IMAGINATIVE DESIGN:
FORMING PRODUCTIVE IDEAS

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Abstract

This project explores Imaginative Design--how Industrial Designers, using creative imagination, produce their most creative ideas from conception to completion. It is a naturalistic, qualitative study, and creation of a video documentary for educational purposes. Inductive themes were gathered from videotaped interviews and related pictures of four Industrial Designers that were arranged and edited on computer, then copied to VHS tapes and DVD's. This documentary depicts a process of refinement and evolution that is strongly informed by a corresponding external, physical visualization and social influence. This process includes: completed design ideas and thoughts on different forms of design creativity; external criteria from the clients' needs and wants to personal and aesthetic principles like function, efficiency, economy, simplicity, and craftsmanship; gathering ideas from both conscious, existent, and related sources and unconscious, nonexistent, less related sources; using physical visualization to enhance mental visualization; discovering, playing with, devaluing ideas in order to conceptualize; choosing, noticing and isolating, and analyzing to edit ideas; and continual refinement even after idea completion. Recommendations from the study are to use physical visualization and social influences to inform the process, use a discriminating both/and approach regarding issues like unconscious or conscious control and combination or synthesis, and intentionally use "whole brain" models and creative thinking strategies.

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IMAGINATIVE DESIGN: FORMING PRODUCTIVE IDEAS

Introduction

My project is about the process through which industrial designers produce creative ideas. This will be obtained by videotaping four interviews with different industrial designers on their process of imaginative design thinking from the initial design stages to the final creative idea. Once pertinent data (videotaped interviews and images) is obtained and particular themes emerge when analyzed for an articulation of the creative design process, a videotape will be put together for educational use in high school or adult art and design classes.

Literature Review Notation

Within the introduction I have reviewed the relatively limited current research on my topic, including historical background in some places to elucidate the important ideas in my specific definition of the topic. These are derived from three fields--Aesthetic Philosophy, Cognitive Psychology, and Art and (Industrial) Design--which overlap. There are many other fields like computer science, neuropsychology, neuroscience and even biology and management which are interested in either in the physical and/or mental processes of creativity and innovation but are more distantly linked and therefore not included in this study. My focus is in Design and Education, but necessarily draws on these areas for research into the definition and inquiry in my topic.

Introduction of Concepts: Definition, Background and Literature

Creativity

Creativity has been seen historically as various different things. Ancient cultures (like the Greeks, Hebrews, Christians) saw inspiration as coming from the gods or God.

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A muse whispered the new ideas into the artist or God breathed life into the new creation

or idea. Later, the Enlightenment promoted a view that the humankind's thought and

science could begin to uncover the mysteries, like creativity, held previously by religious

dogma. In the Modern era, creativity was seen as being held by the genius; one who had

exceptional powers of perception and mental functioning held the key to creative works.

More recently, through such figures as J. P. Guilford (Hampden-Turner, 1981) creativity

has become seen as something of which anyone can be capable, and which is helpful, if

not necessary to our cultural survival and personal development.

Above all other concepts elaborated on in this document, what I will be trying to

tackle is creativity. But like trying to eat an elephant, it is too large to manage in one

sitting. So my approach to this monolith is rather to define which types I am referring in

order to narrow them down to size. The creativity I am interested in is not cultural

changing or genius. It is rather the personal experience and expression of designers (and

their commonalities) who form novel designs. How that is done and by what means, will

be defined hereafter in the elaboration of special types of creativity that pertain

specifically to my research project. First, I will be focusing on creative imagination. Then

I will define creative design production and process.

Imagination

Creativity is imagination but of a specific kind--what is commonly called

productive, constructive (Hobbes' term) (Singer, 1999), esemplastic (Coleridge's term)

(Porter, 1913) or shaping imagination or lateral thinking (De Bono's term--De Bono,

1970)(Roget, 1992). In these senses, it is creation or imagination with a specific goal of

producing, constructing, or forming (Singer, 1999; De Bono, 1970) into a unified

synthesis (Porter, 1913). This obviously distinguishes it from the free play, fantastic or fanciful day dreaming type of imagination mentioned by Sartre (Sartre, 1984) and often connoted in everyday speech.

It is imagination in the sense of visualization, picturing, imaging, envisioning, conceptualization (Roget, 1992), or to some degree, what psychologists broadly term visual and spatial mental imagery (Bloomer, 1990; Ormrod, 1999). First off, this distinguishes it from imaginations that parallel the other senses--auditory, kinesthetic, verbal, interpersonal, or intrapersonal (Ryle, 1984; Bloomer, 1990; Arnheim, 1969). Osborn, however, specifies this type of visual and spatial imagery even further by separating it into speculative imagery (that which you can imagine without it being existent), reproductive imagination (that which deals with remembering existent images) and structural visualization (imaginative ability to construct clear three dimensional forms in the mind's eye) (Osborne, 1963). It is particularly this ability to structurally visualize, construct, or form three-dimensional images in the mind's eye to which I refer. Although there is current philosophical debate as to whether imagination's source is remembered existent forms (Ryle in Ryle, 1984) or created nonexistent forms (Casey in Casey, 1984) I believe (with Beardsley (Beardsley, 1984)) either to be feasible incepts or inspiration in the creative form of this visualization.

However, it needs to be noted that this type of mental imagery or imagination is necessarily incomplete or indistinct or schematic (Arnheim, 1969). Although earlier on in the history research on imagination, it was seen as being a replica or image directly from visual perception (Arnheim, 1969; Casey, 1984), some current philosophers generally agree that it is distinct from, but informed by visual sensation (Ryle, 1984; Ryle, 1949;

Casey, 1984). Arnheim (1969) says in his profound work on visual thinking that it rather parallels the cursory glance in that it is a "paradox of seeing a thing as complete, but incompletely" (p. 105) because imagination "is a matter of shapelessness rather than lack of detail or precision" (p. 109). This quality of imprecision is necessary to this type of constructive imagination. It both allows the conception to exist while allowing creative changing of the idea to occur.

This creative ability has a number of important qualities to point out. Because it is a progressive forming of an idea that is being described, the conscious manipulation of this form and ability to spatially move the image in the mind is necessary to this form of creative thinking (Bloomer, 1990; Ormrod, 1999). Indeed, Osborne's definition of the creative (type of) imagination is that it seeks or discovers ideas (which can be through speculative imagery, reproductive or anticipative--a predictive or "thinking ahead" type of--imagination) and changes ideas through combination or synthesis (Osborne, 1963). This imagination would include certain creative design heuristics like trial and error (play) and utilizing random shapes, and deferment of commitment to a solution noted in psychological literature (Goldschmidt, 1999; Piirto, 1998). It is this creative imagination, which I see as a synthesis of the mentioned types and qualities which I am most interested in researching.

Added to this are qualities often associated with imagination that makes this form of creative ability more productive, more imaginative, or more creative (see my research question). Imagination which is more inventive, fertile, vivid, or active than normal would likely be better at producing creative ideas through imagination (Roget, 1992). One who can naturally synthesize or form what has not before been created (Hertz, 1999)

(this clearly uses speculative and anticipative imagination), one whose mind is rich or generative with applicable ideas, one who has clearer imaging skill, or one who thinks (imagines) quicker, more divergently (Hampden-Turner, 1981) or is willing to take more risks will more likely come up with newer, quantitatively more, clearer, more complex and more unique ideas. In other words, these qualities describe what would be evident in a productive ideation or design (see design--production).

All these types of imagination, particularly the latter ones, are important qualities in the type of imagination I am considering in my research. Though Osborne distinguishes particular types, I pull together in creative imagination what he calls his creative "types" of imagination.

(Industrial) Design

Another distinction which needs to be made in defining the type of creativity I am researching, is that it is Design and in particular, Industrial Design. Industrial design stemmed from the Industrial Revolution where engineers or designers replaced the role of craftsmen in the production of manufactured goods, and came to include conceptions of invented objects, works of art or engineering, and preexisting objects of the craft tradition now made industrially. Design, as defined by the 1969 International Council of Societies for Industrial Design stated

> Design is a creative activity which consists of determining the formal properties of an object to be produced industrially. In referring to an object's "formal properties", we mean not only its external characteristics, but above all the structural relations which make an object...a coherent unity, from the producer's point of view as well as that of the consumer. (Noblet, 1993, p. 24)

This imaginative process (as I have described) in determining the unified whole as defined by the producer and the consumer (and possibly other factors) is what I seek to find out in my research.

Broadly, design is the process of producing and planning visual ideas (in order to produce the physical object or artifact). Creativity and imagination are often infused in this process and it is hard to separate imaginative association or synthesis from forming, planning and production of visual ideas. However, I will define my particular take on design as production and process.

<u>Design As Production</u>

It is important here to clarify that I am talking about producing a visual idea not a product. Although the final end goal of industrial design is to produce an artifact, typically a unique, beautiful, functional thing, I am researching (up to) the production of the idea. Creative design is defined then as productive in the sense of action, the imaginative making or forming within the mind; a fertile process, the conception, generation, bearing, and birthing of the idea; and production, a plan that will literally be industrially produced. I have talked at length of the active imaginative production and alluded in part to the productive design process, but will elaborate further on design as a plan for production and then delineate the design process.

<u>Design as plan.</u> It is important in defining my terms I clarify that "To design is to plan for the making of something new" (Goldschmidt, 1999, p. 525). What I wish to research about Industrial Designers is their plan not their product. I have taken this to the point of stating within my research question that I want to know about the "use of imagination in the production of" their mental plan (most creative ideas) not their

physical representations (although these may be almost identical and can only be visually evident in the video through them and their actual products). Clearly, Industrial Design's end is to make a plan for an artifact (object), but it is the planning and the mental plan or design rather than the evidence of that plan (the artifact) I am seeking.

Design as a plan connotes conscious, meaningful organization as well. As Viktor Papanek has said, design is the conscious effort to impose meaningful order (Roget, 1992). This quote has several key concepts within. First of all it needs to be conscious and active. Although imagination can be quite unconscious or subconscious, imaginative design cannot. And it is at this point that imagination becomes most relevant and productive, artistically and educationally. A variety of psychological literature states that when conscious effort is applied to imagination so it can be actively directed and controlled, then it becomes useful as a creative means, particularly when deriving ideas from the subconscious like daydreaming or hypnogogic images (Singer, 1999; Osborne, 1963).

Second, the term design in everyday use connotes a sense of making order or structure. Common even within the field of Art, Design is seen as typically more ordered, even "scientific", than other visual arts. However, this ought to be seen in the sense of mental organization, arrangement or synthesis. There is an important flexibility both within the creative imagination and the ill defined "problem space" (Goldschmidt, 1999, p. 533) that allows the variable change, rearranging and synthesis as well as the room to move--or conversely, the boundary to determine that it does not "fit".

Finally, because a design is a plan it has intention, meaning or purpose that defines it. The reason for which the plan exists helps to structure the idea. It is this to

which I was referring when I said the plan has "room to move", but it is this that determines whether the design or plan is adequate or outrageous. A furniture designer's chair will be made for different reasons. But it is those reasons that will determine the ill defined problem space within which the design must fit. It is here that the anticipative imagination plays its role as well (Osborne, 1963). To plan or design well one must look ahead what possible problems might exist as well as the ones that do. Technically, these qualities in an Industrial design can save hundreds of hours on a production line. This is the reason also for all the two and three-dimensional drawings and models (Caborn, 1989).

Many unknown reasons or criteria are bound to exist, but some of the known relevant ones have been outlined in primarily art literature. Common standards brought into being by historical proponents like orthogonal projections (now technical drafting), industrial production, the Arts and Crafts movement (exemplified in the Bauhaus design course) are design principles and elements (Randall and Haines, 1965; Wenninger, 1971; Thomas, 1969; Wong, 1977; Wolchonok, 1959) from institutionalized design education, technological excellence, aesthetic appeal or concern, cultural significance (including function), ecological soundness, good management of production and marketing (Goldschmidt, 1999; Fraser, 1990) as well as anthropometrics, ergonomics, past models, function, and maintenance (Caborn, 1989). These criteria play into the type of creativity that can be expressed. The problem space of Industrial Design though ill defined is highly context, field (Paratore, 1985) or culture bound as well as defined by personal purposes (see Appendix A). Some of these personal criteria may include "images of similar entities, abstract ideas, technical data, ideals of beauty, forecasts of performance, appeals

to users and so on" (Goldschmidt, 1999, p. 532) or could even be the autotelic purpose

(Csikszentmihalyi, 1996) --"for its own sake". Christopher Alexander states it thus,

"every design problem begins with an effort to achieve fitness between two entities: the

form in question and its context. The form is the solution to the problem; the context

defines the problem" (Alexander, 1970).

Design as problem solving. Here we are talking about "problem" in the sense of

another common creative term, problem solving. It is the overlap in design of creative

imagination and practical utility or need that promotes the use of "creative problem

solving". Clearly this is not a problem in the sense of trouble or annoyance, but rather an

important topic worth inquiry and resolution and a puzzle to be sorted out. The practical

need of the product (typically) necessitates and forms the structure or problem space for

the design problem (Goldschmidt, 1999). Either the designer themselves or the company

they work for determine the problem worth seeking for solutions and set the task of

resolving this through providing a design or plan for the product or problem. The ill-

defined problem provides the framework, while creative imagination is almost (but not

certainly) necessary to solve the problem--to seek, discover, invent, play with, change

and synthesize or combine--into a unique design within this framework.

The Design Process

In general, literature about the creative process of design notes that there is either

the artistic Methods Movement view of a cyclical or recurring pattern of analysis,

synthesis, then evaluation moving from abstract to more concrete levels of ideation, or a

cognitive psychological view of a problem space for typically ill-structured problems in

which all these occur almost simultaneously, but need cognitive strategies or modeling of

design reasoning and heuristics to promote the necessary ideation (Goldschmidt, 1999).

Clearly, design necessitates a movement from abstract to concrete imaginative thinking

or "prepositional" to "referential" thought (as neurologist Hughlings Jackson would say

(Singer, 1999, pp. 16-17)) or Freud's "primary process" to "secondary process" thought

(Singer, 1999, p. 17). The idea of a problem space within which a design takes place has

been previously elaborated.

<u>Inspiration and Development</u>

Historian Thomas Kuhn claims that historically science develops either through

evolution or revolution--either it changes in gradual developmental steps or it radically

changes into some new paradigm (Hampden-Turner, 1981). Some writers on creativity,

like Koestler (Hampden-Turner, 1981) and Csikszentmihalyi (Csikszentmihalyi, 1996)

claim the evolutionary intersystemic or culturally developmental view of creativity.

Although, I am not discussing creativity in this paradigmatic sense, the principles apply

in the small "c" creativity (Csikszentmihalyi, 1996) in design that I am interested in.

The distinction between discovery and invention further this question of which I

see it to be. Discovery is novel in that it is revealing of something already existing.

Invention is novel in that it is the making of something not preexistent (Hertz, 1999). To

differentiate to extremes, historically creative ideas were seen as being derived from

something--the Muse, God, data, information, or nothing--the void (*ex nihilo*). This

extreme perhaps reveals my bias towards discovery rather than pure invention or

revolution to develop something novel. However, neither invention nor revolution can

claim to be without matter or ideas with which to create. They would claim rather that

matter or ideas are recombined or transformed into a new (never before realized) thing.

