A comparative study of iconic influences amongst British and Canadian design students

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Abstract

Design students encounter a wide variety of influences and inspiration during their education. Moreover, the knowledge and skills required and utilised whilst studying design encompasses both explicit and implicit knowledge, and iconic and canonic knowledge types. This paper explores, comparatively, the iconic influences amongst sets of British and Canadian undergraduate design students. Using naturalistic experimentation techniques, the study's main objective is to investigate whether a student's design influences, and subsequent artifact creation activities, are affected by their educational context, their economic situation, their gender or age, and their geographical conditions amongst others. With this in mind the study will seek to explore the ramifications of this comparative study in terms of undergraduate design curriculum development and the culture and sociology of designers and design practice, in general, in the future.

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Inspiration, influences and the design student's context

Design students' input into artifact creation is influenced by their educational context, their economic factors, their gender, their geographical conditions, their social constructs and their political interests. Design is known to be a creative activity that involves the production of something 'new', the result of recombining, referencing and transforming within a specific context. Recognising that design is not conducted in a "sensory deprivation chamber" vacuum (Frayling in Kwint *et al.*1999: xiv) demonstrates the need to take both quantitative and qualitative approaches in design research in order to explore the influences and inspirational sources within the context of design.

Design inspiration and influences, and the way designers utilize them is widely acknowledged and well documented. Recently, there have been a number of research projects involving creativity in design (Oxman 1994, 1999; Vihma 1998), inspiration in design (Rodgers and Milton 2001; Eckert 2000; Eckert and Stacey 2001), analogy in design (Leclercq and Heylighen 2002) and memory in design (Goldschmidt 1994). Primarily, this work and other research in the area of creativity takes the theoretical position of cognitive psychology (Liep 2001:2) whereby there is a desire to formalize design thinking which focuses largely on the 'minds' of the individual creator(s). Creativity and inspiration in design is explored through several disciplines including: architectural design (Heylighen 2000; Leclercq and Heylighen 2002; Goldschmidt 1994; Oxman 1994, 1999), graphic design and advertising (Nixon 2002; Heller and Pettit 1998), engineering design (Vincenti 1990), and knitwear design (Eckert 2000; Eckert and Stacey 2001). These studies represent a wide variety of ethnographical approaches including laboratory experiments (Leclercq and Heylighen 2002) and naturalistic experiments (Heller and Pettit 1998; Rodgers and Milton 2001). Leclercq and Heylighen (2002) explore analogical thinking used by architectural design students by providing a set of variables that are measurable quantitatively. Naturalistic experiments use combined methods of data collection to collect information under relatively natural conditions (Bernard 1995). Heller and Pettit (1998) and Rodgers and Milton (2001) both utilize informal and formal interview procedures that are open-ended to differing degrees, to collect non-specific and specific information respectively. In laboratory and naturalistic experiments, the measurable traits are reduced in order to simplify the design process to recognizable, more quantifiable details.

The multi-dimensionality of design learning and design knowledge are difficult to measure however, and thus a more holistic, contextualised approach which includes the aspects of social mediation in the context of design is required (Ashton and Durling 2000: 12).

Industrial design context

Industrial design has been commonly treated as a satellite discipline to architecture (Julier 2000: 35) and/or engineering. Industrial design can be described as being a deeply complex design discipline, particularly within the formal education process. Industrial design instructors need to provide a breadth of different design situations in order to prepare students with the variety of design problems they will face in the future. In other design disciplines, such as in architecture, an architect will always design a structure involving land, location, structural integrity and human interface. Those structures may be used for differing purposes such as public venues or private dwellings. The result is a number of common, teachable variables in architectural education. A second example is graphic design, which typically manifests itself into two-dimensional information that communicates visually and/or textually. The elements of design (*i.e.* colour, texture, form) in

graphic design can be deconstructed and continue to form the foundation of graphic design education.

