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An Interactive 3D Experience for the Creation of Personalized Styling

Dawei Lin

Abstract**—**This research proposes an *Interactive 3D Experience* to enhance customer value in the fantasy era. As products reach maturity, they become more similar in the range of functions that they provide. This leads to competition via reduced retail price and ultimately reduced profitability. A competitive design method is therefore needed that can produce higher value products. An *Enhanced Value Experience* has been identified that can assist designers to provide quality products and to give them a unique positioning. On the basis of this value opportunity, the method of *Interactive 3D Experience* has been formulated and applied to the domain of retail furniture. Through this, customers can create their own personalized styling via the interactive 3D platform.

Keywords**—**Interactive 3D experience, enhanced value experience, value opportunity, personalized styling.

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I. Introduction

THE challenges of a mature market are highlighted by market saturation and reduced profit margins [1]. Typically, rival companies offer similar products and services, and compete primarily on the basis of price. In such an environment, new product development becomes critical. This entails not only the identification of new products, but also the related logistics of speed to market, quality and cost of production [2]. Furthermore, contemporary customers are more discerning than those of the pre-digital era [3]. Before making a purchase decision, customers can access information through multi-channel media, and evaluate products based on their benefits and price. Globalization has further compounded the difficulties and resulted in more intense market competition [4]. An expanding range of products and services is now available to individuals, with rare exceptions such as the recent launch of the iPhone. We have entered a buyer's market.

The 21st century can be defined as the period of potential demand exceeding supply. Potential demands are those unsatisfied human desires that need to be fulfilled. Manning and Reece argue that four dimensions make up the *total product*: the generic product, the expected product, the value-added product, and the potential product. The first three products can be achieved via product development and marketing strategy. The fourth, however, potential product, is related to the evolving human needs that designers should consider in their prospective products [5]. To reach beyond existing demand and to look into the future, Kim and Mauborgne stress that companies should focus on potential positioning to achieve greater customer loyalty. To find such potential human needs becomes the key to offering competitive quality [6]. From a product development perspective, Kapoor states that futuristic design based on fantasy leads to product development that would not normally occur [7].

The concept of fantasy is derived primarily from entertainment, such as theme parks and 3D games [8] [9]. Cagan and Vogel argue that we are in a fantasy era and that customers now hunger to satisfy their dreamlike 'fantasy' desires. The concept of fantasy highlights the vision underlying this potential demand that needs to be realized [10]. Companies need to envisage the possibilities when a product transforms into a 'mediator' that embodies fantasy. What will it be? Companies can stage an experience whenever they engage customers, connecting with them in a personal and memorable way. However, existing product development lacks this new vision.

Customers now desire products with higher value and quality that address their upper level needs such as self-realization. Providers now need to offer unique products or services that no one else provides, or offer them in a unique way [11]. In the digital marketing environment, the customer can be closely involved in the creation of any product or service. Therefore, designers need to develop products that are competitive with new personalized capabilities, rather than offering a general product. In short, the digital era has highlighted the connection between design development and possibilities in addressing the customers' unlimited upper level needs.

II. Promoting Customer Value by Value Experience

In today's highly competitive marketplace, addressing the upper-level needs by demystifying such intangible benefits can give a company a competitive edge. For example, companies can achieve this through marketing, merchandising devices, and innovations that could improve the product's image value to customers. It is in the interests of any company to offer enhanced customer value by providing experiences that go beyond customer expectations [12]. Customers do not know what new features a company should offer until they interact with the new products or services presented. The way to promote these improved benefits is to assist customers in

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discovering them [5].

The value experience has been defined as – 'a product or service that when combined with its surrounding experience events goes beyond itself to enhance or bring value to a customer's life' [9]. A product cannot exist by itself because it interacts with its surroundings. Value creation is the main objective in new product development and offers customers additional benefits such as safety, comfort, and pleasure. In the perception of value, it is necessary to establish how a product opportunity can be identified in a highly competitive era. Experiential concepts assist designers to offer greater value to products and turn them into design solutions. It is therefore important to ask what kinds of experiences are sufficiently valuable to transform products into desirable experiences.

A. Value Experience for Product Development

One of the premises for the competitive design strategy is to provide enhanced value for existing products. Enhanced value means offering better quality or services, that are meaningful and valuable to customers, than competitors are able to [13]. In particular, a company producing mature products can no longer use price and functional advantages to create product differentiation. Instead, the company should transform the existing products by providing a unique quality in line with significant customer value. The value experience has been well applied in the entertainment industry and service industry for decades. However, such applications have not been extended to product development. Pine and Gilmore argue that the value experience makes a product memorable [14]. Value experience gives companies a medium to offer products with enhanced value. Shaw also stresses that companies should stage attractive value experiences which arouse positive customer emotions [15].

