The Scope of Design Utility

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Abstract: Utility is a fundamental concept of economics. Economics focused on individual consumer, producer and market behaviors, and, design research's focus is the same, but the methods are totally different. Economic utility is a measure of the relative satisfaction of consumption of goods, and utility theory stands for analysis of consumer's choice among alternatives, and ones balance between needs and desires for maximization of satisfaction, at a fixed cost. Cardinal utility, ordinal utility and marginal utility are concepts and calculations developed by economists for evaluation of consumer satisfaction in quantitative research. Whereas design is user centric, design research tends to understand consumers' needs and desires in the qualitative manor with less concern of cost and productivity. When neo-classical economics was blooming, modern design had not been founded. Today, few people understand the concept of economic utility. Utility is thought to be merely the usefulness of a commodity that can satisfy the needs of consumers. Consumer desires on the other hand, has to be satisfied by style designs. Consumer's needs and desires are often collaborative and not detachable. A continuous "Dimension of Design Utility" can be drawn between the extremes of Utility design and Style design. All designs could happen in this Dimension.

Key words: Design utility, utility, styles, design research, design economics

1. Introduction to the "Dimension of Design Utility"

The "Analogical Product Attributes (APA) Model" of Tong G. was first published in a conference paper by the IASDR 2009, Seoul [7]. At that time, the APA Model was introduced as a design centered analytic tool for business of design. Afterward, Tong further developed the Model into three levels or layers, for discrete analyses of "design", "business of design" and "design innovation", and exploited with it the relationship between design and business for innovation purposes, in his dissertation at Tsinghua University [8]. The APA Model framework was built upon the basic level of "APA Model for Analysis of Design" as shown in Figure 1. It expedites understanding of the design values of a product or service in four directions: "Community", "Utility", "Styles" and "Concept", and the relationships between the values. Tong argues that such understanding is vital to stimulation of idea for design driven business innovation.



Figure 1 Analogical Product Attributes (APA) Model for Analysis of Design

In business, and to the consumers, a commodity good is one with a generic or unspecialized functionality [3], such as sugar and flour, or things that are basically produced from the ground. To the economics and accountancy, anything that may facilitate exchangeability, inclusive goods and services, is a commodity. In the technological manufacturing industry, the generic components that formulate the main functions of specialized products, such as the CPUs and LED displays to the computer products, are called "commodity". Commodity components and parts are where the core technologies of a product are contained. The cost of commodity components is usually very significant to that of a consumer electronics product. In the same regard, the diamond of a wedding ring is also a typical example of the commodity. A diamond's commodity value can be enhanced by the certification of gemologist.

The value of commodity and the design of commodity can basically be measured by efficiency, but efficiency comes in different forms. Design is purposive, design criteria varies according to the business circumstantial changes. Therefore, the emphasis on value of the design of a commodity could vary between different measures of efficiency, such as quality, reliability, performance, size, speed, weight, production yield rate, profit, growth, cost...and etc. Nonetheless, technological development in industrialization is all about improvement on efficiency.

Derived from Commodity component is the notion of the utility model or basic model—designed and adapted for general use—of a product range, such as the low cost desktop computers in the computer products family. Because of its low cost and high adaptability, sales of utility units often represent the majority turnover of business. In many cases, utility model is "cash-cow" business.

Moreover, in the APA Model, the Commodity attribution of design value also refers to any basic functionality and exchangeability of an item producible through a business process.

To many people, the nature of a concept is vague, blurry, broad and not easy to understand. Design concept on the other hand, is very specific to many design professionals, though it is still not clear to the others. The outcome of a design process has to be tangible, and design solution unambiguous. To the design fields, the meanings of "design concept" and "conceptual design" are distractively different. The term of conceptual design might have derived from conceptual art. Conceptual design is the concrete representation of an idealistic, utopian, speculative or hypothetic design concept of the designer. Conceptual design is more often called "concept design", which is the prototyping of the aggressive design concepts. Concept design was first known to the public in 1950s when the American car manufacturers, GM, initiated the Motorama Shows to promote the "concept cars". The concept designs of car speculated only on "styling" in the beginning, then, speculate not only on styling but also function and usability, of products. Concept designs are not always producible and practical. On the other hand, most ordinary designs of products are in lack of a novel concept behind. Hence, novelty, practicality and manufacturability are the keys to innovation success. The Concept attribution of design value in APA Model connotes the conceptual idea of a product that is grounded through conceptualization in the design process, and practical and commercial considerations in the development process.