It is understood that all design disciplines are complex, have multiple levels that interact, and involve a hierarchical problem solving process (Dormer 1990). Vincenti (1990: 8) describes "normal" design and "radical" design, and states that the bulk of engineering design can be categorized as "normal". It is clear that the knowledge-base required for all disciplines of design are enormously diverse and complex. However, the nature of industrial design varies from other design disciplines in that the majority of design problems, especially within an educational context, can be considered "radical". Rittel and Webber (1984: 136) develop the concept of radical problems by describing unique problems as being "wicked". In industrial design the majority of problems encountered weigh heavily towards being "radical". This is because industrial design does not have constants such as a specific location in architecture design or textual information in graphic design. Therefore, the teachable aspects of industrial design require an extreme breadth of knowledge in order to prepare future industrial designers for the variety of tasks they may encounter in contemporary design practice such as the design of a lamp, the design of an artificial limb, a running shoe design, or vehicle design.

Essentially there is no definitive prescriptive approach to creating solutions to extremely complicated problems. There may be similarities with previous problems encountered in industrial design, but a classical systems approach will not necessarily work. With an increased level of complexity in teaching industrial design, the sources of inspiration that drive individual design projects forward necessitate a cross-fertilization of perspectives. Industrial design education is the combination of formal education and social agents (*i.e.* economic factors, gender, geographical conditions, and political interests) that informs all design decision making.

Explicit and implicit knowledge in design

The knowledge-base of each individual can be simply described as diverse and complex but is intimately bound up with economic, political, gender, social, personal and environmental experiences. For the purpose of this paper, the idea of knowledge has been interpreted broadly to include explicit and implicit knowledge, and canonic and iconic analogical reasoning. The following working definitions have been established in order to explore the variety of inspiration sources among industrial design students.

According to Vincenti, (1990: 195) explicit knowledge can be put down in words, tables, diagrams and pictures, and implicit knowledge involves skill, judgement, intuition and associated knowledge. Explicit knowledge includes the tangible aspects of design that are easily taught in formal situations (*e.g.* lectures, seminars). Implicit knowledge can be considered the intangibles of design that are less easy to express and difficult to measure because this type of knowledge is generally related to personal experiences. Implicit knowledge is typically developed and transferred through social situations. It is the combination of explicit and implicit knowledge that the industrial design student integrates towards a finished concept.

Canonic and iconic analogy in design

Canonic analogy is based on abstract systems, prefabricated elements and geometric correspondences and can be seen as the tangible elements of design. These analogies have formed the basis for traditional architectural design and graphic design education as they fall into the category of explicit knowledge. Iconic analogies, on the other hand, are objects from the natural world or from outside of the discipline of study that may contribute to the design process (Heylighen 2000: 17-22). Iconic analogies can be explicit or implicit but comprised of individual

aspects, typologies and categories *outside* of a specific design discipline. Canonic and iconic knowledge can be further subdivided into two categories, direct design transference and indirect design transference. There is an emphasis on iconic knowledge in this study.

Direct design transference and indirect design transference

Design transference is when an element, material, method of production, aesthetic or any other piece of design information is taken from one designed object to another. There are many observable examples of design transference in history, such as the use of Gothic arches and rose window architectural details on furniture design during the Renaissance. Direct design transference is when canonic devices or same-type artifacts directly inform design decisions. For example, Eckert's (2000) discussion on the sources of inspiration within the knitwear industry can be considered direct design transference. In the knitwear example, elements and specific characteristics *within* this discipline of design are described as the primary influences in the creation of a new garment (Eckert 2000; Eckert 2001). Direct design transference can be explicit, implicit or canonic.

