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What is Industrial Design? Providing a Guide for University Applicants

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Abstract: *There are currently a wide range of Higher Education Industrial Design courses available in the UK. In the present era, a wider breadth of narrative has developed within the subject, and as a result the content of industrial design educational offerings varies considerably. The paper assesses the industry view of Industrial Design as a discipline from the perspective of those employing university graduates. These views illustrate a change in the discipline, and this is considered in respect to current education practice. The choice of entry courses for the student wishing to embark on a career in the subject has also widened. It is argued that at present, the access to courses offers a haphazard informational stream to the potential applicant. An approach to developing an online facility to enable potential students to apply for the right course is discussed. It is suggested that a consistent and comparable platform of guidance is needed by which potential students can identify and match the course offering against their aptitudes and aspirations. Given that course choice will ultimately define the nature of their career opportunities this would be a useful and productive asset.*

Keywords: Industrial Design, Design Thinking, Learning style categorization, University Applicant

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Introduction

Industrial design as a profession emerged when competition in the market place gave consumer choice, and is generally dated to the beginning of the 20th century (Heskett 1980). The idea of Industrial Design as a mingling of form and function and the need to meet business expediencies is well established and quoted in its history (Ulrich and Eppinger 2000).

Industrial designers' require knowledge and skill in aesthetic design practice informed by ergonomics and engineering. An understanding of technical processes and requirements for manufacture; marketing opportunities and economic constraints; and distribution sales and servicing processes are also important (IDSA 2013). The balance of these subject areas, course content and the teaching and learning approach adopted however, will vary based on the undergraduate degree course completed.

Potential students are drawn to degree courses by a range of factors including geographical location, university and departmental reputation, facilities and equipment available, personal recommendation, and impression gained by open day. These criteria for selection may not provide a good match between the student and course, potentially leading to student dissatisfaction and drop out. In order to attract and retain the best students, universities need to consider other selection tools for use by students beyond marketing material, prospectuses and reputation.

The current system for university entrants is based on subject choice and level of attainment. The student will have undergone a substantial program of examined education through which their abilities and aptitudes will potentially have been diagnosed. It is assumed therefore that they have had an educational experience across the science and artistic spectrum, and that their results will be an accurate representation of their aspirations and abilities. However, there are a number of limitations to this information including the influence of the schools and teachers, the match between the examination contents and the abilities and aptitudes required by the profession, and the match between the school –level subject of design, and degree level design. The National Curriculum Design and Technology program as taught in secondary schools and regarded as the educational pathway at secondary school level for Industrial Design focuses on the skills/manufacturing aspect of the discipline, which may not accurately represent the subject at undergraduate level.

Degree-level design education is largely studio based and experiential (Lawson 2006). Generally, designers' learning tends to be exploratory and flexible and is well matched to the adaptable, project-based methods of teaching typically employed that involves a large amount of personal tuition. In the traditional design studio pedagogy '*…certain phenomena appear to be chaotic or random, they are actually part of a coherent process'* (Kuhn 2008 p178 cited in Wang 2010). Wang describes and compares the 'positivist' science based teaching of design, sometimes referred to as the 'road-map' approach; and the 'atelier' system, based on free creativity. He suggests the second can be criticized for its potential lack of parity, and influence of individual teachers, such that one experience may not be the same as another. However this has been the usual system of design teaching for over a hundred years. Wang (2010 p173) notes ' *There is a feeling among many design educators that today the discipline has reached a crisis in its development, and that change is needed immediately in the way that design educators articulate their epistemology and their methodology*'.

This paper argues that in recent times, there has been significant change in the Industrial/Product Design sector with design's application becoming broader (Keinonen, 2008). This has inevitably been reflected in the pedagogies being taught at different institutions. University applicants to degrees in the discipline are to some extent victims of this change. It is the responsibility of the sector to give greater clarity to prospective students on the nature of the subject they are to study. The necessary first step to this is, for the sector itself to identify the categories of curriculum being practiced and to make these more explicit to potential students.

The aim of this research is to assess the industry view of Industrial Design as a discipline from the perspective of those employing university graduates. These will be used to comment on whether there is a change in the discipline, and the nature of this change in respect to current educational practice. These views will then be considered in respect to the requirements of the future profession, and a suggestion made for an online facility to enable potential students to apply for the right course.

