THE DESIGN, IMPLEMENTATION, AND EVALUATION OF AN INTERACTIVE
MULTIMEDIA ENVIRONMENTAL DESIGN RESEARCH INFORMATION
SYSTEM:
ARCHITECTURAL DESIGN REVIEW AS CASE STUDY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
The Degree Doctor of Philosophy in the Graduate
School of the Ohio State University

By
Timothy Oserejenoria Imeokparia, B.Sc. Arch., B. Arch., M.C.R.P.

*****
The Ohio State University
2005

Dissertation Committee:
Professor Jack L. Nasar, Adviser
Professor Steven I. Gordon
Professor James E. Christensen

Approved by

Adviser
Graduate Program in
City and Regional Planning
ABSTRACT

This dissertation reports on the design, implementation, and evaluation of an interactive multimedia information system for environmental design research knowledge (IMMEDRIS). One of the primary goals of IMMEDRIS is to leverage the Internet as a channel for accelerating the dissemination and sharing of environmental design research (EDR) knowledge. To meet the requirement of the different user groups, a number of subsystems were designed to facilitate a complex set of views of EDR information for different contexts and applications. The prototype of IMMEDRIS as deployed has a tutorial and a decision aiding subsystem installed as a pilot project and evaluated in their function supporting the decision making process required by local government aesthetic-control regulations.

Philosophical discussions and empirical research on the fundamental importance of categories to both learning and communication provides the framework for the design of IMMEDRIS. The design of the tutorial subsystem relies on the idea of visual learning developed in cognitive science and the notion of ostension explicated by Wittgenstein. The decision aiding subsystem is predicated on the notion of judgment as a contingent and contextual practice rather than as a practice guided by determinately fixed categories. Based on accounts by Kant and Wittgenstein on the role of examples in learning concepts and making judgments the decision aiding subsystem relies on a purely procedural
criteria under a standard of reasonable method. It outlines a decision procedure which
relies on our ability for “empirical classification” and “empirical predication.”

With aesthetic judgment as a paradigmatic example and the architectural design
review function of most local governments in the United States as case study, the
dissertation seeks to locate the goal of objectivity and the methodology of quantification
of much EDR within a broader normative framework to give their findings meaning.

The project that forms the basis of this dissertation offers a tool that enables the
application of concepts derived from EDR to problem solving and decision making. The
dissertation evaluated the effectiveness and utility of the tutorial and decision aiding
subsystems of the prototype. It was evaluated for usability and its effectiveness in
improving a decision making task.
DEDICATIONS

I dedicate this dissertation in memoriam to:

Edmund Emiator Imeokparia

and

Comfort Enimien Imeokparia.
ACKNOWLEDGEMENTS

I wish to thank my adviser Professor Jack L. Nasar for his kindness and for helping me through this process. I also thank Professor Steve I. Gordon and Professor James E. Christensen for their contributions to this dissertation. I am particularly grateful to Professor Philip C. Brown for his vigilance and help in improving the quality of this document.

Most importantly, I want to thank my family for their love and support which sustained me through the difficult periods. Without you this would not have been possible.
VITA

September 18, 1960 .......... Born – Uromi, Nigeria

1987 .......................... B. Sc. Architecture, The University of New South Wales

1990 .......................... B. Architecture, The University of New South Wales

1998 .......................... M.C.R.P. The Ohio State University

FIELDS OF STUDY

Major Field: City and Regional Planning

Minor Fields of Study: Urban Design, Computer Visualization and Presentation Graphics
# TABLE OF CONTENTS

Abstract .................................................................................................................... p. ii

Dedication ............................................................................................................... p. iii

Acknowledgements ................................................................................................. p. iv

Vita............................................................................................................................ p. v

List of Tables ................................................................................................... pp. xi-xii

List of Figures .............................................................................................. pp. xiii-xiv

Chapters

1. Chapter 1 -- Introduction .................................................................................. p. 1

   Hierarchy of Scales, Users, and Impacts of the Physical Environment ................. p. 2

   Models of Knowledge Use ................................................................. p. 3

   The Applicability Gap ................................................................. p. 6

   Conflicting Worldviews ........................................................... p. 10

   Knowledge Utilization ............................................................... p. 10

   Types of Research Use .............................................................. p. 11

   Knowledge Diffusion and Uptake ........................................... p. 14

   Aesthetics ...................................................................................... p. 15

   Environmental Aesthetics ........................................................... p. 17

vii
Approaches to Landscape Assessment .................................. p. 20
Methodological Approaches ........................................ p. 25
Architecture as Inescapable Permanence .......................... p. 28
EDR and the Normative ............................................. p. 29
Architectural Design Review as Case Study .................... p. 32
Project Objective ...................................................... p. 35

2. Chapter 2 – Theoretical Framework .................................. p. 37
Categorization and Knowledge ....................................... p. 38
Categorization ....................................................... p. 39
The “Classical” Theory of Categorization ...................... p. 41
Prototype Theory .................................................... p. 42
Exemplar Theory .................................................... p. 44
Visual Representation and Learning ............................... p. 45
Descriptive and Depictive Representations ...................... p. 46
Multimedia Learning ................................................. p. 47
Wittgenstein and Family Resemblance ........................... p. 49
Learning by Example ................................................ p. 50
Immanuel Kant on Judgment and Understanding .............. p. 53
Walton’s Categories in Art .......................................... p. 59
A Decision Procedure for Aesthetic Value Judgment in Urban Planning ........................................ p. 63
Urban Planning, Objectivity, and Normativity ................. p. 64
Objectivity and Evaluative Judgment .................................. p. 66
Decision Procedure Applied to Architectural Design Review .. p. 68

3. Chapter Three – The Design and Implementation of IMMEDRIS .......... p. 71
   What is IMMEDRIS ........................................................... p. 72
   Design Objectives of IMMEDRIS ...................................... p. 72
   User Groups and Scope of IMMEDRIS ......................... p. 73
   The Internet and the World Wide Web ......................... p. 76
   The World Wide Web ...................................................... p. 77
   Rationale for the delivery of IMMEDRIS via the Internet..... p. 78
   Web Portal – Information Gateways.............................. p. 80
   Features of Web Portals............................................... p. 81
   Classification of Web Portals....................................... p. 81
   Digital Libraries (DL) .................................................... p. 83
   Technological Issues Pertaining to Digital Libraries ........ p. 85
   Web Applications ......................................................... p. 87
   The Design of IMMEDRIS .............................................. p. 89
   The Prototype of IMMEDRIS ....................................... p. 90
   Interface Design .......................................................... p. 91
   Human-Factors Design Guidelines ............................... p. 92
   Designing the Interface for IMMEDRIS ......................... p. 93
   Search Functionality .................................................. p. 94
   Note taking Functionality .......................................... p. 100
   i. Participants ............................................................................. p. 103
   ii. Socioeconomic Characteristics of Sample .......................p. 104
   iii. Procedure ...........................................................................p. 104
   iv. Design Review for Houses _ No Tool (NT) ....................... p. 107
   v. Design Review with Tutorial ............................................. p. 123
   vi. Tutorial Tool and Guidelines (T_G) ............................... p. 133
   vii. Evaluation and Background Information .................... p. 137