Indirect design transference is described by Leclercq and Heylighen (2002) in their recent research experiment with architectural students. Here, they are searching for explicit iconic analogies that are presented unconsciously to a group of design students. Indirect design transference can be explicit or implicit, canonic or iconic. Indirect design transference is much more difficult to trace in the educational process since students are not often fully aware of their personal knowledge-base. Indeed, even the seasoned designer may not be conscious of his/her design influences to a level where it can be articulated (Sudjic 1999). For example, Heller and Pettit's interviews with graphic designer Paul Rand (1998: 8-13) illustrates Rand's awareness of his sources for inspiration. Rand describes the use of a rebus for the design of his IBM logo in the late 1970s. In his interview he articulates direct design transference by referencing rebus as a communication form and Lewis Carroll's use of rebus as a form of dramatization. Later he describes indirect design transference for a Yale poster where he used a step motif and refers to the Ziggurat as a reference point for this imagery.

Indirect design transference is less easily pin-pointed, especially after an artifact is completed. The designer may have not been aware of the influences and/or forget references without deep reflection on this point. At the completion of the design project, the transference becomes a process of speculation and contemplation by design critics or historians to re-construct the said design process. This research project attempts to get to the core of design inspiration at the earliest possible stage within an educational context.

It is important to remember that implicit/explicit, canonic/iconic, direct/indirect design transference occurs to varying degrees during the artifact development phases. It therefore becomes significant to explore which architects, artists, musicians, movies or items from the natural world influence and ultimately manifest themselves in the industrial design student's end solution. Despite Vincenti's (1990) claim that implicit knowledge is inexpressible, implicit knowledge is measurable through indirect design transference by observation, discussion and documentation whilst students engage with the designing of artifacts. Studio instructors provide experiences, situations, experiences and communities for the student to engage with during the design process. Increasingly, students are asked to engage with 'design research' that reflects all levels of information gathering through explicit/implicit, canonic/iconic, direct/indirect design transference. Students must perform market research, historical research, consumer demand issues amongst others whilst continually engaging with the world around them.

Explicit	Implicit
Canonic	Iconic
Direct Design Transference	Indirect Design Transference

Figure 1: Areas of interest (shaded)

Preliminary comparative study

Two separate research studies were conducted using naturalistic experimentation techniques. All information gathered considered indirect design transference sources of inspiration since there was no attention given to the particular projects that the students were engaged with at the time of the studies. The research methodology employed was an informal interview and questionnaire procedure with a sample of undergraduate students at two formal educational institutions in two different countries, the Britain and Canada. The students were interviewed independently in a semi-structured manner within their studio environment. There was an attempt to balance gender when choosing students for their independent and direct interviews. Each student was asked a total of 8 questions with several control questions. They were asked to relate one example from the past or present that inspires or informs their present design work. The questions were a reflection of both explicit and implicit knowledge sets. The category, their relationship to either explicit or implicit knowledge and whether they are made occasionally (◊), average (◊◊), or strongly (◊◊◊) in the educational context is detailed in Figure 2.

	Inspirational Source	Explicit	Implicit
1	building	◊◊	◊◊
2	three-dimensional product	◊◊◊	◊◊◊
3	author	◊◊	◊◊◊
4	automobile/vehicle	◊	◊
5	movie	◊◊	◊
6	music	◊	◊
7	magazine	◊◊	◊◊
8	designer including architect	◊◊◊	◊◊◊

◊◊◊= strong   ◊◊= average   ◊= occasional

Figure 2: Explicit and implicit iconic inspiration knowledge

Two studies took place in 1999-2000 and 2000-2001 at the School of Design and Media Arts at Napier University, Edinburgh. In these studies, Rodgers interviewed a total of 29, and 35 first year students respectively. The primary objective was to explore whether a relationship could be found between a design student's level of design awareness and their design degree performance (Rodgers and Milton 2001).

The second group of studies took place January 2002 at the University of Alberta in Edmonton, Alberta, Canada. Strickfaden interviewed 18 third year, and 23 fourth year industrial design students at the University of Alberta. The primary objective of the second studies was to cross-reference and compare iconic sources of inspiration among British and Canadian students.

