In house design manager (公司的管理者)   
Consultant designer (設計公司的設計師)  Consultant manager (設計公司的管理者)   
Free-lance designer (自由設計師)  Others designer  \_\_\_\_\_ (Multi chose)

What kind words would you choose if you were asked to describe of the future design images?

The format for semantic differentiation presents respondents first with the name or picture of an object or with the object itself, followed by a series of polar opposite terms: modern/traditional. For each part of terms, respondents are requested to indicate how the terms apply to the object on the basis of what the object mean to them.

Example:

	1	2	3	4	5	6	7	8	9	
Modern	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Traditional

Adj. 1.	傳統的造形	1	2	3	4	5	6	7	8	9	前衛的造形
	Traditional										Modern
Sample 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	傳統的造形	1	2	3	4	5	6	7	8	9	前衛的造形

Adj. 2.	男性的造形	1	2	3	4	5	6	7	8	9	女性的造形
	Male										Female
Sample 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	男性的造形	1	2	3	4	5	6	7	8	9	女性的造形

Adj. 3.	大眾的造形	1	2	3	4	5	6	7	8	9	個性的造形
	Popular										Personal
Sample 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	大眾的造形	1	2	3	4	5	6	7	8	9	個性的造形

Adj. 4.	陽剛的造形	1	2	3	4	5	6	7	8	9	柔和的造形
	Hard										Soft
Sample 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	陽剛的造形	1	2	3	4	5	6	7	8	9	柔和的造形



Adj. 5.	當代的顏色	1	2	3	4	5	6	7	8	9	未來的顏色
	Modern Color										Futuristic Color
Sample 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	當代的顏色	1	2	3	4	5	6	7	8	9	未來的顏色

Adj. 6.	調和的顏色	1	2	3	4	5	6	7	8	9	對比的顏色
	Harmony color										Contrast Color
Sample 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	調和的顏色	1	2	3	4	5	6	7	8	9	對比的顏色

Adj. 7.	1	2	3	4	5	6	7	8	9
看得不舒服的顏色	Uncomfortable Color			Comfortable Color			看得很舒服的顏色		
Sample 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

看得不舒服的顏色 看得很舒服的顏色

Adj. 8.	1	2	3	4	5	6	7	8	9
細膩的日本風格	Japanese style			European style			簡潔的歐美風格		
Sample 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sample 13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