To put it in the language of this research, it would break the contextual design framework the creative problem is working within. Although I see this invention or revolution as more creative, I predict the designer's creativity to likely be more of the discovering or evolutionary (small "c") creative variety that are creative within the bounds of their individual criteria. However, I will welcome the other form if it is creative according to field or cultural standards--creating a new thing or idea and not radical junk.

It is for this reason that Casey's conception of imagination as existent or non-existent pure possibilities fits awkwardly within my design research (Casey, 1984) and Ryle's reproductive type of imagination fits well (Ryle, 1984). However, even though it is more likely from known elements synthesized within a framework than from various elements known or unknown reigning as pure possibilities that designers would likely work, a synthesis (like Casey's (Casey, 1984)) of known and unknown elements being imagined within the design framework is most likely.

Whereas revolution connotes a one time radical change, discovery and evolution together connote a gradual uncovering of a series of new ideas. It is the latter developmental type of imagination in which I also predict to be most likely. As a design friend mentioned of his process it is not only the single inspiration (though it can also be that), but through a series of inspirations. There can be then, a variety of other sources of ideas. Some highly occurring sources noted in literature are: from emotional or intuitive sense (Goldschmidt, 1999; Randall and Haines, 1965; Cheatham, 1983; Piirto, 1998), the practice or expression of working with the specific tools or materials themselves (Randall and Haines, 1965; Cheatham, 1983; Piirto, 1998), the environment (social (Cheatham, 1983; Fraser, Aug., 1990), manmade (Randall and Haines, 1965; Caborn, 1989) or

natural (Randall and Haines, 1965)), or past design ideas (Randall and Haines, 1965; Caborn, 1989).

Broadly speaking, in terms of this developmental visual imagination (the term I will use from here on) it seems, as evolution suggests, that the idea develops over time into something more fit for the purpose. This parallels the Methods Movement view of abstract to concrete development while neatly matching the ill-defined problem space within which the gradually (or radically) formed idea fits (Goldschmidt, 1999).

<u>Strategic Models</u>

Literature (mainly psychological) on creativity and particularly Design creativity is rife with what I will call "whole brain" models to explain or strategies with which to achieve this type of creative design. The majority suggest a combination of dualities to achieve this: left and right brain thinking (Hampden-Turner, 1981), divergent and convergent thinking (Hampden-Turner, 1981; Hampden-Turner, 1981), lateral and vertical thinking (Hampden-Turner, 1981), differentiation and integration, dualities (Hampden-Turner, 1981), unconscious or subconscious to conscious control of imagination (Singer, 1999; Osborne, 1963), paradoxical thinking or personality (Hampden-Turner, 1981), dialectical thinking (Benack, 1989; Marzano et al., 1988), metaphor or analogy (Hampden-Turner, 1981), association (Hampden-Turner, 1981; Mednick, 1976), and synthesis (Hampden-Turner,1981; Kant, 1984; Casey, 1984) All of these seem to parallel this process of the designer who necessarily maintains both the imaginative flexibility and productive structure to create form within context.

The concept of left and right brain thinking came from brain splitting neurologists who determined specific differences between the sides--the left hemisphere is verbal,

analytic, reductive-into-parts, sequential, rational, time-oriented and discontinuous (often

seen as "concrete" side), while the right is non-verbal holistic, involves synthesizing,

visuo-spatial, intuitive, timeless, and diffuse (often seen as "abstract")--but noted that

there was a strong need for connection between the two (Hampden-Turner, 1981).

Psychologists used this understanding to develop variations of divergent (expanding

generation of ideas), net like, lateral (or generative) differentiation and convergent

(narrowing focus of ideas), tree like, vertical (single focused) integration (Hampden-

Turner, 1981) ways of describing thinking models which typically enhanced the

undervalued right brain or the better interaction of both. The role of deriving creative

ideas drawing from the unconscious or subconscious to inform the conscious, controlled

imagination has already been mentioned. Dialectical and analogous thinking draws from

paradoxical or metaphorical veins to propose unusual new associations or biassociations

(Hampden-Turner, 1981; Marzano et al., 1988; Mednick, 1976). Design clearly draws on

both sides of the brain physically and psychologically to analyze and synthesize, diverge

or converge, draw from the unconscious or consciously control imagination, or live

within the paradoxical tension of dissimilar elements like organization and imagination to

create new artifacts.

An artistic, philosophical and psychological (current) debate resides around

whether an associative or synthesizing process is the true end of creative imagination

(Casey, 1984; Beardsley, 1984), but some conclude it is necessarily both (Beardsley,

1984; Singer, 1999). Historically, earlier Empiricists saw imagination as a number of

simple ideas (derived from or copies of actual sensations) that were associated, but could

be arranged or rearranged to make complex ideas (Casey, 1984). Writer Arthur Koestler,

who though holding onto the associative idea, developed it into holarchies (complex associations or schematics) which "bissociatively" collide unexpectedly to produce a creative new thing (Koestler, 1969).

Kant extended the original empirical understanding to include not only this reproductive imagination, but a productive synthesis as well. That is, imagination was not just a complex from simple associations, but a synthesized whole which could not be understood by a conglomerate of parts but stood as something new (Kant, 1984). Coleridge echoed this in his notion of fancy-- the mechanical association of fixities and definites-- an esemplastic unified organic whole (Casey, 1984)(Porter, 1913). In addition, the psychologist J. P. Guilford, in his model of intelligence, declared intelligence necessary to make a creative synthesis (Hampden-Turner, 1981).

These notions are reiterated by other modern philosophical theorists on imagination like Beardsley, with whom I agree, who states that perhaps both associative ideation and an unified gestalt are necessary in the imaginative creation of art as there is need for both "open ended" questions and a unified whole in the conceptual completion of artworks (Beardsley, 1984). This understanding parallels psychologist Jerome Bruner's "paradigmatic" and "narrative" processes, which logically order experience and construct possible realities respectively and are both needed in the production of a creative product (Singer, 1999, p. 17).

Visual Representation of Development

Physical visual representations play largely in the role of design imagination (Goldschmidt, 1999; Arnheim, 1969). Diagrams and sketching, and the skill of doing so, enhance the likely creativity of internal ideas (Goldschmidt, 1999; Goldschmidt, 1991).

The most noted example is drawing or sketching as being a way of not only deriving information, but developing the idea (De Bono, 1970; Randall and Haines, 1965; Dahl, Chattopadhyay, and Gorn, Feb., 1999; Goldschmidt, 1991; Gorman and Carlson, Oct., 1992; Wong, 1977; Caborn, 1989; Goldschmidt, 1999). Sketching is seen as a form of visual (even dialectical) thinking as much as a physical act (Goldschmidt, 1999; Goldschmidt, 1991; Marzano et al., 1988). This drawing (nowadays computer renderings are considered under this) is seen as so central in the design and so thoroughly a part of the process that some define drawing particular to the stages: preliminary sketches (and notes), developmental sketches, working drawings, presentation drawings, and the final design (prototypes and products are also outlined but will be shown only in reference to the ideas) (Caborn, 1989). Models and mapping are also seen as a similar form of simultaneous derivation, representation and working through of ideas (Caborn, 1989; Wenninger, 1971; Thomas, 1969; Wong, 1977; Wolchonok, 1959; Gorman and Carlson, Oct., 1992).

Some psychological and artistic literature notes some of the most effective strategies for enhancing the likelihood of creative ideas are encapsulated under this type of visual thinking (through representation) in conjunction with analogous thinking (Goldschmidt, 1999; Roukes, 1988). In some experiments, function instead followed after attractive form had been created from play and combination with given shapes (Piirto, 1998).

This is the overlap between design and plans and how they will be used to depict imagination. Both connote this mental production and physical representation of that mental plan. As noted before, although it is the imaginative mental design I am most

interested with, the physical representations will help to depict and enhance what imaginative processes are revealed in the interviews.

<div align="center">Conclusion</div>

The summation of inquiry into these processes are the thematic video taken from the interviews and related data (like visual representations of the imaginative design process). This form is meant to be an inductive analysis, summation, and creative product on their creative design process. It is meant to visually ask the questions: what is their experience? And what can we learn from their experience?

I hope to derive practical "how to" information about this elusive creative process in general but also, specifically how Industrial Designers practice this. Finding out how they imagine and design a creative idea from start to finish will hopefully draw out practical themes, principles, tactics, strategies (what they do), heuristics, models, design reasoning (how they do it) (Goldschmidt, 1999), etc. for how artists and designers can learn to more easily, more productively, more imaginatively create or, at least, increase the likelihood of creative results.

The principles derived from such imaginative, productive thinking are widely applicable. Clearly understanding this better would apply directly to designers, but these imaginative and creative design qualities are applicable to various forms of educational and practical problem solving, and may have strong correlations to fields other than art and design because of this. For example, psychologists are developing creative strategies that even mathematicians or scientists may be able to apply in the formulation of complex formulae or theories.

IMAGINATIVE DESIGN: WHAT AND WHY

Title Definition

As should be clear at this stage, my title, *Imaginative Design: Forming Productive Ideas*, reflects my defined terms of both creative imagination and design. "Forming Productive Ideas" reflects several ideas. First, this reflects the process Industrial Designers go through in creating their ideas, from initial stages to the end, as noted in the imagination and design description. Second, it refers to my process of forming a productive video for use educationally. Finally, it refers to the viewers of this video, in hopes that they will be forming or learning how to form productive ideas for how to use creative imagination and design.

Although the title refers to the content, process and desired results of this research project, my research question provides the focus of inquiry. Clearly, the title of the project reflects the specific research question I am proposing.

Research Question

My guiding question is: how do Industrial Designers using creative imagination produce their most creative design ideas from conception to completion?

Definition of Research Question

Industrial Designers are people currently working in the design field typically doing smaller (from inches to feet sized) three-dimensional design of industrially produced or man-made artifacts (this then, excludes foods or purely aesthetic art, but rather deals with utilitarian and beautiful object). The end designs can include conceptions of invented objects, works of art or engineering, and preexisting objects of the craft tradition now made industrially. Therefore, they may be Industrial Designers

determined by a professional designation (Industrial, Product, Furniture, or Engineer/ Designer) and qualifications or simply the work they do. In this sense, furniture designers (those doing the work of industrial design) would be included under this distinction; only a few museum, display or set design would be included (those with professional qualifications and partially doing the work); and architects or layout and graphic designers would not be included (as they neither do the work nor have the qualifications). As there is often overlap, those who do both may be included.

The term "creative", in terms of creative ideas, has perhaps the most flexible or uncertain meaning. What is meant by ideas here is the final conceptual plan or design. Therefore, "creative" refers to a novel idea that fits within the contextual framework defining the particular design idea. Novelty refers to a newly created (discovered or invented) synthesis that fits within the framework or criteria of the particular design problem (see Appendix A). Exceptions to this (that are more creative in this sense) are if it is novel to field or cultural criteria. Part of the criteria for a creative idea, then, is that it is in some degree different from the old (past) designs with the same criteria. A design for a chair then may be creative according to personal ideas, but also must look different from a history of past chairs.

The criteria or framework is both contextual and personal, but also specific to the design problem. Therefore, criteria needs to be understood, even defined in part by the designers themselves. First, the field (or company) parameters that exist will need to be found out from them. Some of these will likely include a unified design reflecting institutionalized design education, technological excellence, aesthetic appeal or concern, cultural significance (especially function), ecological soundness, good management of

production and marketing (Goldschmidt, 1999; Fraser, 1990) as well as possible specifics

like anthropometrics and ergonomic function and maintenance concerns (Caborn, 1989).

Second, personal criteria will also have to be made known. Some of these typically

include "images of similar entities, abstract ideas, technical data, ideals of beauty,

forecasts of performance, appeals to users and so on" (Goldschmidt, 1999, p. 532) or

could even be autotelic--for its own sake (Csikszentmihalyi, 1996). Although this

"sliding rule" is more flexible than others it is not amorphous and similar forms have

been used before to measure design creativity (Barron, 1969). In fact, some of these

design problems are so bound by these criteria few of us without training would be able

to find capable, let alone creative designs.

It is for this reason that what is meant by "creative" will need to be determined (in

part) during the interview and indeed why it was deemed "most creative" by the

designer's themselves. This process will need to be clarified at the outset, but follows

neatly with the inductive, phenomenological, qualitative nature of the research.

The "How do Industrial Designers …produce" portion of the question refers to

the process through which these designers create, form or shape their most creative ideas

from initial stage of idea finding or needing to produce the idea to the discovery or

invention (Hertz, 1999) of creative ideas to the final conceptualization of the artifact.

Imagination in the context of this question refers to the creative variety previously

defined in my introduction with the particular use of mental imagery to picture, play with,

manipulate, move, and change images solely in the mind. Even though imagination

parallels other forms of visual design imagery, like seeing drawings or models, it cannot

be what is outside the realm of the mind (Ryle, 1984), but clearly affects and is affected by what is (Ryle, 1949). It is this use of imagination that particularly interests me.

The question then, deals with the creative process and the product (or in this case, idea or plan). It asks how Industrial Designer's imagination is used in this process, and what factors play into how these creative ideas come about.

Rationale

I am doing this because of the need for creative imagination in the field of education particularly in the arts and design. Generally, there is great need for inquiry, innovation and discovery to provide artistic, intellectual and cultural growth. Education thrives on inquisitive minds, innovation on the use of creative inquiry, and discovery and invention clearly follow from this type of inquiry (Hertz, 1999). Creativity is a normative word in education (Barrow, 1990) and positively motivates students and educators alike in inquiry.

Imagination and design then, are two tools to apply creativity in education. Using some experienced practitioners in the field of design brings a practical quality to this investigation. Using them makes imagination not just a whimsy of artistic joy, but rather a practical tool used in the everyday development of creative and functional designs. Exploration of the creative process these Industrial designers use may help clarify in the fields of Design and Education (and even Philosophy, Psychology and others) how imagination is used and developed.

Rationale for Research Question

There are many reasons for asking this question of such a chosen population. They are working in a field that is both aesthetic and utilitarian. Therefore, the results

relate well to both art and science, and therefore interdisciplinary fields such as management, engineering, and education. People in the field of design are operating on a high level of productivity in order to live. Designers, like others in the artistic field have a strong need to create a new product in order to keep doing what they are doing. The high level of productivity and creativity needed in this field is also representative of many others in our market driven economy. Thus, principles derived from design productivity can be effectively applied to many other fields.

Educationally, this study is applicable in several possible ways. Clearly, to educators in the Art and Industrial Art classes of Secondary Education and Design classes of post-secondary such a study and clearly the video would be relevant and applicable from a real process of lived people, in the fields in which many of their students may want jobs. Depending on the results of the study, the role or use of imagination in producing creative ideas may become more concretely determined and applicable. In addition, important (learnable) traits applicable to problem solving in general or in any creative educational endeavor may become evident.

New understandings in the creative process may occur as a result of such research (though clearly more research would be needed to substantiate it), and as such be relevant to a broad range of practical problems. Learnable principles which enhance visualization, conceptualization, and the making of new products (which are large parts of design) are necessary to cultural and personal development and therefore, apply to a broad range of practical problems.

