Interdisciplinary Trends in Design Education: the Analysis of Master Dissertation of College of Design and Innovation, Tongji University

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Abstract

This paper expounds the background of Chinese design education as well as the orientation of the design education of Tongji University in the new times, it also collects 458 master thesis of College of Design and Innovation during 2010-2016 as analyzed sample. Based on the coding of subject classification, quantitative analysis and content analysis are made in order to understand the interdisciplinary education status of College of Design and Innovation from the two perspectives: the overall cross-disciplinary performance and the relationship between different cross-disciplinary directions.

Keywords： Design Education， Interdisciplinary，3D T-shaped，Master Dissertation， Quantitative Analysis ， Content Analysis

In the past few centuries, social development has brought a highly refined social division of labor and thousands of occupations, thus affecting the accumulation of human knowledge and promoting the establishment of specialized subject classification in education sector. Each subject is divided into several smaller disciplines, and then subdivided into different professional direction. Of course, there is connection between the various professions, but what the classification tends to emphasize are their independence from each other and the relevance to their corresponding occupations (Gong , 2010). However, the problems we face today are becoming increasingly integrated and complex, and the disciplines highly refined for hundreds of years are gradually showing a new trend of blending with each other either in the design field or in other areas. For design, this " interdisciplinary " trend is particularly evident as it has a mixed lineage of different disciplines from its birth. Many scholars believe that the emergence of interdisciplines is necessary, as Friedman (2012) maintains, “most of today’s design challenges require analytic and synthetic planning skills that can’t be developed through the practice of contemporary design professions alone." Norman (2010) believes that complex problems involve complex systems and there are no simple solutions to solve them, he also pointed out that the old skills of drawing and sketching, forming and molding must be supplemented by skills in programming, interaction, and human cognition. And Norman himself, is the pioneers who integrates psychology and design into interdisciplinary research. To some extent, "interdisciplinary" design has become one of the necessary means to solve complicated social problems and promote the development of social innovation.

1 The Background of China’s Design Education

Compared to many Western countries, China's design education started late for many years. During the period of transition from handicraft to industry in China since 50s of last century, the arts and crafts major played the role of China's embryonic form of design education, and it performed more like the visual design based with pattern design and decoration design. As industrial civilization promoted the development of Chinese society rapidly, followed by the arrival of the information age, handicraft culture can no longer adapt to the the culture of modern city. In 1998, the name "arts and crafts", after being used for more than half a century, was replaced by "art and design"(also known as "design art") in the subject catalog promulgated by the Chinese Ministry of Education. If the traditional crafts can help people better understand what "arts and crafts" is, then the lower industrial level and social environment at that time did not have much help to make people understand what "design art " is clearly. The definition and boundary of design are still vague and confusing, and many major titles, such as "industrial modeling design" and "environmental art design", still seems closely related to art and shape.
And even more irony is that the graduation of design art is awarded with a literary degree. Since the beginning of the 1980s to this century, China has entered a period of rapid economic growth and the demand for design professionals increased dramatically, which has stimulated the large- scale development of design education as well. Some design schools are still focused on teaching design skills or methods of certain aspects (Gong, 2010), while several first-class design schools have a more open and inclusive understanding of design, and began to go with the tide of world development. In 2011, the Chinese Ministry of Education took “art” out from the literary category to make it as the 13th independent subject category, with “design” as one of its five first-level disciplines for the first time. And under the discipline, design is also subdivided into different majors，such as industrial design, visual communication design, environmental design and so on. At present, the rapid development of Internet technology has brought a new round of social change， with new business models, ways of thinking, and social relationships, as well as increasingly complex social problems and needs. These changes have posed new challenges to design field and have spawned a series of emerging design areas that are mostly interdisciplinary and innovative, such as interactive design and service design. As many western countries did, some design schools in China have gradually established interdisciplinary laboratories and incorporated these new crossings into their discipline systems.

In this sense, in China's design field and design education, the boundary of design has gone through such a process: from simple to fuzzy, from fuzzy to gradually clear, and then to the integration and expansion.