5. Chapter Five – Results and Discussion .................................p. 140
   i. Rating of Tool ...................................................................... p. 140
   ii. Decision Review Judgments of Houses ......................... p. 141
   iii. Decision Review Judgments of Streetscapes ............... p. 145

6. Chapter Six – Conclusion...................................................... pp. 150-152

7. List of References ............................................................... pp. 153-184
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Types of research use, methods of application and decision models</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Approaches to landscape assessment</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Methodological approaches to landscape assessment</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Normative and positive theory</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>Socioeconomic characteristics of respondents</td>
<td>104</td>
</tr>
<tr>
<td>6</td>
<td>Experimental design</td>
<td>105</td>
</tr>
<tr>
<td>7</td>
<td>Socioeconomic characteristics of respondents according to treatment condition</td>
<td>105</td>
</tr>
<tr>
<td>8</td>
<td>Mean scores (SD) for IMMEDRIS and Yanklovich most favorite Website</td>
<td>141</td>
</tr>
<tr>
<td>9</td>
<td>Mean scores (SD) for houses arranged from most to least preferred</td>
<td>143</td>
</tr>
<tr>
<td>10</td>
<td>Mean scores (SD) for each house by treatment condition</td>
<td>143</td>
</tr>
<tr>
<td>11</td>
<td>Obtained rankings for each house by treatment condition</td>
<td>144</td>
</tr>
<tr>
<td>12</td>
<td>Mean scores (SD) for Guidelines and No Guidelines</td>
<td>144</td>
</tr>
<tr>
<td>13</td>
<td>Mean scores (SD) for Tool and No Tool</td>
<td>145</td>
</tr>
<tr>
<td>14</td>
<td>Mean scores (SD) for streetscapes arranged from most to least preferred</td>
<td>147</td>
</tr>
<tr>
<td>15</td>
<td>Mean scores (SD) for streetscapes by treatment condition</td>
<td>147</td>
</tr>
<tr>
<td>16</td>
<td>Obtained rankings for each streetscape by treatment condition</td>
<td>148</td>
</tr>
</tbody>
</table>
17  Mean scores (SD) for Guidelines and No Guidelines………………………….. 148
18  Mean scores (SD) for Tool and No Tool ................................................. 148
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figures</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Entry page to the IMMEDRIS Portal</td>
<td>95</td>
</tr>
<tr>
<td>2</td>
<td>General layout of interface showing main menu item</td>
<td>96</td>
</tr>
<tr>
<td>3</td>
<td>Layout of interface showing main sub-menu items</td>
<td>97</td>
</tr>
<tr>
<td>4</td>
<td>Research page for information based on specific variables selected</td>
<td>98</td>
</tr>
<tr>
<td>5</td>
<td>Search results dynamically written to central display area of interface</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>Intro page to tutorial sub-system of IMMEDRIS</td>
<td>107</td>
</tr>
<tr>
<td>7</td>
<td>Design review of houses with NT_NG</td>
<td>109</td>
</tr>
<tr>
<td>8</td>
<td>Design review of houses with NT_NG</td>
<td>110</td>
</tr>
<tr>
<td>9</td>
<td>Thumb-nail images of houses</td>
<td>112</td>
</tr>
<tr>
<td>10</td>
<td>Thank You (first part of project)</td>
<td>113</td>
</tr>
<tr>
<td>11</td>
<td>Design review of streetscapes with NT_NG</td>
<td>114</td>
</tr>
<tr>
<td>12</td>
<td>Design review of streetscapes with NT_NG</td>
<td>115</td>
</tr>
<tr>
<td>13</td>
<td>Thumb-nail images of streetscapes</td>
<td>116</td>
</tr>
<tr>
<td>14</td>
<td>Thank You (second part of project)</td>
<td>116</td>
</tr>
<tr>
<td>15</td>
<td>Questionnaire collecting demographic information for NT_NG and NT_G</td>
<td>117</td>
</tr>
<tr>
<td>16</td>
<td>Thank You (third part of project)</td>
<td>118</td>
</tr>
</tbody>
</table>
Final Thank You ................................................................. 118

Design review for houses NT_G ............................................. 119

Design review for houses NT_G ............................................. 120

Design review for streetscapes NT_G ................................. 121

Design review for streetscapes NT_G ................................. 122

Tutorial on houses ............................................................. 124

Tutorial on houses ............................................................. 125

Tutorial on houses ............................................................. 126

Design review of houses T_NG ............................................. 127

Design review of houses T_NG ............................................. 128

Tutorial on streetscapes ....................................................... 129

Tutorial on streetscapes ....................................................... 130

Tutorial on streetscapes ....................................................... 131

Design review of streetscapes T_NG ................................. 132

Design review of streetscapes T_NG ................................. 133

Design review of houses T_G ............................................... 134

Design review of houses T_G ............................................... 135

Design review of streetscapes T_G ................................. 136

Design review of streetscapes T_G ................................. 137

Evaluation questionnaire for T_NG and T_G ........................ 139
CHAPTER 1

INTRODUCTION

This dissertation results from my concern with discussions of the “applicability gap” in the Environment Design Research (EDR) literature. Environmental design researchers study the complex interrelationships between people and their physical, social, and cultural environments. The research aims to guide design, programming and policy to help make environments more responsive to human needs (cf. Moore, Tuttle, and Howell, 1985). Increasing the factual content of design decisions can promote a more rational approach to environmental design and decision-making. Some researchers are motivated by previous design failures of critically acclaimed architectural projects such as the Pruitt-Igoe apartment complex in St. Louis (built in 1956 and demolished in 1972) and James Sterling's housing project at Runcorn- known locally as Legoland¹ and demolished twenty years after its completion. Researcher often claim if designers and decision makers adopt the concepts formed out of the studies necessitated by these failures, the result will be better designed and managed environments – physical settings that better match the needs and activities of their occupants.

¹ According to the design architect, the design concept was based on the proportion of eighteenth-century squares in Bath, Edinburgh (see Architectural Review Nov. 1976).
To obtain a better scientific understanding of the processes of person-environment interactions, researchers focus on different scales of the physical environment. In this next section, I outline a hierarchy of scales which in turn allows for a finer grained discussion of users and impacts.

**Hierarchy of Scales, Users, and Impacts of the Physical Environment**

Moore et al. (ibid., p. 26) have noted that “[e]nvironmental design research deals with all scales of the physical environment from the space of objects to the space of a region.” They identify three scales: micro-scale (small) at which analysis focuses, for example, on interior spaces or even smaller; meso-scale (intermediate) analysis of which ranges from a single building to a neighborhood level; and macro-scale (large) environments with analysis looking at the city or even the region (see also, Saarinen, 1976).

Equally, the transactions between people and their physical settings occur over space and time (op cit.). The quality of experience of a physical or social setting could depend on the period over which the person-environment interaction occurs. When combined, the time-space dimension and the scale of analysis has implications for the study of human experience and action in everyday setting, how user groups are defined and constituted, and the process of public policy decision making (ibid.).

