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Referencing the sociocultural during designing

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The development of an artefact is inherently bound up with meanings, relationships, and value systems relative to the individuals creating them, and to the context of their immediate and external environments. This paper begins to explore the sociocultural affects on the design process through two field studies within two industrial design education studios. Two separate design groups and projects are followed for extended periods of time in order to collect naturally occurring 'references'. These are analyzed revealing central themes and categories that are presented here as indicators of the varying context of artefact design. In doing so, a model called the design process milieu has been developed and is presented as a framework to understanding the multiple levels of the design environment. The design process milieu includes the local and universal, emic (inside) and (etic) outside. Some surprising results are revealed about how the sociocultural context and an individual's sociocultural capital may be affecting the design process.

1 Introducing references

This paper explores the notion of references being made during the design of an artefact, but more specifically, the sociocultural affects on the design process. This is done through elaborating on two ethnographically oriented studies based within the context of two design studios on different continents. The term reference is used here to describe the mode of communication that contains information about the artefact, the creator and the context. Speech and language are the central medium for references. According to Chomsky (2002) words and sentences contain and frame an immense amount of meaning. Language references are described here as the words and phrases that carry literal meanings that involve clear-cut relationships with the artefacts being created or the world they describe (Good 2001:84). Along with references being represented through words and phrases, references in design may also be presented in the form of images (e.g., photographs, sketches). Goldschmidt (1998) defines references to include the precedents that designers openly reveal to have inspired them along with the points of departure that are not known as precedents. Therefore, it is acknowledged that references may or may not directly link to the artefact being created (see figure 1) and the use of references in the design process can be fleeting and ambiguous.

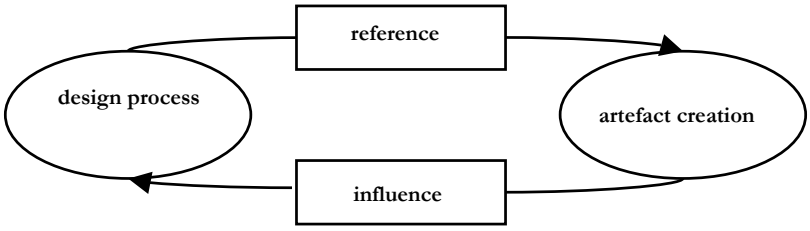

Figure 1: The role of reference in the design process

At the core of this research is the assumption that all things communicated, referred to, and spoken about are considered to be meaningful (Alvesson, & Sköldberg 2000) because these somehow drive the design process. The term references is deemed suitable for this work because references are all inclusive and involve *all* the information communicated by the designer, even that which may be considered to be irrelevant or far from the task at hand.

Understanding references is directly linked to context, specifically that of the sociocultural environments. Within these are interactions among the designers, interactions with leaders, and relationships with people external to the design environment. This paper explores four different yet interconnected contexts including, the design studio and in the broadest sense western civilization. Explorations undertaken here include examining the near (local) and the far (universal), the emic (inside) and (etic) outside. In order to investigate the nature of the references, a model is presented that is capable of identifying the contextualized environment. In the case of design education, the focus of the studies illustrated here, a more holistic context includes references that are connectable to the inside design environment and those that are connected to the outside. The context inside design includes the:

1. design brief;
2. educational setting;
3. tutor(s) contribution and perspective including local studio culture, group dynamics (i.e., social capital) and interactions (e.g., conversations, presentations, visual documentation);
4. design process including the use of research materials (e.g., books, journal, Internet resources, objects) from inside and outside the classroom that are specific to design, previous projects and previous design experiences.

The inside context is divided into the local and the universal, where the local is considered to be the immediate sociocultural context and the universal is the sociocultural context that is less evident but includes the programme of study, the university, and the general notion of design. The context outside of the immediate design environment includes:

1. personal perspectives including experiences, memories and interpersonal relationships;

2. common cultural currency that relates to the sociocultural information/knowledge/capital that is gained long before entering the educational setting.

The outside context also includes a local and universal component. The model, called the design process milieu, is developed as a result of four in-depth field studies and is used to investigate the full range references made by individual student designers is shown in figure 2.

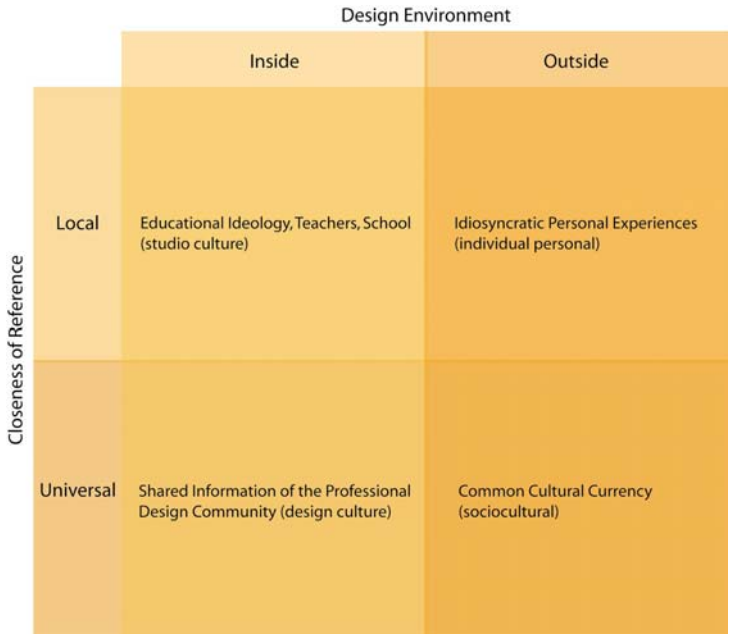

Figure 2: The model of the design process milieu.