The responses of the students involved in the preliminary comparative studies were recorded into spreadsheets where gender, age, country of origin, and frequency of responses were noted. It became clear that in general, year 3 and 4 undergraduate students answered with a more specific and detailed response. Responses from each student in all cases were wide ranging, as expected, and showed a varying degree of awareness of the subject area of each question. There were some similarities between responses in each group despite different geographical locales and different degree programmes. These similarities can be attributed to the industrial design context being embedded predominantly with 'Western' societal values, the result of increased globality (Beck 2000), and mass media's "visual encyclopaedism" which includes imagery from many cultures, past and present, from all over the globe at a touch of a button (Woodham 1997: 190). Examples of the common responses from *both* the British and Canada studies include high profile building design such as Frank Lloyd Wright's *Falling Waters*, the *Eiffel Tower*, and the *Guggenheim Museum* (NY and Bilbao); well known "high design" products (Julier 2000: 69-71) such as Starck's *Juicy Salif*, Apple's *iBook* and *iPod*, and Alessi's salt and pepper shakers; popularized and cult movies such as *Bladerunner*, *Star Wars*, *Pulp Fiction* and *Braveheart*; and popular culture designers such as Ron Arad, Frank Gehry, and Philippe Starck.

Explicit knowledge and educational context
The design programme at Napier University in the UK is a 4 year degree programme based within the School of Design and Media Arts in the Faculty of Arts & Social Sciences.
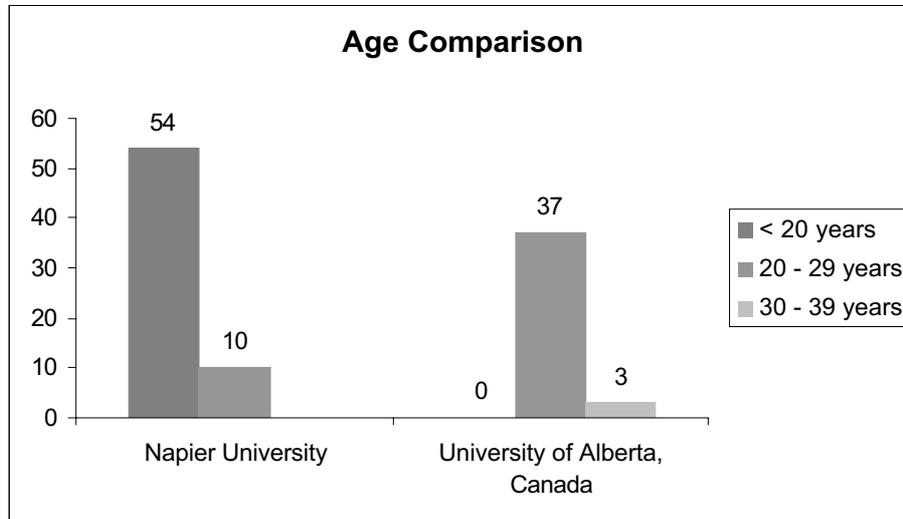