One value experience for product development is the differentiation of product appearance. The differentiated appearance serves as a product image. The visual satisfaction makes a product more valuable than others. Postrel states that aesthetic identity signals both personal expression and social communication [16]. Beardsley states that aesthetic experience directs the customer's attention to products that are attractive and they disregard the other products [17]. Product image is important with soft functionality such as pleasure, so that customers are willing to pay a higher price. Through evaluating different product appearances, customers can discover their ideal products. In the end, customers would search for the most valuable product that yields visual satisfaction, personal image, and novelty.

Products interact with their surrounding environment and users. With the inclusion of the factor of the surrounding environment, the value experience is complete. In contrast to the active interaction between product and user, the relationship between the product and the surrounding environment tends to be passive and often neglected. The value of the surrounding environment lies in the interaction with products where the customers purchase, use, and own them. Before the purchase, companies establish the bricks-and-mortar or the communication platforms in which customers search for the ideal products, with the shop image parallel to be friendly interface. Kooijman states that the shop environment plays an important role in the interaction and relationship with customers [18]. Therefore, the surrounding environments incorporate the entire place where products have been involved. The most typical surrounding environment is the interior, such as the furniture and home appliances. In addition, the atmosphere of the shop environment and the virtual platform (where the products are displayed) significantly affect purchase decisions.

The experience of variety seeking is an important process for customers which provides opportunities for browsing related possibilities. Customers, then, search for the optimal options before they make the purchase decision. Variety seeking serves as the function of assisting customers to deal with the changing environments [19]. Even customers who do not make a purchase will still appreciate a physical and emotional experience. Thus, the company should offer effective portals where customers can discover the desirable products easily. The value experience of variety seeking gives incentives to designers in offering various products that satisfy customers with pleasure and unique experience by the distinguished product appearance. Furthermore, it provides the possibility of searching for the optimal products within potential environments.

B. Enhanced Value Experience

The four main value areas of *Enhanced Value Experience* are: (1) differentiated product appearance, (2) customer involvement, (3) surrounding environment, and (4) variety seeking. These are based on the definition of value experience. In addition, on the basis of strategic marketing principles, well-integrated value experience could offer differentiated and perceived value [15]. Therefore, the *Enhanced Value Experience* could incorporate the four sub-sets of value experience, where variety seeking plays the connection role in the process of enhanced value creation. Through the variety seeking process, the customer can easily experience the full spectrum of differentiated product appearance with the environment interaction. It provides a value opportunity that facilitates customers in discovering potential needs through the pleasure experience of product appearance with its surrounding events. Normally, each value experience can be easily realized. The integration of the *Enhanced Value Experience* has made the problem complicated. However, the added challenge now is

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to demonstrate the importance of successful integration for fulfilling the value opportunity. Fig. 1 illustrates *Enhanced Value Experience* derived from the integration of four types of value experience.

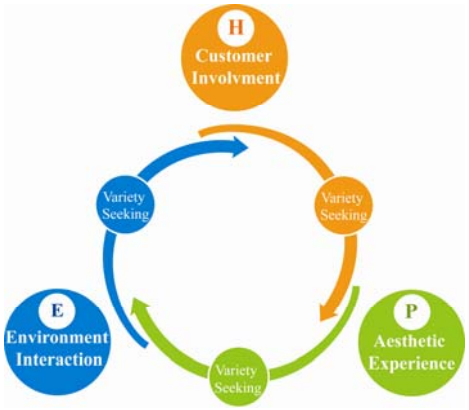


Fig. 1 Enhanced value experience

III. Method Of Interactive 3D Experience

The four types can be easily achieved separately by offering alternative pre-made products, exhibition centers, and marketing research. This is the current practice in product development. However, the four types also affect each other. By connecting them, they bridge the gaps between product, environment, and users that have been neglected in current product development. The challenge is to search for solution for staging the four types simultaneously; hence creating the *Enhanced Value Experience*. A notion is provided by the *Interactive 3D Experience*. Fig. 2 illustrates the architecture of the *Interactive 3D Experience*, consisting of design techniques, marketing tools and *Enhanced Value Experience*.