The scales of the physical environment noted above are not defined by rigid boundaries. Rather, they constitute “a nested hierarchy of places” allowing for a more practical and conceptually integrative approach (ibid., p. 61). For example, user evaluation of a new housing project will depend on whether the users are tenants (in
which case the focus might be at the micro-scale) or residents of the neighborhood in which the project is located (in which case the focus should be at the meso-scale). The same applies to the role of environmental design and decision makers. For example, several public agencies typically constitute the clients for most projects at the macro-scale and the environmental decision making professionals involved are typically “resource managers, urban planners, landscape architects, urban designers, and civil engineers” (ibid., pp.60-61). The micro-level deals “with building subsystems and materials” and the environmental decision making professionals typically involved are “interior designers, product designers, industrial designers, and graphic designers” (ibid., p. 61).

**Models of Knowledge Use**

According to Beyer and Trice (1982, p. 608) “[t]he most persistent observation in the literature on utilization is that researchers and users belong to separate communities with very different values and ideologies and that these differences impede utilization.” Thus, the underlying conceptual structure for much of the debate on the use of social science research knowledge is provided by the “two-communities” metaphor (see Oh and Rich, 1996; Frenk, 1992; Webber, 1987; Dunn, 1980; Caplan, 1979; Rich, 1979). Bridging the gap in the culture, need, and belief between researchers and practitioners becomes the focus of research informed by the “two-communities” metaphor. On this account, the lack of use of research knowledge is attributable to differences in researchers’ and practitioners’ knowledge and expectations regarding research problems, solutions, interpretations, and applications. Similarly, in the EDR literature much of the
debate about the applicability gap is framed by a perceived difference between designers and researchers (Purcell and Heath, 1982). From this perspective, the problem of knowledge use begins after the knowledge is produced or created. It views the use of knowledge as a technical problem involving issues of how to best establish linkages between “the point of knowledge production” and the point of its application (Kerr, 1981 p. 484). Other theories or models of knowledge use are knowledge-specific theories and policymaker constraint theories (Caplan, Morrison, and Stambaugh, 1975; see also Wingens, 1990).

Suggestions for reducing the applicability gap tends to focus on the various techniques or strategies for “increasing effective communication between researchers and practitioners” (Seidel, 1985 p. 53). The literature discusses three strategies:

1) Clarification and dissemination strategies involve efforts to make research results more readable and accessible by non-researchers. These strategies suggest that research outcomes be expressed in more usable and comprehensible terms involving a low “level of abstraction” (Glaser, Abelson, and Garrison, 1983 p. 15); reinforcement by brief and repetitive delivery (Soumerai and Avorn, 1987); and adding analogies to research articles. 2) Linkage strategies focus on the importance of personal contact in the diffusion of research knowledge. Felker (1984, p. 37) suggest “face-to-face and custom-tailored communication” between researchers and practitioners; and Peterson and Emrick (1983, p. 243) called for “directed personal intervention.” Others suggest that researchers should be available to communicate and observe (see also Backer, 1988; Fullan, 1991, p. 53; Crandall, 1989, p. 95; Sorenson et al., 1988).
3) Collaborative strategies call for “face-to-face” interaction involving practitioners in the design and execution of the study throughout the research process (Huberman, 1990, p. 365). Huberman (1992) calls for “sustained interactivity”; Dentler (1984) claims the intensity of assistance is an important factor (see also Peterson and Emrick, 1983; Louis, 1983).

These strategies involve user–oriented translation and transformation of research results into more understandable and therefore, more usable form. However, current research in the field suggests such technical measures do not necessarily address the needs of the user. Knowledge use is a complex, transactional process that depends largely on the potential user’s pre-existing knowledge, beliefs, and experiences (Louis, 1992). Edwards (1991) points out that “[t]oday the complexities and the dynamic, transactional aspects of knowledge utilization have become more widely recognized” (p. 36). Wingens (1990, p. 37) argues for a shift to a user-oriented paradigm based on an understanding of the “active-creative role of the user for the process of use.” Tydén (1985, p. 30) argues that it is possible “different professional cultures require different types of dissemination methods.” Therefore, he suggests “that methods for the transfer of information must be specially tailored for different recipients.” Some researchers have sought the management of the process of creating and disseminating scholarly communication. Backer (1988, p. 20) suggests a “centralized repository of information … conveniently available in one place, in one standard format.”

The project that forms the basis of this dissertation offers a tool that enables the application of concepts derived from EDR to problem solving and decision making. I
developed a Web based tool which I called IMMEDRIS for an Interactive Multi-Media Environmental Design Research Information System. The system makes EDR information available to researchers, environmental designers, decision-makers and students to aid in environmental design learning and decision-making with a particular emphasis on environmental aesthetics. The proliferation of electronic communications, in particular the widespread use of personal computers, has changed dramatically “the communications environment of knowledge utilization” (Paisley, 1993 p. 222). However, the effective use of knowledge requires more than the implementation and utilization of a particular information system. Merrill (1976, quoted in Seidel, 1985 p. 56) claims that “information retrieval systems, per se, are not pat answers to access problems.” Their conceptualization must recognize how the intended decision maker arrives at decisions and whether the information understands the relevance of the information presented. Thus, the dissertation evaluated the effectiveness and utility of the tutorial and decision aiding subsystems of a prototype of the system.

In what follows, I discuss the applicability gap in the EDR literature, research use in the social sciences; I focus one aspect of EDR – environment aesthetics.

The Applicability Gap

A cursory reading of the conference proceedings of the Environmental Design Research Association (EDRA) reveals a recurrent concern with the applicability gap. The applicability gap refers to the claim “that a wide range of available research data on people’s behavior is not being utilized by designers” (Mitchell, 1993, p.36; see also Seidel, 1985; 1982). Seidel (1985, p. 47) notes that “scholars in the field of environment
and behavior (E&B) have expressed concerns repeatedly about the use of research information by professional designers and planners.” Similarly, Mitchell (1993, p37) commenting on the influence of environmental design researchers on environmental design notes “that despite all of their rhetoric and voluminous publications, the design process has been completely unaffected by their efforts.” Designers have not adopted environmental design research knowledge and applied it in their designs. Researchers have advanced a number of reasons for the persistence of the gap. These include the use of “impenetrable jargon in research reports” (Deasy, 1975); the “presentation of findings in a numerical/verbal, rather than visual/verbal mode” preferred by most designers (Dean, 1975); the lack of “a common framework or structure within which” researchers and designers “can share research study results” (Conway & Goglia, 1978 p.3); and a “conflict between the nature of research and design tasks themselves”, one dealing in generalities and the other with the particularities of an extant design problem (Mitchell, 1993 p.36). Likewise, people have offered suggestions to help bridge the gap. For example, (Mitchell, 1993; Seidel, 1981a, Purcell, 1982) call for more collaboration, making design research part of the design process rather than merely trying to inform the design process. Such collaboration might involve incorporating architectural theory in research design (Groat, 1987a, 1987b; Seidel, 1981b), or introducing and integrating Environmental Design Research (EDR) information and concepts or environmental knowledge into studio-based design education (Burnette, 1976, p. 322).