Figure 3: Age comparison

The students interviewed were all of a similar age range, between 18 and 20 years old (*see Figure 3*), with a balance of gender (*see Figure 4)* and with the majority of the students being from the immediate locality (*see Figure 5*).
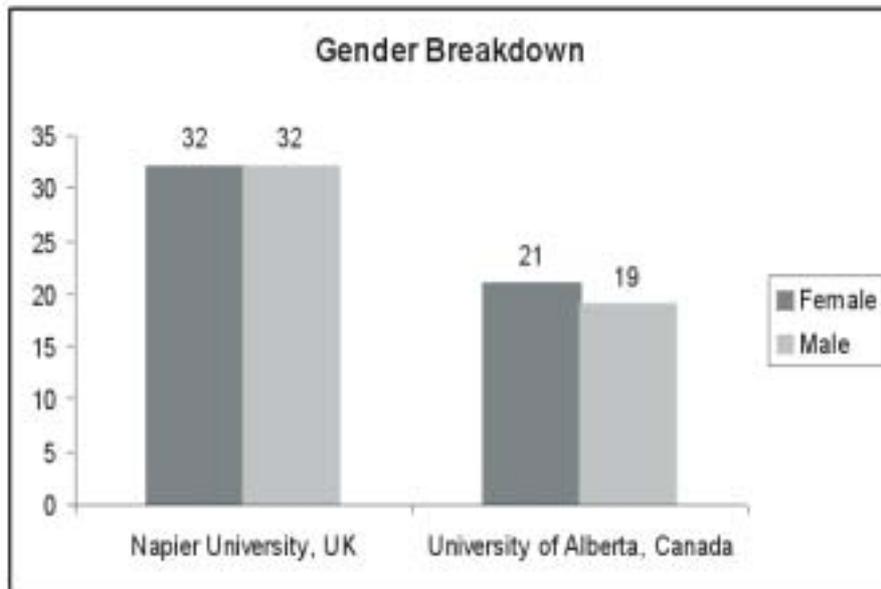
Figure 4: Gender comparison

The industrial design programme at the University of Alberta is a 4 year BDes degree programme in the Department of Art & Design, Faculty of Arts and Humanities. The BDes is a liberal arts degree whereby students choose a 'design pathway' (*e.g.* engineering, computers, social sciences or general). Students have a wide range of personally chosen options from a number of departments in addition to the Department of Art & Design. The students interviewed were between the ages of 20 and 37 with a high percentage being mature students (+25) *(see Figure 3),* a proportional balance of gender *(see Figure 4),* and a majority of local students *(see Figure 5).*
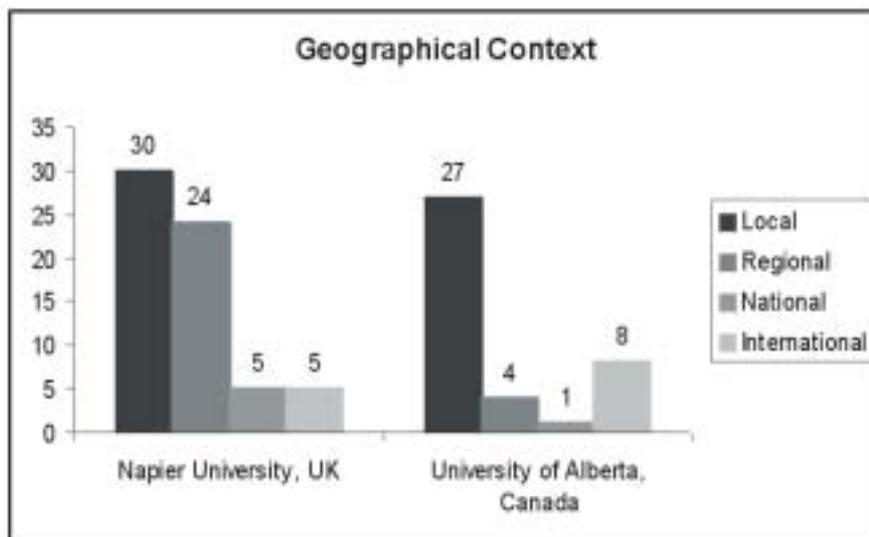

Figure 5: Geographical breakdown

In order to pinpoint explicit knowledge in the student groups, the interviewer must have an intimate understanding of the programme of study as a whole, and specific characteristics of the programme. Explicit knowledge, in this case study, is measured through predictable responses. As in many interview situations, a high percentage of respondents provided answers that they perceived as 'correct' despite the interviewer stating the interview and questionnaire was not a test. This is known as the response effect (Bernard 1995: 229-31). Responses included Mies van der Rohe, Le

Corbusier, Ron Arad, Frank Lloyd Wright, and Philippe Starck from the Napier students. The students had been exposed to these designers in formal lectures and seminars prior to the interviews.