Exploring the views of design professionals

Method

A written narrative analysis approach was used to collect and compare the views of established designers on the current focus of Industrial Design as a discipline. Five experienced designers were selected, all of whom are business leaders, to represent a range of different organizational sizes and areas of industrial design. As potential employers the participants could provide a reference to the desired future career destination of graduates. The sample is summarized in Table 1 below:

Table 1. Summary of participants

Participant	Years experience	Job role	Size and type of organization
1	18	Director	1-5 employees, contemporary
2	34	Director	1-5 employees, established
3	38	Senior Partner	15-20 employees
4	30	Principal, Product Design	35-50 employees
5	32	Design Manager	200+ designers

The designers were contacted and invited to take part. Upon agreement they were then asked to provide a considered written narrative to the title 'What is Industrial Design?' They were not given a specified number of words to provide. Thematic analysis of the resulting data was undertaken. 5 key themes were identified through the analysis and the importance of these 5 themes was identified based on the frequency with which they were referred to during each narrative.

Results & discussion

The text lengths varied between 439 and 1042 words. The analysis revealed 5 key themes that were used to describe Industrial Design within the collective narratives, these were defined as follows:

- **Business:** Words referring to the business aspects of an Industrial Design company, e.g. commercial, dialogue with clients, managing client expectations.

- **People:** Words referring directly to human investigations e.g. ergonomic tests, customer insight investigations, ethnographic research, market analysis.
- **Operation:** Words referring to the design process as carried out by the design company itself, application of techniques and tools such as CAD, presentation techniques, consultancy offer frameworks.
- **Function:** Words relating directly to designing as an iterative activity of exploration and experimentation to find solutions to a brief that has been constructed to create artefacts to perform a purpose.
- **Cognitive:** Words referring to intangible thought and emotion based activities e.g. dream, innovate, inspire, ingender.

For each narrative the words linked to each key theme were identified and counted. Table 2 below summarises the number of word references in each of the 5 design themes produced by the participants.

Table 2. Table of keyword segmentation taken from texts of 5 design company leaders

Design Company	Business	People	Operation	Function	Cognitive
Contemporary 1-5	3	3	13	6	8
Established 1-5	11	1	6	2	10
15-20	9	12	2	4	23
35-50	8	1	8	1	19
200 plus	3	1	7	1	30
TOTALS	34	18	36	14	90

The results show that the most words used to describe Industrial Design fell in the cognitive theme (n=90) that is 'words referring to the intangible, thought-based activities'. The proportion of 'cognitive' keywords used appears to increase with the size of the business (this is not consistent since text length varied). Some of the statements given include:

'The Industrial Designer can visualize his dream he can define it and share it and inspire' (P3)

'Industrial Design is not what it was 20 years ago! It is far more intellectually rigorous' (P5)

Cognitive attributes referring to thought and emotion based activities took a prominent part in all of the narratives. '*Innovation', 'design thinking', 'vision',* and '*culture*' are referred to as explicit aspects of the industrial design offering to clients;

'We create dreams, we develop themes, we provide direction, we provoke discussion and we engage in discourse. And we like to disrupt..'(P4).

Industrial Design as presently described varied considerably from a traditional skills/task analysis base to a cognitive emotional activity base. The focus of the narratives was found to differ based on the type of organisation that the participant represented. The small businesses had a less clear focus on cognitive activities and were found to refer more to the operation of their business, and the meeting of outcomes for their clients businesses.

Thematic analysis of the statements indicates the move towards '*the globalisation of design*' and the increasing importance of human and therefore intangible skills on the part of the graduate Industrial Designer. The role of the designer to *'create dreams' and 'disrupt'* and balance this against practical delivery of a design solution was clear.

The results suggest that the current view of professional practise does not just lie in a traditional Industrial Design domain. The leading statements by four of the five designers were not concerned with the Industrial Design framework of form, material, production, market place, aesthetics, and costs that have traditionally formed the primary content of industrial design practice. Instead the drive at senior level is for cognitive capabilities such as visualisation and communication.

