Establishing a Design Process for Museum Exhibition Design

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Abstract: As museum exhibition become technically complex and design teams more specialised and fragmented, the need to plan and co-ordinate the design process with greater quality is becoming important. According to previous research of museum studies, traditional object-based displays are being replaced by multi-disciplinary technology-based exhibits in science museums, therefore, a specifically multi-disciplinary model is necessary to develop a workable MEDP model.

This research explores the theory of design processes and museum exhibitions toward integrating as a means of museum exhibition design process. The study takes a comprehensive look at how a design process model used in developing museum exhibitions within the multi-disciplinary design work. Research methods comprise an exploratory study of literature and collected data, the development of case studies and qualitative analysis of the results in terms of MEDP methodology. The research also examines theoretical models (Architectural, product and exhibition) and develops a small number of case studies of how design concepts are managed in real-world practice.

The aim of this research is to develop a systematic design process that allows designers and curators to cope with the complexities of multi-disciplinary design working as well as meet curatorial requirements in the museum exhibition context. In particular, this study aims:

(a) To identify the characteristics and concepts of the design process as they relate to exhibition design;
(b) To establish the benefits of the application of design process theory to the practice of museum exhibition design;
(c) To examine the feasibility of applying a museum exhibition process framework to museum requirements and needs;
(d) To contribute to a more complete understanding of museum design management by developing guidelines for adoption in practice.

Keywords: museum exhibition, multi-disciplinary, design process.

1. Aims of the Study

In the past two decades, museums have seen rapid changes in terms of the application of information technology, which has been used to represent their collections in new ways. Museums provide a public service and communicate through collections associated with information applications which create new visions of museum issues for the visitor. Through the centuries, museums have evolved to provide major social and cultural benefits. Museums are essentially concerned with their collections which contribute to museum objectives. Based on the previous involvement of Taipei Astronomical Museum project, the researcher found that interdisciplinary museum exhibition design work was made more difficult because there was a lack of design documentation which could be used within the disciplinary interface. Therefore, the research in this study concentrates on bringing high quality design process methods to museum exhibition design development.

The aim of this study is to develop a systematic design process that allows designers and curators to cope with the complexities of multi-disciplinary design working as well as meet curatorial requirements in the museum exhibition context.
2. The Design Process for Museum Exhibition

Exhibition design is a complex area of practice in design work and requires planning to meet both actual and potential demands of museums and visitors. Exhibition design involves all kinds of relevant techniques and interacts with the nature of the relevant information applied. Exhibition designers have to work with curators as well as other experts. In particular, conducting inter-disciplinary museum exhibition projects is more complex than many other design projects. Managing them involves monitoring the planning, design, and production phases and co-ordinating multi-disciplinary decision making. Because of the diverse features of museum exhibitions, they require the active participation of different professions as well as a specific curatorial approach.

2.1 Multi-disciplinary Tasks

The theory of museum exhibitions and their practice, unlike many more recent professions, remains a singular design-based development. Designing a museum exhibition is becoming a complex process that requires a multitude of decisions to ensure a smooth progression after establishing the client’s needs (Figure 1).

![Figure 1 Inter-disciplinary responsibilities in museum exhibition design](image)

Based on Figure 1, here is a growing awareness that other disciplines are necessarily interrelated and co-operate in the flow of museum exhibition design work to carry out design tasks. Undertaking the museum exhibition design process involves available and reliable information flowing between tasks at all levels. Managing design information increases success in improving and accelerating the delivery of design ideas during the design process, as well as coping with the many complexities of developing museum exhibitions.

2.2 Museum Exhibition Design Criteria and Challenges

As a research objective, the ‘Museum Exhibition Design Process’ (MEDP) model cannot exist without investigating the specification of design and the roles and functions of museums. The purpose of identifying museum exhibition design criteria is to create a sophisticated interpretation of museum expertise. For example, many museum exhibitions have digital communication systems through which the majority of the information and images are delivered. The roles and functions of museums are currently considered within design development which includes design specifications and museum criteria. Both factors involve important interactions between the professionals concerned: architects, designers, curators and other specialists, and ensure that museum exhibition design fulfills museum objectives.