The view that environmental designers and decision-makers need access to EDR to inform their decision-making grows in part from design failures of critically acclaimed
architectural projects noted earlier. The architectural critic Martin Pawley (1989) blamed the failure of Sterling's critically acclaimed housing scheme on the occupants having the 'wrong' aesthetic values. He claims “[i]f you want architectural precedents for 'Legoland’ you have to find them in the eighteenth century squares of Bath and Edinburgh where the same suppression of individual identity to grand geometry occurs. But the sort of people who appreciate that sort of thing don't live in Runcorn and never did” (quoted in Alcock, 1993 p. 47). Alcock (ibid.) notes that what was in effect the failure of an urban design theory lacking “universal validity” was “nimbly transposed into a failure of taste.”

Environmental design researchers blame these failures on a design philosophy which creates buildings that fail to match the needs of its users in many ways including aesthetic value. For example, while architects focus on design aesthetics of buildings, the public has more concern with emergent effects, such as the impact on the safety of public spaces, which comes from how the buildings are related to one another (Bentley, 1994 p. 70). Punter (1993, p. 10) argues that the intuitive assumptions of professional designers frequently miss peoples aesthetic evaluations, including “perception of sites and places, what they notice and what they want to see maintained or changed.” Research confirms that the perceptions, cognitions, and aesthetic preferences of architects differ from those of non-architects (Groat, 1982; Devlin and Nasar, 1989; Nasar, 1989; Devlin, 1990;)

---

2 Bourdieu's ideas about the role of the arts in class cohesion among elites is most relevant here. He places an emphasis on aesthetic knowledge and tastes. Bourdieu (1984[1979]) in his critique of (aesthetic) value by means of a critique of a critique of taste views taste and cultural distinction as means of power and social differentiation. As formulated by Kant, taste ought to be shared universally. Instead, it has, according to Bourdieu, become institutionalized to such an extent that it excludes and oppresses. Thus the "disinterested" aesthetic no longer refers to freedom but is reduced to a class-based preference for certain forms.

3 A number of these differences have been attributed to the professional education of architects. Other
Wilson and Canter, 1990; Purcell, 1995; Wilson, 1996). For example, Devlin and Nasar, (1989) found that architects have a preference for “high” styles while the public prefers “popular” architectural styles. Findings consistently indicate a divergence in the way architects and ‘lay people evaluate architecture. Designers and non-designers evaluate the buildings differently. Wilson (1996, p. 33) claims that “design professionals in general, and architects in particular, hold a different system of constructs through which they understand [conceptualize] and evaluate the environment. Conceptualization and evaluation involve two distinctly different systems of construct.” Conceptualization involves a system of concepts (essentially descriptive, objective and non-evaluative) with which to organize and understand architecture (ibid.). Evaluation guides subjective judgments (ibid.). Groat (1982) found that architects use different concepts from non-architects, but Nasar and Purcell, (1992) found that architects and non-architects use the same schema to organize and understand buildings but evaluate them differently. Differences in evaluation tend to reflect a difference in preference for the typical vs. atypical and popular vs. high style (Devlin and Nasar, op cit.). The mismatch between architects and the people for whom they design has clear implications – a built environment that fails to match the value-systems of ordinary users. 

sources could be due differences in value systems, of what has been inherited, learned, and indoctrinated from experience, education or practice”, or due to “received wisdoms of planning [and architectural] ideology, of national culture, of design education or of personal experience.” “predispositions, design training that alters the architecture student’s understanding of symbols and introduces a specialized language (e.g. Wilson, 1996); “on-the-job experience” that “apparently leads to a different set of design criteria and values (cf. Groat, 1982, 1995).
**Conflicting Worldviews**

The debate about the applicability gap reveals two underlying and conflicting worldviews. Environmental design researchers believe EDR knowledge can “lead directly to improvements in environmental design” (Purcell, 1982) and they claim that architects have failed to use the available research knowledge to create satisfactory environments responsive and meaningful to users. Some architects believe you cannot translate research results directly into design practice; others lack awareness of it; and others do not apply the results of EDR because of “a deep-rooted skepticism” of empirical research (Weber, 1994 p3). Many architects consider any empirical research into the design process an infringement on their rights to free artistic expression, particularly when one is dealing with “aesthetics” and given the perception that aesthetic judgment “cannot be plausibly defended” (ibid.).

To broaden our understanding of the conflict in world views, let us turn to the broader question of knowledge use.

**Knowledge Utilization**

According to Rich (1979, p. 18) “[t]he notion of adapting knowledge to society dates back to the Greeks and is a theme running through much of Western thought.” Yet, studies have found that policy makers, practitioners, and even social science scholars have a low expectation that social science knowledge will be applied by users (Caplan, 1975; Dunn, 1980; Weiss, 1980; Nagel, 1987; Lester, 1993; Rappert, 1997; Wilensky, 1997). The research reveals a common finding – while social scientists believe the information they produce should be used, decision makers often do not use the
information (see Ciarlo, 1980; Webber, 1987). Thus, the non-utilization of EDR by architects is part of a broader problem that cuts across a number of disciplines. The literature on dissemination and utilization spans diverse fields including education, rehabilitation, sociology, psychology, and marketing (Backer, 1991).

Exactly what constitutes information use remains a salient issue in research on the use of research information (Taylor, 1991; Friedman and Farag, 1991; Machlup, 1979). Among the many definitions of research use built on different conceptions of information, the dominant theme revolves around the idea of people doing something with research results (Beyer and Trice, 1982 p. 595): the transformation of the findings of one or more empirical studies into knowledge for use in practice. The research may or may not be translated into a product, that is, a material form such as a decision protocol, a decision algorithm, or a guideline for practice. Knowledge use⁴ as a framing concept for research on knowledge dissemination encompasses “a variety of interventions aimed at increasing the use of knowledge to solve human problems” including “research, scholarly, and programmatic intervention activities” (Backer, 1991 pp. 225).

**Types of Research Use**

Empirical studies and measurement of research use “has revealed three types of use: instrumental, conceptual, and symbolic” (Beyer, 1997, p. 17; see also Beyer & Trice, 1982; Pelz, 1978) (See Table 1).

---

⁴ The terms *research use* and *evidence-based practice* often are used interchangeably; however the terms are not synonymous. As a review of recent literature on planning theory shows, evidence-based practice is one of the new trends in planning theory. Evidence-based practice is the more general term and encompasses research utilization. Evidence is constituted of more than the findings of research; the term research in research utilization denotes only the findings of (usually scientific) research.
Table 1: Types of research use, methods of application and decision models.