Industrial Design has always straddled the two camps of rationality and free creativity, and the observations of the five texts of the professional designers suggest that both ways of thinking are applied in the professional discipline and should therefore be reflected in the education. In observing the dominance of these cognitive qualities it would be wrong to suggest that the categories of business , people (ergonomics), operation and function were not still significant, and teaching in these areas equates more with Wang's 'positivist' methodologies. However, the most striking observation from the texts is the dominance of references to cognitive words describing intangible qualities. The term 'Design Thinking', which has strongly engaged the interest of practitioners and educators in the design sector in recent years embeds methodologies that relate to a non-regulated approach to Industrial Design. Its methodologies are already being explored in various centres of design education, and its explicit inclusion into the declared curricula of undergraduate Industrial Design degrees.

It is argued here that the relevance and role that these skills now play in degree courses is not made sufficiently explicit or understandable, to potential students who have been exposed only to school level design education. Evidence from the employer's side supports the expansion of the Industrial Design narrative and indicates the need for communication and clarification to the teenage applicant whose experience is only within the secondary school system.

This paper therefore scopes out a potential tool for matching students to available courses based on their personality and learning preferences. It aims to identify the key components of industrial design in order to inform improved matching of students to degree courses in a way that is accessible and useful to the applicant.

Developing a system to match students to degree courses

It is proposed that in order to address the changes in the practice of Industrial Design and to cater for future development and diversity in degree course offering,

that a system should be developed that better advises student on their course options. In the following sections, the inclusion of thinking and learning styles are considered in addition to the accepted criteria of academic experience and achievement.

Design Thinking

The paper will make reference to the work of Owen (2007 p 17). Owen identifies the presence of design and scientific thinking in the design process and considers: '*Design thinking is in many ways the obverse of scientific thinking. Where the scientist sifts facts to discover patterns and insights, the designer invents new patterns and concepts to address facts and possibilities'.*

Owen identifies two ways creative people work. He recognises *'finders'* and *'makers'.* Finders exercise their creativity through discovery and are driven to understand and find explanations. Professionally they typically become scientists or scholars. Makers are creative in a different way and demonstrate this through invention, construction, composition and developing new concepts. They typically become designers, engineers and artists.

Finders are driven to understand, to find explanations for phenomena not well understood. In professional life, they usually become scientists or scholars and are responsible for much of our progress in understanding ourselves and our surroundings.' (Owen 2007 p 17). Expanding on these views, Owen identifies other factors that differentiate professional fields and further defines design thinking. Figure 1 illustrates a framework to distinguish the activities based on mental activity and culture of operation:

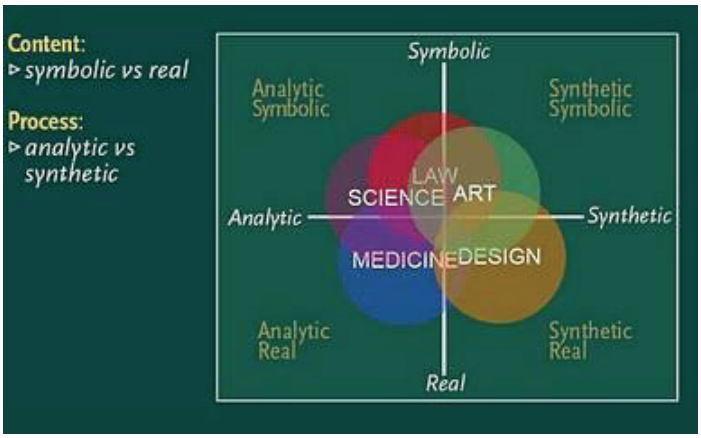


Figure 1. Map of creativity (taken from Owen 2007 p18)

Owen's map positions design in the lower right quadrant associated with making and inventing, and focused on the real world and the synthesis of artefacts and systems necessary for managing the physical environment (Owen 2007 p 18). This is in contrast to the position of science. Owen argues therefore that a combination of science and design thinking, rather than just one, is the strongest approach.
This spread of mental (and possibly emotional) activity required through the breadth of

different Industrial Design activities, demonstrates the need for a guide for potential applicants to identify the right degree course among a range of offers that focus on different areas of this map. Owen goes on to propose a progression of need/goal to values to measures, and gives word descriptors associated with each area. The following table lists descriptions of the focus of different disciplines:

Table 3. Descriptions of disciplines (constructed from Owen 2007)

Field	Need/goal	Values	Measures
Science	Understanding	Understanding Testability	True/false Correct/incorrect Provable/unprovable
Art	Expression	Insightfulness Novelty Stimulation	Thought provoking/banal
Design	Form	Cultural fit Appropriateness Effectiveness	Elegant/inelegant Better/worse Sustainable/unsustainable

It can be seen from Owen's methods of comparison that contrasting qualities can be identified regarding the different aspects of Industrial Design in which all these categories are represented. The proposal is that these measures can be used to illustrate the balance of course content and focus of an Industrial Design course. This can be utilized in a reflective exercise or questionnaire by a student seeking a degree course to map their skills.