Finally, as the question concerns values and process surrounding creativity, it encourages creativity itself. As creativity is normative (Barrow, 1990), it gets at a deeper

human question--the enjoyment of human existence. To encourage this is to encourage us to live better.

Rationale For Research Strategies and Techniques

The research approach I am taking is naturalistic, qualitative, and inductive and to some degree phenomenological and hermeneutic. The method I have chosen is the videotaped in-depth research interview and production of a video from these interviews (and related images, sounds, etc.).

There are many reasons why I have chosen these particular paradigms to work from. First off, these paradigms match my personal philosophy. Although there is clearly merit, advantages, and applicability to human experience in all the other approaches, these follow some of my most common, everyday ways of inquiring, gathering data, thinking and processing data, and presenting results. In addition, I believe more firmly in these approaches (or it "resonates" with me, to use a naturalist term). Though I see the importance of statistics and numbers to quantify things, I believe more in the importance of purpose and people to qualify things.

Another reason I have chosen this approach is the nature of my research topic. Creativity, and particularly my derivative, how designers use imagination to produce their most creative ideas, lends itself more easily to a naturalistic, qualitative, inductive approach. Because of the complexity involved in studying creativity (particularly, the creative process and ideas) it is easier to research people's creativity than to pick out variables. To make a variable does tend to pull out a part of an intersystemic phenomenon, making artificial the result. The very nature of creativity is that it deals with the novel and unique. To try to verify ideas is difficult, to quantify process is challenging,

and to deduct specifics from a general sample of people aiming to be unique could easily be fruitless. Whereas pursuit of naturalistic research would allow flexible, (partly) subjective, development of research design, based on insights from qualitative induction from (and social interaction with) the creative people. What I am most interested in receiving as a result is general themes and principles of specific creative thinking.

I have chosen the in-depth interview for a few specific reasons. First, in comparison to other methods of qualitative research like observation, oral history, surveys and case studies it seems the better method for my purpose. My question focuses on internal thought processes of which observation would likely provide only secondary information. Oral history, though relevant to the past process as expressed by the designer, would likely focus also on extraneous historical information, irrelevant to the particular process I wish to focus on. In addition, surveys generally assume a certain amount of prior knowledge that would structure or impose fitting data within certain "boxes" that I wish to avoid based on my inexperience in design and desire for their view of their process. Perhaps a case study would be quite useful with a particular person and their process, but I want to find patterns from various designers' processes not just one.

I chose the in-depth interview over casual, semi-structured and structured interviews with purpose in mind. The in-depth interview is also called semi-structured or standardized non-scheduled, the casual is also called unstructured or non-standardized, and the structured is also called standardized in various methodological literature (Runte, 2001; Key, 1997; Richardson, Dohrenwend, & Klein, 1965). As I have background knowledge in creativity, design and education, and as I am seeking information on a specific area overlapping these, the casual interview would be redundant. I would simply

be asking questions I know the answer to. In addition, the casual interview would likely provide data more difficult and time consuming to analyze, summarize, or evaluate particularly when compared against other designers (Key, 1997).

However, using the structured and even semi-structured interview would be pretending I knew too much and not allow the flexibility I desire (Runte, 2001; Key, 1997). My knowledge extends to, but is limited by basic patterns, heuristics and a working knowledge of design. Therefore, to assume I have equivalent experience and education and thus, could assume answers to necessary questions and provide a more comprehensive guide (as in a structured interview) (Mahoney, 2001) or even predict answers (as in a semi-structured interview), would be to assume too much. I am in a place of exploration of the interviewee's hidden process, to formulate or predict particular idea finding processes would be to put words in the interviewee's mouth and bias or consciously skew data. In relation, I need some naturalistic flexibility to be open to any new directions that crop up during the interview and a strong but limited amount of structure provides this (Palys, 1997).

In addition, the strengths of the in-depth interview most concisely match my need. As I am dealing with complex subject matter and seeking rich, detailed, insightful data, it allows me to explore topics in-depth because of personal contact (Mahoney, 2001). I can explain or clarify questions if necessary and both affectively and cognitively experience and encourage responses, and therefore increase rapport and the likelihood of accurate and relevant data (Richardson, Dohrenwend, & Klein, 1965; Mahoney, 2001; Palys, 1997). These, combined with high participation rate and flexibility for individual circumstances (i.e. questions can be reworded, etc.), are strengths in both the face-to-face

interview (Mahoney, 2001; Palys, 1997; Runte, 2001) and somwhat less in the telephone

interview (mainly owing to the missing non-verbals) (Palys, 1997; Donaghy, 1984). The

telephone interview isn't quite as strong for the purpose because it is often shorter and

more superficial because of its lack of "situatedness". However, it still holds to most of

the significant strengths like quality and honesty of answers, and even lacks some of the

significant weaknesses like bias owing to non-verbals and visual judgment (Donaghy,

1984; Palys, 1997). However, in each, the costs of time and money are far outweighed by

the specific and research relevant strengths (Richardson, Dohrenwend, &Klein, 1965;

Mahoney, 2001).

Adding the element of video documentation of designers' experiences (the

phenomenological element) and personal synthesis of elements in creation of a

documentary video clearly adds my own naturalistic, hermeneutic twist to what could

otherwise be quite an objective means of recording. However, this analytic and

synthesizing process matches my naturalistic, qualitative, inductive approach, parallels

the creative nature of the topic, and produces an interesting, practical, and educational

final product. The latter reason, in conjunction with more realistically fitting within a set

time frame, is more to the final purpose of the research. Producing this research as a

video for use in educational art or design classes makes both me, the interviewee, and the

final viewer, reflect on and engage with the research (the process of creativity) in a way

in which other methods could not. Creatively producing a final product that engages

students to consider their own creative process in the light of designers' is multi-

dimensionally to the point. For the designers, it allows them to reflect on their internal

process (hopefully for better practice). For me, it allows creative, multileveled analysis

and synthesis. In the field of art and design education (particularly adult education), there

is constant need for this type of visual, reflective learning. I would be hard pressed to find

other kinds of methods or final products that would allow this kind of process and

achieve as effective or appealing a result.

METHODOLOGY

Overview of Process and Product

This project included: videotaped interviews of four Industrial Designers; videotaping of other visuals to enhance the designers' statements, such as: drawings, renderings, models, prototypes and designs; use of graphic organizers, visual representation, language analysis, aesthetic criticism, and technology to enhance documentary creation; and the actual creation of a video and DVD documentary. The purpose was to thematically describe, four Industrial Designers' use of creative imagination in producing their most creative ideas. In this process, I wished to make my research procedures and methods of analysis and synthesis in creation of the documentary most resistant to bias or error. Certain biases exist in any interviewing, recording, analytic and synthesizing method, but hopefully careful procedure and researcher awareness limited them (Donaghy, 1984; Palys, 1997).

Content was derived mainly from interviews, but included other images and visual or auditory material or techniques that enhanced the interviewees "voices". For example, I used text in title frames and particular filming choices (as well as the aforementioned related images and sounds) within the video to enhance visual communication of ideas. My aim was to be strongly descriptive rather than prescriptive in any use of these. Obviously the nature of creating a video from any material introduced artistic license; the balance was to obtain the highest quality inductive analysis while trying to maintain a unified artistry in synthesis. If I have achieved this aim, it will be the Industrial Designers and viewers, no less than the committee and I, who will be happy.

Ethical Considerations

According to the ethical considerations of the Human Subjects Research

Committee at the University of Lethbridge Education department, informed consent,

confidentiality, right to withdraw, and anonymity was maintained through the procedures

outlined in the methodology. A sample of the letter the designers read that outlined these

issues and the consent form they signed gave me permission to use the respondents in an

interview and on the final video (in addition to their images and "sounds") is included in

Appendix B and C respectively. In addition, a sample of the consent form email sent to

them for permission to show a rough cut draft of the video for critical feedback and to

copy final drafts for the interviewed designers' use is also included in Appendix D.

Confidentiality and anonymity became less relevant at the end of the project as the final

video was being made primarily so that others will see it. This may have been seen by

them as one of the benefits--publicity, personal interest, etc. However, these issues were

simply made inconsequential in making them aware initially and through signed consent

and their right to withdraw at any time.

Research Procedures

Videotaped Interviewing

I interviewed four industrial designers. The ones I interviewed were from

Lethbridge, Montreal, and Edmonton. This sample of respondents were randomly chosen

from a group of speakers who came to the University of Lethbridge to speak on their

practice in Industrial Design (Donaghy, 1984; Doyle, 2001; Runte, 2001). This lecture

series, in combination with conversation with each of them, made them both accessible

(Key, 1997) and gave strong background information (Donaghy, 1984; Doyle, 2001). All

were approached in person and verbally agreed to be interviewed on the topic of how they find their most creative ideas. Some agreed with strong interest and clearly rapport was built with some of them. This was followed up with an email or telephone call describing the study in more detail. The particulars of this were: the re-introduction of the study (topic and purpose of the study--interview and research the creative imagination and ideation process of designers); why they had been chosen; the method of the interview (including videotaping); the time length of interview and other videotaping (45 minutes and another 30 minutes); their permission to videotape the interview; and the level of confidentiality I would maintain. At this point, I also discussed and tried to set good dates, times and (non distracting) settings conducive to videotaping in which to conduct the interview (Runte, 2001; Donaghy, 1984; Key, 1997).

The week before the interviews, I confirmed the appointment (date, time and setting), checked the video recorder and tape and batteries for good function, and reviewed questions, if necessary, for reliability and validity to complete an effective interview guide (Donaghy, 1984) and refreshed my interviewing skills in order to avoid interviewer effect (Donaghy, 1984). Prior to the interview, I dressed with consideration for location and interviewee bias; and just before the interview, reintroduced myself and the study, why they were chosen, permission to tape record the interview, reviewed the level of confidentiality, had them sign consent form, and, when necessary, hung an "Interview in progress. Please do not disturb." sign to limit the likelihood of interruptions (Runte, 2001; Donaghy, 1984).

As was common to the face to face in-depth interview, I used clearly stated, short, simple, but open-ended questions from my interview guide and probes to elicit the

industrial designer's views on the topic, and documented on the tape pertinent filing information (such as respondent name, project name, time, date and interview number) (Runte, 2001).

<u>Critical Review Of Interviewing Skills</u>

The experience of interviewing added to my understanding of what comprises good interviewing and research. The areas that I could improve on could be summed up as "guiding". By that I mean staying aware of the fluid movement of interviewing mostly generated by the interplay of various factors: time and place, the interviewee's personality, and the interviewer's questioning and probing skill.

One of the most significant factors was my questioning and probing. My skill was adequate especially in light of the minimal verbal or non-verbal probing necessary for this video interviewing. However, my questions tended to be ambiguous, too general (or conversely too specific), longwinded, or double-barreled. This happened particularly if their answers were too divergent for my liking. Two examples of questions that were too vague or general were "How does this process change over time?" and "How does place influence your process?" Although within the context of the other questions "process", "change" and "influence" become more specific, the interview process showed them to be still too vague or ambiguous, seeming ill defined or open-ended. This became apparent when the responses went in an undesired direction. A change to more specific terms or adding descriptive words would have helped further define them.

In addition, because of the abstract nature of the topic, there was often a need for the interviewee to more clearly understand what I was asking for. A more "structured" interview would have helped. The structure could come primarily through more carefully

worded questions (like leaving "creativity" out of some of the unnecessary places) while leaving the "semi structured" flow of answers, listening and probing to exist. In addition, some description about the topic would have helped at the outset. An example of this would have been to define creativity as "the most novel (creative) mental image designed into an actual product". These interviewing skills will likely come with more practice as questioning and (silent or limited) probing is the difficult art of partially guided inquiry in such an interview. It often demands more of intuition informed by awareness of content, interviewee personality, and other interview dynamics. I realize there is a subtle line between intelligently shaping the interview and leading the interviewee, biasing the outcome response. I would like to have done the former while avoiding the latter.

Sometimes it was difficult to guide the conversation because I was tired, limited to nonverbal and minor verbal interventions or had to quickly adapt to strong personalities of the designers themselves. The designers too were sometimes tired or impatient often owing to the time of day and distractions in the place of work. Although these factors were determined through agreement with the interviewee these factors were out of my control and next time I would try to avoid these detrimental factors.

I believe that more contact with future interviewees before the interview could also enhance my awareness of how to word questions, probe, use time effectively, and use non-verbal responses as signals for direction according to each one's personality. Although all answered most questions adequately, some disliked some of the questions and some found the more abstract or open-ended ones difficult to answer. Most of this can be attributed to the difference in personality, values, and conscious awareness of their own mental processes (Arnheim, 1969). Although I could choose according to

personality, this is difficult to determine beforehand and would likely introduce bias. Difference adds needed variety. In continued research, it would be better to simply complete more interviews and let the numbers help determine consensus. To encourage more of this, I received names of other designers who could be interviewed. From three of the interviewed designers, I received four names of other Industrial designers across Canada who would likely be willing to interview on my topic.

Although I worked to reduce bias, one unforeseen bias was suggested by one of the designers (Santella, 2002). He noted that all interviewees were Industrial Designers with their own businesses and manufacturing facilities and that this was not the case with all Industrial Designers. Some have a business; some have manufacturing capabilities; some work for a firm or business that may or may not have their own facilities. This was a significant point in that it could affect their imaginative design process in a variety of ways. For example, less time can be given to actual design when running a personal business since more marketing is needed. As well, manufacturing capabilities allow designers to work directly with their materials in process rather than after the design completion or not at all, which could be the case for some free lance designers.

<u>Documentary Creation</u>

I videotaped information during the interview and at least partially reviewed them after to increase reliability of information (Donaghy, 1984; Runte, 2001). As well, I videotaped and received through email other images related to content of the interviews. Examples of this were notations, drawings, pictures, renderings, mock-ups, models, prototypes or actual artifacts, the place or environment in which they worked, and various

tools or materials they used. This was done in conjunction with the interview and usually occurred right after.

Use Of Camera In Filming

Before filming I decided on being a "silent questioner" rather than include my questions and myself in the video. I felt this was best for several reasons: I wanted a shorter film length; it is difficult to show oneself well on camera because of the angle necessary for questioning and the fact that I was the videotaper as well; it is difficult placing oneself well within the edited version of the video, owing to poor physical space or background, overlapping speech, and need for a short video; and I wanted to avoid the "intrusive but conspicuously absent" quality of commentary of interviewers in many documentaries (Adkin et al., 1993; Bogdanov & Morin, 1998; Daly & Winkler, 1981; McLaren, McWilliams, and Verrall ,1991). In addition, on the strength of technical advice, I considered good lighting and space at the bottom of the frame when shooting video in case I wanted to use title screens at the bottom.

I chose to place the person within the frame generally "screen left" or "right", near the center, asymmetrically balanced for visual interest. I had them face toward but not directly at the camera and left room at the top and bottom of the frame. Background was left minimal or thematically related.

The camera angle was face on. Some were more close up, some less, but generally shot at medium range to add interest. The shots during the interviews were static. The pictures of the works or drawings were either hand-held if movement was needed or digitally (camera) shot or mounted on a tripod, if possible, for better static shots.