細膩的日本風格 簡潔的歐美風格

1 2 3 4 5 6 7 8 9

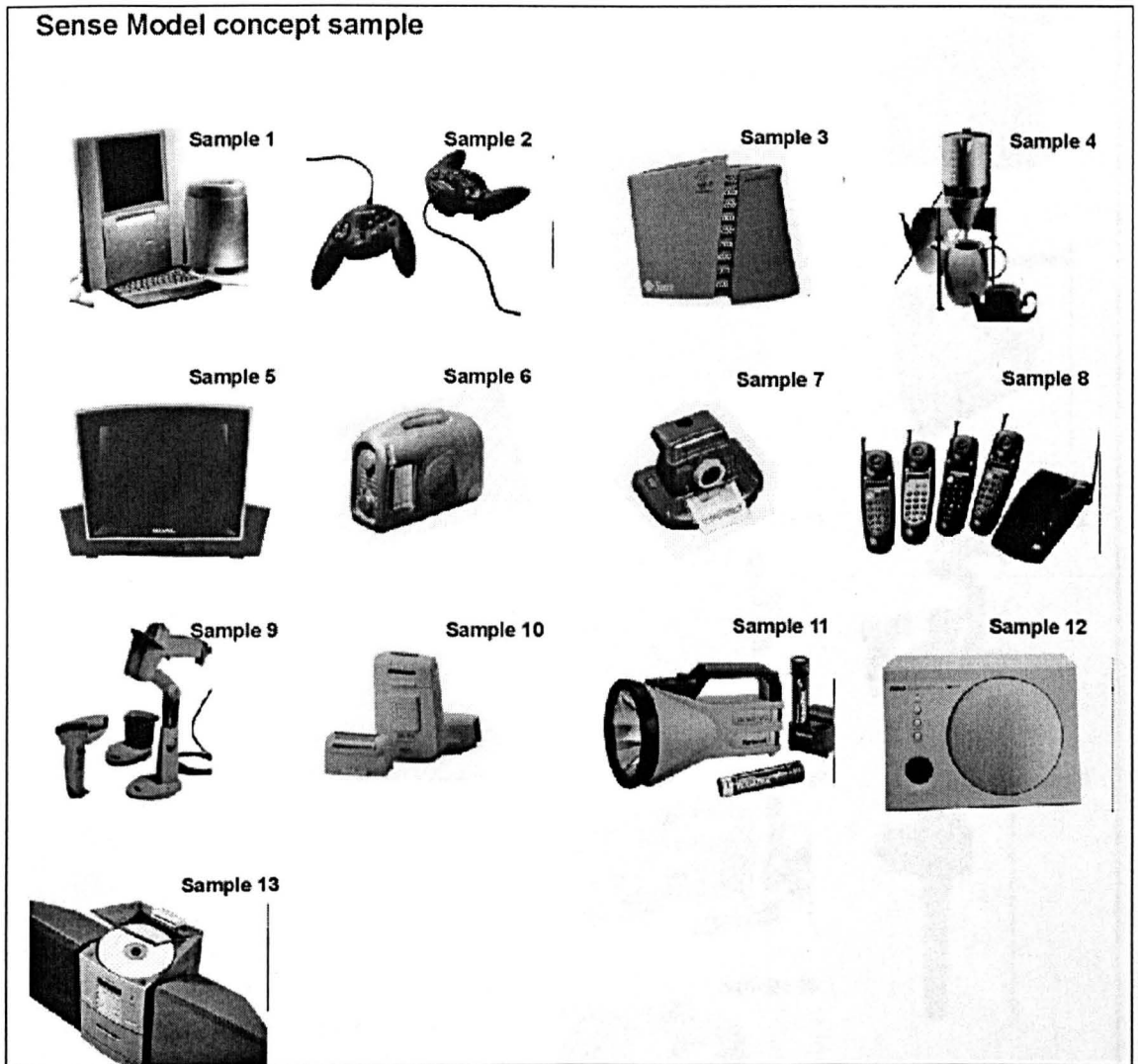
Adj. 9.	1	2	3	4	5	6	7	8	9	
地域性的風格	Local						Universal			世界的風格
Sample 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
地域性的風格										世界的風格

Adj. 10.	1	2	3	4	5	6	7	8	9	
不屬於我個人的風格品味	My taste						Other taste			屬於我個人的風格品味
Sample 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
不屬於我個人的風格品味										屬於我個人的風格品味
	1	2	3	4	5	6	7	8	9	

Adj. 11.	不喜歡	1	2	3	4	5	6	7	8	9	非常喜歡
	Like style										Dislike style
Sample 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample 13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	不喜歡	1	2	3	4	5	6	7	8	9	非常喜歡

# Appendix VII-a:

13 concept samples for design sense SD test



# Appendix VII-b:

19 concept samples for design sense SD test (Pilot)



# Appendix VIII:

## A Lego test recording for engineering skill

Dear friend,

This research help designer to understand client's 3 views drawing ability. Thanks you spend many time for this survey. The final results could be helped design manager to organize a suitable design approach for industrial companies.

All the information only for research. Thanks your help.