2 A 3D “T-shaped” Design Education Framework

The object, environment and requirements of design are becoming increasingly complex, which brought the design field with a series of new challenges. In this context, College of Design and Innovation (D &I) was established in May 2009 as one of the independent colleges of Tongji University, and before that it was only a part of the College of Architecture

and Urban Planning. On the basis of the discussion of "T-type talents" with both vertical and horizontal abilities at the same time, D&I has put forward a 3D T-shaped educational framework based on the prevailing Undergraduate-Master-PhD system: Undergraduate education focuses on vertical capability, aiming to educate design professionals who have innovative thinking and broad knowledge; Master education focuses though on moving beyond vertical capability toward horizontal development, emphasizing fostering learning experience of interdisciplinary knowledge, integration of innovation, design methods and international practice; PhD education emphasizes the depth of knowledge and theories (Lou & Ma, 2014) (See Figure 1). According to Lou, this orientation on the one hand is derived from the teaching tradition of Bauhaus， on the other hand, is related with the current undergraduate education conditions in China (Fang &Wang, 2015).

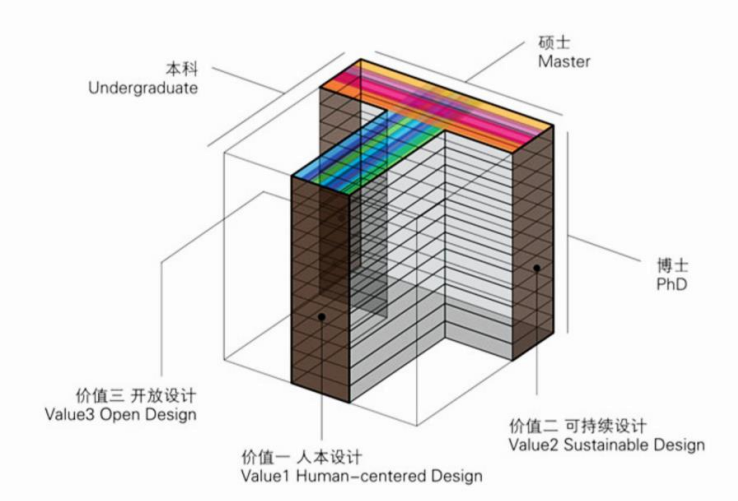

Figure 1: A 3D “T-shaped" innovative design education framework (Lou & Ma, 2015)

It is easy to understand that the emphasis on cultivating vertical capability in undergraduate education is largely based on the consideration of the existing social needs, while the emphasis on cultivating horizontal capability in master education is a positive response to the interdisciplinary trend. In order to meet this training goal, D&I canceled the classification of departments in its policy and teaching system, that is, to create a "program" system to organize different majors. (Fang &Wang, 2015). All the students are distributed into 3 vertical programs (industrial design, environmental design, media and communication design) and 4 horizontal programs (interactive design, product service system design, design strategy management, design history and theory) according to their choices. In addition to taking the required courses included in one’s own program, he can also choose courses or projects in other programs freely and get the credits, which breaks the obstacle of interdisciplinary between different departments. In addition, two practical projects, collaborative design and collaborative innovation, are set in the master's teaching modules respectively in the second and third semester, which promotes the master students to deal with complicated design issues through the communication and cooperation with students of different majors.

D&I came into being in the transition era of design, and its reform was carried out step by step during the process of exploring development and teaching practice. Reconsider this process, we would like to ask: How much does the idea of fostering interdisciplinary knowledge and integration of innovation impacts the students? And What is the actual performance of the students in the interdisciplinary design and research? As we know, the master students receive professional education and engage in academic research in the college, their thesis can reflect their status of design and research intuitively， which means the dissertation could be an important medium for us to get the answer.

3 Research Designing

3.1 Data sources and methods

The master dissertation data of graduates for this paper is derived from the Degree List of Tongji University (Degree management office, 2016), and the sample collected starts from 2010 because the D&I awarded its first batch of master's degree in this year. Finally, 458 title lists of master dissertation of D&I from 2010 to 2016 are collected in total, each containing the author's name, degree award Year and thesis title. Based on this sample, this paper is going to make a research by quantitative analysis and content analysis (Qiu & Zhou, 2004) among all these title lists, and to give a description and brief review.