A. Marketing tools of the Interactive 3D Experience

Interactive 3D serves as the communication platform between customers and companies. The *Interactive 3D Experience* requires a communication platform that can intuitively simulate the design process. An intelligent way for discovering potential products is to engage customers with the simulation of design processes. Interactive customization allows customers to go through similar mental experiences as the product designers during the purchase process. In spite of the functional factors, designers adopt product modules to generate various appearances systematically. Each product module stands for an independent fraction with perceived value to customers. Countless possibilities can be propagated through the various compositions of product modules. The various possibilities are perceived and evaluated before they are produced. Finally, only a few of the conceptual possibilities emerge in the market for the target audiences.

B. Design Techniques for Interactive 3D Experience

There is a range of design techniques but two techniques are particularly appropriate for the *Interactive 3D Experience*. There are: *intuitive 3D transformation* and *compatible form design*. *Intuitive 3D transformation* provides the core technique in the *Interactive 3D Experience*. With this technique, potential products can be constructed from 3D modules. Also, *intuitive 3D transformation* bridges the gap between designers and customers, whereby the customer can participate in the design process. This should give a sense of self-achievement and enhance the value experience. This new technique combines 3D modules and 3D transformations, leading to unlimited product possibilities. With it, virtual products can be constructed digitally. The implementation of intuitive 3D transformation assists customers in searching for desirable products and in discovering product potential in a virtual environment. In combination, they provide a platform where customers can explore, instead of accepting, a predefined product.

To support these product possibilities, the 3D database of product modules should be constructed with a formation grammar that ensures that (a) the entire parts inventory is meaningful, and (b) it does not allow impossible combinations. This formation grammar is the foundation of the 3D database of product modules and it incorporates different product parts with functional intentions. In the *Interactive 3D Experience*, the aesthetic experience drives the compositions of various 3D product modules rather than predefined alternatives. Therefore, all components should be compatible with each other.

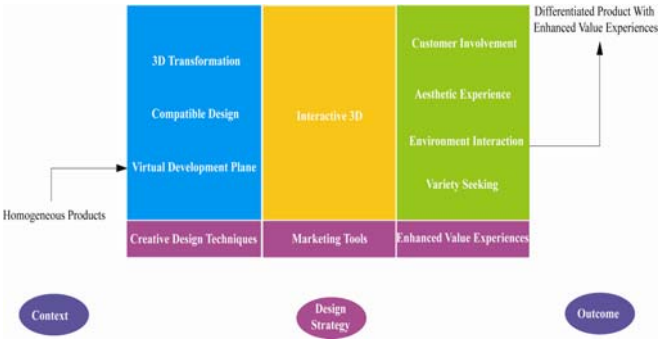


Fig. 2 The Method of Interactive 3D Experience

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C. Essential Components of the Interactive 3D Experience

To achieve the *Interactive 3D Experience*, the essential components should be established before integration. Each component serves an essential function and the components interact with each other through interactive 3D. In this way customers can experience the enhanced value in their choice through the platform. The components of the *Interactive 3D Experience* include: (1) 3D databases of product modules (2) 3D environment modules (3) audio and video modules (4) interface modules and (5) Interactive behavior modules. Fig. 3 demonstrates how the essential components of the *Interactive 3D Experience* fit together.

The 3D database of product modules consists of all virtual product modules that incorporate functionalities and physical elements. They are the fundamental visual components of the *Interactive 3D Experience*. A large number of products can be developed through the use of product modules. These compatible product modules are the key element in differentiation. To build the 3D module database in a meaningful way, each equivalent function module must be distinguished from the other modules. Furthermore, they must be entirely compatible in an easy to use format.

The 3D environment modules provide environmental settings for potential customers. The products that customers construct can then be viewed within their chosen settings. The 3D environment modules provide possibilities for interaction between products and the environment in which they are used. In so doing they assist customers to make informed decisions before they purchase. They also allow customers to decide whether a product will fit into an environment.

The interface modules are designed to assist customers in experiencing enhanced value creation in the virtual environment. A friendly interface design offers users guidance to move through the virtual environment. Most of the available interface designs are composed of 2 dimensional graphic designs. In the virtual environment presented here more flexibility and diversity is brought to the interface design. It includes 3D props, audio guidance, and animation.