The "APA Model for Analysis of Design" consists of two dimensions. Across the dimension between Commodity and Concept, is the spectrum between Utility and Styles or "Dimension of Design Utility". At the heart of the APA Model, the "Dimension of Design Utility" or "Design Utility" concept holds the whole Model framework together.

Design happens between extremes, but never on the extreme, otherwise the subject matter is not a design but work of art, engineering or something else. In the regard, Design is uniquely "Utility in Style". A good design is an integration of the Concept value with Commodity value into a product through the aspiration of Utility and Style designs. Tong argues that the theory of "Dimension of Design Utility", as Figure 2 represents, can be developed into a fundamental theory for future development of the science of design.



Figure 2 Dimension of Design Utility

Utility is one of the most fundamental ideas of the economics. For a long period of time, economics was built upon theoretical development of utility. This paper tempted to supplement the discussion on "Design Utility" with historical development of the relevant economic theories, and relationships between some basic concepts of economics and design, from the perspective of design.

Modern design began to develop since the establishment of Bauhaus in 1919-1933, while the development of economics is a few centuries longer in history. In the course of globalization of market and economy, design has expanded and become vital to development of business. Under severe and recurring shock of the recent financial crises, doubts in traditional economic belief have arisen in the society. In downturn of economy, both ascending and transcending of business are more dependent on design and its development. Design is still a very young

discipline, and design research has only begun since 1960s, fundamental theories of the science of design have not been founded. Hence, knowledge framework for the design profession is in deficient. In comparison to economics, design is more of a practical skill, yet the scope of design is still expending. The condition has aroused the research interest of many other disciplines, but few works have been done on comparison of concepts between economics and design. Understanding of the conceptual relationships between the old and new disciplines will help further research on both ends as well as convergence of knowledge, hence the significance of this paper.

2. Utility in Economics

The main purpose of economics is to understand the individual consumer, producer and marketer behaviors. The concept of utility plays a very significant role in research of economics.

In the time of Smith A. (1776) and Recardo D., utility value was regarded as the usefulness of a commodity subject to exchange on the market, though Smith has never emphasized on utility since his "classical" work of the economics has no direct relationship with the usefulness of commodity. Attention had been on the cost and supply as determinant of price.

In the stage of the neo-classical economics, attention has shifted from cost and supply to desire and demand as determinant not only of price but also of productivity. Mechanization of price, cost and income distribution of market has become the focus of research. Utility becomes quantitative measure of relative satisfaction of consumption, and basic tool for conducting analysis of the economic phenomenon.

Economic theories are primarily built upon restricted assumptions. Neo-classical economists assumed that consumers are extremely rational, which means: (1) consumers' preferences are consistent; (2) they calculate the costs and benefits of all possibilities before making a decision of consumption, and that their calculations are always correct; and, (3) consumers are "utility maximization" driven.

Under these assumptions, the concepts of "utility function" and "production function" were introduced, respectively for the explanations of the consumer and firm (producer) behaviors. Utility represents one's satisfaction by consuming a unit, or a set of goods or services. Utility function is the mathematical way to describe

the alternatives of consumption bundled under the constraint of one's income. It is usually written in the form of "U = f (x1, x2, x3, ...xn)", in which from x1 to xn all contributes to the person's utility, and these alternatives may represent a car, a house, a leisure trip, and any commodity that can contribute to the increase of satisfaction if consumed.

There was strong argument that consumer satisfaction cannot be measured directly, but is possible to analyze consumer's choice among alternatives and his balance between needs and desires for maximization of satisfaction at a fixed cost. The concepts of "cardinal utility" and "ordinal utility" were put up for solving this problem. Utility theory was developed into measuring the relative satisfaction of consumption of goods.

Cardinal utility allows attachment of a value or score to each of the items that the individual consumes. "Util", as the unit for the measurement of utility, was introduced. Just like in volume, weight or length, one may simply add or deduct the number of utils assigned to each of the goods and services. For example, if a piece of bread has 10 utils of utility and a glass of water has 8 utils of utility, by consuming the piece of bread and the glass of water, one will get 18 utils of utility is total.