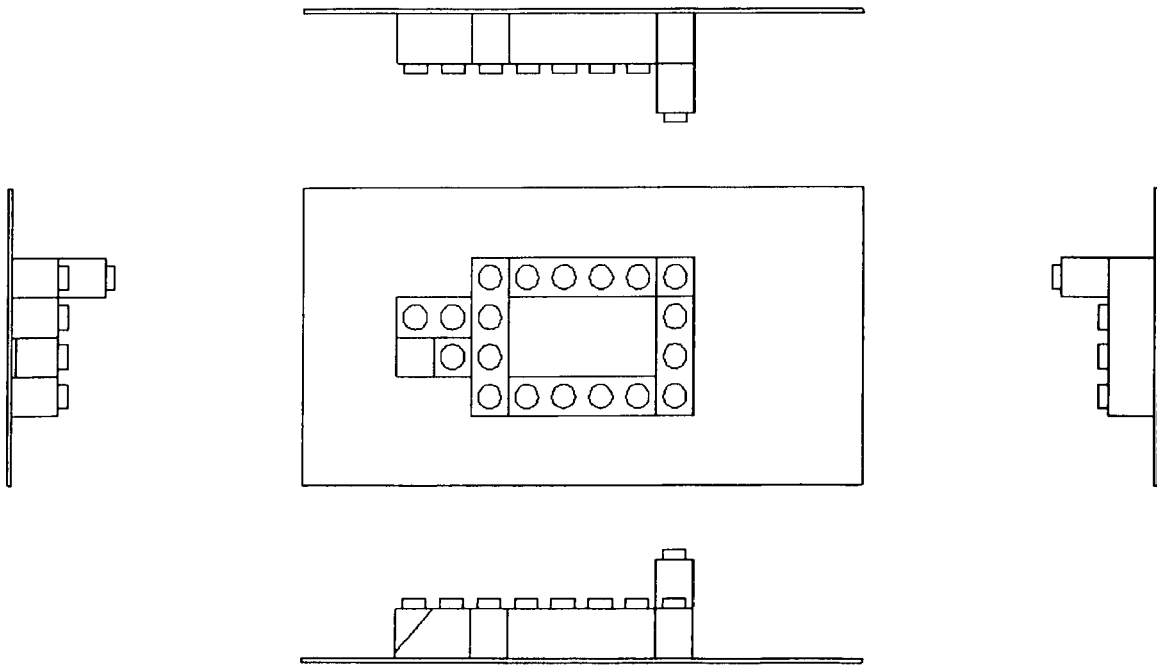
De Montfort University School of Design and Manufacture

Ph.D. student: Jun-Chieh Wu June/1998

Supervise: Ray Holland

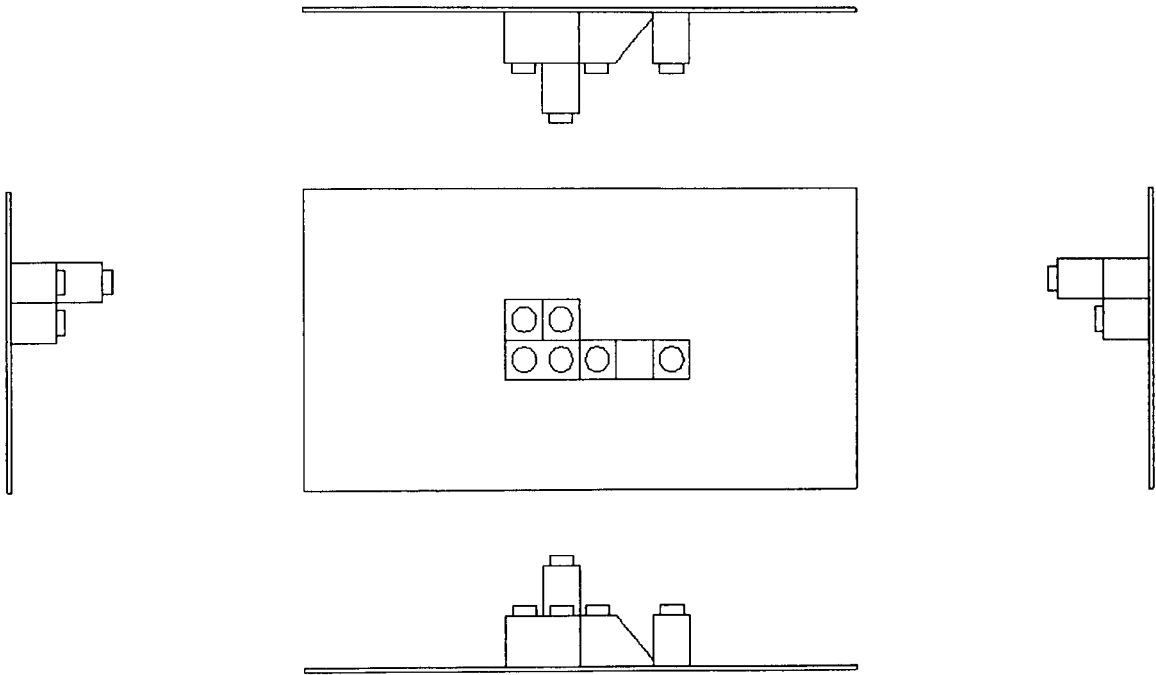
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### Sample 1



Answer: 1.  2.

Sample 2



Answer: 3.  4.