Interactive behavior modules are central to interactive 3D. The interactive behavior for a *behavioral object* is composed of many *building blocks* with detailed parameter settings. The performance of interactive behavior is extremely important for a friendly interface, maintaining a connection between users and the virtual visualization platform. The flexibility of interactive 3D makes it possible to explore the potential of breakthrough path and innovations. In short, interaction and integration is possible with well designed interactive behavior modules.

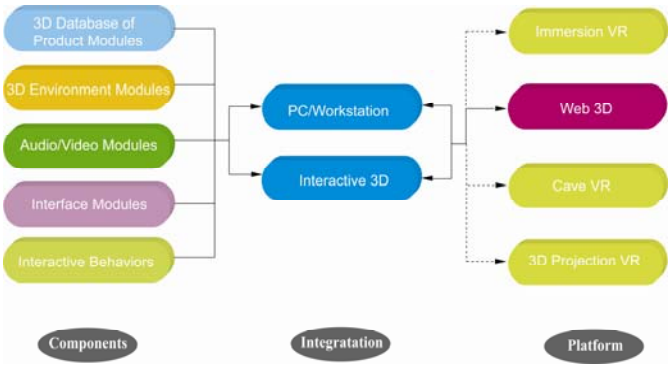


Fig. 3 Essential components of Interactive 3D Experience

IV. An Application Of The Interactive 3D Experience

One application example of the *Interactive 3D Experience* in the product development field of Chinese-style furniture will be described. The application of the *Interactive 3D Experience* demonstrates how designers can exploit the proposed design method to enhance value by offering an experiential virtual platform. The 3D database of furniture modules can serve as a virtual incubator to assist customers. Modular architecture facilitates varieties by adopting changeable combinations of components in forming various products [20].

Before the 3D database of furniture modules can be built, the first prototype should be created. To successfully achieve the differentiated appearance and variety-seeking experience for virtual customers, a bank of complementary product modules will be set up. The modular design of the Chinese-style furniture based on functionality makes the modules compatible and differentiated.

The development of compatible prototypes follows the digital construction of the first prototype. *Compatibility* and *differentiation* must cover the entire range of furniture modules. Fig. 4 illustrates the various compatible prototypes of the Zen chair. When all the product modules have been developed, the construction of a 3D modular database will follow, so that potential products can be created.

Based on the premise that the product cannot exist by itself, and that it interacts with its surroundings, the environment provides one of the most important information sources for customers in making purchase decisions. The most relevant environment for the furniture is the interior in which it will be located. Presenting a simulated interior for each customer, however, is impractical. The objective, therefore, is to provide a series of representative interior settings from which the customer can choose to locate the furniture of their choice. A prototype interior is required that will serve as the representative space for all interior modules.

Fig. 5 demonstrates the virtual Chinese house created by a systematic construction method.

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Fig. 4 Variations of chair prototype



Fig. 5 Virtual house prototype

Interactive behavior modules are the internal processing mechanisms. They make the virtual experience possible through their integrated performance and flexible compatibility. Their functions are to integrate and interact with the other components. Therefore, interactive behavior modules can be attached to the 3D database of product modules, 3D environment modules, audio/video modules and interface modules.

The interactive behavior of *intuitive 3D transformation* is the core of the *Interactive 3D Experience*. It enables customers to create various virtual products intuitively. A creative design notion will be adopted to achieve this purpose. Fig. 7 illustrates part of the interactive behavior of intuitive 3D transformation. This incorporates the building blocks of *wait message*, *broadcast message*, *remove mesh*, and *select mesh*, whereby the 3D furniture modules can be transformed, as they receive messages from the users' interactions. The *wait message* is activated when the awaited message from the user is received. The *broadcast message* sends a message to the 3D objects which share the same object mesh. *Remove mesh* means withdrawing an existing mesh from the selected 3D module. *Select mesh* specifies which mesh should be used to represent the geometrical visualization of a 3D furniture module.