References made during design are easily identifiable as relative to one of the four contexts in the model shown in figure 2. These four contexts are hereafter called the inside-local, the inside-universal, the outside-local, and the outside-universal. References are therefore relatable to four distinct yet interconnected sociocultural contexts.

2 References further defined

The references are further defined in this research as being tangible or intangible and relative to the individual experiences and the cultural capital of designers. These theories and terms are used here to aid in the classification of the references and in order to understanding how these relate to the soiciocultural contexts. The use of (in)tangible references are not meant to create an absolute distinction between the two but are an aid to examining the nature of references.

The terms tangible and intangible are currently used infrequently and loosely in the design community. For example, Klassen's paper entitled *Tangible to Intangible* (2002) uses the terms to describe a move from a relatively prescriptive teaching scenario in design to one that is more collaborative. John Chris Jones refers to intangible

design as the allusive experiences of the people (users) who engage with artefacts (Mitchell 1996). More recently, Hartley (2002) states that the intangibles are "assets such as knowledge, competence, intellectual property, know-how … culture …" (ibid 118). Hartley asserts that the intangibles are deeply linked to culture and knowledge, which are at the heart of the sociocultural processes being explored here. Therefore the term intangible is used to describe the references that are less easily pinned down as the teachable, generic aspects of design. A contemporary definition of the intangibles of design is that these are those things that are more difficult to define because they are dynamic, ever changing and relative to context. For the purpose of this exploration, the tangible aspects of design are defined as the rational, the cognitive and the well-defined and teachable aspects of design including the design process, and the elements and principles of design. The tangible aspects of design typically reside in the inside-local and inside-universal but also include references to things from the outside that are highly connectable or relevant to the task at hand. The intangible aspects of design are subjective and specific to the individuals involved because they are about the many "little narratives" (Dormer 1990) of the designer. These little narratives are the individual personal and sociocultural capital (Strickfaden et al. 2005) or cultural capital (Bourdieu 1984) that emerges through memories and past experiences referenced. Sociocultural capital is considered an asset that the individuals take to the design process.

Recently, there is an increased interest in the idea of how the experiences of individuals contribute to the design process. Hellström and Hellström (2003) create an interesting discussion about the relationship of past, present and future experiences in the design process. Downing (2003) explores the notion of the designers experience through the use of memories. She states that designers "re-create from memorable experiences" (ibid 230) and that memory "consciously or unconsciously surrounds the [design] task". Sociologists such as Bourdieu (1984) describe an individual's cultural capital as being central to the approach a person takes, for example, to their education. Bourdieu describes cultural capital as a class-based theory that considers the non-explicit activities of everyday life as they define individuals (Julier 2000). It is easy to make a connection between the theory of cultural capital and artefact creation because Bourdieu feels that all individuals act their cultural capital in everyday activities. Sociocultural theories such as this begin to get at the idea of what the intangible aspects of design may be; however, these are not described in terms that relate to, specifically, the education or practice of design. Other theories such as those developed by social and cultural anthropologists are examined in order to collect and analyse the data collected in the field studies.

3 Anthropological theories about holism and inside-outside relationships

The methods used to collect data in the two field studies presented in this paper are carefully chosen to explore the sociocultural aspects of the design environment. Ethnographic methods are typically associated with sociocultural investigations and these are well established in the traditions of anthropology. It is therefore natural that some of the assumptions and theories embedded in the discipline of anthropology are useful for understanding the sociocultural aspects of designing.

Central to anthropology is the notion of holism (Monaghan & Just 2000, Geertz 1973/2000), which involves all people being interconnected with their immediate and external environments. This worldview assumes that

individuals are affected by and affect the contexts they move within. Further to this, the notion of emic and etic are anthropological perspectives that refers to an orientation to a culture, not to membership (Wolcott 1999: 137). On the most part, research into design has involved emic (inside) approaches. The research presented in this paper moves towards looking outside of the designer (i.e., social and cultural forces that enter into the design process) rather than purely the inside of design (e.g., design processes, problem solving, the design school and studio). The outside forces are accessed through the references to the internal world of the individual through their memories and experiences. The distinction between the inside and outside are described by Bauman (1999:xxiii):

> The 'here' versus 'out there', 'near' versus 'far away' oppositions, an so also the opposition between 'inside' and 'outside', recorded the degree of taming, domestication and familiarity of various (human as much as non-human) fragments of the surrounding world.

In this statement, Bauman describes the notion of something being close or further away, tame or wild, familiar or exotic. These ideas including distance from the target, and the nature of a reference are important, as they begin to get at the heart of the (in)tangible references and the design process. The intangible references are *out there* and *unusual,* characteristics that are idiosyncratic and a deep reflection of an individual's sociocultural capital.

It is not unusual for research about sociocultural aspects to ring true to individuals who understand the nature of that inside environment. Therefore, the inside of design includes those activities and references that designers take for granted. These inside things are called tangible references, for example, some parts are common or universal to most design situations and other parts are particular to a group. The references to inside things dominate over those that come from the outside because of basic human nature. That is, the majority of people wish to remain stable and on familiar ground, therefore they discuss the things that are inside or acceptable to the group. In a learning environment this is especially emphasized by the student's desire to do well and learn, and to be accepted and respected by the group and the their instructor.

The theories of holism and inside-outside are a distinctive way to view the design process. The model of the design process milieu presented here is a hybrid of these theories and provides a framework to examine all the references made during designing.