Editing and Structure

Editing is

the process by which film or video footage is selected or rejected for inclusion in the final film or program. It is also the process by which meaning is created through the ordering and juxtaposition of sounds and images. Editing determines the final length of a film or program, its pacing, its emphasis, and its overall structure. (Adkin et al., 1993)

During the *rough cut*(s), the original shots, which ranged from hour long segments to single video frames of interview, were edited to short picture shots only a few frames long. Themes were derived from all the original interview shots. About an hour's worth of thematically appropriate takes were selected, leaving about six and a half hours worth of outtakes. Sequences of thematically joined takes were made through crosscutting, montage or visual juxtaposition of different people without transitions. This created a transitory, varied pace to the overall rhythm. This, together with a positive verbal emphasis promoted a sense of "yes, and" type of conversational style suggesting themes and a progression of ideas. Continuity was created primarily through these sequences joined together in a larger rhythm through screens and "natural progressions" such as concrete to abstract, external to internal (see Appendix E), or the classic creative progression of conception to completion.

During the *fine cut*(s) phase, cuts were refined--that is, lengthened, shortened, cut and transitioned or audio settings changed--but left for stronger visual juxtaposition between different designers. Also, transitions were put in between the same designers or images or title screens. These took the role of fade ins and fade outs when black screens were included before the movie and after. Synchronized, actual sound was included from the interviews, while images were left (MOS or) silent, using the sound of the designers

to elucidate the meaning of the included images. Still and video images were typically placed in the middle of a designer's commentary. The images corresponded to the designers' themselves and their voice-overs helped to associate them, with the one exception where Addison Lanier's drawings were included in Dennis' talk about drawings. In sound editing, many clips were changed to make the sound louder and therefore clearer, or were partially cut or manipulated to enhance rhythm and pacing between cut or transitioned clips.

Documentary Style

My documentary style was strongly informed and determined by watching numerous documentary videos about documentary production (Adkin et al., 1993) and videos on interviews and creative processes (Adkin et al., 1993; Bogdanov & Morin, 1998; Conrad & Johnson, 1998; Curtis, Stevenson, and Hutchison, 1995; Daly & Winkler, 1981; Gilbert & Weintraub, 1964; Hanley, Nielson, and Znaimer, 1995; McLaren et al., 1991). As well, I drew on experienced technicians and artists prior to having the interviews and making the video. This was important in choosing how to use the camera in filming, how to structure and edit in the process of making the documentary, and how to determine the final style or type of documentary. For example, being the "silent questioner", choosing a three quarter camera angle shot, and the length and cutting of clips, was determined in part by what I liked in the style of a Robertson Davies documentary (Hanley et al., 1995).

The style of my documentary follows directly from the choices of camera use and editing. The "silent questioner" approach, full framing of only high quality, relevant content from the interviewees, and cross-cutting, montage, and visual juxtaposition

through editing created a "yes, and" postmodern conversational style. This seemed to best communicate the collective views on the complex topic of imaginative design, while allowing my interpretation and the individual voices of the designers to also be heard.

Analysis and Synthesis of Themes through Documentary Creation

As previously mentioned, I reviewed the videotapes of the interviews for useful clear, pictorial quality and noted relevant verbal but unclear visual content, after the interview. I then analyzed the videos for common themes about how they used imagination to produce their most creative ideas, thus giving my interpretation of the evident patterns. Initial thematic categories were derived from the interview blueprint or guide (see Appendix F). And as is the nature of this qualitative, inductive approach, other themes came through common patterns that emerged from the interviewing (Donaghy, 1984; Palys, 1997). Specific, pertinent clips (like quotes or sections of interviewing or images) were visually (and auditorially) initially rearranged under these topical headings as well. Physical copies and rearranging were done on or from the computer using Adobe Premiere, while any other necessary coding was organized according to specific interview and clip numbers (Runte, 2001).

Drawing Out the Themes

Following the previously stated methodology, the initial video storyboard was derived from the general themes of the interview questions. Specifically, these were the designers' individual ideas, their (collective) definition of creativity, the criteria for their projects or ideas (general criteria and personal influences), and their creative imagination process--where they got their ideas from, what was the process, how they came to their final ideas.

Keeping these general themes in mind I watched and listened to the interview tapes allowing any related themes or new ones to emerge. It progressed through stages from first repeatedly listening to the tapes to transcribing general points, then listening for individual themes about imaginative process of design, and finally finding relevant, clear clips with thematic content in them.

The choice of clips or takes was also evaluated according to a number of underlying and interrelated criteria. Initially they were judged on whether they matched the research question or topic and whether the footage was good. This weeded out clips according to the most obvious research and documentary criteria.

Second, according to my naturalistic, qualitative, inductive approach, I often reviewed the clips to pull out what *they* were saying. Continual review, general transcription, and use of graphic organizers to picture concepts (see *Graphic Organizers, Visual Representation and Language Analysis*) helped me elicit themes the designers were implicitly or explicitly speaking to. It also helped determine what they experienced both individually and collectively in imaginative design. Because of this extraction of themes, I noticed that my approach was also to some degree phenomenological, in that I wanted to draw out their collective experience of the complex phenomenon of creative imagination.

<u>Sequence Of Themes</u>

In this vein, I also brainstormed various options regarding choice and place of clips in the documentary. These options were: to use one clip which included a single idea that all designers stated; to use two clips juxtaposing viewpoint polarities to reveal opposing views, differences, similarities or views within a range such an artistic or more

scientific view; or, to use three or more short clips to show various ideas within an overarching theme. Taking into consideration use of graphic organizers (see *Graphic Organizers, Visual Representation and Language Analysis*), the limited amount of computer memory (see *Use of Technology*) and documentary style (see *Documentary Style*), I chose a combination of these first and the last ideas that stated a thematic point for all the designers, and elaborated through others' commentary. This "yes, and" conversational, postmodern style seemed to state the themes better than constant conceptual juxtaposition, which likely would have been interesting, but probably less clear and in need of more clips and external helps such as title bars, etc. to support its continuity.

I also chose positive statements rather than the few negative ones that occurred in the interviews. For example, the designers rarely said statements that included dislikes, pessimism and negative opinions. While discarding these could have significantly biased the video, the fact is that for the few negative statements there were, there was a positive statement with the same content that seemed to work better and kept the video lighter and more to the point. So this, combined with the previous stylistic choice, clarified common themes, narrowed the number of clips, and added to clear communication of those themes.

As is common to documentary (Adkin et al., 1993), what *they* said was balanced with my hermeneutic interpretation or what *I* wanted to say or how I wanted to say it. Although my interpretation focuses on the question and its thematic points, the nature of documentary is artistic, requiring a more intuitive, impressionistic approach. The selection, placement, rearrangement and weeding out of video clips were often based on

whether they matched criteria, "worked" with others, said it in the way I thought best or were most interesting. But as this was more open to researcher bias, I was open about any possible errors or bias made in the interviewing or analytic and synthesizing phase and sought out other methods like aesthetic criticism, better technology, and use of graphic organizers, visual representation, and language analysis in order to further enhance the reliability of the data (Runte, 2001; Key, 1997).

Aesthetic Criticism

During and near the end of the video creation I had rough copies of the video viewed by many others. Several times I had my supervisor review the video and give critical suggestions. In addition, with emailed permission from the designers (A. Lanier, personal communication, June 4, 2002; G. Lilge, personal communication, May 29, 2002; D. Lenarduzzi, personal communication, May 29, 2002; H. Bertrand for M. Santella, personal communication, June 4, 2002), I had four groups of family and friends observe and make critical suggestions on a rough-cut version. The main comments were: that title screens seemed jarring and occurred too often shifting focus off the discussion by the designers; that its conversational style and engaging content was conducive to educational presentation (especially to audiences interested in Art, Design, or creativity); that pacing, rhythm and visual juxtaposition of clips was unique, coherent and maintained interest; and that my choice of backgrounds and how I placed designers within the camera frame was visually appealing. Taking my cue from this, I dropped some secondary themes and categorized them in with primary, larger themes under one title. I also cut or rearranged some irrelevant or confusing screens, changed the length, volume and transitions in and between certain screens, changed the consistency and darkness of

title screens, and renamed ambiguous title screens, such as "people" (see also

Documentary Style).

Graphic Organizers, Visual Representation, and Language Analysis

I used some additional research methods that further enhanced clarifying themes

and overall patterns of the creative imaginative process. These were: printing out and

using Premiere video timelines; listing verbs and descriptive phrases said by the

designers about the imaginative design process in the thematically selected clips; and

creating various graphic organizers depicting interview content organized according to

emerging patterns and logical sequence.

The graphic organizers (including timelines) were useful throughout the entire

process, from initial data gathering to final synthesis in the video. Initially, collective data

was pulled into the general topics mentioned as a part of design creativity (i.e. client,

function, market, etc.) then slotted into aforementioned general process themes as

appropriate. For example, if a topic fit more than one it was placed in more than one.

Throughout, printed timelines helped quickly place and organize video takes within

larger groupings.

Later, concept maps and diagrams were created from individual comment on the

designers' unique imaginative design processes. This clarified specific viewpoints from

general topics and further defined themes. Related to this, their individual choice of verbs

and descriptive phrases (often slang or analogy) regarding this process was charted

collectively (individual's words grouped under general process themes) to help selection

of group themes as appropriately seen within the individual's contextual use (see

Appendix G). These were rearranged several times to suit the most appropriate,

semantically and contextually consistent groupings.

In conjunction, I continually utilized a dictionary and thesaurus to clarify, broaden

or narrow definitions of important concepts. Finally, by using the dictionary and

thesaurus, creating these graphic organizers, and putting the actual documentary together,

I made a conceptual diagram to depict my best understanding of the overall themes of the

research.

<u>Use of Technology</u>

Technological considerations enormously influenced the process and particularly

the end product of my research documentary. Initially, my chief concern was to produce a

quality documentary to be used educationally, and perhaps to be adapted or shown later

on TV or in an art showing. On the advice of various technicians such as computer

technicians, information technicians, video artists, etc., I chose to use a variety of

technological tools: the highest quality video camera that was available from the

university--a Sony TRV-900 DV Digital 8; an iMac computer with limited, but adequate

space and added external hard drives which were used later for storage and transfer;

adequate hardware such as an external zip drive for transfer of photos and CD burner;

software such as Adobe Premiere for video, Microsoft Office for writing, diagrams, and

charting, Netscape Communicator for email communication and photo transfer, Adobe

Photoshop for photo editing, and Apple IDVD for rendering and burning a final copy

onto DVD; and, for the final copying, a MiniDV camera and a dual VHS/MiniDV player

machine.

The camera functioned well, but needed to be recharged as it was used constantly for videotaping the interviews, reviewing and selecting pertinent clips and digital photos, transferring from original tape to Adobe premiere movie clips, transferring back to digital 8 tape once the movie was complete on the computer and transferring from video 8 to VHS tape for the rough and final copies. I needed to learn certain functions such as taping and reviewing taped film, pulling up information counters on screen, and correct settings for transfer to or from the computer. The main effect on the documentary was the extra time it took to learn from technicians, instruction books, on-screen help or personal trial and error to find and work through some of these obstacles, particularly in delaying transfer between the camera and the computer.

Computer limitations strongly influenced the resulting documentary. Initially because I was limited by the amount of memory available (RAM, internal and external drive space), only a select number of video clips of limited lengths were possible to work with on Adobe Premiere. Rendering, for example, which is Premiere's way of synthesizing visual and audio data--took about 8 megabytes and therefore needed to be accounted for beforehand so it didn't "crash" the computer. Consequently, from the outset I had to review the whole of the raw data, and choose according to general predetermined themes and quality footage, cutting down the overall material from twenty to thirty percent of the total.

Because there were large time gaps between some interviews (more than a month in one case), review was typically done individually first rather than collectively (all at the same time). A danger was that the combination of predetermined themes and selection, and individual review could bias my selection of data either toward my

predetermined themes or many individual designer themes rather than the inducted collective patterns. To counter this, selected clips were reappraised in light of single and collective reviewing. This was done both visually and through cursory transcriptions and through the use of graphic organizers to analyze individual and collective patterns of overall data (see *Graphic Organizers, Visual Representation and Language Analysis* for the latter).

A screen size change that negatively affected the visual look of the final video occurred when brought from camera to Adobe Premiere (and back). The camera videotaped at a 720 x 480 (pixel) width to height aspect ratio. When transferred to Adobe Premiere, however, it became 4:3 or 640 x 480 (pixel) ratio screen. Again when transferred back to tape then copied for VHS for TV, it is stretched back to 720 x 480, but some visual was cut off at the sides of the screen when on VHS (as was seen in a rough copy). In response, photos particularly were reformatted to adapt to this unforeseen technological feature.

An array of technological support and other hardware and software enhanced the transfer, manipulation, and insertion of important information and related data. An extra external hard drive and zip drive added more storage and transfer capabilities. Email allowed communication between the designers and myself, including many photos and renderings that were added to enhance the video. Photoshop helped to manipulate photos helped to make them work in the video. A variety of software was used to graphically organize research content and to write the written portion of the project. In the final copying, a MiniDV camera, MiniDV/VHS player, and IDVD program and CD burner

were used to produce the highest available quality transfer of digital video to VHS and

CD copies. CD's were also used to store video clip data for possible future use.

FINDINGS IN PROCESS AND PRODUCT

Development of Themes

My process of discovering and developing themes held a kind of "dialogue" with the process of the designers' themselves. As a result, the new developments of this documentary creation, particularly the editing and stylistic choices, owe themselves to changes in my perception of the imaginative design process. In fact, many of the new methods that emerged in the process of creating the documentary, particularly the use of graphic representation and social criticism, parallel the process that emerged from the research. Changes from the original interview categories of the imaginative design process to the ones on the final video are the best example of this.

My original themes from the interview questions were their individual ideas, their collective definition of creativity, the general criteria for their projects or ideas including personal influences, and their creative imagination process--where they got their ideas from, what the process was, how they came to their final ideas. Initially this changed to become *ideas and definitions of creative ideas* together, *criteria, aesthetics* as a general criteria, *gathering ideas* including personal influences under various sub themes like reading, *visualization, creative imagination*--which was the largest theme with sub themes including *people, analyzing, noticing and isolating valued ideas, devaluing, serendipity, play,* etc.--and *idea completion.* Finally, after critical feedback from various people, the title screens of the main themes became *Creative Ideas, Criteria, Aesthetic Principles, Gathering Ideas, Refinement of Ideas, Visualization, Conceptualization, Editing,* and *Idea Completion.*

The individual designer's ideas, pictures of the final products, and their definitions of creativity seemed to fit well together. Most designers got caught up on the use of the term "creative", especially "most creative" as too open ended or ill-defined and they either avoided it or spent a lot of time defining or reacting to the concept. This may have been because their conception of creativity was closer to a sense of consciousness (Csikszentmihalyi, 1996) than an idea. Or, perhaps the definition needed to be attached to something such as an idea, part of a process, or thing to make it less abstract. A common pattern that proved interesting was that each idea was indeed creative and successful-- even if not radically novel--and often in more than just the formal respect. Indeed, there is a variety of creativity in their imaginative designs: functional creativity such as detailing of folding mechanisms or attachment to a wall; material and methodological creativity like more efficient or economical ways of bending or laminating wood, or assembling and packaging the product; serendipity or discovery of these ideas; and novelty within specific markets. Despite this wide range of responses to the use of the term "creative", I only needed to know whether their design idea was creative in terms of the form or field. So I opted to show some of the common or articulated opinion on what is creative, and to focus primarily on their creative ideas as the theme for both ideas and definition of creativity.