<table>
<thead>
<tr>
<th>Type of use</th>
<th>Application</th>
<th>Decision Type/Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrumental</td>
<td>Direct</td>
<td>Rational decision-making process</td>
</tr>
<tr>
<td>Conceptual</td>
<td>Indirect</td>
<td>Diffused and indirect</td>
</tr>
<tr>
<td>Symbolic</td>
<td>Political/Normative</td>
<td>Bargaining-conflict</td>
</tr>
</tbody>
</table>

Instrumental utilization entails the direct application of research results to a specific problem (Beyer, 1997 p. 17; see also Rich, 1977). Huberman (1992, p. 6) describes it as “changes in levels of knowledge, understanding, or attitude.” According to Rich (1977, p. 200) the use of research knowledge instrumentally involves acting on information in specific, direct ways where “respondents cited and could document … the specific way in which information was being used for decision-making or problem-solving purposes.” For example, Cooper Marcus and Francis (1997) offer research-based design guidelines on how to create people-friendly urban open spaces. They transferred the research into a material and useable form for making specific decisions or interventions.

Conceptual utilization focuses on a person's store of knowledge and its translation and application to a particular problem. Larsen (1980, p. 428) defines conceptual utilization as “knowledge which is under consideration, either explicitly or implicitly”; “Huberman (ibid.) describes it as “changes in levels of knowledge, understanding, or attitude,” and as an activity “in which one processes information, construes and reasons” (Ibid., 1983 p. 495); and Weiss (1977, p. 535) calls it the “gradual sedimentation of insights, theories, concepts and ways of looking at the
world.” She labels it as “enlightenment.” Thus “conceptual use involves using research results for general enlightenment; results influence actions but more indirectly and less specifically than in instrumental use” (Beyer, ibid.). For example, general enlightenment might involve consistent findings in EDR of differences in preference between architects and others. This could enlighten some designers to consult the public as part of their design process. However, the modalities of this consultation are not directly specified.

*Symbolic utilization* involves the use of research by practitioners and decision makers “to legitimate and sustain predetermined positions” and practices (Beyer, ibid.; see also Pelz, ibid; Weiss, ibid.). Huberman (1987, p. 590) characterizes symbolic use as belonging to “the ‘research-as-ammunition’ tradition.” For example, a community might use the results of a study that found communities with unique character tend to attract more tourist dollars and economic growth to legitimate a system of aesthetic regulation designed to preserve and maintain existing visual character. Thus, critics characterize symbolic use of research knowledge as “bad use of knowledge” and instrumental and conceptual use as “distinct but nevertheless ‘good’ applications of information” (Souchon, and Dianmantopoulos, 1994 p. 67 Quoted in Ouimet, Landry, 2004 p. 79). However, symbolic use might have a pragmatic purpose (Feigl, 1952, 1968; Hempel, 1965 p. 85). Granrose (1971, p. 159) claims a pragmatic justification of actions (for example, the adoption of a particular rule or set of rules) appeals to human interests and desires. In this sense, research knowledge can be formulated as a conditional *if* … *then* …statement. Empirical knowledge can establish such a conditional statement; it can
provide the factual information required for the resolution of normative issues (Hempel, ibid.).

EDR literature tends to overlook symbolic use. For example, Seidel (1985 pp. 51-52) characterizes EDR use as falling on “a continuum from the conceptual use of the rights of research to the instrumental use of research.” Depending on the decision-making situations, the use of EDR by designers and decision makers could be instrumental, conceptual, and/or symbolic. However, much of the discussion focuses on the narrow or standard narrative of the application of social science knowledge – the model of instrumentality (cf. Stehr, 1992).

Knowledge Diffusion and Uptake

Some researchers have studied the evaluative criteria used by design professionals in design decision making (Wilson, ibid.; Groat, ibid.). However, no studies in the environmental design research literature have attempted to identify the characteristics of research knowledge that influence adoption or use by practitioners. For example, studies have examined the influence of type and quality of research evidence on decisions about implementation in practice. Weiss and Bucuvalas (1980) have found that decision-makers utilize two major criteria when deciding which research results to adopt: a “truth” test (cast as research quality and conformity with prior knowledge or expectations) and a ‘utility’ test (cast as action orientation and challenge to the status quo). Patton et al. (1977) found that of eleven factors advanced as influencing the uptake of research results, respondents only consistently identified political and personal relevance as affecting utilization. Sunesson et al. (1989) in a study that classified 170 research reports according
to origin (local vs. academic), level of scientific sophistication, and theoretical vs. action orientation found the most widely used research combined scientific sophistication with action orientation. However, choice of the most favored type of research appeared to be influenced by the type of use that was made of the research, and the organizational culture. Hutchinson (1995) also found action-orientation, or practical utility for the practitioner was the most important criterion used to judge research. Also influential in the decision to adopt research findings were research quality, conformity to user expectations and the importance of source expertise. These studies seem to suggest that practitioner perceptions of research quality, relevance or practical utility and fit with existing knowledge are determining factors in research uptake. However, depending on user need and context, evaluative criteria may differ.

As this dissertation focuses on one aspect of EDR – environmental aesthetics, an overview of aesthetics is followed by a discussion of the philosophical and methodological underpinnings of research in environmental aesthetics.

Aesthetics

It is hard to pin down the domain and subject matter of aesthetics. Mann (1998 p. 3) claims “[i]t is hard to imagine a subject matter being more capricious and elusive than aesthetics.” The meaning of the word aesthetic” has become at best imprecise, at worst confusing in common parlance (Rostankowski, 2003 p. 105). Aesthetics has been variously characterized as "the philosophy of art" or more broadly, the philosophy of art.

---

5 Nasar (1998) and Rapoport (1992) have outlined why the term environmental meaning is to be preferred to environmental aesthetics. However, I have decided to stick with the term aesthetics because it allows for a more effective explication of the issues.
and beauty (Mann, ibid.). The term first appeared in the English language in the
nineteenth century and derives from Alexander Baumgarten attempts in the mid-
eighteenth century to name his “science of sensory cognition” (or perceptual knowledge)
(cf. Kainz, 1962; Saw and Osborne, 1968; Beardsley, 1975). Although Baumgarten’s
inquiry into sensation or perception provides the modern designation “aesthetic” – he
defined “aesthetics” as the “science of knowing”, the term “aesthetics” derives from the
classical Greek verb *aisthanesthai*, meaning that which is “perceived, as opposed to
conceived”; *aisthetica*, things perceptible and in its original formulation refers to a
category of knowledge.

Since its introduction by Baumgarten, the “aesthetic” has undergone a functional
change of meaning such that, it “is today widely seen as the philosophy of art and/or
beauty, limited to artworks and their perception” (Gross, 2002 p. 403). Contemporary
discourse in the philosophy of art on aesthetics as a philosophical inquiry into beauty in
art and nature, the experience of aesthetic pleasure, grows out of the formalization of
theories of taste and beauty by Immanuel Kant in his *Critique of Judgment* (1790). After
Kant, the central assumptions of a modern formalist aesthetic are that “aesthetic
experience depends on universality of form, perceptual and psychological
disinterestedness, and the primacy of originality and innovation” (Tumas-Serna, 1999 p.