	Inspirational Source	Explicit	Implicit	No Response
1	building	31	21	12
2	three-dimensional product	29	21	14
3	author	1	54	9
4	automobile/vehicle	12	50	2
5	movie	10	49	5
6	music	2	60	2
7	magazine	17	35	12
8	designer including architect	42	19	3
	Total	144	309	59

Figure 6: Breakdown of explicit, implicit and no responses in Napier University students

The same patterns were discovered among Canadian students who responded with Piet Mondrian, Gerrit Rietveld, Van Gogh, and Charles and Ray Eames; all of which they had learned through a required design history module prior to the interview. Further examples of explicit knowledge were demonstrated through references to *Droog* design (Marcel Wanders and Jurgen Bay), and to sustainability (William McDonough, *The Ecology of Commerce*, and the Eco-house). Karim Rashid was referenced most frequently (5 of 40) with the University of Alberta students since he had visited the University as a guest lecturer the previous month.

	Inspirational Source	Explicit	Implicit	No Response
1	building	18	13	9
2	three-dimensional product	3	30	7
3	author	5	31	4
4	automobile/vehicle	3	32	5
5	movie	5	28	7
6	music	0	36	4
7	magazine	17	18	5
8	designer including architect	26	5	9
	Total	77	193	50

Figure 7: Breakdown of explicit, implicit and no responses in University of Alberta students

By providing a relatively structured interview procedure within a naturalistic setting, each student is triggered to respond so that there can be a reliable comparison among the students. Because of this procedure, the responses were mapped according to what was perceived being explicit or implicit (*see Figures 6, 7*). Within the British student group, it estimated that 28% of the responses were explicit and within the Canadian group, approximately 24% were explicit (*see Figure 8)*. The explicit responses from both the British and Canadian students are intrinsically connected with the individual students' definition and understanding of design based on their educational context.

	Explicit	Implicit	No Response
Napier University	28%	60%	12%
University of Alberta	24%	60%	16%

Figure 8: Distribution of explicit, implicit and no responses

Implicit knowledge through design culture

Implicit knowledge is explored through the design cultural context, the student's gender, their geographical conditions, and other factors (*e.g.* personal interests, economic factors, and political interests). Design culture has been described by many researchers, critics and historians over the past several decades, and includes the conception, discussion, and planning of artifacts before they are made. While these objects are the result of human decisions, the subject of design itself is not fixed: design is constantly undergoing exploration and continually evolving. Creating a design culture in the classroom is known to be very important as this provides a forum for students to explore design (Ashton and Durling 2000). It is expected that the design culture will be dynamic in relation to specific location. For example, design culture can be present in the studio, in the pub and through the private and social interactions of the students. For the purpose of this study, design culture is explored through industrial design.

Increasingly, a variety of design researchers describe design as searching for a problem through identification and questioning (Heller and Pettit 1998; Rittel and Webber 1984). The ability to conceive and develop questions is an integral part of the design process. It is speculated that the more "radical" or "wicked" the problem, the quality and quantity of questions increase. This is due to the need to explore levels of knowledge that are less tangible and more difficult to access.

Within a more open-ended interview process, it became apparent that the question-posing approach towards resolving design issues in industrial design was one that most students relied on heavily. The interviewers were constantly questioned about the questioning process. For example, a number of students asked how *designer* was defined within the context of the interview. They wanted to know if an artist like daVinci should be defined as artist, designer or inventor. The number of questions posed by the students increased directly with the year of study. The result of the students question-posing approach was most apparent with the Canadian group where the 4th year students took nearly double the time to interview as the 3rd years.

It was clear that the senior 4th year students had a better grasp on the idea of industrial design through their ability to engage with the study and the interviewer. An example of this was one student responded to the query 'designer' by saying that he could "spout off a number of designers" but that his response had to be "God". This response was then supported with the statement that "nature was the best source of inspiration". In addition, the student referred to the book *Biomimicry—Innovation Inspired by Nature* by Janine Benyus, and wrapped-up with a barrage of designers names.