Criteria and A*esthetic Principles* were separate themes because of several important distinctions. Data on criteria consisted of general principles and design criteria as well as criteria specific to individual project ideas. Some specific criteria that applied to all or most designers were included. As well, most general design criteria applied to all imaginative design ideas and therefore were included. However, relevant imaginative

design principles also emerged, but fit awkwardly into the former category because they were aesthetic values or guidelines rather than restrictions of design. Although the line is gray and they clearly overlap, it seemed best to make separate categories connected in the video by content and placement (one after the other). Later, this was further distinguished by labeling the first *Criteria and Restrictions* and the latter *Aesthetic Principles*.

The design criteria in both themes clearly concur with the majority of my previous research. Specifically, that criteria is derived from both personal and contextual spheres is true, but is less personally autotelic (for it's own sake: Csikszentmihalyi, 1996) and more from the clients' needs and wants than was previously assumed. Personal purposes and intentions like function, use of technical data, forecasts of future performance and even one's own beliefs in the history of design and beauty (Goldschmidt, 1999) were implied or clearly stated in these themes. Knowledge of design history and specific projects, pursuit of technological excellence, aesthetic considerations, and function as a means to make a client happy, and good management of production and marketing were obvious (Caborn, 1989; Goldschmidt, 1999; Fraser, Aug., 1990). Other previously mentioned research like maintenance of design ideas was assumed under continued refinement of *Idea Completion*. Anthropometrics, ergonomics (Caborn, 1989), and ecological soundness (Goldschmidt, 1999; Fraser, Aug., 1990) are likely assumed for projects with their implied contexts of laid in beds or outdoor chairs and tables. Osborn's anticipative imagination (1963) plays a role for most designers under both themes as they all talked about how previous consideration of these criteria hinder or allow an idea to "work" or not. Indeed, all noted that these criteria defined or restricted the ill-defined

problem space (Goldschmidt, 1999) or "criteria salad" (Lanier, 2002) context within which the idea was created.

Gathering Ideas and the rest of the subsequent headings were under the overall title screen *Imaginative Design Process*. As it seemed obvious that all clips were in some way related to this and it was the video's initial title screen as well, it was quickly discarded as a redundant overarching thematic title. Clips under *Gathering Ideas* came to include a lot of content drawn from influences and inspiration, which were previously under different themes, as well as the usual content: where they got ideas from. This thematic heading also had sub theme title screens of *Innovation, Arts, Reading, Creative Thinkers, Sense of Wonder, Daydreaming, Mindfulness, Nature*, and *People* which were discarded owing to the distracting number, placement and words of title screens noted by observers of this version. These screens were seen as distracting because of word to image association, the time it took to make the association, and because it broke up the overall rhythm and pacing of the video.

Two philosophical debates from previous research remain at a stalemate considering the data collected under this theme. According to the video, it is uncertain whether the ideas were gained from remembered existent forms (Ryle in Ryle, 1984) and reproductive imagination (Osborne, 1963) or created nonexistent forms (Casey in Casey, 1984) and speculative imagery (Osborne, 1963). Clearly there was reproductive imagination used; specific and general art, design and natural objects were mentioned as influences. However, ephemeral or secondary sources such as daydreaming, a sense of awe, mindfulness (Marzano et al., 1988), and nature, reading, creative thinkers and people were also mentioned; this points to speculative imagery as the likely source.

Although this complex issue is difficult to determine with the limited data in my research, it seems, as before, that both are feasible incepts to draw from (Beardsley, 1984; McKim, 1980).

The largest unique theme that emerged unanticipated was *Visualization*. Initially, I separated it under its own category because it was clearly noted by all designers and seemed physical rather than mental and therefore not part of mental imagery. However, as I reviewed contextual data and further research (Endt & Grandadam, 1993; Finke, 1997; McKim, 1980; Laseau, 1980; Zeitoun, 1993) for better understanding several possibilities emerged. Visualization could be seen as either internal (mental) or external (physical) or both (see Appendix E). Clearly, the designers did not see it as an exclusively internal process, though some mentioned that they do this as well in some cases. It seems unlikely, if not impossible, that one could mindlessly with no associated internal imagery produce an external picture or object related to the developing design. Since all designers understood that the question was in the context of the process of mental imagination (and not about the end physical object), it seems that all were describing the external representation or "vehicle" (McKim, 1980, pp. 4-5) of visualization as a means to inform, develop (to organize, represent, or simulate a problem--Krulik & Rudnick, 1984) or hold onto the internal representation in process of creating a final idea and thing. As Zeitoun (1993) has said,

> It must be represented, in one way or another, at each successive stage of development, before being made into a prototype. This observation holds true for any work which, through reflection, analysis and imagination, leads to the production of an object, a product or action. To conceive means to manipulate ideas and forms present only in the mind and give them concrete form by converting them into drawings, models or texts. (p. 375)

Although the designers themselves ranged from one who "stored ideas in the mind" (Lanier, 2002) to another who "did it out here, on the computer" (Lilge, 2002), all informed their mental visualization (imaginative design) through external visual means (Lanier, 2002; Lilge, 2002; Lenarduzzi, 2002; Santella, 2002). As Ryle points out, the physical representation, whether it is a sketch, photograph, computer rendering, or model, is not the mental image, yet they are indeed similar and rather inform one another in the development (Ryle, 1984). In other imagination literature, this metacognitive visual thinking (Costa, 1996) seems a common human endeavor particularly in the design field (Arnheim, 1969; Finke, 1997; Goldschmidt, 1999; McKim, 1980). External and internal representations are not seen as equating the other (Arnheim, 1969; Ryle, 1984), but are rather close correlants that strongly influence and parallel the other (Arnheim, 1969; Finke, 1997; Laseau, 1980; McKim, 1980). Arnheim (Arnheim quoted by Laseau, 1980) notes that visual thinking

> has advantages over internalized thought. First, direct sensory involvement with materials provides sensory nourishment--literally 'food for thought.' Second, thinking by manipulating an actual structure permits serendipity--the happy accident, the unexpected discovery. Third, thinking in the direct context of sight, touch, and motion engenders a sense of immediacy, actuality and action. Finally, the externalized thought structure provides and object for critical contemplation as well as a visible form that can be shared with a colleague... (p. 18)

It seems to work the other way around as well. The mental imagination, more flexible in some respects than the physical, works with(in) the criteria of the project and principles of the person and design to inform the creation of the object (see Appendix H). Finke notes that psychological research greatly confirms this complex correlation between mental imagination and visual creativity stating,

images have many properties that can contribute to creative thinking. These include the capacity for and image to be mentally scanned, transformed, and reinterpreted. In addition, the visual and spatial characteristics of an image allow one to consider complex relations and to anticipate the possible consequences of actions. (1997, p. 196)

He notes this through use of mental images and spatial properties, image scanning, combinational play, mental transformation and synthesis, image reinterpretation, and global (creative) imagination in the pursuit of design problem solving or planning (Finke, 1997). Arnheim, regarding visualization, extends this and says,

This spontaneous use of metaphor demonstrates not only the at human beings are naturally aware of the structural resemblance uniting physical and non-physical objects and events; one must go further and assert that the perceptual qualities of shape and motion are present in the very acts of thinking depicted by the gestures and are in fact the medium in which the thinking itself takes place. (1969, p. 118)

Therefore, it seems *the use and development of one highly informs the other, and the completion of both (an unified idea, a completed piece) is the goal.*

It also seems to work to communicate the basic idea of the object to people (like a client or colleague). Noblet (1993) said, "To simulate, understand, question, become informed: these are the basic activities which make up his work and his way of communicating with other people involved in the design and production process" (p. 375). In regard to this communicative role, Ashwin (1989) points out that design drawing serves referential, conative, phatic, and metalinguistic functions as much as aesthetic and emotive. That is, drawing serves also to inform, persuade (of certain actions), emphasize points to others, and comment on the designer's and other people's thinking, as well as aesthetically picture and emotionally express. As all designers also expressed forms of physical visualization in reference to communicating to clients, colleagues, manufacturers, and other professionals, it follows that they had this communicative

function as well. Indeed, it seems that *in the designer's conception of visualization, the idea and the thing, and communication of these (to oneself and to others) are almost inseparable.*

This changed my understanding of imaginative design dramatically. From here it was difficult to throw out data on the design object unless they were only discussing the thing separate from the idea or the end product (rather than the process). Another thing further strengthened this point. Three of the designers pointed out that the development of the product and idea was often made better after the product went to market. Because people in the market informed the product of its function, wear and tear over time, etc., the idea and product often changed to suit that reality. Therefore, the idea made into a thing, was further changed by people's interaction with that thing or product.

This continual visualization was noted in the designer's comments in *Idea Completion* when they said "it's continually evolving, getting better" (Lenarduzzi, 2002), "it's never finished" (Lanier, 2002) or "it's never finished till it's finished" (Santella, 2002). The idea, then, becomes almost inseparable from the thing. Perhaps the imagination is limited more by physical form of the product, but for the product to change, the designer still has to compare it with the original imaginative design and choose to change both idea and piece. After coming to this conclusion, the information under the theme, *Visualization* was later reinserted after *Refinement of Ideas* as a major part of the imaginative design process.

In comparison to my past research, Ryle's conception that physical representation is not the mental image, but rather informed by it (Ryle, 1984) seems to hold most true, whereas my desire to separate the mental plan from the physical representation and final

product seems quite artificial according to the designer's comments. While the imaginative visualization is often active, fertile and productive it seems these qualities are enhanced by the corresponding physical visualization or, conversely, would be hampered without it. It appears, though, that it is a representation derived from the mind and a way of working through the idea. In addition, the physical representation is not primarily just drawing, as was previously assumed, but includes the many forms that have already been mentioned.

The title screen *Refinement of Ideas* introduced both the overall process of developing imaginative ideas and refinement of ideas in interaction with people. As previously mentioned, I opted for single title screens, over primary screens and secondary subscreens, based on critical feedback that discarded the idea for clarity in visual flow. As an overall theme *Refinement of Ideas* summed up the mental, physical and social development process of "adding and eliminating" or "reframing" (Marzano et al., 1988, pp. 25-26) that I will comment on below.

It was initially difficult to know just where refinement of ideas through interaction with people would best fit. *People*--the clients, market group, colleagues, designers' and professionals with whom the designer interacted--fit in both the *Gathering* and *Development of Ideas* categories. Under *Refinement* I meant to highlight the idea that through social feedback such as collaboration, conversation, or simply comments that designers' ideas were refined (Feldman, 1999).

In reviewing the content of the interviews, I realized that I had underestimated the importance of social influence in my preliminary research. Whereas I had perhaps seen it only as an influence, I began to realize it was to a large degree the guideline by which the

product was often measured because the client, market or manufacturer typically determined whether a product was going to be produced at the start by providing the need, want, money, or facilities. Consequently, the criteria, volume, manufacture and even style of a design depended largely on them. What emerged from the data was that from conception to completion (and even beyond to the continual refinement) these people along with colleagues, other professionals and designers, were continually sought out to provide feedback in order to evaluate feasibility of the design idea.

The following core minor groupings were originally included under their own headings in this order: *Analyzing, Noticing and Isolating, Choosing, Devaluing,* and *Playing With Ideas.* These headings included some of the most primary data about how images were formed mentally during the design process. The flow of the data was from more "concrete" to "abstract" processes, more "left" brain to "right" brain activities, and more cognitively structured (analysis) to less cognitively structured (play). Although this flow seemed to work, it was noted in critical feedback and my preliminary research that it likely did not follow the actual chronology of process or the overall flow of the video at this point and that "abstract", "right brain" conceptualizing activities typically came before "concrete", "left brain" editing activities (Goldschmidt, 1999). A parallel in the literature would be Jackson's "prepositional" thought and Freud's "primary process" proceeding to Jackson's "referential" thought and Freud's "secondary process" (Singer, 1999, pp. 16-17). This also fit well within the overall flow of the video that seemed to be from external--ideas from something or somewhere, to internal--ideational process, then external again with the product on the market (see Appendix E). In reality, it is difficult to say which processes actually occurred before the others because this content was

gathered from various points and questions in the data few of which point out any

definite chronology. So, based on the feedback and research, I chose to rearrange them

under *Conceptualization* (adding *Discovering*, *Playing with*, and *Devaluing*) then *Editing*

(*Choosing*, *Noticing and Isolating*, and adding *Analyzing Ideas* to continual refinement)

headings.

Play contained data that is primarily dominated by two designers. It is included

because either they were speaking for more than themselves as bad footage was

eliminated, related content from the other designers suggested they also did similar

activities, or it simply added interesting strategies to the video.

The *Idea Completion* category remained the same and at the end included more

referents to continual refinement (and visualization) in addition to general comments on

how designers determine an end to a product idea.

Overarching Conclusions

From the data it seems clear that imaginative design is *a mental process of*

refinement and evolution, strongly informed by a correlated physical and social process

(see Appendix I). The primary consistent finding through all the interviews was that the

imaginative process was refinement and evolution. They all used the words "refine",

"refinement" or "refined" and "evolving" or "evolutionary process" and/or described their

process as having these characteristics (Lanier, 2002; Lilge, 2002; Lenarduzzi, 2002;

Santella, 2002).

Deductive refinement was particularly evident. For all of them, it was refinement

in the sense of extraction and subtraction for purification (see Appendix J). It seems that

all started with a general idea (Lenarduzzi, 2002) which "funnelled down" (Santella,

2002) and "proved itself" (Lanier, 2002) "keeping the good and eliminating the bad" (Santella, 2002) till it was "simplified" (Santella, 2002) or they "deciphered the DNA" (Lenarduzzi, 2002) or "came up with the best possible solution based on ... knowledge and experience" (Santella, 2002). Starting with ideas gathered from various sources, the more essential qualities were extracted or drawn out from discovery, analysis or research while the less essential qualities are discarded or "weeded out" (Santella, 2002) according to specific project criteria or restrictions. While it may be assumed that this is determined by conscious choice or controlled imagination, this is not actually the case with all of these designers. With some designers the elemental ideas "come up" (Lanier, 2002), are "noticed" (Lanier, 2002; Lenarduzzi, 2002) or just "happen" (Lenarduzzi, 2002), while some "analyze it" (Lilge, 2002) or methodically work it through themselves.

The degree of conscious control of this process became a significant issue for future exploration. Indeed, from the varied responses of all designers it appears that the work of refinement is likely both conscious and unconscious, and is controlled and uncontrolled by a number of voluntary or involuntary choices, or a matter of "making it happen" or "letting it happen". While conscious control and practical application of imagination is a key factor in this study (Bloomer, 1990; Ormrod, 1999; Osborne, 1963; Roget, 1992; Singer, 1999), this research seems to indicate that the imaginative process from conception through to completion is also affected largely by known and unknown influences and internal processes (or "levels" (McKim, 1980, p. 4)), and corresponding willful, intuitive or unconscious choices (Marzano et al., 1988). These, in turn, significantly play into keeping the good and weeding out the bad qualities in pursuit of a purified end.