---

6 Kant is generally regarded as the father of modern aesthetics and he gives the definitive account of
aesthetic judgment in The Critique of Judgment; the one that helped launch aesthetics as a field and which
is still in many ways canonical. Hegel claims that Kant “spoke the first rational word on aesthetics” (Cf.
McCormick, 1990 pp. 268-269); Greenberg (1955, p. 151) calls Kant’s Critique of Judgment “the most
satisfactory basis for aesthetics we yet have”; Mundt (1959 p. 288) claims that “almost all the aesthetic
issues discussed in 19th-century philosophy were raised, and in some manner, answered by Kant”; and for
Baldacchino (1991, p. 1) “Kant’s is arguably the greatest if not the unique philosophical system capable of
yielding a comprehensive account of the character and possibility of aesthetic experience and therefore of
providing answers to the perennially elusive problems of aesthetics: What is beauty?”
78) and the role and significance of art in modern culture (see also Bernstein, 2000 p. 158). However, apart from its specialized uses in discussion of art and literature the term aesthetics is also used in popular culture to refer to questions of “visual appearance and effect” (Williams, 1976, p. 42).

**Environmental Aesthetics**

Empirical aesthetics “uses scientific methodologies to help explain the relationship between physical stimuli and human response” (Nasar, 1988 p. xxi). For environment aesthetics it combines “a concern with aesthetic value … and a methodological emphasis on applicability” (ibid.). It centers on human evaluations of the natural and built environments and formulates its conclusions from knowledge derived from systematic observations and data collected from user ratings rather than on the basis of abstract deductions.7

Eaton (1989) has written that the landscape as source of effect (pleasure or motivation for aesthetic response) has been a mainstay of Western Intellectual thought since Plato and Aristotle. Environmental aesthetics extends the preoccupation of contemporary aesthetic theory with art objects and the beautiful to encompass the whole range of human affect – the environment included (Wohlwill, 1976). For example, Kaplan and Kaplan (1989) describe aesthetics as a primary aspect of people-landscape interactions. Aesthetic quality influences our experience of physical settings. People often form perceptions of a place based on what they see and experience. Aesthetics, or

---

7 Gustav Fechner (1801-1887) who coined the term “experimental aesthetics” advocated what he called aesthetics “from below” or a “bottom-up” approach; that is, the study of the dimensions of aesthetic experience “through empirical investigation and induction in contrast to aesthetics ‘from above’ as characterized by philosophical aesthetics working deductively” (O’Hare, 1980 pp. 20-21; see also Arnheim, 1986).
perceived visual quality, is important to the human sense of well-being (Porteous, 1996; Nasar, 1988). Yet, protecting and enhancing visual aesthetic values is an important although a frequently contentious issue.

Heightened public interest in the late 1960s and 1970s in preserving the visual quality of the environment focused attention on the need to increase and guarantee the protection of areas of great aesthetic value or natural beauty. In principally English speaking countries, issues of landscape or scenic quality were included in statutory regulation. For example, in the US, the National Environmental Policy Act (NEPA) enacted in 1969, mandated federal agencies to “insure presently unquantified environmental amenities and values be given appropriate consideration in decision-making along with economic and technical considerations” to ensure “safe, healthful, productive and aesthetically and culturally pleasing surroundings” (Cutler, 1979 13; see also Redding, 1973). The aesthetic begins to be conceived of primarily in visual terms as scenic beauty (and diminished aesthetic quality as visual blight) and to allow comparison with other resources, operationalized as visual quality.

Dearden (1985) has argued that landscapes are a resource and as such should be considered a variable in land use decisions. However, Carlson (1977, p. 135) notes that “[i]f the aesthetic quality of the built environment is to be seen as a resource and the demand on it is to be weighed against that of other resources, then we must have an objective basis for comparison.” The result is a combination of practical assessment techniques, management programs and research endeavors aimed at producing more explicit and “objective” and therefore, more defensible measures of landscape and visual
quality. These attempts at achieving objective results led to the development of “systems of quantification designed to facilitate the measurement of aesthetic quality” (ibid., pp. 134-135). The quantification which this dissertation addresses “involves the attempt to render in quantitave terms that which has [traditionally] been rendered in qualitative terms” (ibid., p. 144). I believe such a conception of quantification rests on a mistaken assumption that with measurements “qualities are ‘transformed’ into quantities” and “is connected with the idea that quantities rather than qualities reveal the true nature of the universe” (Kaufmann, 1944 p. 38). Such a conceptualization of quantification derives from the view noted by Rescher (1997, p. 75) “that quantification provides a high-road to objectivity in science and rational inquiry in general.” Similarly, Porter (1995 p. 74) notes that “among the most credible strategies for rendering nature or society objective” is “[s]trict quantification, through measurement, counting, and calculation.” That is, the main idea of objectivity is made visible by computation.

Daniel and Vining (1983) refer to efforts by resource and environmental management and land-use agencies to manage and plan for the aesthetic, practitioners to measure and manage the “visual resource,” and researchers to study people’s perceptions of and preferences for landscape scenes as “assessment of landscape quality”; Porteous (1982, 1996) calls it “environmental aesthetics”; and (Zube et al. 1982) calls it “landscape perception research.” Whatever the label, current research in this field is dedicated to the possibility of creating a completely credible model of environmental assessment by primarily concentrating on objectively demonstrable criteria. The next section outlines the different approaches to landscape evaluation and note the
philosophical and methodological presuppositions that give research in this field its quantitative focus.

**Approaches to Landscape Assessment**

Many disciplines and professions have contributed to the evolution of landscape assessment, each approaching the problem from different philosophical presuppositions, theoretical perspectives and methods. Zube *et al.* (1982, p. 2) in a review of 162 studies found a “seemingly diffuse collection of studies and findings.” However, two broad approaches have emerged in the evaluation of landscapes: landscape evaluation studies and preference studies.

*Landscape evaluation* studies evolved within the framework of disciplines traditionally related to design. Their basic theoretical underpinnings of are:

1) The claim that aesthetic values (visual quality) are intrinsic in the formal properties (such as shape, color, textures and their inter-relationship) of the landscape rather than external to it forms.

2) The relationships between these elements can be classified in terms of variety, unity, integrity or other complex formal characteristics and stated objectively.

3) The presupposition that certain qualified professionals (experts) trained in art, design, or resource management are capable of analyzing scenic beauty objectively and translating its components into formulas appropriate for use in design.

*Landscape preference* studies are based on an analysis of empirical research on human reactions or responses to landscapes. They derive judgments of aesthetic value from respondent preferences in relation to environmental variables. Preference studies
use judgments of the landscape in totality, as opposed to the measurement techniques, which rely on the definition of factors to explain variation in landscape quality (Dunn, 1976). The model makes a number of claims:

1) A normative claim that “the relevant preferences are those of the general public” based on public concern for the quality of the environment.

2) An empirical claim that the aesthetic quality of a landscape is meaningfully correlated with certain preferences for that landscape.”

3) A methodological claim that “the ‘aesthetic quality of different landscapes’ can be determined by measuring only formal aspects of photographs” (Carlson, ibid. pp. 140-141).