3 Collecting and analyses of the references

Insights are gained into the sociocultural forces through collecting all the references in as complete a form as possible. In order to do this, ethnographically oriented methods are used to allow for longitudinal (Bernard 1995) involvement in the design studio. The field studies presented here follow one project per study from the onset to the completion. The time commitment involved has the potential for an excess of data and requires a significant degree of preparation including refined collection procedures and iterative analyses procedures. One of the benefits to ethnographic research is that data is collected in a natural setting where the information gathered is reflective of the participants. The role of the researcher is to understand the data as it is presented

as naturally as possible. Therefore, real-life, real-time methods are used in collection. In the tradition of contemporary anthropology, these methods are a combination of techniques that include field observation, making field notes, doing semi-structured interviews, and performing questionnaires. The methodology here is described as ethnographically oriented because of this mixed method approach. The modes for capturing the visual, textual and verbal references are also mixed and include:

1. videotape during observation and interviews;
2. still photography to capture the visual representations used- and created-by the students, and the studio / university context;
3. note-taking during interviews and observation to support the videotapes and photographs.

The data types collected are references to the visual, verbal and textual. It is common to consider that there is no such thing as pure image or pure word references (Pink 2001:17) because conversations in design are about visualization. Design discussions and conversations in design consistently draw upon absent imagery from many different sources. Visual references may include, for example, individual representation of the world created by the designer (e.g., illustration, charts, photographs, sketches), objects that are physically present created by the designer (e.g., models, mock-ups) or mass-produced (e.g., apparel, personal possessions). Verbal references include all conversations including formal and informal, group and one-to-one. Designing involves a great deal of discussion that involves descriptions and arguments. Textual references are the documentation of words and phrases in the form of flow charts, tables, lists, sentence fragments, labels and paragraphs. Textual references tend to be considerably less than visual and verbal references.

Once collected, the data is organized in order to process the information. Two levels of processing are used to gain the results presented in this paper. The two levels of processing that are employed are characterized as data reduction and display (Harper 2003). Data reduction involves summarizing, coding, finding themes, clustering and writing stories. Data display is when data is organized, compressed and assembled. Data reduction includes transcribing the conversations word-for-word from the videotapes in chronological order. Table 1 shows a comparison of the raw data and transcripts of each field study.

UK	**Canada**
25 hours of video footage of observation and interviews with students	40 hours of video footage of observation and interviews with students
3 hours of video footage of interviews with instructors	3 hours of video footage of interviews with instructors
221 still photographs	590 still photographs
159 pages of transcripts	443 pages of transcripts

Table 1: Raw data and transcript comparison.

The second stage to data reduction is coding and finding themes, which are connected to the overall descriptions of the environments within the design process milieu model. In this way, the references are

targeted as having connections, firstly, to the inside or outside environments and then to the local or universal environments. Data reduction is iterative and tied to data display. The data is displayed by reorganizing it, compressing it, and reassembling it in a variety of ways. In this research the data was displayed in a number of coding matrices where indicators of the specific categories identify specific themes. In doing so, links are made across and within categories, illustrating the iterative process whereby new categories and themes emerge.

The next level of data analysis is a simplified coding scheme based on the data display and reduction. This involved a technique where a specific coding scheme is used involving the search for content morphemes. Gray (2002:435) describes content morphemes as the parts of a sentence that carry meaning. These are nouns, verbs, adjectives, and adverbs that stand for objects, events, characteristics and relationships (ibid). References are content morphemes and are comprised of three different categories:

1. nouns (people, places, things);
2. metaphors and analogies made;
3. and specific references to the individual's personal experiences and memories.

For each participant, verbal references are combined with their textual and visual references. These are charted out systematically week-by-week, and are mapped out in parallel, then broken down into the three categories of content morphemes.

Naturally, issues of validity and reliability of data are important in collecting and processing data. In ethnography, part of the validity of data is based on the time spent with the group being researched and not with the number of participants in the study. Furthermore, the researcher is considered to be the primary instrument to collect data; therefore, the approach taken is relevant to the validity of data. In this case, the researcher is a designer and design educator studying designers who were previously unconnected to the researcher. The researcher acted as a participant-observer because she was an insider to design and therefore able to develop a relationship of collegiality with the participants. Naturally, a degree of distance was maintained and the participants were unaware of the specific enquiry into designing. The benefits to the role of participant-observer are that the researcher is not a complete stranger and this reduces the problem of reactivity. Furthermore, the researcher is less of a curiosity and people behave more naturally because of the comfort level. In having an insiders view on design, the researcher has an intimate understanding of the practice which helps to formulate sensible questions and come to a more intuitive understanding of the topic. Bernard (1995:140-2) details these and other points about the validity of participant observation.

5 Two design problems on two continents

In order to adequately investigate the intangible references, two field studies are preformed at two universities that offer degree programmes in industrial design. One university is in Scotland and the other is in Canada. Both institutions have a tradition of excellence having won a number of competitions and awards in design, along with advertising excellent career placement. Naturally, each programme has a distinct quality, yet they each teach similar types of projects. A different design brief is used with each group but each is fairly objective and represents common design problems. In both cases the tutor/professor chose the briefs. One is from the

British Design and Art Direction Award (D&AD) annual competition (http://www.dandad.org). The chosen brief is sponsored by *Virgin Atlantic Airlines* and *Corus Steel Packaging* and involves the design of an in-flight meal tray. The second design brief is conceived by the two professors guiding the module and is titled *Vision in Sport*. The design problem involves designing eyewear for a specific sports activity.