Miles, et al. claim that there are two considerations in designing an exhibition, which are 1): what objectives are to be defined and 2): how such objectives once identified, can best be achieved. Recently museum exhibitions have been facing several challenges, including an increased rate of innovation, the increased requirements of
museum visitors, and transforming new technologies into exhibition phenomena.

3. Case Study

3.1 Case Study Methods

This research attempts to construct the case study as a framework with an empirical basis. Such a framework identifies the characteristics of the museums selected and then examines the actual events of how their design process models were formed and demonstrated in real-world practice.

Figure 2 Domain Map of the MEDP Case Study Framework
Figure 2 shows a framework, which illustrates the proposed development structure for the MEDP through case study methods. First, museum exhibition design data from a number of sources, such as museum publicity, museum sites, exhibition projects, literature, designers, curators, questionnaires and interviews were collected and verified in the preliminary survey. Then, based on the research aims, case studies were limited by a number of museum exhibition criteria in order to develop the MEDP model. The framework consists of various methods which were used to undertake the preliminary survey, analysis, case selection, and case studies. To develop valid results and determine the factors and their impacts on design work, a broad variety of investigation methods were used in this research.

The case study essentially involved three steps. In the first step, exploratory studies of the literature involved theoretical design processes which were evaluated and analysed. In the second step, case analyses were undertaken to gain an understanding of people’s attitudes and their experiences of exhibition project developments. In the third step, all data collected from fieldwork (e.g. project observation, site investigations) were evaluated in detail in order to characterize criteria for developing the MEDP model. The case study includes the following activities: observing the exhibition projects; museum archives studies; and site investigations

3.2 Case study activities

3.2.1 Observing the exhibition projects

An on-going exhibition project: ‘Kids In The City’ in the Birmingham Museum of Science and Discovery, UK, was observed as a live case study. This was undertaken to provide a comparison with other museum experiences. The findings allowed the MEDP model to be considered from the point of view of real site events. This activity derives from museum exhibition project observation and site investigation and identifies details of theme, development plan, project development team, design process and managing the project.

3.2.2 Museum archives studies

Throughout the exhibition projects, archive data was analysed to highlight design planning and methods which provided a central principle for overall project development for all the parties involved in the project. As this complex project involved a number of professional disciplines, briefing highlighted the vital importance of effective communication of information, and general strategy amongst the various participants in the project. The creative and content directors used briefing to manage the design process, co-ordinate the participants, and to discuss and approve design decisions. Furthermore, the data were useful to check incorrect results, progress and delays, errors and omissions, in the planning, design and production phases.

3.2.3 Site investigations

Investigating museum sites is useful to gain a clear understanding of the real environment of exhibition forms and contents. The purpose of site visit was to obtain an overview of the exhibitions. The aims of the visit were:
to examine the site and space environment of each exhibit;

to examine the contents of exhibits (items and objects);

to examine the visitor reaction to the exhibits; and

to examine the size and proportion of exhibits within the museum site.

Another purpose of site investigations is to record visitor reaction to the content of exhibitions for the case study. Observation was undertaken to see how children used the exhibits by themselves or under guidance. Some parts of interactive exhibits were also tested in order to evaluate their suitability for children at an intuitive level. The aims were to locate any problems with exhibition features and gather the reflections of visitors. These findings were useful to the researcher in developing a better understanding of the design process.

3.3 Case study

3.3.1 Case study 1: Thinktank, the Birmingham Museum of Science and Discovery, UK.

Thinktank, the Birmingham Museum of Science and Discovery is a new science centre, which promotes the public understanding of science, technology and history. The aims of the museum project were to promote the public understanding of science, technology and history, implementing the very best practices in museum interpretation appropriate for a major museum in the twenty-first century.

The purpose of developing the Birmingham Museum of Science and Discovery was to explore aspects of the technology, industry and science, social history and natural history collections to provide an excellent museum environment. The existing collections at the ‘Museum of Science and Industry’ in Newhall Street, had a display area of about 6,000 square metres. It was replaced by the Thinktank exhibition with an increased display area of 9,000 square metres.