3.2 Data processing and research steps

In the data processing stage, this first step is to use the Excel software to quantitatively analyze the year of the degree awarded and dissertation quantity correspondingly, and then describes the general situation of the master's degree granted in the College. In the second step, the coding table of disciplines/majors is compiled according to the title lists of all the dissertations. The third step is to manually analyze the subject content of each dissertation and code it with its involved disciplines/majors tags. When it comes to the one that is difficult to judge, keywords, abstract and the full text of the dissertation will be used to help make an identification.

3.3 Coding process

As the research range in design field is broad and blurry, and the academic framework has not established yet, there is no clear classification of disciplines that can be applied directly. This paper is to explore the interdisciplinary trend on the basis of the existing disciplines. To ensure a targeted research, the classification of discipline was based on the combination of the 7 programs of D&I, the "six in one" design arts disciplines system described in the article Design Objectives and Scope of Design Art Studies by Li (2003) as well as the the actual topics presented in the sample. As a result, the10 design disciplines tags were identified to cover all the major design categories contained in the sample: 01 industrial design, 02 environmental design, 03 media and communication design, 04 interactive design, 05 product service system design, 06 design strategy and management, 07 design history and theory, 08 craft design, 09

experience design, 10 system design. It is worth noting that "04" , "05", "06" and "07" are the D&I's horizontal "program", which themselves were developed by the cross-disciplinary, but what will be discussed later in this paper is the re-cross and re-integration based on regarding them as separate independent disciplines or majors.

For the main non-design disciplines involved in the sample, this paper referred to the classification of "related disciplines" by Li (2003) and the existing disciplines in the field of natural sciences and humanities, and identified which has been a lot of non-design disciplines categories: computer science, materials science, psychology, culture, economics, marketing, behavioral science and so on.

Coding the title lists is the core of this research. According to the coding tags formed above, all the master dissertations in the sample will be classified into the 10 design disciplines and the corresponding non-design disciplines. The classification criteria described in Object and Scope of Design Art Studies is the main standard of coding. However, the boundaries of each discipline are not very clear actually, so the coding process needs always follow the principle of " closely linked to subject, highly summarized, with no one missing " (Yan& Zhang, 2015).

4 Analysis of the Sample

4.1 The overall situation of the dissertations

In general, the number of dissertations is basically stable at 60-70 per year, while in 2013 there was a small peak, mainly because there were 17 double master's degree students coming from the other countries who were awarded a master degree in this year and it is generally at 6-12 or less in other years (See Table 1).

Table 1 Distribution of the number of master dissertations in different years

Year of degree granted	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*Total number of dissertations*
Total number of dissertations	61	56	57	82	69	68	65	458

4.2 The distribution of disciplines and the interdisciplinary trends

It can be observed that the main research contents of many master dissertations involve different disciplinary dimensions, including the cross of the directions related to design and the cross between the design disciplines and the non-design subjects.