The Scottish university boasts a programme that is a bridge between the arts and sciences and considered to be a hybrid in the UK university system between engineering and the fine arts. The strengths and weaknesses of the programme are articulated by the programme leader and the tutors involved. It is generally considered that the hybrid approach has allowed the students a great deal of technical competence and an ability to present a well-argued presentation about products; however, the main weakness is the struggle to find "enlightened" engineering instructors who provide appropriate/usable information which ultimately means that it is a challenge for the students to bring the information taught into a cohesive, useful whole (unpublished transcripts). The Canadian university is a programme that attracts a number of international students and is within a faculty of environmental design. The approach to teaching design at the university in Canada considers itself to have an academic focus. This academic focus is considered to be a strength and a weakness because although there is high level of "design thinking", but at the same time there is a shortfall in design-specific skills development such as drawing and modeling (unpublished transcripts). Both universities are selected because they are considered to be fairly typical settings with similar facilities and instructional strategies, with a cross-section of student abilities, socio-economic levels and some cultural diversity. In addition, both universities offer degree programmes specific to design, which indicates that the students have likely chosen the programmes as career moves towards a design-related profession and are not simply taking them for general or recreational interest.

Tables 2 and 3 are summaries of the student populations based on information provided by the participants at the onset of each study. The information in these tables is used to cross reference where the references may be coming from (inside or outside) and is a way to streamline the observation process. In both studies senior students are selected for their level of knowledge in design and their confidence with the subject. One could argue that they are no longer novices in design because they have completed several years of a design degree. However, they cannot be considered experts in their field either, as they do not have numerous project successes under their belts. In addition, the tutors/professors are considered to be experts in both design and teaching because they have extensive knowledge in practice and have numerous years of experience.

At the Scottish university the brief is assigned to an all male group of fourth-year design students in the first term of their honors degree year. It is their second design brief of the year. The brief is delivered in a module titled 'user-centered design'. One tutor was responsible for and taught this module; however, the students had access to other staff members. Each individual participant accomplished the design of an airline meal tray over six weeks.

The Canadian university brief is assigned to a group comprised of four males and four females studying industrial design in a master's degree programme. They are in their second year of study of a three-year

programme. All the students in the Canadian group hold an undergraduate degree that is related or unrelated to design. The brief is delivered in a studio-based module that is taught predominantly by one professor but involves a second professor approximately fifty-percent of the time. All participants accomplished the design of sports eyewear over approximately seven weeks.

	UK1	UK2	UK3	UK4	UK5	UK6	UK7	UK8	UK9	UK10	UK11
Gender	m	m	m	m	m	m	m	m	m	m	m
Age	21	21	21	22	21	22	22	21	21	21	21
County of birth											
Prior education			•Life saving •First aid •Swimming •Sailing •Music	•3D studies			•Understand. industry •TEFL •Radio license				•Art & design found.
Relevant design experience	•Graphic design	•Engineer	•Landscape artchitect	•Toy design		•Set design	•Lighting design •Graphics	•Engineer	•Architect		•Music product design
Travel											
Interests & hobbies	•Sports •Church	•Sports	•Sports •Extreme sports	•Extreme sports •Music	•Sports •Socializing	•Extreme sports •Socializing	•Music •Travel •Sports •Socializing	•*Sports* •*Extreme sports*	•Sports	•Socializing •Extreme sports	•Church •Music
Electives	•Packaging •CAD	•Packaging •CAD		•Life drawing •CAD	•Graphic comm.. •CAD	•Auto engineer •CAD	•Life drawing •CAD •Photo	•Graphic comm.. •CAD	•Life drawing •CAD	•CAD •Photo	•CAD •Italian
Direct entry		yes									yes
Taken breaks				yes		yes					

Table 2: A breakdown of the Scottish student population.

	CAN1	CAN2	CAN3	CAN4	CAN5	CAN6	CAN7	CAN8
Gender	f	f	m	m	m	f	f	m
Age	27	28	26	26	37	26	28	31
Country of birth								
Prior education	EngDip	BFA	BCom	BFA	BEd	BDes	BSc	BPSc
Relevant design experience		• Mural design • Prop builder • Display design • Graphics	• Graphics	• Art teaching • Graphics	•Medical device design • Technician and shop teacher	• Architecture • Graphics • Medical product design	•Exhibit design	• Graphics • Leather book binding
Travel								
Interests & hobbies	• Dancing • Music	• Art	•Snowboarding • Music	• Art • Music • Christianity	• Family • Jewelry • Religion	• Water sports • Art and art galleries • Movies • Friends	• Volleyball • Snowboarding • Soccer • Skiing	• Music • Hockey • Climbing • Kayaking • IDSA member
Electives	•Commercializing industrial design • Emotion and design • Sustainable living	• People and products • Emotion and design • Participatory design • Multimedia	• Furniture design • Design criticism • Sustainable living	• People and products • Commercializing industrial design • Emotion and design • Sustainable living • Multimedia	• People and products • Emotion and design • Sustainable living • Multimedia	• Emotion and products • Sustainable living • Product and technology assessment • Design criticism	• Commercializing industrial design • Design criticism • Multimedia • Sustainable living	•Furniture design • Design criticism • Sustainable living • Product and technology assessment

Table 3: A breakdown of the Canadian student population.

6 The overall references

Using the design process milieu model, the references are plotted into one of the four quadrants and detailed as either tangible or intangible. For example, references made to the inside-local related specifically to the design brief, the instruction and included reactions to the social group and research that was accomplished specifically for the purpose of designing either the meal tray or the sports eyewear. Through detailing all the references made during the design of an artefact themes and patterns emerge. These patterns and themes are relative to the general categories that are established for each quadrant at the onset of the study. The themes

among the two groups studies are remarkable similar, yet there are some differences. Figures 3 and 4 detail the themes discovered within each group.