The main characteristic of the museum exhibits is that they are interactive-based. Objects and interactive forms are adopted to explore and interpret scientific theory. The interactive exhibits provide hands-on tools and facilities to give visitors more experience with the exhibits. For example, in the ‘Future’ and ‘Showcase’ exhibitions, audio-visual media are used to reflect contemporary science and its future implications.

The exhibits offer significant knowledge of what, how and why science does for people. For example, an exhibit entitled ‘Water Lock’ uses small scale objects (e.g. fans, boats, pumps) to show how the wind is used to power boats and make them move in the water. This exhibit does not use any historic artefacts or even illustrations of them.

3.3.2 Case study 2: National Museum of Natural Science, Taichung, Taiwan

The National Museum of Natural Science (NMNS) is one of three science museums in the country. NMNS was planned and building started in 1981. The museum had four main goals which were:

(1) to explain the principles and phenomena of natural science and provoke the public’s interest in science;
(2) to assist schools at all levels, to achieve their science-related educational goals, and to form a basis for the long-term development of natural science;
(3) to collect representative natural specimens and anthropological relics from Taiwan, as well as related information; and
(4) to use collections and research for the purposes of exhibition and education.

Gallery development was arranged in four phases. Phase one: The Space Theater and Science Center were officially opened on the 1st of January 1986. Phases two, three and four consisted of the Life Science Hall, Chinese Science Hall, and Global Environment Hall. The Life Science Hall opened in August 1988 and the others were opened in 1993. The museum serves as a traditional natural history museum in collecting and displaying natural specimens and anthropological relics. Unlike the Taipei Astronomical Science Museum, exhibitions in the NMNS do not take technological or industrial approaches to museum content.

The exhibitions object-based and the primary exhibition content illustrates broad categories across the fields of science, culture and history: 1) the development of natural science; 2) the development of ecological theory; 3) the processes of discovery and invention; 4) the relationship of natural science to society and culture; 5) significant aspects of Chinese Science and Technology. The exhibition project at the NMNS includes 14 galleries, designed by two UK design companies, 3D Concept Design Company (3DC) and MET Studio design consultancy. Development started on the project in 1981 and design work was completed in 1984.

Most exhibits provide a learning environment with object, supported by graphics and story lines. This type of exhibit communicates meaningfully to visitors without any physical interaction between visitors and objects. In the Science Center, mechanical interactive exhibits are provided to encourage children’s involvement and the development of scientific and historical skills.

3.3.3 Case study 3: Taipei Astronomical Museum, Taipei, Taiwan.

The Taipei Astronomical Museum is situated in the north of Taipei City. The goal and mission of the museum is to act as a bridge between astronomy and society, allowing the public to learn more about astronomical science. The museum’s exhibition function is one which promotes an understanding of the history, technology and theory of astronomy. The first phase of exhibition planning and design was started in 1991.

The museum exhibitions present the history and theory of astronomical science, with models and explanations provided by storyboards. The exhibition provides a learning environment and encourages participation and involvement in the exhibits which meet the highest needs and expectations of visitors. The displays are generally not changed very often, but the special display room and many small theatres regularly change their displays to show featured constellations or stage special themes and displays.

The exhibitions were designed on an interactive basis. The interactive exhibits used computer displays, and film projection which attempted to create a live-performance opportunity for the museum visitors. The purpose of the
Taipei Astronomical Museum was its educational function, which was more important than entertainment. The objectives of the Taipei Astronomical Museum are listed below:

(1) To be educative: The purpose of the museum is to achieve an educative approach. Many exhibitions are interactive in form to provide hands-on activities and enable the visitor to learn.

(2) To be attractive and fun: The museum attempts to show how astronomical science is defined and used by scientist and astronomers. The exhibitions were also planned to provide features which allow the visitor to explore many aspects of astronomical history and theory through interesting content and forms. However, learning science should also be fun and the visitors are made to feel a part of the exhibits. A major exhibition objective, therefore, is to attract the intended audience.