Carlson names “certain general themes” which he claims characterize the landscape preference model and forms its overall approach: “objectivity” “measurement” or “quantification,” “egalitarian” or “public opinion,” and “formalist” themes respectively (ibid., pp. 131-134). The first two themes relate to “the quest for objectivity and quantification” and derive from “the need to make resource decisions about the environment’s aesthetic quality” (ibid., pp. 136-137). He labels the third theme rather dismissively as “egalitarian” because it results from “public concern for the aesthetic quality of the environment.” He labels the forth theme “formalist” because the methodological presupposition of the landscape preference model necessitates the measurement of formal properties of the landscape (ibid.).

The philosophical presumption of a broad consensus within a society of what constitutes aesthetic value underpins and substantiates research in this field is. You can
situate environmental quality on a continuum of excellence or perfection, but the two approaches disagree on who makes that judgment – whether assessment of aesthetic quality should rely on the public or design professionals (Galindo and Rodriguez, 2000 p. 13). Craik and Zube (1976) call for landscape quality assessment based on either preferences or judgments. Robinson et al. (1976, p. 55) note a difference between preference and judgment which they explicate by defining judgment "as a critical opinion based on an assessment of merit" and preference as “an opinion which specifically relates to a personal ‘liking’ based on experience." Prima facie, while such a distinction appears syntactical, the claimed difference represents a rhetorical device used to classify evaluations by experts as “objective” and those by the public as “subjective.” Presumably, only design professionals who have the competence to evaluate “visual quality” exercise judgment; the preferences of the public represent value judgments making them subjective.

Preference is a relative judgment about the desirability of two or more objects or combination of objects. The process that underlies preference is inferential, direct, and immediate; it expresses or measures a desire (Morris, 1987). Preference is an appraisal and its measurement can vary depending on the degree of affect. Measuring our responses to the urban environment is an aesthetic “comparison” with preference in fact the “measuring index.” As Birkhoff (1933, p. 11) has noted, preference has “substantial meaning only when it represents the normal or average of some selected group of observers.” As Railton (1998, pp. 60-61) has stated, evaluation is “closely tied to preference.” While acknowledging that “more than strong preference” is needed “to
claim authority on value,” preference is still nevertheless, “the main point of entry into evaluation.” He notes that “we even speak of value as explaining preferences.” Therefore, landscape preferences are associated with people’s environmental value orientations.

Both expert and lay judgments relate to the physical attributes of the environment. Expert judgments use the presence of these attributes to explain variations in landscape quality (Dunn, 1976). Public preference judgments use evaluative responses to the environment and seek to determine the environmental determinants of this response. Where the judgment rests marks the distinction between experts and the public. Table 2 (p. 25) shows several contrasting schemas used to structure the various approaches that have emerged from research in this field.

Zube et al. (1982) proposed four paradigms – Expert/Professional, Psychological, Cognitive, and Experiential – and created a model of “landscape perception” based on a rigorous quantitative analysis of the available literature. The expert paradigm relies on expert opinion and judgment to determine the visual quality of an environment based on artistic and design principles. The psychological paradigm attempts to determine the mathematical (measurable) relationships between the physical characteristics (objective attributes) of the landscape and the perceptual judgments of human observers. The relationships of interest are those between the physical features of the environment, such as topography, vegetation and water, and the psychological responses, often judgments of preference, aesthetic value or scenic beauty. The cognitive paradigm has as its main objective, the development of conceptual and theoretical frameworks that permit the discovery and description of the underlying psychological bases or processes that explain
aesthetic preferences for landscapes. The *experiential* paradigm contrasts dramatically with the psychophysical and cognitive approaches in its approach to valuation. It places priority upon the subjective experience of particular landscapes, rather than attempting to develop objective measures of a population’s general response landscape.

Porteous (1982) takes a more problem-oriented approach and using the two criteria of relevance and rigor, he also proposed four paradigms – Humanists, Experimentalists, Activists, and Planners. The *humanist* approach emphasizes the unique surface qualities while at the same time seeking universals intuitively. *Experimentalists* believe “before we change the world we must first understand it” (1996, p. 14). The *activist* characterizes the extreme of relevance – “act now!” (ibid.). The *planner* occupies an intermediate position because they “confront immediate issues” (ibid.).

Punter (1982, p. 102) claims “three interdisciplinary perspectives or paradigms are immediately apparent” – Landscape or Visual Quality, Landscape Perception, and Landscape Interpretation. His *landscape or visual quality* approach deals with formal sensory-aesthetic qualities. The second approach, *landscape perception* focuses on the mechanics of how we perceive landscape and upon the links between perception, comprehension, preference and action. Punter’s third approach – *landscape interpretation*, deals with “landscape as an expression of cultures, lifestyles, and value” and therefore, focuses on meaning” (Porteous, ibid. p. 11).

Daniel and Vining (1983) extend Zube et al.’s classification by dividing their “expert paradigm into formal (landscape architecture) and ecological (biological) approaches” (Porteous, ibid. p. 13).
Table 2: Approaches to landscape assessment (adapted from Porteous, 1996 p. 15).

**Methodological Approaches**

Broadly, the approaches differ in the role of the public as observer or respondent. The expert paradigm excludes the public. The expert represents a detached observer with purely utilitarian goals. In the psychologically-oriented paradigms – the psychophysical and the cognitive, public preferences become important; and researchers use measures to obtain the landscape evaluation of the public. Researchers test for correlations between public evaluations and landscape properties (Table 3).

<table>
<thead>
<tr>
<th>Expert</th>
<th>Experimental</th>
<th>Experiential</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Psychophysical</td>
<td>Psychological</td>
</tr>
<tr>
<td>Visual quality intrinsic to landscape</td>
<td></td>
<td>Visual quality based on public preference</td>
</tr>
<tr>
<td>User-Independent methods</td>
<td>Quasi User-Dependent methods</td>
<td>User-Dependent methods</td>
</tr>
<tr>
<td>Assessment by experts</td>
<td>Predominantly quantitative</td>
<td>Assessment by the public/user</td>
</tr>
</tbody>
</table>

Table 3: Methodological approaches to landscape assessment (adapted from Dakin, 2003).
A difference between user-independent and user-dependent methods provides another useful evaluative distinction. User-dependent methods have two categories; quantitative/quasi-experimental and qualitative methods. The key difference between the two groups of methods lies in the intended use of the results. Researchers use quantitative, quasi-experimental methods to build mathematical models of relationships (e.g. user preferences for particular landscape attributes), for use in predicting future patterns of preference. Researchers might represent results in tables of percentage responses in the form of (e.g. 65% of respondents preferred a scene with moderate complexity) or as multivariate equations that explain the main predictors of scenic beauty by the presence of certain environmental features as variables in the equation with differing degrees of influence. For example, Shafer’s (1969) landscape preference model uses perimeter and area measurements of certain landscape features to predict people’s preference for natural landscapes. The model predicts preference as a mathematical function of perimeter of immediate vegetation, perimeter of intermediate non-vegetation, perimeter of distant vegetation, area of distant non-vegetation, area of intermediate vegetation, and area of water.