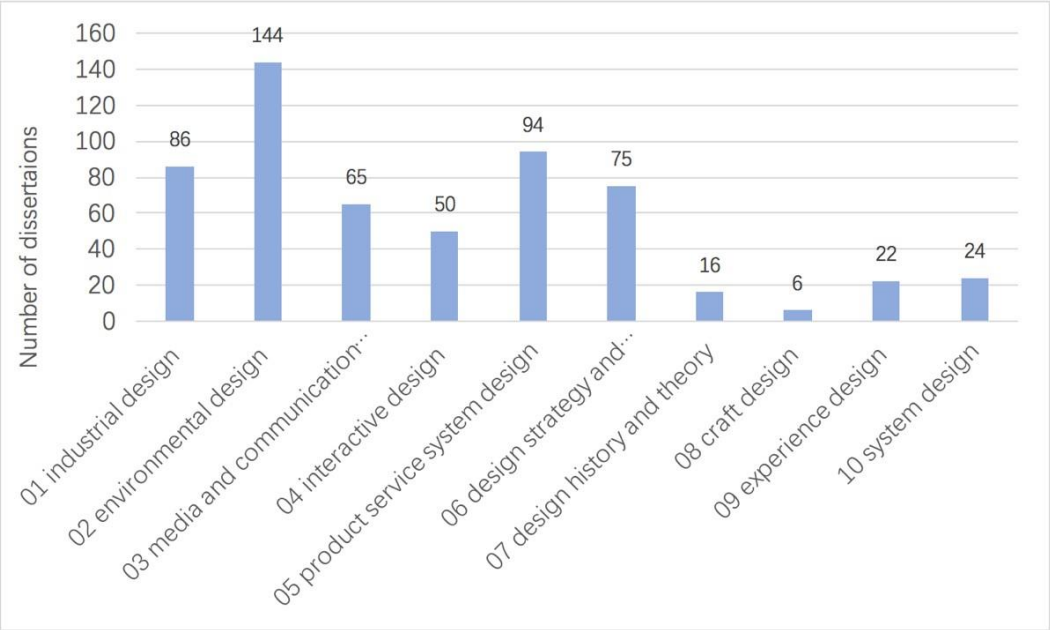

Figure 2: Distribution of the number of master dissertations at D&I in different design disciplines

Just look at the distribution of 10 design disciplines/majors，the dissertations involved in all directions is not uniform. As shown in Figure 2, environmental design, industrial design and product and service system design are the most concentrated directions, especially environmental design with 144 dissertations related to it, and the number of industrial design direction is 86.
Although the product service system design has been frequently mentioned in China only in recent years, the master dissertations in D&I has been a large number, up to 94.

In general, most of the dissertations focus on one discipline or direction. But in the total 458 master dissertations, there are still 183 significant interdisciplinary performances, and the proportion is over 40%. Among them, a large part (92.3%) of the interdisciplinary dissertations mainly involves the research of two disciplines, and there are still a few involving 3 to 4 subjects. (See Table 2).

Table 2 Proportion of interdisciplinary dissertations

Number of crossed disciplines	*1*	*2*	*3*	*4*
Number of dissertations	274	170	13	1
Proportion	59.86%	37.12%	2.84%	0.22%

4.3 Multi-dimensional association between disciplines

As the majority of the interdisciplinary dissertations are those involve two disciplines or majors (92.3%), and it is more convenient for us to observe the relationship between two variables, this paper in the following will deal with this part of data to make a statistical analysis in order to find out more rules in the association between different disciplines.

This paper grouped the statistics of dissertations involving two disciplines and then got the the correspondence between various disciplines (See Figure 3). The figures in the cells of Figure 3 represent the number of dissertations involving the two disciplines that correspond to that correspond to the horizontal and vertical directions. From the total quantity of cross-disciplinary dissertations, the discipline which has the largest number is environmental design, followed by industrial design, design strategy and management, media and communication design, which reflects to a certain extent that the vertical discipline such as industrial design, environmental design and visual communication design, shows a greater potential in combination with other new disciplines compared to the horizontal cross-disciplines. In addition, there are also 62 dissertations related to both design and non-design disciplines, indicating that the cross between design disciplines and non-design disciplines is also significant. The following will be the specific analysis of the interdisciplinary association.

Number of crossed master dissertations	01	02	03	04	05	06	07	08	09	10	Non - design discipline
01			2	3	3	8	2	1	3	1	20
02			9	3	6	8	1		10	11	17
03	2	9		6	3	8	3	1	1	1	3
04	3	3	6		2	2			2		5
05	3	6	3	2		3	1		2		6
06	8	8	8	2	3		1				8
07	2	1	3		1	1		1			
08	1		1				1				
09	3	10	1	2	2						1
10	1	11	1								2
Non - design discipline	20	17	3	5	6	8			1	2	
Totality	43	67	37	23	26	38	9	3	19	15	62

Legend:

01 industrial design 02 environmental design 03 media and communication design

04 interactive design 05 product service system design 06 design strategy and management

07 design history and theory 08 craft design 09 experience design 10 system design

Figure 3: The Correspondence of two crossed disciplines

4.4 Interdisciplinary research within design disciplines

Most of the main disciplines and directions involved in the master dissertations are in the range of design disciplines, which perform as the communication, infiltration and interaction between various design disciplines.