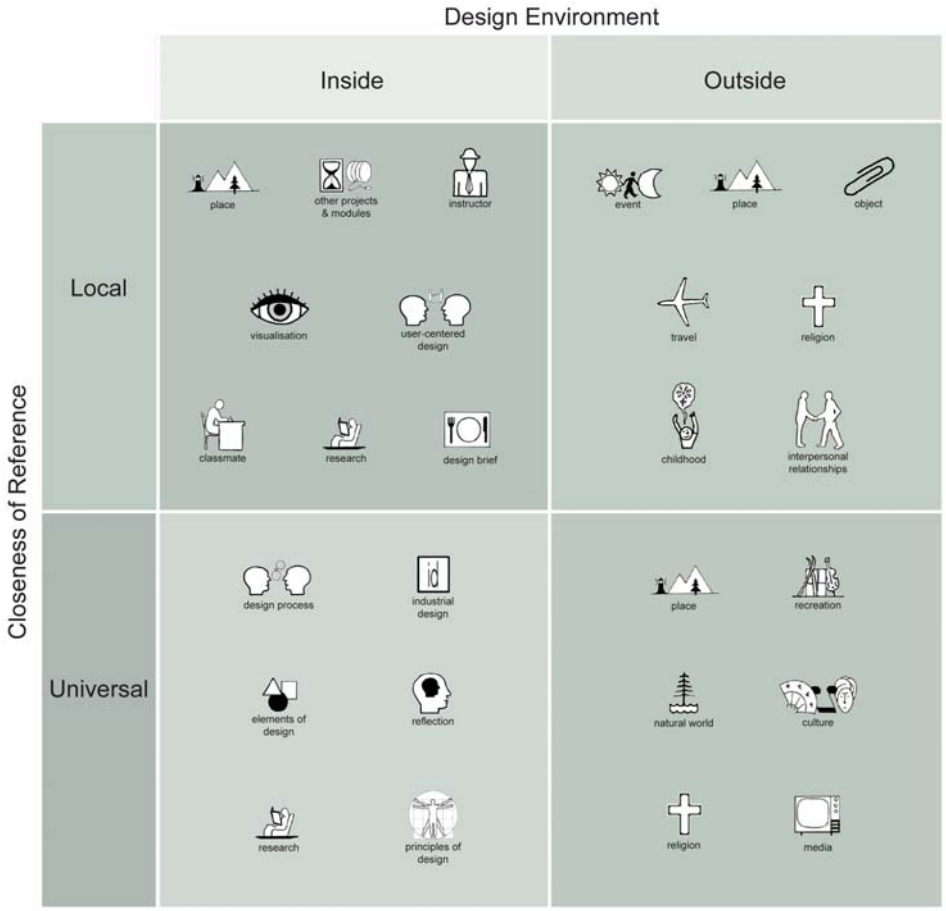

Figure 3:The references as themes identified in the Scottish study.

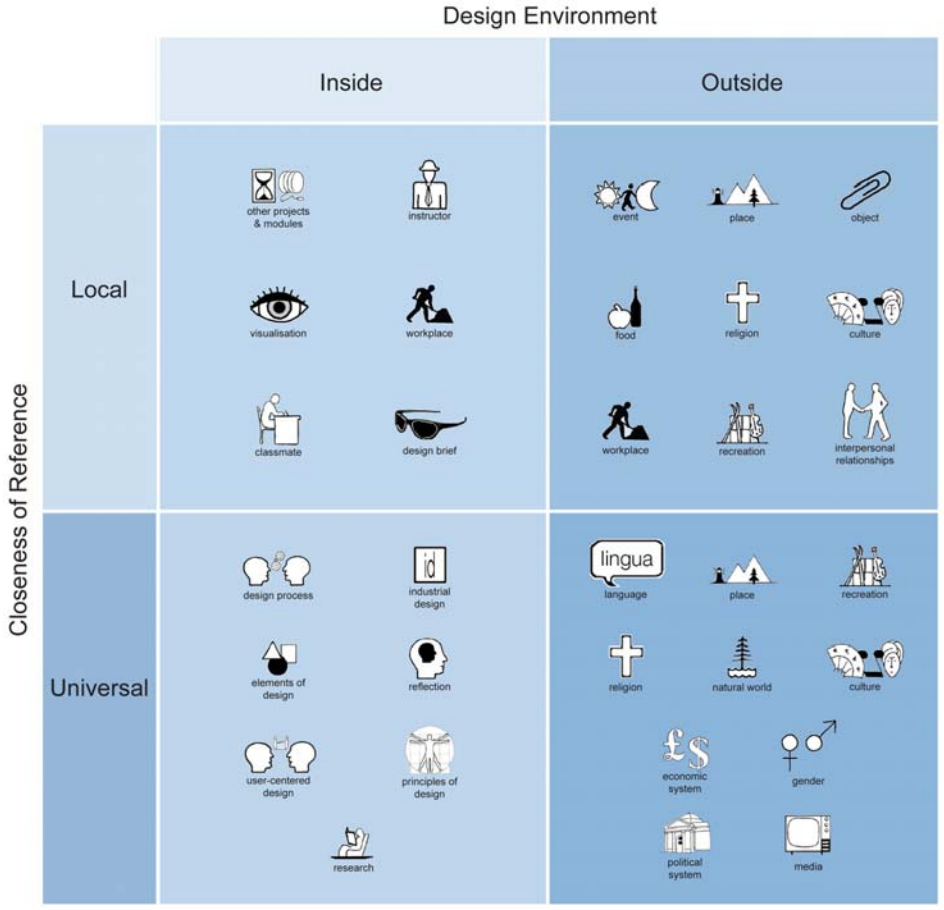

Figure 4:The references as themes identified in the Canadian study.