From a different perspective, the student's grasp on design culture was demonstrated through responses in all categories that were directly relevant to design. The most design relevant responses were in the categories of designer, building and magazine, with the majority of these being categorized as explicit. The incidence of design relevance across all categories was very rare, however, two different Canadian students replied with design related movies (*The Power of Ten* and *Microcosmos)*, and design related authors (Paul Hawkins and Kenji Ekuan). These responses can be considered to be highly contextualized within design. These students seemed to understood the purpose of this study and design culture, particularly compared with others who provided responses reflecting their design awareness and personal likes and dislikes. Overall, the awareness of their sources of inspiration appeared to be relatively unconscious to these design students.

Implicit knowledge through gender

Gendered responses can be separated into two categories, stereotypical responses and design-oriented responses. Stereotypically gendered responses can be described best through the categories of automobile/vehicle, movies and magazine, however others were also present. In response to the automobile question, the male students typically replied Porsche and Ferrari. Fewer females knew particular model descriptors and numbers and most frequently referred to an automobile they owned presently or one they had owned in the past. All creative responses in this category came from the female students, examples of which were from the 4th year Canadian group. These include: "my feet", "*Kona* bicycle", "go-cart", "Raymond Loewy buses" and "stretch-limousines". To the query of movie, males typically responded in the genre of Science-fiction, and females responded with *Disney* or romance movies. For the category of magazine, males responded with masculine examples such as *Scientific American, GQ, Muscle International,* and *Road and Track;* whereby females responded with feminine examples such as *Cosmopolitan, Canadian House and Home*, and *People*. These stereotypically male and female responses reflect known gendered Western societal values.

Gendered responses that were design oriented were rare. Several female students chose three-dimensional products from the fashion and perfume industry, such as Issey Miyake. Male students did not hesitate to the query designer, whereby female students had more 'no' responses, more personal references such as "my friend", and more general responses such as "Ikea" and "Ideo". Several female students replied that this question was unfair in that they simply did not feel inspired by individual designers. One 4th year Canadian student stated that she did not "believe in the *media star* approach to individual designers", she was more interested in "ideas embodied in objects" and in "groups of designers that worked with specific philosophical beliefs". Of all 105 students interviewed, only 2 responded with the names of female designers. These were, Vivien Westwood and a reference to the interviewer Megan Strickfaden, who is known locally for her design work.

The most interesting example of a gendered iconic inspiration source was a response to the query of three-dimensional product from a 4th year female Canadian student when interviewed by the female interviewer. The student's response was the "Keeper menstrual cup". Not only is this a highly gendered response, it is intensely linked to the value system that this individual likely employs. "Keeper" is an alternative re-usable product used during menstruation. It is considered to be a healthy alternative to sanitary napkins and tampons, and is primarily used by the "health conscious", "home birth", "environmentally conscious".

It is clear that the design student's implicit knowledge-base is highly influenced by their gender. Both the male and female students show interest in a wide range of inspiration sources, however, the context of gender within Western society must be considered as influential in the design process.

Implicit knowledge through geography

Exploring the notion of implicit knowledge through geographical locale necessitates the gathering of personal information from the sample groups. The students were asked to provide their permanent home city (*e.g.* parents address), their place of birth and with the Canadian students, travel experiences. From this information, the researchers were able to determine additional outside influences and the broader context of the student.

The majority of responses of all students showed a very typical Western design attitude. Particularly the British students who follow a relatively narrow art and design curriculum at pre-degree level in the secondary school system. The younger students (*i.e.* age) with little past experience responded more frequently with local examples of architecture. The Napier students indicated Scottish architecture such as the *National Museum of Scotland,* Edinburgh and *Buchanan Galleries,* Glasgow; and the University of Alberta students indicated architecture in Alberta such as the *Grant MacEwan Downtown* campus, Edmonton and the *University of Lethbridge* building, Lethbridge. For the category of 'author', British students replied with Iain Banks and Terry Pratchett; and Canadian students replied with Margaret Atwood, and Thomas Wharton, all well-known local novelists.