Learning Preferences & Design

To further enhance student understanding of their own aptitudes, psychometric tests may be appropriate. Carl Jung's theory of psychological types illustrates preferred ways of adapting and learning. Based on Jung's theory, the Myers-Briggs Type Indicator (MBTI) is a psychometric tool for assessing 16 'types' and their associated learning styles (Myers and McCaulley 1985). It operates by categorization under 4 comparisons as summarized in Table 4 below. These comparisons gives rise to 16 constructs, e.g. ESFP, each of which has a personality description.

Table 4. MBTI personality preferences (MBTI® Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator®)

Do you prefer to focus on the outer world or on your own inner world?	Introvert (I) / Extrovert (E)
Do you prefer to focus on the basic information you take in or do you prefer to interpret and add meaning?	Sensing (S) / Intuition (N)
When making decisions, do you prefer to first look at logic and consistency or first look at the people and special circumstances?	Thinking (T) / Feeling (F)
In dealing with the outside world, do you prefer to get things decided or do you prefer to stay open to new information and options?	Judging (J) /Perceiving (P)

The MBTI has been used to evaluate the learning styles of various different groups. Work by Durling et al. (1996) identifies that designers as a group are quite different to

the general population and to other subject disciplines in relation to their learning preferences (see Figure 3 below).

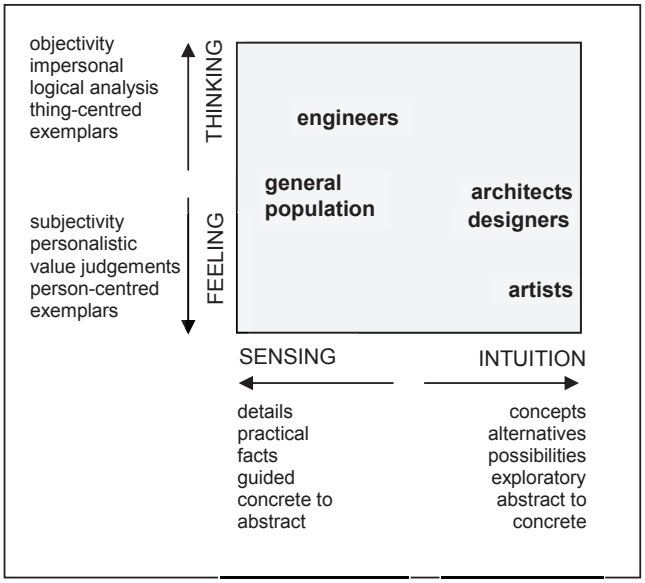


Figure 3. Learnin preferences based on MBTI Types (Adapted from Durling et al.1996)

Broadly speaking designers prefer teaching which begins with the big picture and then explains details, focuses on future possibilities and gives alternative view-points. It has a lightweight structure, allowing for guided exploration, and predominantly shows objective data, is logical and analytical, and is based on demonstration examples (Durling et al. 1996).

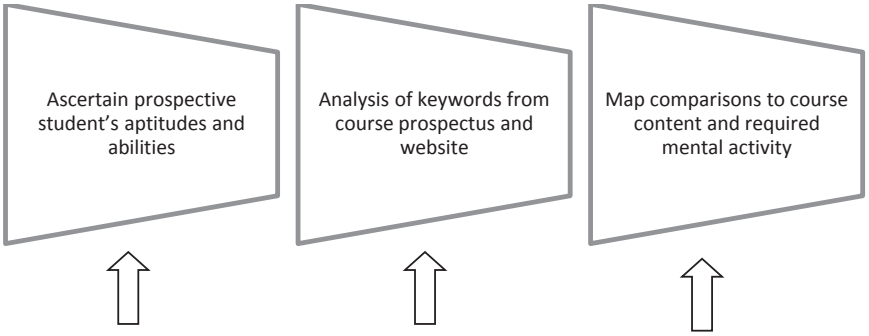
The disparity between engineers and designers is highlighted in this research. Durling et al. (1996) point the difficulties of teaching some designers subjects such as engineering, ergonomics and computing, particularly when taught by a non-designer / subject specialist who is likely to have a different style. Designers tend to have a natural leaning towards intuition and away from facts and a guided approach. This discord will be relevant therefore and influence success when a student enters a course that is design engineering rather than design thinking oriented. Having a means to assess students learning preferences through a test such as the MBTI, would provide another tool to equip students to match themselves to the content and style of a degree course.