The concept of Cardinal utility has leaded to another fundamental economic theory, "marginal utility", to denote the additional utility one gets from consuming additional units of goods or services. As represented in Table 1 [6], marginal utility is diminishing, once total satisfaction is reached, the additional utility that one gets from consuming the extra units of the same products will decline, and eventually down to zero utility [6] and sometimes minus utility could result. It could happen also to the excessed consumption of goods and services of different kinds. According to the "rationality" assumption, people would not pay for the extra units of products that they will get zero utility from.

Table 1 Marginal Utility		
Consumption Amount	Total Utility	Marginal Utility
1	10	10
2	18	8
3	24	6
4	28	4
5	30	2
6	30	0
7	28	-2

Cardinal utility could provide an index of the individual satisfaction, but it is not convincing to say that every person's valuation of the goods and services are exactly the same. There was no universal standard for evaluation of satisfaction.

Then, "ordinal utility" was induced in 1930s, util comparison abandoned, and, consumer satisfaction is evaluated by hierarchic ranking of utility of products or commodities instead. In the above example that a piece of bread has 8 utils and a glass of water has 8 utils, we can still say that the bread is more preferred than the water, but we cannot tell anymore how much more utility the bread has against the water. Ordinal utility also indicates that the consumption of two pieces of bread gives the individual with more utility than if he or she consumes just one piece of bread, but it does not specify exactly how much more utility is provided by the second piece of bread.

Ordinal utility was considered a more objective measure of the subjective consumer perceived value of a commodity. Its basic principle of hierarchically ranking of utility has been developed into the popular qualitative research method widely used today, for example, in questionnaires designed for market survey on consumer satisfaction for the particular business forecasting inquiries.

Undoubtedly, both cardinal utility and ordinal utility can reach the outcome of a consumer demand curve, by jointing it with a supply curve derived from the theory of "production function", the price and quantity in market equilibrium could be determined. The fundamentals of the classical demand theory in microeconomics may still function today, yet the economists understand the deficiencies of these theories and therefore debate on the utility theory has never stopped, and meanwhile no common consent has been reached. Utility theory can easily be found in any economics textbook. It is not the purpose of this paper to discuss these theories in depth, but to review the significant concepts from the design perspective.

3. The Utility Attribution of Design Value

Today, utility theory of economics has been developed into stands for analysis of consumer's choice among alternatives, and his or her balance between needs and desires for maximization of satisfaction, at a fixed cost [4]. Total satisfaction has to be accomplished through consideration of both the usefulness of product and the consumer's personal preference. Design is user centric by no misgiving. From the perspective of design, its notion of the utility must align with that of today's consumers of goods and services, users of designs, and producers of products. When neo-classical economics was blooming, modern design had not been founded. Today, few people understand the utility theory of economics. Utility, to the majority of consumers, users and producers, is merely usefulness of products and services that satisfy the consumer's need of functionality. Personal preference or desire on the other hand, has to be satisfied by Design, in particular, design Styles.

Hence, the value of functionality and usefulness of product and service design is categorized as the Utility attribution in the APA Model that Figure 1 shows.

4. The Styles Attribution of Design Value

The work of Styles is exclusive to design. Styling is the main job of many professional designers in practice, including car designers, fashion designers, jewelry designers...and etc. Design is interpersonal, and Style design, in comparison to Utility design, is implicit. The concept of the Styles attribute in APA Model is broad, which can

be denoted by means of "general" styles and "specific" styles. Work of Styles includes appearance and aesthetic, general styles include form creation and styling for popular mass-merchandise, trend, fashion...and etc., whereas specific styles refer to personal attitude, way of living and doing, so is "lifestyles".

Styles has a longer than design's development lifeline to it, which is full of incongruities. Repellence between different styles still exists today and will continue to, which also connotes that preference between individuals could be very different. Leveraged from diverse consumer desire and preference is opportunity for design to create consumer value and to exploit new market demand with the design value. For example, some people who have already had a PC may still want to possess a newly launched Mac Air, simply because of its stylishness in both the appearance and usage. The economic assumption of "rationality" cannot stand alone in the "matured" markets today. The emotional desires of a consumer are far more complex and difficult to understand than his or her physical needs, but design has its answer to it. Design's counter offer to total consumer satisfaction, besides Utility, is Styles, and that it has been more practical than theoretical.