The most basic themes are all tangible references made to the inside design environment. The majority of the references are what would be expected while designing an artefact such as the airline meal tray or sports eye wear. These references do not have much distance from the artefact being designed since they are relative to known aspects of designing. A summary of the inside-local references include the following:

1. Brief specific tangible references: the airline meal tray.

- Turntable, music, DVD's, disc.
- Travel experiences (personal, friends, family members).
- Objects (dishes/crockery, glasses/cups, trays, cutlery).
- Food, drink and cooking (experiences, sushi, haggis, fruit, coffee, tea, wine).

2. Brief specific tangible references: sports eyewear.

- Sports activities directly related and sometimes not to the sport being designed for (mountain biking, surfing, kayaking, skydiving, motor biking, swimming, horse racing, paint balling, skate boarding).
- Eyewear of many types (glasses, sunglasses, goggles, safety glasses).
- Headgear including helmets.

- Objects (goggles, eyewear, glass head models).

3. References to things from the educational context at the programmes of study.

- Previous projects.
- Previous modules.
- Other students.
- Work experiences relating to the programme (*i.e.,* work placements, work at the university).
- Tutors/Professors.

A summary of the inside-universal references include the following:

- Elements of design (e.g., form, shape, volume).
- Shape classification (e.g., spiders web, organic, rectilinear).
- Aesthetics.
- Materials and production.
- Principles of design including user-centred design and branding.
- Skills relating to design (e.g., model making, drawing).
- Research into anything that related to the artefact development.

Other tangible references are found within the outside-local and outside-universal. These references are things that are easily relatable to the design of the meal tray or eyewear. For example, it was not out of the ordinary for the students to reference flat mates, family members, or friends who they had interviewed about travel, eyewear or the artefact context. Students also discussed places in the immediate and external environments that they had visited or remembered relative to the artefact being designed. For example, the students in Scotland mentioned local attractions and foods specific to Scotland (e.g., sites in Edinburgh and Glasgow, haggis); and the students in Canada mentioned local shops to purchase gear and locations for doing the sport they had chosen (e.g., skateboarding stores, rivers in Kananaskis, beaches in Nova Scotia).

The top themes referenced are all within the tangible category. With the Scottish group these include references to the design brief, the design process, user-centred design, the elements of design, research, objects, industrial design in general, and media. With the Canadian group these include references to industrial design, the design brief, the design process, place, the natural world, visualization (design skills such as drawing etc.), elements of design, culture, recreation, research, classmates, interpersonal relationships, and user-centred design. It is not surprising that the top referenced categories relate primarily to the topics of the design brief, the module and the expectations of the instructor (tangibles). This shows that students are responding to their instruction on design assignments and the environment they are in. The references to industrial design, elements of design, and the design process are clearly ways in which the students define design since these are things not explicitly taught in the module. What are surprising are the relatively low number of reference to travel and objects relating to the design brief with the Scottish group; and a high number of references to interpersonal relationships with the Canadian group. It is clear that the context of the design process milieu provides a framework that allows a rich and wide range of references and categories to emerge.

7 The intangible references

Both studies indicate that the majority of the referencing within the design process milieu is focused on the inside environment, except when students need to draw upon information from outside to aid in designing their artefact. The approximate overall references of both studies to the inside the design environment is 80% with only 20% of the references made to the outside. The approximate average number of tangible references is 96.5 % with just 3.5% for the intangible references. It is clear that the references to the inside of design and the tangible references far outweigh those made to the outside and the intangibles.

Within the Scottish group the references to the intangibles are relatively conservative. For example, the majority refer to objects including everyday things (e.g., key, toolbox, door hinge) and things from childhood (e.g., games). These relate to the cultural capital of the students, which is narrow due to their relative youth and their limited range of experiences described during interviews and shown in tables 2 and 3. This group is cautious about making connections to thing that may be perceived as too far 'out there' or too abstract. Other patterns in the Scottish groups include references to the natural world, to everyday events (e.g., train journey) and a surprisingly high number of intangible references to interpersonal relationships.

The Canadian group references a wider range of intangibles; even so, the reference types are similar to the Scottish group. There are a number of references to everyday objects including clothing items and numerous ones to everyday events (e.g., shopping, socializing). There are also references to local and childhood places. The natural world is a popular reference, which, perhaps is because the design brief focuses on sporting activities within the context of a sporting environment (the outdoors). Another factor may be that part of the Canadian identity is wrapped up with the outdoor environment. There are also several references to things that individual students' value such as music. Overall, the intangible references made among the Canadian group are much more ambiguous and individualistic than those made with the Scottish group, which is easily explainable through leadership styles and the maturity of the students.

When looking at the intangible references among all the participants involved in both studies these references are made most often during concept definition, development and refinement and less often during formal and informal critiques. This is likely because concept definition, development and refinement involve more exploration (therefore results in looser referencing) while critiques are established as a time to focus on the characteristics of a particular design (resulting in a more focused, careful referencing). In general, intangible references are most frequently in the form of everyday objects. It is probable that because students are learning how to design everyday objects (i.e., consumer product design) that referencing objects is the natural choice. Additionally, there is a pattern that the mature students make more random intangible references, while the younger students maintain considerable more focus on the task at hand. This, again, is not unusual since with maturity comes greater confidence along with considerably more time to develop and reflect on their personal cultural capital.