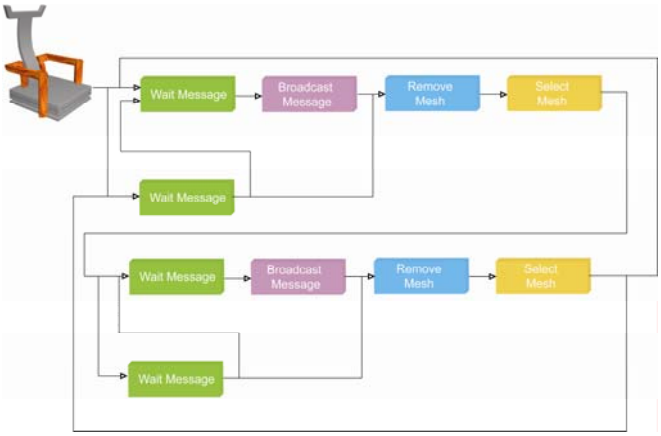


Fig. 6 Interactive behavior of intuitive 3D transformation

V. Integration of Virtual Visualization Components

When all virtual visualization modules have been constructed they will be integrated into a common virtual platform where customers can create their own furniture via the platform. Based on the interactive behavior modules which have been developed previously, the interactive behavior modules of *intuitive 3D transformation*, material interchange, and related behaviors can be implemented on each furniture and interior module. Once the interactive behaviors of furniture modules have been set, they can be merged with their interior modules. When all the virtual components have been integrated into the common platform, they will be exported as a *virtools* player format and subsequently published on the internet.

Fig. 7 displays the digital modules of Zen chairs with Zen room. When all the digital components have been integrated and exported as web pages, the creation of personalized styling is possible. A total of 324 (3*3*2*3*6) possibilities for a set of Zen chairs can be achieved. Fig. 8 illustrates some variations of the Zen chair. Fig. 9 illustrates some variations of furniture with customizable interiors for customers to create their own personalized styling.

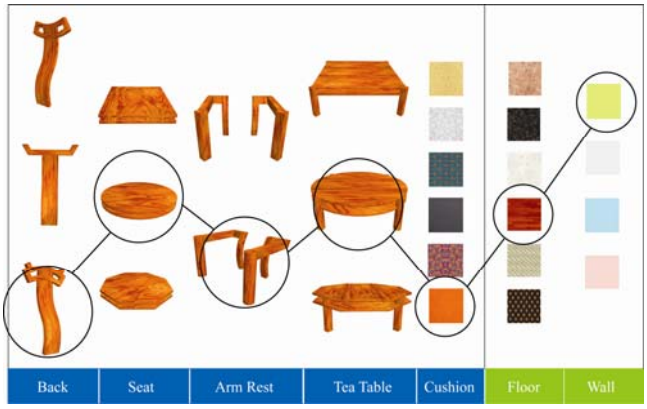


Fig. 7 Digital modules of Zen chair and Zen room

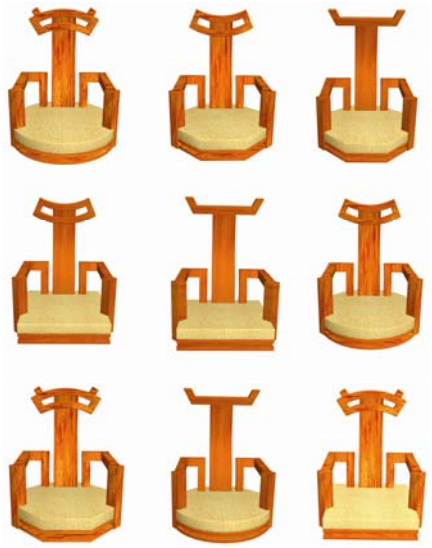


Fig. 8 Variation of Zen chair

VI. Conclusion

This design research makes a number of contributions to the promotion of mature products in an intensely competitive market. The contributions can be summarized as follow:

(1) Identification of a value opportunity

To revitalize mature products in the fantasy era, an *Enhanced Value Experience* has been identified for promoting higher product value. This shifts product development from product benefit to experiential value.

(2) Formulation of the *Interactive 3D Experience*

To achieve the *Enhanced Value Experience*, the *Interactive 3D Experience* has been formulated. The *Interactive 3D Experience* can assist designers to create unique product positioning.

(3) Invention of a *virtual intuitive 3D transformation*

The *intuitive 3D transformation* enables customers to explore variations with dynamic 3D prototypes in intuitive 3D visualization. This technique provides a more efficient method in searching for the best fit in product module selections for both customers and product designers.

(4) Development of an intuitive virtual platform for creating personalized styling.

The application of furniture development has demonstrated that an intuitive virtual platform for creating personalized product can be achieved. It provides product and environment differentiations for individual customers to choose from.

This research proposes an *Interactive 3D Experience* to enhance value for product development in the fantasy era. Finally, the intention of the research project was to investigate the concept of an *Interactive 3D Experience* and to construct a prototype. While both have been achieved, they none-the-less represent the initial stages of a fully operational system. Further research with more variations can be followed.



Fig. 9 Variations of chair and interior

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