In Figure 3, the interaction between environmental design and other disciplines is the most frequent. From the perspective of its cross-correlation, the integration of environmental design with system design as well as experience design is relatively frequent, followed by media and communication design, design strategy and management, service system design. Observing the specific dissertation titles, the integration of environmental design and system design is mainly based on the design for residential space, exhibition space, farm community, subway transfer space and other space. As it shows in Table 3, the systematic design focuses more in global organization and overall optimization compared with the layout planning and decoration design in the traditional environmental design. In addition, the combination of environmental design and experience design mainly focus on the design of commercial space, learning space and display space, while the integration of environmental design with media and communication design is manifested in the visual image design, information system design and guidance system design of a certain space. The expression in the design of the guidance system often needs the elements and tools of media to help convey its idea, but guidance system design requires a stronger spatial cognitive function compared to media and communication design alone (See Table 4).

Table 3 Title list of Master dissertations involving environmental design and system Design

Year of degree granted	*Author*	*Title*
2013	Francisco	Application of System Design in Xianqiao Village of Chongming Island
2013	Bao Peijin	Systematic Design of Traffic Space of Subway and bus transit hub in Shanghai
2014	Zhou Huping	Research on the Interior System Design of Old People 's Residence in Shanghai
2014	Tao Ruoshi	Research on the System Design of Indoor Residential Energy Saving in Shanghai - Based on the Encouragement Policy of Small Households in China
2014	Li Na	Research on Method of Sustainable Design for Exhibition Space
2014	Su Zhaoyang	Research on System Design Method of Sustainable Design in Campus
2015	Andrea	System Design of Xingen Farming Community
2015	Zhang Yi	Research on Community - based Urban Family Storage Space System Design
2016	Tang Wen	Research on System Design of Temporary Sale Space under Exhibition Space

2016	Han Xinhui	Research and Application of Market Ecosystem Design in Shanghai Core City
2016	Chen Qiming	Research on the Systematic Design of Narrative Space in Specialized Museums under Tourism 4.0: A Case Study of Shanghai Urban Historical Development Exhibition Hall

Table 4 Title list of Master dissertations involving environmental design and media and communication design

Year of degree granted	*Author*	*Title*
2010	Lu Di	Research on the Application of Planar Visual Elements in Modern Building Facade Design
2010	Qian Fengde	Exploration of Shanghai Rail Transit Site and City Image
2011	Xu Li	The Design and Research of Humanized Guidance System
2011	Shen Dongdong	Extension of Plane Elements in Interior Design - Taking Shopping Commercial Space as an Example
2013	Luo Lu	Information System Design in Ecotourism - Taking Shaxi Navigation Chart Design as an Example
2013	Sun Junying	Design and Research of Campus Logo System - A Case Study of Tongji University 's Campus
2014	Li Yiran	Visual Image Design of Tourist Area - Taking the Visual Image Design of Shuangshan Island as an Example
2015	Wang Shishun	Study on the Relationship between Information Structure and Spatial Combination of Town Hall
2016	Gong Ping	Research on the Design of Commentary System in China National Park

What's more, the interdisciplinary characteristics of industrial design is relatively clear as Figure 3 shows. In many design disciplines or majors, the association of industrial design and design strategy and management is the most obvious, including strategies research on competition for students and industry design enterprises, and the improvement of brand image or exploration of design management for the industrial design-related Enterprise ,as well as process research of specific product design (See Table 5).