(3) To encourage visitors to participate in the exhibitions: All the exhibitions in the museum are designed to attract visitors to take part in the museum’s activities. The exhibitions use digital technology, graphics and 3-dimensional models to encourage the visitor to participate in the exhibitions. Through using the exhibition programmes, mechanical objects, digital computer-controlled systems and other hands-on objects, the visitors are encouraged to think about all sorts of scientific problems.

3.4 Case Study Findings

The case studies indicated that enhanced opportunities for inter-disciplinary museum exhibition design working should be developed in terms of a prescriptive framework for the process model. Such a framework would enable every person who participates in a museum exhibition design project, to identify the design information required by the process model.

3.4.1 Multiple Disciplinary

Exhibition development is a complex activity, which is expanding beyond the design discipline. Various kinds of specialist have brought a new perspective to museum exhibitions especially in terms of digital technology, which has had a major impact on the design process in museum exhibition development.

3.4.2 The New Curatorial Approach

The design information used in museum exhibition development, is identified as a key requirement for co-ordinating curators and designers’ relationships as well as integrating other disciplines. In order to undertake museum exhibition design properly, the overall activity needs to be co-ordinated to meet curatorial requirements. As the work of museums has changed, curatorial work has become heavily dependent on other knowledge and techniques to make the museum exhibition more effective. Curators have become more design conscious and improved their knowledge of modern design skills (Figure 3).
4. The Design Process Model for Museum Exhibitions

The ultimate purpose is to present the design process as a prescriptive method that produces an effective flow of information and encourages project participants to follow the staged design process and work in a systematic manner. The process model therefore can provide an approach that offers users a greater understanding of the design process. Such a model can be used repeatedly to plan multi-disciplinary design work.

By representing the information based on the project requirements, the flow of information between all project development parties and the design process could be simplified. The implications drawn from the cases were that the process model should include the following properties:

1. A graphic framework should represent the flow of design information better than individual activities.
2. The tasks should be performed as functions of design concept development as well as management.
3. The design information links should co-ordinate all parties involved in the design project.
4. The model should provide a clear understanding of the design specification for all parties in the design project.
5. The model should take a systematic approach to planning to achieve project objectives.

5. Outline the Museum Exhibition Design Process (MEDP) Model

In order to construct the MEDP framework, a set of components of design method were isolated that were representative of the conceptual phase of museum exhibition design. Extensive discussions resulted in several solutions that were pertinent to the development of the proposals. To improve the productivity of the design process as well as the quality of design projects, the case study findings suggested consideration of the following issues:

1. Good utilization of design information: Based on observation of the ‘live’ case project, it was found that members of development team were good at communicating and sharing their expertise with each other.
2. Multi-disciplinary design based on curatorial criteria: After a brief discussion with museum curators Sykes, Wang and Tou (Taipei Astronomical Museum) about design process objectives in the case studies, they identified that a good understanding of criteria as expressed in the brief was important. They also described misunderstandings of curatorial criteria, which had caused ineffective design work. Therefore, a
criteria-based design method should be utilised.

(3) Design communication: Good communication between all relevant participants allows design decisions to relate to all members rather than one individual. According to interviews about Taipei Astronomical Museum projects, participants rarely had a clear understanding of the information requirements of other disciplines. In this sense, workable design documentation is required to cope with complexity of museum exhibition design.

Roozenburg and Eekels [13] stated that the design process offers the basic cyclic function which begins with problems and ends with problem-solving. Methodical design work with curatorial direction, allows the members of the development team to carry out their own duties. The MEDP framework therefore needs to emphasise criteria for the following stages: Project planning (2) Feasibility study (3) Outline proposal (4) Design development (5) Production.

An outline framework addresses the various stages by effectively co-ordinating the transfer of information amongst different tasks and disciplines (Figure 4).

![Figure 4 Outline MEDP Framework](image)

In this outline of design method, the phases where ‘analysis’, ‘synthesis’ and ‘evaluation’ are important parallel the ‘planning’, ‘design’ and ‘production’ tasks in the framework.