Replies that reflect growing globality were demonstrated best to the queries of movie, music and magazines. It is speculated that these forms of popular culture are easily accessed through the media, the internet and the 24-hour information world. Responses to all categories represents the global diffusion of ideas and messages. These are shown through the examples previously discussed in the sections *Preliminary Comparative Study* and *Explicit Knowledge and Educational Context.* Obvious examples were J.R.R. Tolkien and J.K. Rowling for authors of recent movies; the movies *Lord of the Rings, The Matrix* and *Star Wars*; Canadian music group *The Barenaked Ladies* from a British student; and magazines such as *ID and Wallpaper.*

The most interesting example for implicit knowledge through geography was a female Japanese student who responded with Megan Strickfaden, to the query of 'designer'. This response may interpreted as being an attempt to win favor with the interviewer. However, in this situation this student had been taught by Strickfaden in design history and as a studio instructor over the past several years. It was clear that the student was genuinely responding to the question. Furthermore, it is well known that in the Japanese culture, teachers are highly revered due to their overt influence. The response of this student represents the intense relationship that an individual student has to his or her value system established by their geographical influences.

Locating implicit knowledge through geographical locale provides an interesting forum for discussion in the context of design particularly due to increased globality and cross-fertilization between separate cultural forms and environments. Iconic inspirations relative to geographical origins can provide a rich environment for the student to develop artifacts. The cross-fertilization of values and typologies among students enriches implicit knowledge. This is supported by national and international exchange programmes that have existed for decades in design education.

Implicit knowledge through other factors

Implicit knowledge explored in multiple-dimensions from a social perspective is a complex, but more holistic approach towards a design student's sources of inspiration. The personal details of the individual students is also a factor. For example, one Canadian student is an internationally acclaimed athlete. This immersion in a particular lifestyle is distinctly reflected through responses to the queries. This student responded with *Kona* bicycle for vehicle, *Nike* running shoe for product and had 'no' responses to popular culture categories (*i.e.* movie, music). Getting to the root of inspiration means that the researcher must spend time and get to know individuals in order to sort out the extent of their implicit knowledge-base and how this is applied to the design of artifacts.

There are, of course, many other factors that contribute to implicit knowledge not explored due to the constraints of this paper and the preliminary stages of this study. Some of these include economic factors and political interests. These factors and others are being examined using a variety of information gathering techniques, and will be a topic for discussion in the future.

Conclusion and future recommendations

Discovering iconic inspirational sources in undergraduate industrial design students is a process that requires a multi-dimensional research gathering approach. It is clear that in order to track such references, the researchers must use a variety of methods including interviews, observational studies, active participation and protocol analysis under naturalistic conditions. Further research is required in this area in order to get to the roots of the design process as a collective, social process, not just one that is enacted by individuals. Iconic references in industrial design are not limited to the examples explored in this paper, but include many aspects of what is known in the academic realm as popular culture.

The implications for this kind of exploration and research will inform design curriculum development and the culture and sociology of designers in the future. For instance, implicit knowledge needs to be recognized as the primary source of inspiration especially among industrial design students. By recognizing that design education occurs *within* University studios and *outside* in all social situations, formal education can better support knowledge that is personally - and socially - based. Educational settings need to support this through providing a breadth of experiences in theory, history and practice. In addition, design students need to be challenged to generate their knowledge-base through creative, abstract design research. Finally, design education requires a liberal University setting where students with a variety of backgrounds can share their expertise and experiences. Louridas (1993) describes the designer as using an inventory of semi-

defined elements such as experience, knowledge and skills to create an artifact. It is the synthesis of explicit and implicit; and educational and social contexts that orchestrate the diverse activities of industrial designers to create artifacts of value.

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