Table 5 Title list of Master dissertations involving industrial design and design strategy and management

Year of degree granted	*Author*	*Title*

2010	Pan ming	A Study on the Strategy of Concept Product Design Competition - Taking the College Students' Entry as an Example
2010	Gao song	The Relationship between the Image system of Engineering machinery products and its Brand
2010	Liu lian	Research on Enterprise - led Industrial Design Competition
2011	Fabio	Application and Research of Design Management in Automobile Wheel Development System
2011	Chen xu	Research on the Relationship between Luxury Design and Luxury Brand Image - Based on the Learning and Practice of Richemont School
2011	Jiang yan	Exploration of Automobile Design Management
2012	Yin chuan	Research on Innovative Design of Data Behavior of Industrial Designers - Taking Handheld Power Tools as an Example
2012	Cao wei	A Preliminary Study on the Design Process of Household Medical Devices

Except for environmental design and industrial design, the interdisciplinary design is relatively frequent between design strategy and management with media and communication design. For example, "brand design" is usually locate the brand image through strategic method, and express the brand concept effectively by the means of media and communication design. Media and communication design and interactive design also have a lot of integration, such as “game design”, its presentation is often inseparable from the collaboration of both visual communication design and interactive design; In addition, "interface design" often appears in industrial products, tending to make an interactive interface for the product, and it is usually combined with the media and visual communication design as the graphic design knowledge often plays a fundamental role in this process.

4.5 Cross research between design disciplines and non-design disciplines

As we can see from Figure 3, the design disciplines do not only make an internal integration with the other design related disciplines, but also collide with some non-design disciplines to form new research directions.

All non-design disciplines included in the samples cover a wide range of disciplines, exceeding 30 categories. Among them, psychology and materials science appears the most frequently, followed by behavioral science and culture. Computer science also appears, especially in the application research of the current cutting-edge technology such as virtual reality and augmented reality. Some disciplines appear few times in the sample, but are quite characteristic, such as information visualization, network engineering, mathematics, perceptual engineering, physical education are such related non-design disciplines and so on (See Table 6).

Table 6 distribution of non-design disciplines mainly involved in the Master dissertations

Non - Design Discipline/ majors	*Number of dissertations*	*Non - Design discipline/ majors*	*Number of dissertations*
Psychology	8	Environmental Engineering	1
Materials science	8	Structural mechanics	1
Culture	7	Green design	1
Behavioral science	7	Transport Engineering	1
Economics	4	Perceptual engineering	1
Animation design	4	Mathematics	1
Computer science	4	Aesthetics	1
Pedagogy	3	Fine art	1
Agriculture	3	Information visualization	1
Market science	2	Network engineering	1
Acoustics	2	Bionics	1
Optics	2	Biology	1
Sociology	2	Public management	1
Statistics	2	Physical education	1
Manufacturing	1	Transportation Organization	1
Human engineering	1		

In the direction of the 10 design disciplines, industrial design integrates with non-design disciplines most actively, with 20 dissertations in the sample. Among them, the combination of industrial design and psychology has a high quotient of the master dissertations. For example, the dissertation Analysis of the influence of the design of the lighting products on the user 's emotion written by Liang Guopeng and Research on the approaches of emotional design for Chinese kitchenware written by Li Bo are typical case of emotional design which explores how to take the user's psychological needs as starting point to improve the emotional effect of the product design. Moreover, material science is also a major discipline that industrial design combined with. Interestingly, the three dissertations which shows such a combination in the sample all have discussed the application of bamboo material in product design, it might because bamboo itself has excellent nature characteristics and Chinese have a deep affection for it. In addition, behavioral science and culture are also the non-design disciplines that combined with industrial design frequently (See Table 7).

Table 7 Title list of Master dissertations involving industrial design and non-design disciplines

Year of degree granted	*Author*	*Title*
2010	Zhao Ke	From Manufacturing to Design: A Study on the Present Situation of Industrial Design of OEM Enterprises in Yangtze River Delta – Taking Speaker Products as an Example