Obviously, it is difficult to determine what is unconscious by the very fact that it is unknown (Arnheim, 1969, p. 116). However, there is clear evidence of effects from unconscious causes that play significantly into the production of ideas. First, from the *Criteria* certain designers articulated many principles and restrictions yet others had a hard time articulating any. This suggests that some simply did not consciously know what personal or contextual criteria determined their ideas. Second, *Gathering Ideas*--the theme including sources of imagination--includes both obvious sources and seemingly disconnected sources. While the connection between their final ideas and ideas from related artistic or design fields appear obvious, ideas from people, reading, nature and fields like physics seem less connected, and daydreaming, mindfulness, and a sense of awe seem quite unconnected. This suggests that sources of ideas range from conscious to deeply subconscious, if not unconscious. Finally, it seems that during the *Refinement*, *Conceptualization* and *Editing* parts of the process, new ideas and surprise solutions (discovery) seemed to effortlessly appear some of the time, whereas most of the time conscious effort was made to achieve them (or impose order (Roget, 1992)). Therefore, it appears that *conscious sources and effort is necessary, but that in conjunction with it, often unconscious and effortless inspiration occurs.*

This corresponds with current psychological research that states that a level of cognitive goal-orientation and structure is needed regarding a complex problem such as design. It is within this framework that primarily strategic structured creativity can operate best. However, within the bounds of this goal-orientation and structure, some strategic exploratory and unstructured but not arbitrary creativity also can work best

(Ward, Smith, and Finke, 1999). These structures and goals were provided by the individual project criteria in the case of these designers (see Appendix A).

It may be in relation to this point that (conscious) psychological models and strategies (particularly the mentioned physical visualization and heuristics like trial and error) work most effectively to cause this sought for inspiration. Although it is difficult to determine from my research specific types other than the debates, models and heuristics already mentioned, it seems fair to say that reorganization of cognitive structures (Runco, 2000), using "whole brain" or varied thinking strategies (or "operations" (McKim, 1980, p. 4)), would work best. These include such thinking strategies, styles or types as: lateral (DeBono, 1970; Hampden-Turner, 1981), interhemispheric (Hampden-Turner, 1981; Bogen & Bogen, 1976), divergent and convergent (Hampden-Turner, 1981), dialectical (Benack, Basseches, and Swan, 1989; Goldschmidt, 1999; Goldschmidt, 1991; Marzano et al., 1988), dualistic or duality-type (Hampden-Turner, 1981), paradoxical (Hampden-Turner, 1981), analogous (Goldschmidt, 1999; Gordon, 1976; Hampden-Turner, 1981; Marzano et al., 1988; Mednick, 1976), synectic (Gordon, 1978; Prince, 1978; Roukes, 1984; Roukes, 1988), and associational (Casey, 1984; Hampden-Turner, 1981; Koestler, 1969; Mednick, 1976) or synthesizing thinking (Kant, 1984; Casey, 1984; Beardsley, 1984; Porter, 1913), and using both a conscious or unconscious process (Singer, 1999; Osborne, 1963) (most types--Hampden-Turner, 1981; Stein, 1974). It also includes heuristics like trial and error, play, utilizing random shapes, deferment of solution (Goldschmidt, 1999; Piirto, 1998), and a host of other strategies (Crawford, 1978; Raudsepp, 1978; Simberg, 1978; Smith, 1998; Stein, 1974; Treffinger, 1982). From my

research, there is a lot of evidence that most of these would enhance the likelihood of inspiration and resulting refinement and evolution occurring.

The end point of this refinement process is purification in the previously mentioned sense of a "coherent unity, from the producer's point of view as well as that of the consumer" (Noblet, 1993, p. 24). As was explicitly or implicitly communicated by the designers, the process is meant to arrive at a more elemental, pure, unified, integrated, simplified, better and/or new result. Many of the designer's aesthetic principles--what they believe or "know and think about design" (Santella, 2002)--point this out. Novelty, beauty, "to make lives better" (Lenarduzzi, 2002), functionality, "feasibility" (Lenarduzzi, 2002), economy, "efficiency" (Lanier, 2002), simplicity, good craftsmanship or "details" (Lenarduzzi, 2002), and historical design knowledge are principles which aim for this purified end (Noblet, 1993, pp. 30-36). It needs to be noted that novelty, beauty, functionality, simplicity (or simplification), and even betterment were found in the designer's ideals of purification. While these may not be assumed or equated with purification in some fields which aim at refinement toward purity, it is clearly connoted with these Industrial Designers to the point where one asserted unequivocally that simplified purity (or economy) of function results in beautiful form (Lanier, 2002).

This purification, perhaps, could be considered a type of modernist idealization. Many of the ideals like functionality, economy or "streamlining" (Endt & Grandadam, 1993, p. 33), and simplicity clearly fit the modernist design paradigm. The common design notion that the progressing and final idea needs to "work" (Lilge, 2002) applies to this type of idealization and realization. However, while some designers would hold to

these, it must be noted that others would not, and so these principles may lie rather in the use of the material, manufacturing or technology. To simplify, for example, saves hours of cutting or assembly. Or, perhaps they lie within the person as much as in the field. For example, the principle of efficiency may be personal as much as condoned by the field. Therefore, *purification,* as it pertains to the imaginative design process of these designers, *is to a large degree according to one's ideals* (whether they are from personal principles and experience or field standards). And, in addition, is *a form of idealization and practical realization that occurs in keeping with personal or external standards.*

This refinement pattern provides evidence for both sides of a debate in current creativity research noted in my preliminary research. According to my data, the argument over whether this imaginative refinement is associational (Casey, 1984; Koestler, 1969; Mednick, 1976) or synthetic (used here to describe the process of creative synthesis) (Kant, 1984; Casey, 1984; Beardsley, 1984; Porter, 1913) remains at a standstill. On the side of association, various individual criteria must be met, and it is on the basis of these bits of criteria that refinement occurs or the end product can be evaluated. On the side of synthetic refinement, various ideas are developed into a completed whole (gestalt) idea and physical product, which ideally can't have anything taken away or added. In reality, while an imaginative design idea may lean toward an associational understanding, it is likely both associational and synthetic, even more than in the finished product. Where an associational part may be taken from a chair to change it, this would also make an entirely new, although perhaps not better, synthesized whole. In the mind this process is even more intangible. It is as difficult to determine solid imaginational parts, as it is to outline a distinct whole. Or, said differently, whether these ideas synthesize or "parts"

associate to create the end idea. As stated previously, I believe the idea in process rather to be necessarily indistinct, incomplete or schematic (Arnheim, 1969) and *both* an associated grouping and synthetic whole at the end (Beardsley, 1984; Singer, 1999).

The assumption of betterment and novelty added to this process over time brings us to the second term mentioned or described by all of them--evolution. According to the data, the process as evolution connotes the production and maturation of an idea--a forming or shaping over time. Production here implies the practical forming of new ideas from old but generative conception; maturation, that it evolves into a new better whole. That is, something new and better is made by progressive refinement over time. The continual refinement noted at the end of the video, points out that like Darwin's conception of evolution, there may be stages of production and maturation, but even at the "end", the idea continues to change to become better adapted to suit the client's need or want.

In my preliminary exploration, I predicted that evolutionary creativity and discovery would be the more likely creative type than "revolution" and invention. Some designers' ideas implied that they may be revolutionary, "category changing" innovations such as the Wavin' Tray as more than just a wine rack or including a novel production process, for example. However, unique innovations within the categories or the evolutionary type creative ideas were more evident. Discovery or serendipity were so commonly evidenced after playing with ideas and through heuristics like trial and error and utilizing random shapes, that initial subthemes of *Playing With* and *Discovering Ideas* were created, then placed under *Conceptualization*.

In addition, there is a strong continuous correlation between the physical representation of the design and the imagined design itself (see Appendix H). Although designers have various common means by which they represent this--from sketches and models to computer renderings (Zeitoun, 1993) and finished prototypes (Caborn, 1989)-- these designers mentioned a few more. Some of the more interesting were: photographed models as final "prototypes", model parts put together, digitally photographed then printed off and sketched on, or going straight to the prototype stage. It could even be said that various other artistic, design, natural, or manmade physical representations mentioned under *Gathering Ideas* could have contributed, if not strongly influenced, the designers' ideas in the same way early on. The purpose of any external representation was that the visual, tactile and constructive physical representation of the idea (particularly the three dimensional types) added greatly to determine whether aspects of the design were functional, practical, well proportioned, durable, good to the touch, beautiful or otherwise. In short, whether it was a sketch, a photograph or a prototype, the physical representation informed the refinement of the idea all the way through the process (Noblet, 1993) (see Appendix H).

Social influence also acted with either direct or indirect involvement in the refinement process. Most obviously, the client and market early on strongly determine what an idea is about and whether it will even be made. In *Gathering Ideas* strong influences ranged from clients, manufacturers, colleagues and professionals to other designers, artists, and creative thinkers. Their involvement ranged from intense collaboration and interested conversation to informal comments and market surveys. Whoever the person and whatever the depth of involvement, social influence was noted

by all designers throughout the refinement of the idea (see Appendix H). This social influence, whether emotional, cultural or contextual, or domain and field specific, is noted largely in current psychological literature as major dimensions of studied creativity (Feldman, 1999).

One of the comments that most poignantly illustrated both physical representation and social influence in shaping an idea was the observation by one of the designers who said that his design essentially emerged "on a napkin, like so many designer stories" (Lanier, 2002). This, to me depicted both the physical representation of the idea--the drawing--and the social influence described and implied from conversation among designers about designs--on a napkin while sitting around a restaurant table. Napkin drawings as a means to physically represent and hold onto an idea that emerges during a time of social influence, certainly seems to reveal how they both represent and inform the future development (refinement) of imaginative design.

Conceptually, creative imagination as seen in the video, fits with my original definition of visual and spatial mental construction, visualization, and conceptualization. Although visualization stood out as a corresponding internal and external theme, mental visualization, construction, and conceptualization could easily be considered as being evidenced all the way through the process. In addition, a level of idealization and practical realization in keeping with personal or external, typically social, standards was evident during the noted refinement process. Although typically seen as near the end of the process, these also are evident throughout, even in the "pre*conceptions*" determining the criteria.

My conceptions of design as production, plan and problem solving also fit well with design as defined by the designers. Although the confines of the process--from conception to completion--were put in question, the design ideas as stated by the designers were an action of formation, a fertile ideation process, and a plan to be produced physically. Process confines were a little unclear as things before conception influenced the process and things after completion, particularly social influence, extended the refinement process. As a plan, design was consciously directed and mentally combined or synthesized according to personal or external criteria. However, unconscious or subconscious direction also occurred in this process. As problem solving, creative imagination was necessary to resolve the sometimes complex problems within its often ill defined problem space (Goldschmidt, 1999). Even those (Lilge, 2002) who did most of their designing externally (Lilge, 2002) gave credence to the necessity of visual thinking (Arnheim, 1969; McKim, 1980) to derive their refined, creative solutions.

The data from the interviews with these four designers, suggested the same patterns as pointed out by psychologists studying the design process or the creative (imaginative) process. That is, during the process of design the mental processes of analysis, synthesis, and evaluation generally occurred often and continually or there was an ill-defined problem space (Goldschmidt, 1999) within which the designers came to a design solution, and that this included visual representation to help this come about (Goldschmidt, 1999). In my research there was primarily personal and sometimes social analysis and synthesis that occurred throughout the process. Both social influence and physical visual representation were means to evaluate project criteria or restrictions that occurred from anytime before conception to completion (see Appendix H). As well, the

ill-defined problem space existed and was created by the varied, abstract and sometimes uncertain project criteria.

In addition, the commonly known "stages" of the creative process--information, incubation, illumination, verification, communication, and validation (Cropley, 1997)--were evident, though not necessarily always in this sequence. As the description of refinement connotes (and as mentioned in my preliminary research), it tended to be a recurring series of creative processes, with all or some stages repeated rather than always one single process. Of special note is the final stage, validation, which previously was unnamed because it was seen as occurring after the idea had been made into a product and therefore was no longer deemed an idea. However, what was heard through the interviews was that continued refinement and subsequent validation actually informed the designer and often influenced a further change in the product and the idea (Lanier, 2002; Lenarduzzi, 2002; Santella, 2002).

FINAL VERDICTS

Documentary As Imaginative Design Process and Product

Throughout my creative process in putting together my documentary, the process strongly paralleled the findings of the research. Even the process "research" of putting together the documentary and the conceptual conclusions matched the imaginative content and design topic of the research project. The creation of this documentary was *an imaginative design process of refinement and evolution that was strongly informed by visual representation and social influence* (see Appendix H, I and J). I had to formulate an interesting, creative documentary according to specific research criteria. Highly informed by both the visual means of computer programs, videotape, graphic organizers, and various digital technology and critical social feedback of professors, family and friends, I refined an evolving documentary. While many clips were weeded out and copied, thematically grouped, edited and regrouped, continual analysis, synthesis, and evaluation occurred. All stages of this evolving and refining creative process-- information, incubation, illumination, verification, communication, and validation-- occurred and recurred. Validation--and possible continued refinement--is continuing to happen.

I believe choosing the educational video documentary for my final project was essential for such a project. Beyond creating an interesting and useful educational and creative product, it best suited the original research methodology set out for myself. Clearly, it followed the flexible and partly subjective naturalistic development and qualitative induction from the designers' experiences. Personal adaptation of the themes and documentary creation necessarily flowed from the inductive emergence of new

themes in the research. Stemming from this, specific and overarching themes became more clear and more organized only through graphic organization and returning to the designers' experience repeatedly to gain a better understanding of what they meant. This inductive, qualitative approach to the research and the resulting product clearly shaped it. To use different approaches or methods (quantitative or deductive) would have produced different ends entirely, likely less conducive to letting the designers tell their experience and less conducive to the production of an educational documentary.

Conversely, choosing another product such as a written document wouldn't have produced the same result. A documentary is primarily visual and auditory rather than written words. Because of this, much more interview data, including ethnographic personal and contextual data, is given than would be possible from a survey or even a taped interview. Body language and pictures of designs communicate more because they are multi-dimensional. This allows the interviewees to phenomenologically "say" more, while asking that the video technician hermeutically "interpret" and "shape" it to communicate more clearly. Whereas, poor videotaping is more likely to be edited owing to the variety of things that make it poor such as bad lighting, poor videotape, bad angle, weak sound, ineffective technology, etc., a final written document could include information from a weak audio tape. Although a documentary can include information conceptually or thematically, it makes little sense to include actual bad footage. The strength of video documentary is its quality, interesting and relevant footage and coherent communication. A variety of images combined with sound create a complex, multisensory experience for the observer. It allows for more contextual and qualitative

themes, more naturalistic and integrated flow (or synthesis), and a more complex and appealing product.