A Proposed Model

Using a combination of personality testing and subject interest (alongside traditional metrics of capability and examination achievement) a guide to Industrial Design courses could be offered. Bringing together the work of Owen and the MBTI

profile, allows construction of a detailed model of the designer and their way of thinking and feeling. The following three stage process is suggested:

Figure 4. Model for mapping a student to a degree course



STEP 1 Candidate Action	STEP 2 System Action	STEP 3 System output
Answering a brief set of online questions in an established and verified simplified form of the Myers Briggs Preference Indicator (MBTI) and based on Owens' measures of creativity	A 'find courses' request will prompt computer analysis comparing keywords from prospectus and website scans and relating these to the individual profile words.	The user will be presented with a quadrant map visual mapping individual characteristics to demonstrate subject and course suitability and providing hyperlinks to relevant courses

It is assumed that the system would be computer-based and accessible on a wide range of platforms including smartphones and tablets to potential students. The system would require inputs from the user of learning style and subject preferences as well as traditional indicators such as predicted grades and subject choices.

The success of this model would be dependent upon an accurate picture of university courses to allow the automated comparison. It is not an unreasonable expectation that a keyword analysis of a University course prospectus and website will give a useable representation of the course's focus and content. These words are generally constructed with integrity, safeguarded by the published nature of the material. It would not be generally in the interest of the university or department involved to publish synopses of its courses that are fictitious or inaccurate since this will inevitably lead to problems when the student is enrolled. However, these descriptions tend to focus on facilities and equipment available and less on the characteristics of the students that succeed well on the courses. On that basis they may need re-visiting and updating with the aims of the system in mind.

Whilst courses have their unique selling points, they are also likely to thrive on a mix of students from different backgrounds and experiences. Psychometric tests are not intended as a mean to create a homogenous group but to allow applicant reflection on their aptitudes, abilities and career options. The aim is to educate the student to the nature of the discipline of Industrial Design to enable them to make accurate and useful decisions within the subject area to which at that stage they are making a probably

tentative early investigation. It would serve as a signpost for the student, and function also as an introduction to the contemporary breadth of the discipline, broadening their knowledge correcting limited or inaccurate perceptions of the discipline of Industrial Design.

Conclusions

This paper has arisen from an awareness that the field of Industrial Design has broadened to encapsulate a variety of perceptions of the subject that are influencing the nature of courses offered at higher education level. This is leaving the investigating potential applicant with an information gap that can result in their enrolling on an inappropriate course of study. This is disadvantageous to both the student and the institution.

A small initial study from the position of career destinations has been undertaken. Five successful practitioners in the discipline, from a range of design companies have provided a description of Industrial Design. The findings have been used to argue a development in the nature and perception of the practice of the subject in the UK. The investigation suggested that the understood boundaries of 'Industrial Design' have developed in recent years. The emphasis towards descriptors of intangible, cognitive activity, such as behaviors and emotions that contrast with the words describing practical skills and knowledge that characterize the content of the secondary schools curriculum regarded as the preparation for a degree in Industrial Design. The findings suggest a need for cognitive skills, when school education is focusing on skills/manufacturing aspects of the discipline.

An independent aptitude indicator was then considered to guide candidates to Industrial Design university courses, and ultimately a career path that would be appropriate to their personal abilities. For this purpose the work of Owen (2006, 2007) was considered, and the role of psychometric tests such as the MBTI to identify learning preferences. A model was proposed whereby the mapping of candidate capability through a short computer-based questionnaire against course categorization based on keyword analysis of prospectus and website descriptions is undertaken.

It has been argued that there is a value in an online indicator that provides a guide to potential applicants to the nature and focus of the variety of university courses offered under the titles 'Industrial' and 'Product' Design. Through simple measures of that this provides the prospective university student with an indication of suitable courses, and like Industrial Design aims to '*..help users cope with the increasingly complex world they live in'* (Wang 2010).

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