2010	Lu Cang	Research on Personalized Design of Interesting Small Products
2010	Lu Xi	Research on Product Design Based on Play Behavior
2010	Liang Guopeng	Analysis of the influence of the design of the lighting products on the user ’s emotion
2010	Wang Yun	A Comparative Study on the Design of Outdoor Seat in Shanghai and Milan - From the Perspective of Behavioral Research
2010	Chai Zhi	Research on Application Design of Bamboo in Business Gift Design
2011	Peng XiaoLu	The Design and Research of Children ’s Furniture Growth and Interest
2011	Guo Sifan	Research and design of children ’s daily necessities for the purpose of cultivating good habits
2011	Shu Qiong	Research on the Application of Sound Design in Product Design
2011	Wang Xibei	Research on Design of Household Portable Medical Products Based on Inductive Engineering
2011	Wu Ting	Research on the Application of Light in Interactive Product Design
2012	Zhao Minjie	Mathematical Elem
2012	Lin Lin	Research on the Re - combination Design of Bamboo Material in Modern Design
2012	Zhao Yongzhi	Research on Modern Gift Design with Chinese Traditional Culture
2012	Zhao Jing	The Presentation of ″Double Decoding″ in the Design of Tourism Souvenirs
2012	Li Bo	Research on the Emotional Design Method of Chinese Kitchenware
2012	Zhu Gang	Conception beyond the Image ——Exploring the Artistic Conception of Product Design from the Perspective of the Relationship between Traditional Poetry and Calligraphy
2012	Ye Qigui	A Study on the Design Approach of Chinese Harmonious Culture Inheritance in Domestically-designed Products as Internal Connection
2012	Wang Xiao	Research on the Application of Bamboo in Household Products Design
2012	Chen Kewei	Research on Product Design that Help to cultivate Children ’s Good Living Habits

Environmental design also has been combined with non-design disciplines a lot in researches. Some of them discuss how materials can be used in environmental design, some of them explore how to incorporate culture or bionics into space design. In addition, the combination of agronomy and environmental design is also typical in research, which is mainly based on the introduction of the topics "family farm" in recent years， it has also formed a new area gradually for the cross research in environmental design field.

Besides, there are many cross-research examples between interactive design and some other non- design disciplines, such as the design research of children's educational games on mobile terminal based on the collaboration of pedagogy and interactive design, as well as the dissertation Research and application of augmented reality technology in the APP Design of Mobile Terminal written by Cui Xiaochen in 2016, which combines both computer science and interactive design to follow the research boom of AR in the current technology industry. In addition, Media and communication design is often combined with the specific branches of culture, trying to seek inspiration for graphic design from certain cultural elements.

5 Conclusion

In the past seven years, D&I in Tongji University has formed a philosophy of expanding the students' capability from horizontal to vertical through the educational practice, just as the formulation in its 3D "T-shaped" Design Education Framework, learning interdisciplinary knowledge, integration of innovation and design methods are emphasized in the master education. The topics of years of master dissertations in D&I actually reflects a great degree of "interdisciplinary" performance as a result. Among them, the cross-integration within the design disciplines takes over the dominant position, and the communication between the design disciplines and the non-design discipline is also reflected in numbers of master dissertations, especially the integration between industrial design and environmental design with psychology, materials science, behavior science and some other relevant disciplines.

As an applied discipline, the design is responsible for solving the practical problems of the society, so that to adapt design education to the practical social needs is particularly significant. Interdisciplinary education is not a denial or subversion of the classification of traditional disciplines, but should be understood as the way to form a new academic point of view, methods and cognitive through the interaction and integration between multiple disciplines (Tang, 2014), its core lies in enhancing diversity of research organizations and disciplines structures, thereby enlisting the subject and promoting innovation to address the increasingly complex social problems. In the specific design education practice, it is important to implant the sense of jumping out of circle into the students' mind, so as to make the interdisciplinary idea become their conscious behavior in order to cultivate a group of qualified innovative and compound design professionals.

References

Fang, X.F., Wang, X.M. (2015). Active school, sustainable development - Interview with Dean of Design and Creation College of Tongji University Lou Yongqi. *Decoration* (10), 55- 59. doi: 10.16272/j.cnki.cn11-1392/j.2015.10.010

(in Chinese: 方晓风, & 王小茉. (2015). 主动办学,永续发展——访同济大学设计创意学院院长娄永琪. *装饰* (10), 55-59. doi: 10.16272/j.cnki.cn11-1392/j.2015.10.010

Friedman, K. (2012). Models of design: envisioning a future design education. *Visible Language*,46, 21.