Finally, the content lent itself to this approach. Themes likely would have been drawn out, emphasized and replaced differently in a written document. Therefore, a versatile, comprehensive product was required to match the complexity of imaginative design drawn from the collective experience of a group of designers. Although a written document may have done this differently, likely nuances, angles, essential ambiguities and even whole themes may have been lost. A complex thinking, feeling, and volitional experience such as imagination may have been too difficult to separate into paragraphs and would likely have distanced the reader from the designer's reality simply owing to written format anyway. The video allowed the designers' various thoughts and images to be presented in their own words and in their own personality without being overly narrated by the editor. This, combined with the conceptually organized placement of clips, separated each designer's words from their original contextual meaning less than only written words might have done. In this way, themes such as (physical) visualization and social influence were easily drawn out and placed within the video in ways conducive to visual rhythm and content flow.

In addition, the prime strength of this documentary and its ability over writing is revealed best in the postmodern "yes, and" conversational style that emerged in my video. In the postmodern manner, this style reveals a visual juxtaposition between designers and yet allows them to add to one another's meaning to create whole united themes. The "yes, and" conversational style allows them to individually state their view

in their manner, but collectively present themes as in a conversation. This allowed for individual styles but collective views to be presented in a palatable manner.

The creation of an educational documentary allowed me to best use the naturalistic, qualitative, inductive approach I have taken. As well, it matched my personal philosophy. The video as an artistic creation allowed for my naturalistic, everyday inductive method of inquiring through observation of people and conversation about their experience, which was then presented in an appealing, educational format. Unlike many written documents, this educational video has been and will likely be seen by a number of people to inspire thought and discussion on related topics. Because of video's inherent visual and auditory appeal, it will likely be more used, and more useful for educational purposes in generating feedback and discussion about the issues.

This documentary's findings of the creative process of refinement and evolution with its physical and social influences, likely parallels or could add to many people's creative and imaginative processes and projects beyond my own. The video's content on creativity, imagination, and design, has applications in various disciplines. There is a continual need in many fields for creative characteristics like inquiry, discovery, and innovation; imaginative qualities such as envisioning, mental and physical visualization, inspirational conceptualization, directed idealization and practical realization; and design processes such as generative production, purposeful planning, and creative problem-solving. The normative motivation found in creative development could be beneficial in various artistic, mental, and cultural areas.

Obvious fields to which this could be applied are Design, Art, and Education of Design or Art. Philosophy and Psychology have a vested interest in this content as it

relates to the mind or psyche. As can be seen through the various debates within the written portion of my project, the information in the video could further inform some of the related, complex issues within these fields. Other fields where creative thinking applies could also utilize the content within this project. For all these fields and perhaps a few unforeseen ones, this video will most likely provide an educational tool and a human face to imaginative design in the pursuit of forming productive ideas.

<div align="center">Possible Future Directions</div>

There are various possible directions future research in this area could take. One of the most obvious is the creative correlation between mental imagery and physical representation. While the evidence for physical visualization was both unforeseen and strong in this research, specific reasons and relations could be found--and to some degree has been (Arnheim, 1969; Finke, 1997; Goldschmidt, 1999; McKim, 1980). Another is the degree, relation and chronological stage of unconscious and conscious control and awareness in the creation of ideas. Much deeper and specific studies would be needed to determine whether conscious or metacognitive understanding was occurring, and if so, to what degree, when, how and why this enhances or detracts from creative process. As well, more in-depth studies on specific *types* of thinking, like "whole brain" models or analogous thinking, and specific strategies on how, why, and how much they affect inspiration, imagination, design or aspects of creativity would greatly add to the likelihood and pursuit of creative endeavor.

Two more specific directions could proceed from my research. Although I focussed on the creativity of the imagined or mentally formed idea, many other types, like functional creativity, were mentioned as specific to Industrial Design. These

individual types within this field are narrow enough to direct fairly specific studies on this complex topic. In addition, studies on existent imagery would be valuable in two ways. First, to resolve or inform philosophical debate on whether or not creative imagination is based more on existent, conscious, or clearly related images and processes or non-existent, unconscious, or unconnected sources and processes. Second, my conclusions of design refinement and evolution assumes an already (at least partly) existent idea or ideas from which to work. Where this comes from or how it is developed could be researched in further detail providing important information on a key aspect of this imaginative design process.

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Treffinger, D. J. (1982). Stimulating creativity: Methods and techniques. In D. Treffinger (Ed.), <u>Handbook of creative learning</u>. Williamsville, N.Y.: Center for Creative Learning.

Appendix A

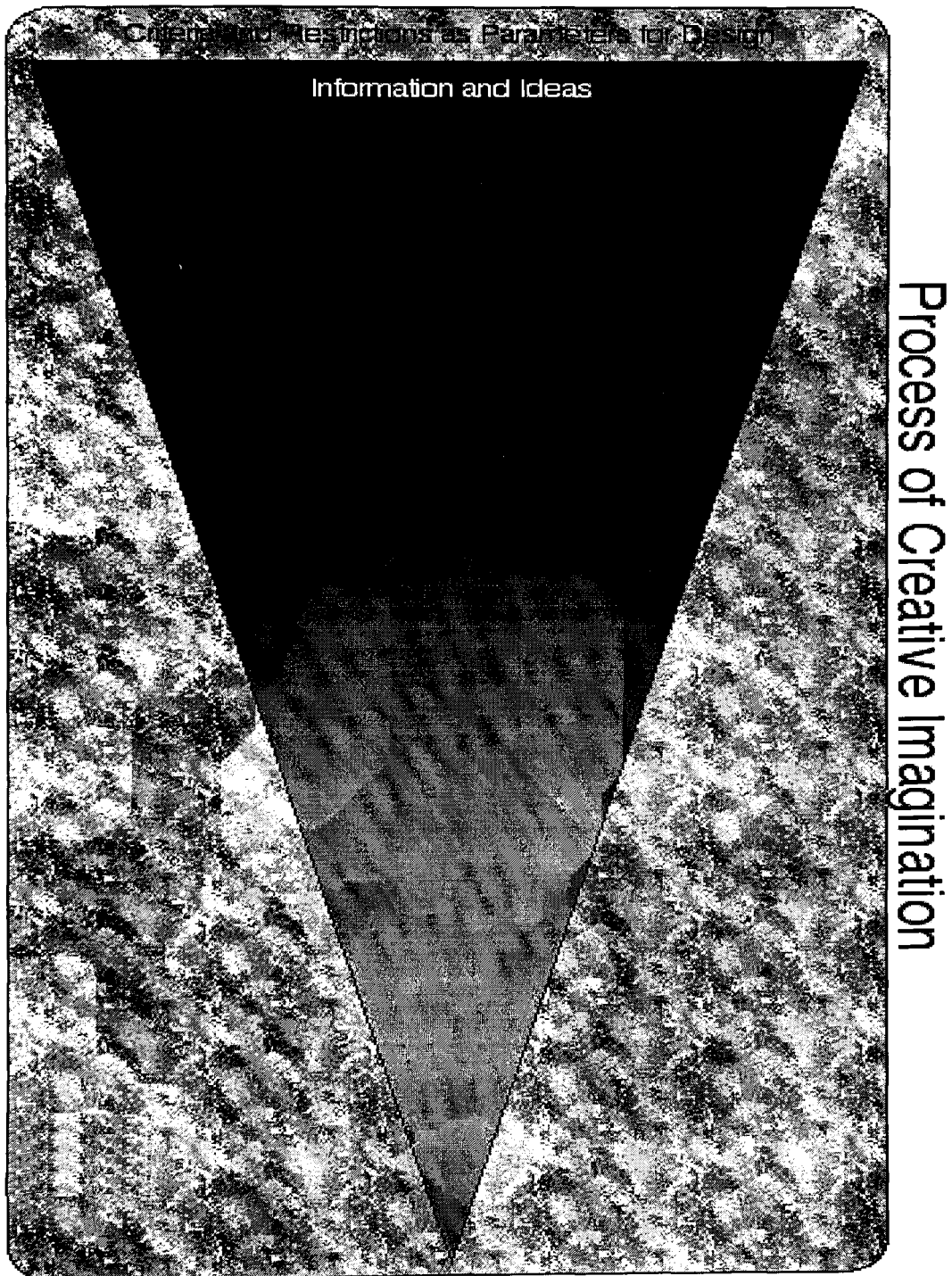Process of Forming Productive Ideas Through Imaginative Design

Figure A1.

Appendix B

Consent Letter

<u>Videotaped Interview for the Study of</u>
<u>Imaginative Design: Forming Productive Ideas</u>

Research by *Jonathan Legg*

I am conducting a study on how Industrial Designers' using creative and constructive imagination produce their most creative design ideas from conception to completion. The purpose is to put together a documentary video from clips from interviews of Industrial Designers, and their drawings, models, and related visual works for use in classroom settings (primarily adult or high school Art and Design). I would like your permission to interview you on videotape and videotape some of your related works.

As a part of this research you are being asked to participate in a 45 minute videotaped interview and show work related to your ideas (possibly another 5 to 45 minutes). In addition, you are being asked for permission to use these tapes to put together a video viewed for non-profit educational purposes (schools, conferences, workshops, and small group presentations).

Your responses on the original tapes will be confidential to the degree that only my committee members and myself have access to the tapes of the interview during the process of forming the final edited video. The original tapes will not be given to anyone without your consent. You also have the right to see a version of the video in process (segments with only you in it). When the video is released, you will be identified only by name, company name, position, (if you would prefer to be identified by only or two of these, please note this on the *Consent form*) and thematic content. Full credit will be given to you as the designer for any other images. If you would like feedback from the video after release, you may obtain it from me. As participation is voluntary, you may stop the interview or showing of work or withdraw footage without prejudice at any time.

I would very much appreciate your participation in this study. If you have any further questions regarding this research, please feel free to phone me at 381-6437 or leggja@uleth.ca. Also feel free to call the supervisor of my study, Janice Rahn at 329-2445 or janice.rahn@uleth.ca, or the chair of the Faculty of Education Human Subject Research Committee, Dr. Keith Roscoe, at 329-2446 or keith.roscoe@uleth.ca if you wish additional information.

Appendix C

Consent Form

<u>Videotaped Interview for the Study of</u>
<u>Imaginative Design: Forming Productive Ideas</u>

Research by Jonathan Legg

I have read the above information (the *Consent letter*) and agree to be interviewed, show

work, be recorded on videotape, and have recorded images and words used for a

documentary for educational purposes.

Name_____ Position Title_____

Signature_____ Date_____

I agree to be identified in the video by (please check boxes):

Name   o
Position   o
Company name   o

Appendix D

Consent Email (Letter and Form)

<u>Videotaped Interview for the Study of</u>
<u>Imaginative Design: Forming Productive Ideas</u>

Research by Jonathan Legg

In addition to the previous permission to videotape interviews with you and make a non-profit video of the research interviews for educational purposes, **I am asking for your permission to preview a rough copy of the video with a small group to enhance the final copy, use your name (if necessary to describe to others in case they ask), copy and give completed videotapes to each of the interviewed designers for non-profit personal use.**

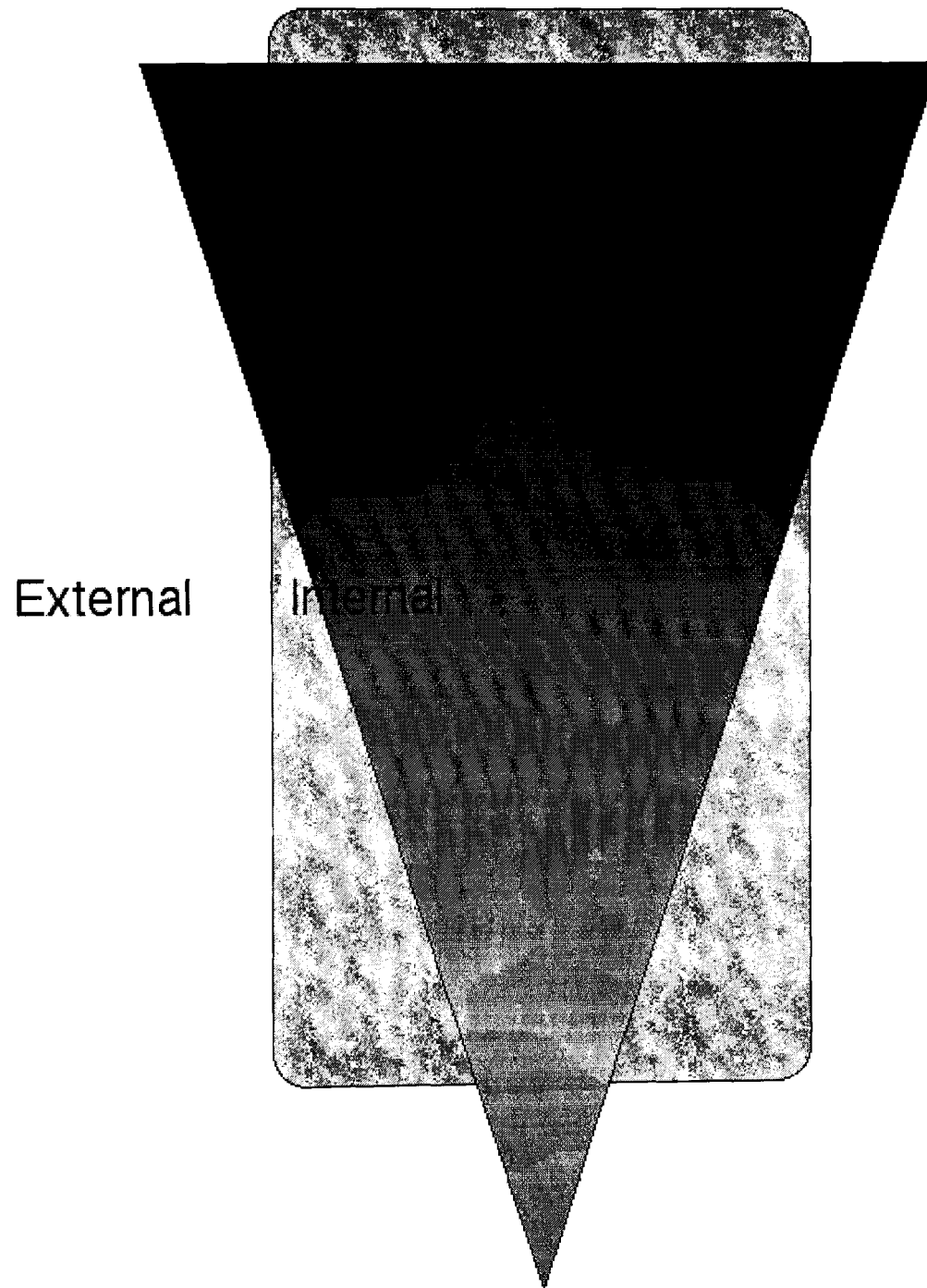I have read and agree to the above information and give my permission.

Name_____

Address_____

Appendix E

External and Internal Process of Design

Process of Creative Imagination

External   Internal

Figure E1.