In APA Model, the design value of Styles, to the extreme, is defined as the virtual quality of a product of design intended to satisfy an individual of a group of consumers' preference or desire per lifestyles.

5. Disparities between Economics and Design Research

There are "things to know, ways of knowing them, and ways of finding out about them" [5]. Both the economics and design disciplines may have shared the same "things to know", but their "ways of knowing them" and "ways of finding out about them" are distinctively different. Economists are problem-focused, and they pay more attention to discovery of rules behind phenomena, whereas, designers are solution-focused, and are often obsessed with finding distinctive ways of doing things or solving problems [1, 2]. From the perspective of methodology, the difference is also fundamental. Economic research is in general quantitative whereas design research is usually qualitative.

Scientific method has been domineering in the fields of economics and other social sciences since natural science in 17th century. Scientific rigor has provoked quantitative development in research methodology.

Economic inquiry in research calls for proposal of assumptions for explanation of phenomena, and testing of the assumptions via predictions which can be derived from the assumptions. In the process, assumptions in the form of numeric models of the phenomenon are introduced. The process also requires precise numeric data, predictions and analyses for the arrival of a correct answer, or the research outcome.

Building of precise phenomenal model for specific research requires qualitative analysis to begin with. As per previous explanation, economics is fundamentally conceptual, yet its prime focus was on supply and demand in equilibrium or production and consumption relationship is broad sense. There was no tool in economics for understanding the individual's psychological desires before behavioral economics in 1950s.

Compare to economics, design research is interpersonal and substantial. Economists explain the behaviors of market, whereas designers create values for the consumers. Design research is qualitative, understanding tempts to be holistic and investigation inductive. The process of design research would involve a lot of observation and discussion on the experiences. Qualitative analysis in design studies aims at identification of basic factors and elements of the scenario, definition, attribution, variance and relationship between the factors and elements, for synthetic understanding and generalization of a reasonable explanation of the scenario.

Building of "scientific" model to derive a "precise" outcome is not the typical purpose of qualitative design research. Quantitative research on the other hand, must rely on the accuracy of qualitative understanding of the subject phenomenon for building of an effective model which shall lead to the correct mathematical analytic result.

We are not in the position to criticize economics or design research, but to analyze the conceptual differences between the two. To sum up what we have discussed:

Table 2 Disparities between Economics and Design		
Economics	Design	
Theoretical	Practical	
Abstract in nature	Concrete in outcome	
Problem-focused in research	Solution-focused in development	
Rational in thinking	Perceptual in thinking	
Analytical	Observational	
Quantitative and Numerical	Qualitative and Visual	
Result in Equilibrium	Result in Change	

6. Conclusion

A conference titled "...Integration of Management Science with Art Design" co-organized by the School of Economics and Management, and Academy of Arts and Design, of Tsinghua University, was held on 24 April 2012 [9]. At the incident, Prof. Qian Yingyi, Dean of School of Economics and Management, and other senior professors of the School, opined that there is limitation in economic research method, and, without major breakthrough in the method the development of economics and management will be slow. They believe that the hurdle is in way of understanding the consumers, since design is claimed to be user-centric and is practically satisfying, design must have the answer that they are looking for.

Obviously, design research is not easy to understand, not even for the design practitioners. Though there are many popular books written by economists under the various design related topics, and that the theories that these economists introduce are well received by the design community, "designer-researchers" have had little interest in the fundamental economic ideas hence are not able to express the design issues in the way that the economists could easily understand. This paper tempted to address such issues.

This paper conveys the view that the theory of Design Utility is as important to design as the economic utility theory to economics, the concept of Design Utility and APA Model is fundamental and is significant to the

development of the sciences of design, and, the Design Utility cored APA Model can consiliences the knowledge of economics and design.

This paper has revealed a possibility of the development of a comprehensive "quali-quantitative" research methodology through identification of the gap between qualitative and quantitative research methods, which also coincides with the "technological development for Kansei value creation" main theme of the IASDR 2013 Conference that this paper is intended for.

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