6. The Design Framework

The plan for designing a museum exhibition should clarify the parties involved in its direction and provide a pattern for a ‘project development team’ rather than a ‘design team’ alone. Collaboration is needed to initiate the development of the design project. Collaboration is an active principle to and involves negotiation, agreement, and discussion in order to carry out decision-making in the design process. The design process should provide feedback loops for all members of the team.

For all but the simplest of design tasks, the design process is not in simple linear form, but feedback features in each design stage allow designers to work systematically with other specialists. This forms the basis of the
‘management’ and ‘design’ functions of the design process (Figure 5) and allows each discipline in the development team to contribute as well as feedback and reflect on experience of the previous stage.

![Figure 5 A Feedback Process in Design Collaboration](image)

6.1 Stage A: Project Planning

In the initial stage, the tasks identified will vary, depending upon what drives museum strategy, for example government policy, competition or existing collections. The first step is to prepare a general outline project proposal based on museum requirements, define the basic objectives and identify the museum’s role in order to plan the next section. The second step is to determine the level of detail the client requires about the project’s characteristics, themes and purposes, to approve the next stage of development. This stage is based on a client presentation. A preliminary project proposal will be developed and approved by the client.

The task of project planning is to set up a strategy for verifying that its objectives have been met and identifying the client’s requirements in order to launch the project and appoint an appropriate development team.

6.2 Stage B: Feasibility Study

This stage will be based on the outcomes of project planning. The aim of undertaking the feasibility study is to decide the elements of the exhibition project and involves collecting information about them in order to assess the project’s feasibility.

Concepts and development planning are discussed at this stage. After decisions on suitable project concepts, feasibility is summarised by presenting a design brief. The project manager should provide the client with an appraisal and recommendations in order to determine the form in which the exhibition project is to proceed, ensuring that it is feasible, functionally, technically and financially. In this stage, a design brief is established to identify curatorial requirements and design aims. The feasibility report includes design, specialist and financial feasibility and is approved by the client. The tasks are to:

1. Develop alternative project concepts;
2. Test the feasibility of the preferred solutions;
3. Prepare a target outline timetable; and
(4) Establish a cost analysis.

6.3 Stage C: Outline Proposal

The outline proposal involves preliminary planning and design development. The creative director or manager of the design team will be responsible for the proposals to match the client’s target budget and aims. The objectives of the outline proposal stage are:

(1) To decide on alternative outline design proposals;

(2) To determine the necessary resources for the development teams;

(3) To plan detailed target dates, milestones and the scope of the design and development tasks; and

(4) To provide a general concept design and exhibition plan.

6.4 Stage D: Design Development

Design development is to prepare the design concept and decide on specific proposals with the respect to the design brief. Two design stages are included; concept design and detailed design. Concept design develops alternative concepts and sketch plans are prepared to show alternatives. Detailed design is the development of a detailed set of exhibition components including site, space, exhibits, technology applications, graphics, storyboard and products.

The objectives of the design work stage should include:

(1) A cost analysis of project;

(2) Design of materials, layout, concepts, communication methods and exhibition characteristics; and

(3) A written design specification to supplement the drawings and production specification where appropriate.

6.5 Stage E: Production

The aim of this stage is to provide sufficient information on the arrangement and assembly of the detailed production parts, to enable manufacture and construction to be successful and the best way of achieving the desired result.

The purpose of providing production information is to invite contractors to submit bids. After the design solution is selected and approved by the client, production information is prepared. The information includes technical drawings, detailed specifications or other related formats needed to get the exhibition fabricated and built.

The detailed production information is used to build the exhibition. The tasks are:

(1) To prepare production information in sufficient detail to enable tenders to be obtained;

(2) To provide information for continuous cost checks;
(3) To amend production information as necessary;

(4) To check that the detailed design meets design requirements; and

(5) To obtain authority to proceed to production.

Figure 6 shows a sampled work stage D ‘Design development’ which is the forth step of the museum exhibition design process (MEDP) model. Design development consists of two main phases; concept design and detailed design. Concept design provides a general plan for developing ideas into a coherent working proposition in terms of the overall programme and for providing fundamental information to support detailed development. Detailed design provides design information on all exhibition components with accompanying details and technical specifications which provide the basic requirements for production design. All participants of the design project should take this model as a communication format in order to process their own work.