Appendix F

Interview Blueprint

Interview Blueprint	How do Industrial Designers using creative imagination produce their most creative ideas from conception to completion?	
Research Concept	Description or Definition of Purpose	Interview Question/Statement
Introduction	Introduce person to interviewing process.	I've prepared some questions but if they don't seem to be hitting the mark, please feel free to correct me or elaborate on your answer.
Definition of "most creative idea"	Personal naming, definition and description of "most creative (design) idea" Personal judgement as to which idea is most creative	Tell me about your most creative design idea or ideas. >Why do you consider it/them your most creative? >>How would you determine whether an idea or ideas was creative? >>How would you determine whether an idea or ideas was more creative than another?
	Problem criteria	What were the criteria or parameters of this project(s)? >>Why did you do this project? >Who or what set these up (the criteria)?
Idea production using creative imagination	Description of the imaginative process they went through to produce their most creative ideas	Using creative (or constructive) imagination, how did you produce your most creative design idea(s) from conception to completion?
	Seeking or discovery in creative imagination	1>Where did you get your most creative ideas from? (existent, non-existent?) >>What did you get your most creative ideas from? >>Who did you get your most creative ideas from? >>What did you do leading up to the discovery of your most creative ideas?

	Changing or manipulating in creative imagination	2>How did you use creative imagination to form your ideas? (may need definition - (imaginative processes, strategies or methods)) >>How did you change or develop this idea in your mind or imagination? >>How did you use visualization or conceptualization in producing your most creative ideas? >>How did you hold onto this idea in your mind? >>How did you add other elements or qualities to your idea in process? >>How did you sort through other ideas to find your most creative ones? >>How did you play with the main idea in your mind? >>How did you "move" images in your mind to help the production of your idea?
	Overall synthesis of idea	3>How did the final idea come about? >>Did it come right away, in developing, near the end or production of it, or some other way? >>How does this process change over time? (ie. How different at conception, middle and completion) >>How did you know you were done?
	Further description of other factors in the process of this idea finding	What other (mental, emotional, physical, social, spiritual or other) things did you do that helped the development and production of these ideas?
Conclusion	Conclude interview; a chance to add any other comments on questions.	Is there anything else you would like to add or you think I'm missing?
	Documentation of interview	The preceding was an interview with _____, # ___ for the Imaginative Design Research Project, [date], [time], by Jonathan Legg.
		(> and >> refer to primary and secondary probes of the main questions; Numbers signify chronologically related probes of the primary question)

Appendix G

Graphic Organizer of Designers' Use of Verb actions of the Imaginative Design Process

Ideational Stage	Designers 1	2	3	4
finding				gathering information
				reading
	looking	looking	looking	looking
			walking	
			exposing oneself to new ideas	exposing oneself to new ideas
				Knowing Experiencing
developing	visualizing burn to liquid memory envisioning	visualizing	visualizing	visualizing
	drawing/sketching rendering photographing modelling prototyping printing out photo of	drawing/sketching rendering	drawing/sketching rendering photographing modelling prototyping printing out photo of	drawing/sketching rendering modelling prototyping/making
	noticing noticing others noticing		noticing	
	refining	refining	refining filtering weeding out holding onto ideas clipping film reel	refining eliminating bad keeping good
	coming up again			

ending				
percolating				
			tweaking deciphering code/DNA	funneling analyzing questioning ideas thinking solving
	evolving	evolving	evolving mutating	evolving
	proving itself (evaluating acc. to client crit) criteria salad?	(evaluating acc. to client crit)	(evaluating acc. to client crit)	testing (evaluating acc. to client crit) balancing criteria/parameters juggling criteria
	devaluing discarding falling into place		putting together components disposing of letting go of throwing to wall/seeing what sticks	
	making functional	(making functional)	collaborating making feasible making functional	talking with others about (making functional)
	giving birth to			
ending	(refining)	(refining)	(refining)	(refining)
	others conceptualizing letting others develop it		letting others develop it	

Appendix H

Correlation of Physical Representation and Social Influence on the Process of
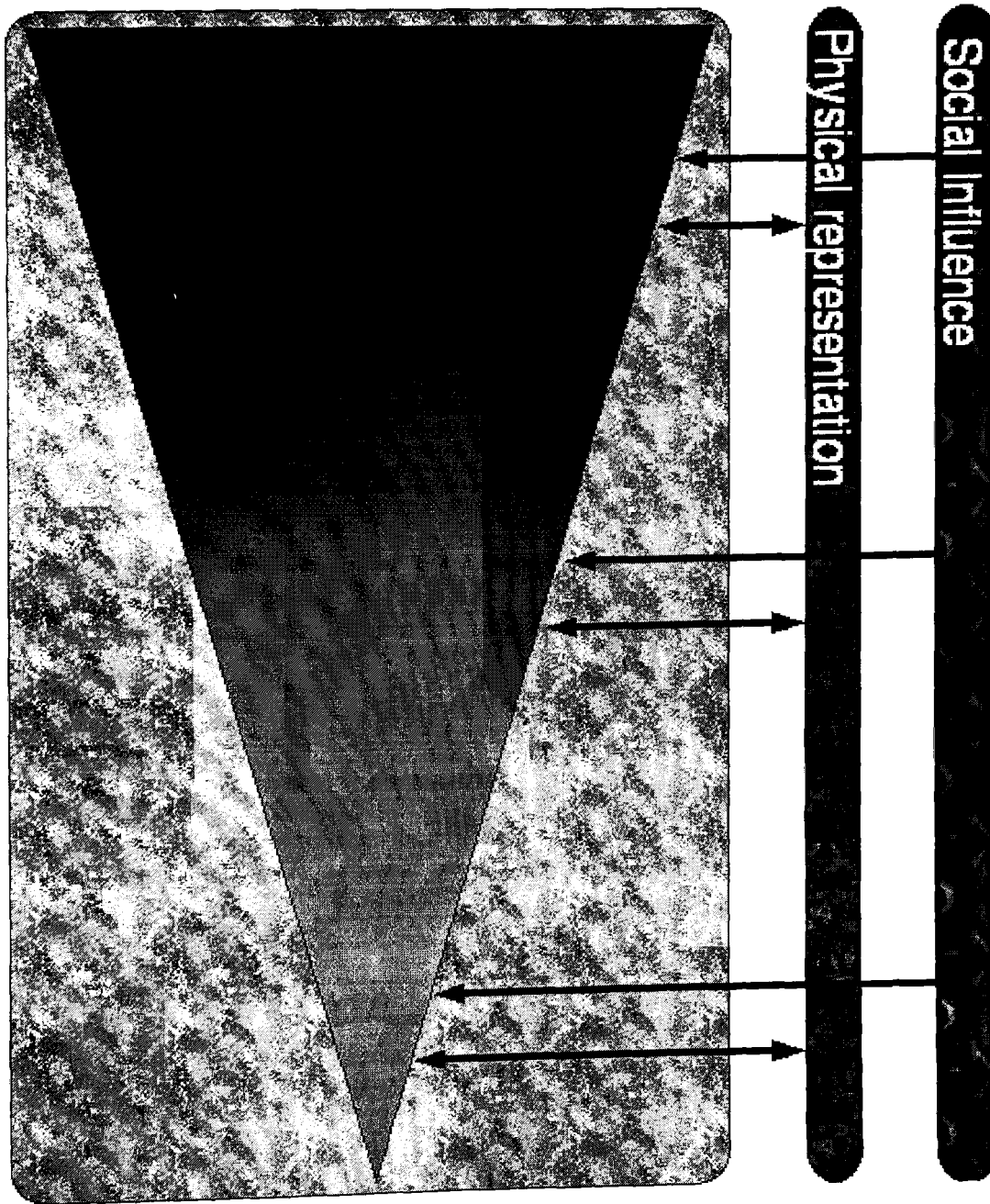
Imaginative Design

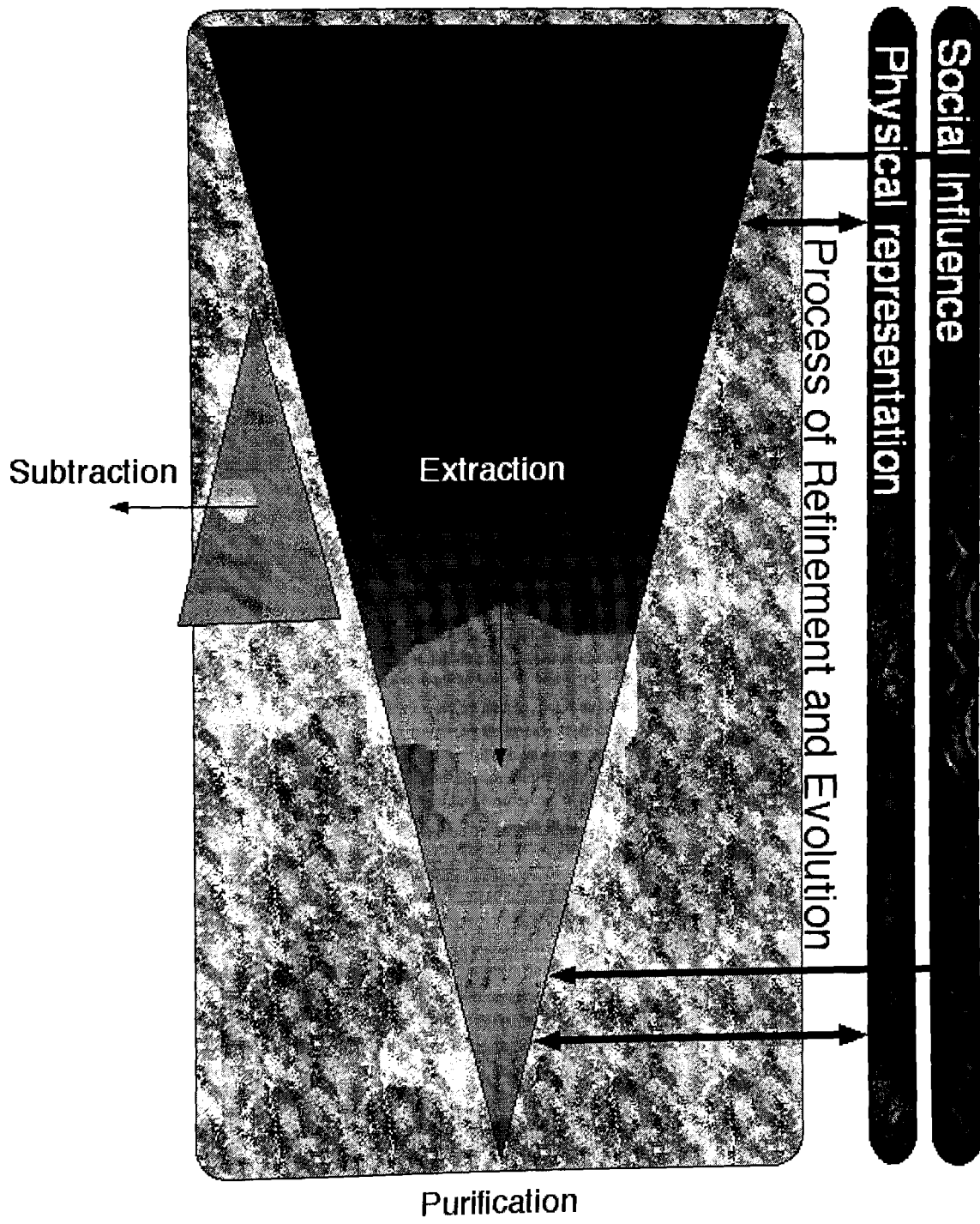Figure H1.

Appendix I

Overall Imaginative Design Process

Figure I1.

Appendix J

Process of Refinement and Evolution
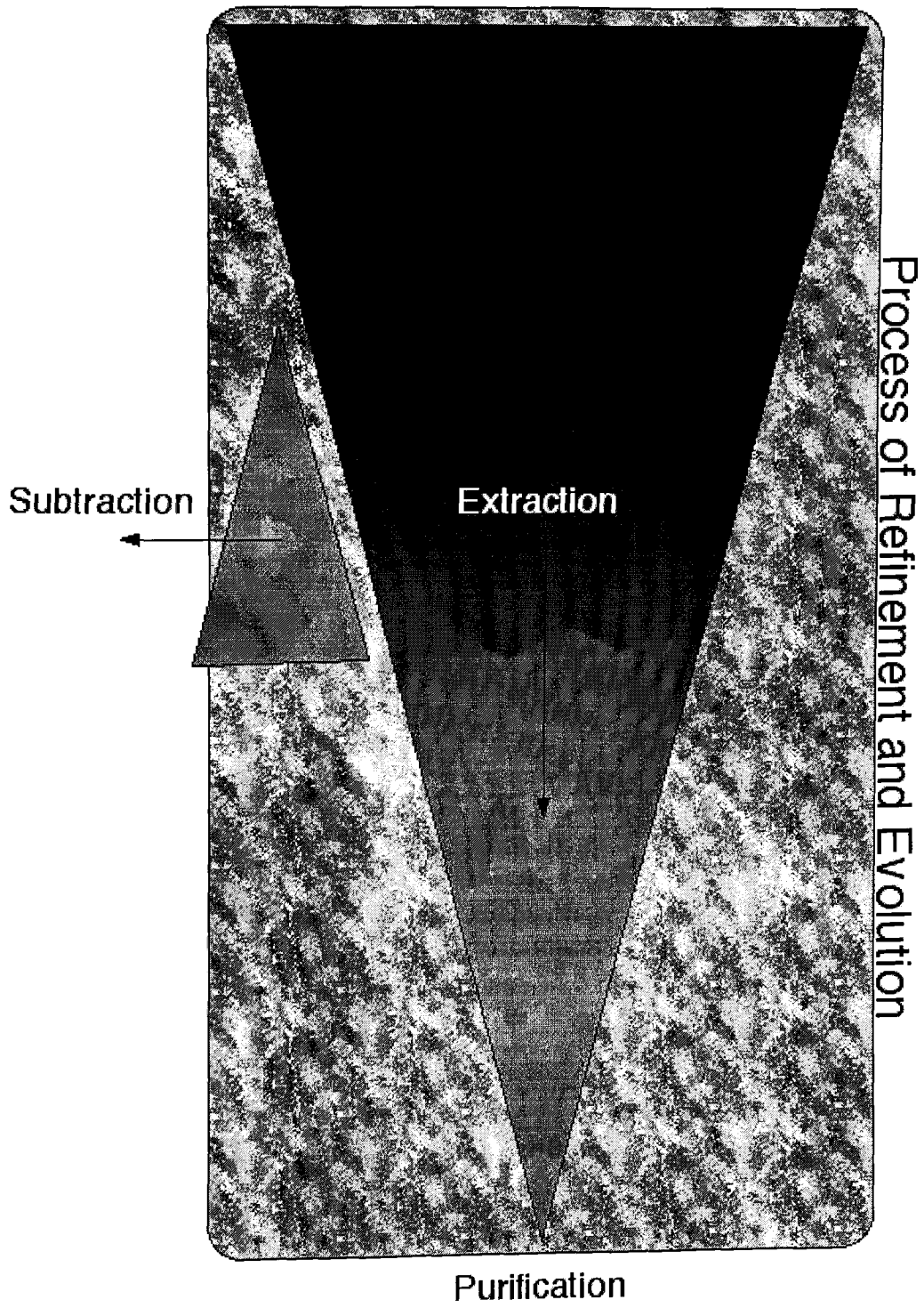

Figure J1.