Kong, M. S., (2010). Interdisciplinary: the design of new trends in higher education. *Creativity and design*(2), 32-35.

(in Chinese: 巩淼森. (2010). 跨学科:论设计高等教育的新趋势. *创意与设计*(2), 32-35.)

Norman，D. (2012). Why Design Education Must Change. Retrieved from http://www.core77.come/blog/columns/why_design_education_must_change_17993

Li, Y.Z. (2003). The Object and Scope of Design Art Studies. *Journal of Tsinghua University (Philosophy and Social Sciences)* (5), 69-75.

(in Chinese: 李砚祖. (2003). 设计艺术学研究的对象及范围. *清华大学学报(哲学社会科学版)*(5), 69-75.)

Lou, Y. Q. & Ma, J. (2015). A 3D "T-shaped" Design Education Framework. Springer International Publishing. doi: 10.1007/978-3-319-09909-5_7

Lou, Y. Q. & Ma, J. (2014). Emerging Practice: Design Specialty, Value and Approach. *China Construction Industry Press.* (pp. 228-251)

(in Chinese: 马谨, & 娄永琪. (2014). 新兴实践:设计的专业、价值与途径. 中国建筑工业出版社. (pp. 228-251)

Q, J.P., & Zhou, F. (2004). Research on Content Analysis Method. *Chinese Journal of Library Science*,30(2), 12-17. doi: 10.13530/j.cnki.jlis.2004.02.002

(in Chinese: 邱均平, & 邹菲. (2004). 关于内容分析法的研究. 中国图书馆学报, 30(2), 12-17. doi: 10.13530/j.cnki.jlis.2004.02.002)

Tang, R. M. (2014). Innovative Design Education: the Interdisciplinary Development Trend of Higher Education in Art Design. *Journal of Nanjing Institute of Arts (Fine Arts & Design)* (5), 125-128.(in Chinese: 汤箬梅. (2014). 创新设计教育:艺术设计高等教育跨学科发展趋势. 南京艺术学院学报(美术与设计)(5), 125-128.)

Tongji University Degree Office, (2016). the Degree List of Tongji University. Retrieved from http://gs.tongji.edu.cn/html/xwgz/zsmd/2016/11/08/d98a7ed5-b0ff-4430-949d-17dd672dbeb3.html.

(in Chinese: 同济大学学位办.(2016). 同济大学授予学位名单. Retrieved from http://gs.tongji.edu.cn/html/xwgz/zsmd/2016/11/08/d98a7ed5-b0ff-4430-949d- 17dd672dbeb3.html.)

Yan, B. N. ,& Zhang, T. (2015). A Review of the Research on Library and Information Science in Taiwan and Its Prospects and Prospects: An Analysis Based on the Contents of Master's Dissertations. *Chinese Journal of Library Science*, 41 (4), 83-95. doi: 10.13530 / j.cnki.jlis.154007

(in Chinese: 严贝妮, & 张彤. (2015). 我国台湾地区图书资讯学研究的回顾、现状与前瞻:

基于博硕士论文内容的分析. 中国图书馆学报, 41(4), 83-95. doi: 10.13530/j.cnki.jlis.154007)

Author Biography

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Lisha Ren was awarded her doctorate in architectural history and management by Tongji University in 2010, and she has been a visiting scholar at University IUAV of Venice, Venice International University and Lehigh University. She is currently working as the associate professor and master tutor in College of Design and Innovation, Tongji University. The main research directions of Ren include design history and theory, bridge aesthetics and bridge landscape, and she has published a number of professional papers at international conferences such as IASDR, DRS, CUMULUS.

Yan Wang

Yan Wang is currently studying for her master degree in College of Design and Innovation, Tongji University. She has communicated in the Italy design summer school organized by the University of Bologna in 2016, and have also studied in University of Art and Design Offenbach in Germany as an exchange student.