8 Referencing the sociocultural

Thus far, references have been examined as relating to the inside of design, the outside of design, and are divided into two additional categories, the tangible and intangible. Making these distinctions provide a framework to better understand the nature of the references and how these relate to the individual's sociocultural capital, which enables us to address the broader question of how sociocultural forces may be affecting designers while engaged with a project. As previously noted, through anthropological theory, we understand that individuals affect and are affected by their contextual environments. An ongoing question for anthropologists is: to what extent are individuals affected and affecting context? This is explored here through beginning to understand the nature of the multiple sociocultural environments That is, a design student (and designer) is interconnected to numerous different contexts including the local design culture (specific group of individuals, specific studio), the universal design culture (the generic understanding of what it means to be a designer), the local sociocultural environment (where they live and interact with friends and family), and the universal sociocultural environment (a specific country or group, western civilization and the 'global village'). By looking at two groups of design students on different continents it is possible to establish identifiable themes and categories of references to these different contexts. These are shown in figure 5.

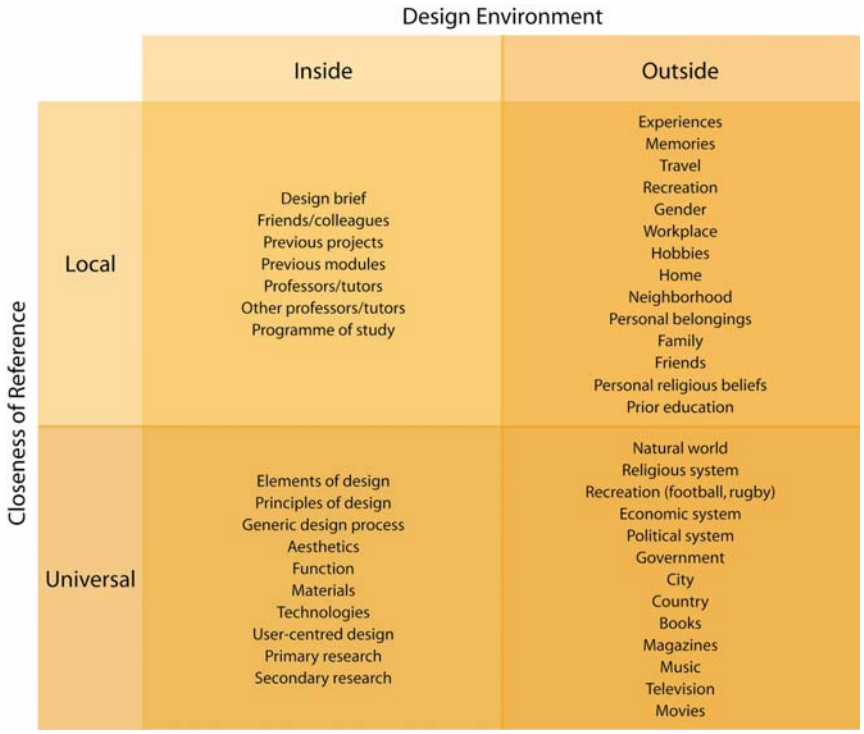

Figure 5: Identifiable themes and categories for each contextual environment.

These themes provide important information about the nature of the references but also about the affects of the sociocultural environments on design students. For example, although there are references to things outside of design, the majority of references are made to things inside design. These inside references illustrate that students are responding to the leadership provided and are focusing on understanding the task at hand.

Another way to interpret this is that the students seem to be most influenced by their immediate sociocultural context. On one hand this is positive because students are focusing on their projects. On another hand, it is understood among educators that one of the fundamental ways to learn, integrate and retain information is by relating new things to what individuals already understand. For example, it is common knowledge that new number sequences are most easily remembered if they relate to ones that have some prior meaning, such as birth dates and anniversaries. This concept is called here linked learning, but is also the essence of the theory of dynamic memory on which case-based reasoning in design is based. In case-based reasoning a single case may be adapted or several cases may be merged to create a new solution (Heylighen 2000:49). It is considered common for designers to take fragments of many previous projects, each which address a different aspect of the design task at hand, hereby creating analogies for their new design (Pasman & Hennesey 1999). The design community has explored linked learning or analogical reasoning; however, it is explored primarily through the tangibles. But when a student does not have a large repertoire of projects, what does he or she link their current work with? Interestingly, in the field studies discussed here the students who make more references to the outside of design (including those that are intangible) moved through the design process more effectively by completing a more refined project. This is an indication that these students found (knowingly or unknowingly) their individual sociocultural capital to be an excellent resource for linked learning.

In addition to this, the studies here show that the references to the sociocultural environment help move many of the discussions forward. Because references are immediately accepted or rejected as something that others can relate to (or not), the use either shifts the focus of the discussion into a higher level (more energy and enthusiasm) or into another topic, or re-focuses the discussion back to where it was originally. There is also an indication that when an intangible is rejected an individual rarely goes back to it later. Chaining of sociocultural references is another way that these are used during interactions. For example, one student fleetingly mentions games and this is passed along down a chain until another student decides to explore and finally use the idea of games in his product design. Sociocultural references are also used during critical thinking or critically analyzing the design work. These are made useful for testing ideas, for criticizing what already existed and to clarify the objectives of the design brief. For example, a Scottish participant talks about how he can control the passengers on the aeroplane by having them eat as if they "are marching in unison" or by forcing them into right-handed or left-handed "desks like American school children" (unpublished transcripts). In these statements he is clarifying the objectives of the meal tray, testing the limits of physicality, and using two metaphors to create clear imagery in discussion. An example of an intangible used for testing an idea is when another Scottish participant references a "Cornish box" (ibid). When the 'test' was not completely negative, he pursues this line of investigation and later presents the idea of using a "whisky box" (ibid), which later develops into the key source of inspiration for his final design (Strickfaden et al. 2005). When using the references to criticize something that has been created, the main objective seems to be to evaluate what has been accomplished. In many instances the students use things that they can relate to in order to describe or discuss their work. For example, "oyster" and "flower" are used to describe two different design outcomes.