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<tr>
<th>Participants</th>
<th>Client</th>
<th>Project manager</th>
<th>Designers</th>
<th>Subject Specialists</th>
<th>Quantity surveyors</th>
<th>Contractors</th>
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<tr>
<td>Objective</td>
<td>Approve detailed design for stage E.</td>
<td>Develop detailed proposal for stage E.</td>
<td>Develop detailed design for stage E.</td>
<td>Develop details for stage E.</td>
<td>Develop detailed cost for stage E.</td>
<td>Develop Production Specification for Stage E.</td>
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<td></td>
<td>Review of detail design drawings and advise designer of changes if required. (Curators)</td>
<td>Review Outline Design Proposal.</td>
<td>Provide all subject information to designers as necessary.</td>
<td>Co-operate with designers to develop concept and detail of exhibition content.</td>
<td>Co-operate with designers to develop cost-effective design.</td>
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<td></td>
<td>Approve Design Specification</td>
<td>Prepare a detailed Design Specification including audio-visual, visual image, site plan, material, exhibit and interactive specifications as appropriate and present to project team.</td>
<td>Continue to refine Cost Plan. Advise appropriate participants of critical elements.</td>
<td>Develop Cost Plan and include production cost plan.</td>
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<td></td>
<td>Present Design Report to client.</td>
<td>Discuss final design with client and obtain approvals.</td>
<td>Circulate Design Report to participants.</td>
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Figure 6 Museum Exhibition Design Process Stage D: Design Development
7. Conclusions

The project using the MEDP model can vary considerably in content and form depending on the nature and complexity of the exhibition project. The process provides a way of defining, ordering and specifying museum objectives, criteria and design specifications, as well as of achieving design aims.

The MEDP model does not prescribe the way in which a task is performed, it only shows the design information required and the activities to be undertaken by each discipline. The outcomes of the research were used to check the components of the MEDP and ensure that it was a correct representation of process flows. Its suitability was also established for other future studies. The model’s suitability for real practice or other applications was checked with designers and curators and modified appropriately.

7.1 Benefits for Museum Curators

In their role as client, curators should have a relatively clear idea of their needs and what information to provide to the relevant disciplines in order to achieve project aims. If the client is concerned to achieve something new, they will need to rely on professional advisers. Clients always need to be educated about the professional role of each discipline. This is very useful for them as they can reflect on their experience in next project.

7.2 Benefits for Designers

The museum exhibition design system can be viewed as a problem-solving and decision-making process. Within the framework, the designer becomes able to fulfill project objectives as a result of multi-disciplinary communication with curators and other project developers. The MEDP model offers many advantages over existing methods for the designer:

(1) It allows designers to identify their role in the design project; it allows designers to handle interdependent tasks and reduce the number of tasks within each interactive cycle;
(2) It indicates to designers which tasks require cross-disciplinary co-ordination and integration;
(3) It enables designers to understand museum exhibition requirements.

7.3 Benefits for Museums

Further studies could explore the potential application and adaptation of the MEDP model to other projects within museum programmes, such as museum exhibition management, school learning programmes, marketing initiatives, collection management or other special activities. For example, a process model for museum collection management can be drawn out containing management objectives and activities based on the requirements of museum collection strategy.

Collection, management and education strategy are fundamentally linked. The MEDP model would be of most use where it can associate with other process models, integrating them to at organisation level to enable museum staff to carry out many types of museum programmes or projects (Figure 7).
The principal research outcome is the MEDP model itself, which could be used in a future 'live' museum exhibition design project. The MEDP model is at the prototype stage and further work is required to transform the model into proved methodology. The MEDP might form a new area of design research which would make original contributions to the development and validity of the concept of museum exhibition design.

This study, based on mixed research methods, examined the challenges that have been faced by science museums in designing exhibitions. It has resulted in a prototype MEDP with substantial potential benefits for participants which need to be tested in practice. It has also resulted in potential for further study in a number of related disciplines.

**References**