As the examples in this section indicate, referencing the sociocultural while designing is logical even when the references are far from the task at hand. The distance of the references from the target (project) provides some

indication of the purpose of the sociocultural references. For example, those references that are more relatable to the artefact being designed are likely made to serve the artefact itself (e.g., a whisky tin reference is easily related to the structural and aesthetical components of the meal tray). Whereas random references may not have any relevance to the artefact, but act to aid in communication processes necessary for relaying important messages about the design process and the design thinking behind that process. Along with this, referencing the broader outside environment is an important way to connect and interact with people in general. These references aid in building and developing a strong local environment. For example, in one of the field studies the local culture is highly developed and many references to broader (outside) things reinforced that culture. Evidence of this is demonstrated through repeated use of an 'inside language' that is only understood by the group and is even 'played with' by adding new anecdotes that are highly idiosyncratic. That is, the individuals involved with this group used sociocultural references to build their culture.

To summarize, sociocultural references seem to serve different purposes within the design process. First, these act as aids to learning by linking that which is known to something new. Second, these aid in creating imagery while interacting and sometimes act as part of chain towards an outcome. Third, these are used as analogies and inspiration and are directly related to the artefact. Fourth, these serve to create a stronger sense of culture and aid in strengthening and building an existing inside culture.

9 Conclusions and future work

When Louridas (1999:519-520) stated that a designer acts as a bricoleur who is at the mercy of contingencies including the internal (cognitive) and external environments (local, universal), he was beginning to question design more holistically. This paper elaborated on this concept by developing a model that helps look at designing more holistic, and in doing this, has identified that design students reference a range of things that are easily related to the task at hand (tangible) and things that are abstract and less relatable (intangible). The design process milieu model provides an alternative outlook on the design process that includes the inside, the outside, the local and the universal. This constitutes a practical tool with guidelines for determining where references come from and a resulting theory about designing.

Having established some themes and categories of references, including some of the key characteristics, the central finding of this work is that the sociocultural enters into designing in a number of surprising ways. Referencing the sociocultural during designing is not simply about the artefact. It is about how design students (and designers) work within multiple layers of sociocultural environments that feed the design process in a variety of different ways. That is, sociocultural context not only helps to directly inspire the artefact, it also aids in communication and understanding and helps to build deep and meaningful experiences by enhancing strong sense of local culture. Judging from our field studies, the design process is complex, exceedingly difficult to define and comprehend, and especially challenging for novices like design students.

Furthermore, sociocultural capital is a resource that is at the designers' disposal without researching or even thinking too hard. They can select from their personal thesaurus and find the closest match or highest contrast to the task at hand, depending on what is needed or preferred. This personal thesaurus is the script of each

individual and it is commonly known that new situations bring out existing scripts and old scripts are revisited (Heylighen 2000:45). As Alexander argues in his book *A Pattern Language* (1977), designers select, adapt, and combine patterns. When specific patterns are not taught explicitly, such as is common in industrial design, designers and design students are left to create patterns of their own. The most readily available and easily created patterns are relative to their sociocultural capital. It is speculated that the level of expertise of professional depends upon to what degree their sociocultural capital is focused. Even so, having a highly tuned 'design-orientated' sociocultural capital may not be the ultimate goal for all situations. Research about creativity has indicated that randomness enhances creativity; for example, Csikszentmihalyi (1996:329) states, "most breakthroughs are based on linking information that usually is not thought of as related". Boden (1995) supports this by stating that randomness contributes to creativity. On the most part, much of design research to date has focused on the best or closest analogies (e.g., past projects, like artefacts, precedence); due to the close link between research into analogical reasoning such as Gentner's structure-mapping theory (1983) that states the source (references) and the task at hand should be close in order for it to be effective. It is recognized that closeness of reference is an advantage in computationally oriented work, such as the sciences, but distance might be preferred in the arts (Boden 1998:43). Therefore, besides using sociocultural references because they are an easily accessed resource, these may also serve to aid in creative reflective processes.

The research presented in this paper is but the first step in the investigation of referencing the sociocultural during designing. Naturally, with the introduction of a theoretical model such as the design process milieu, further research is needed to test the model in different design environments and situations. In addition, it is recommended that further research be done, in general, on the sociocultural forces that affect the designer during artefact development. More specifically, research is needed into the sociocultural references where, for example, how references are chained including interconnectivity, patterns, strengths, diversity and duration of chains is explored. It is also speculated that it may be possible to integrate some of the information about references into a computer modeling system (much like case-based reasoning and the precedence based modeling programmes) to aid the designer with concept development processes. And finally, further research is needed into how the sociocultural forces influence the final artefact.

Where there was a need for generic design processes in the past, this research begins to look at the antithesis – the ambiguities of the design process including the sociocultural. Many questions remain about how the intangible references relate to the context of artefact creation; however, this research has revealed that a great deal can be learned through adopting an anthropological perspective and engaging with ethnographically oriented studies.

Acknowlegements

The authors would like to thank the fourth year industrial design students in Scotland, the second year masters students in Canada, and their instructors Duncan Hepburn and Barry Wylant for their time, support, patience and honesty.

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