Carlson (1977, 1995) criticizes the landscape preference model for its over-emphasis on measurement and prediction, which he claims tells us very little about why certain landscapes are preferred or valued. He believes preference scores do not indicate value. To him, while the landscape preference model may help predict the average preferences of a population, they say nothing about the reasons why one should follow it. Therefore, he questions “what is being quantified” and “the usefulness of such
quantification” (1977, p. 162). Carlson favors valuation based on the philosophical tradition and suggests as an alternative to quantification, what he considers the objectivity “obtained through the carefully considered qualitative assessments of knowledgeable and sensitive individuals” (ibid., p. 163). Carlson (ibid.) views “the environmental critic’s assessment” as “perhaps the best, if not the only, source of knowledge of the aesthetic quality of the natural environment.” He further argues that “what is important and desirable about objective judgments, assessments, evaluations, or whatever, is not that they be based on or the result of quantification” (ibid., p. 164).

In sum, Carlson and others like him, represent a normative point of view to which most architects/designers subscribe. They assume aesthetic judgments must come from the expert.\(^8\) This dissertation follows from my belief that the critical judgments made, for instance, by architectural critics about the built environment should not have normative authority over the judgments of the public. Recognizing the role of expertise does not mean we have to endorse an elitist model of aesthetic judgment. Obviously, the development of critical judgment is essential to criticism. While recognizing the intrinsically evaluative nature of criticism, we should be careful to separate aesthetic criticism from evaluative judgment. I agree that critical judgment plays an essential role in the development of aesthetic judgment.\(^9\) Thus, decisions on aesthetics rely on the “capacity to judge”\(^{10}\) –

---

\(^8\) Plato and Aristotle were skeptical about the common people’s capacity for judgment. Thus, Western Political theory dating as far back as the Greek polis has struggled with the question of whether professionals with their wisdom, expertise and efficiency or lay people with their everyday experience and values should allowed a role in policy formulation and decision-making aimed at advancing the common good.

\(^9\) A somewhat more ‘democratic’ model of aesthetic judgment is represented by those theories which regard aesthetic judgments as pure expressions of sentiment. Abbé Du Bos, influential in the early 18th century discourse on taste, argued that "Men are not born with knowledge of astronomy or physics, as they are born
that is, of the public to make appropriate judgments about what aesthetic values they wish to embrace.

**Architecture as Inescapable Permanence**

There are two kinds of normative judgments involved in our discussion; those derived from the aesthetic judgment of critics and those derived from public preferences. Those of the critic come from philosophical aesthetics; evaluations of the public come out of separate norms. The important question is whose judgment should be relied on when making decisions about the built environment.

The built environment is inevitably experienced and our interaction with the built environment is not always a matter of free choice. Thus, unlike in the other arts - music, literature and paintings – the products of urban design cannot have their “own public”. In other words, the “more important distinguishing feature of architecture is provided by its character as a public object” (Scruton, 1979 p13). Ruskin recognizes architecture as “the most public of the arts, in that it imposes a vision of man and his aims independently of any personal agreement on the part of those who live with it” (Quoted in Scruton, 1979 p.15.). Elaborating on this point, Scruton notes that “architecture is public; it imposes itself whatever our desires and whatever our self image. … Every man whatever his taste and aptitudes, is forced to confront the buildings which surround him” (ibid.). This

---

10 Kant defines the understanding as a “capacity to judge”: “We can reduce all acts of the understanding to judgments, and the understanding may therefore be represented as a capacity to judge [Vermogen zu urteilen]” (A69/B94). (Longuenesse, 1998 p. 7). By ‘judgment,’ or Urteilskraft, Kant sometimes means the power or capacity to judge (Coleman, 1974 p. 27). We should be aware however, that even the most liberal writers like Du Bos, still raised questions about the capacity of every member of the public to judge.
reflects the conflict between the vision of “architecture as a form of personal expression, or as a self-conscious gesture” and architecture as a public artifact; and the need for “architecture to become new, or renew itself” and the desire of communities to create a stable, visual environment (ibid.).

An acknowledgement that the products of the urban development process are inevitably experienced makes it appropriate that the public should judge whether or not a design is good, apt, different and/or exciting of its kind, even if they might flinch on being asked about its aesthetics (Hillman, 1990 p.42, quoted in Alcock, ibid.). All cultural productions inherently are based upon an implicit pact with society. Acceptance of such a view means it is incumbent on architecture to “engage in a dialogue with those for whom we build in order to discover what to build” (St. John Wilson 1992, p viii).

**EDR and the Normative**

Carlson bases his criticism on Sibley’s (1959) concept of ‘aesthetic’ and ‘non-aesthetic’ terms. According to this view, one cannot deduce an ‘ought’ from an ‘is’. Hume distinguished between 'is'-statements and 'ought'-statements, and argued that you cannot deduce the latter from the former. Hume's distinction is often expressed as a distinction between fact and value. It simply assumes that there cannot be facts about values. Similarly, Moore’s (1903, p. 13/1999) critique of the “naturalistic fallacy” reduces to the truism that factual statements – the *is*, alone cannot possibly entail normative conclusions – the *ought*. Lewis (1955, p. 84) agrees, stating that “[w]hat is

---

11 This is a misapplication of Sibley’s concept of ‘aesthetic’ and ‘non-aesthetic’ terms. Sibley (1959) does not equate ‘non-aesthetic’ with descriptive terms, nor does he equate ‘aesthetic’ terms with evaluative judgment. That said, his underlying point is accepted; which is, you cannot derive evaluative judgments from descriptive facts.
right cannot be proved by summoning premises which themselves say nothing about right or wrong.” Similarly, Dickie (1962, p. 295) claims that “[n]o matter how many data are collected, they still remain descriptions (the is) and no normative principles (the ought) can be derived from the descriptions alone.” In sum, you cannot derive evaluative judgments from descriptive facts. Normative discourse – the establishment and the justification of what is good or right as well as its critical and evaluative function – does not belong to the domain of empirical research. One cannot fulfill the normative function of aesthetic judgment by relying exclusively on empirical data about public preferences for certain built environments. In other words, if one locates the basis and the justification of aesthetic judgment in factual statements derived from empirical research, one faces the danger of a loss of normativity.

Empirical aesthetics in general has failed to address in any meaningful way, the problem of how to maintain “normativity in such a value discipline as aesthetics.” Fenner (1992, p. 284). called it “[t]he normativity problem.”

Consider the distinction between normative and descriptive models (Table 4).

<table>
<thead>
<tr>
<th></th>
<th>Normative theory</th>
<th>Positive theory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aims</strong></td>
<td>Prescriptions for practice</td>
<td>Explanations of practice</td>
</tr>
<tr>
<td></td>
<td>Inductive (codification of practice)</td>
<td>Observation</td>
</tr>
<tr>
<td></td>
<td>Deductive (premises to prescriptions)</td>
<td>Generation of hypotheses</td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td>Little testing</td>
<td>Emphasis on testing</td>
</tr>
<tr>
<td><strong>Uses</strong></td>
<td>Standardization of practice</td>
<td>Better understanding</td>
</tr>
<tr>
<td></td>
<td>Normalizing practice</td>
<td>Better predictions</td>
</tr>
<tr>
<td></td>
<td>Post-design rationalizations</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Normative and positive theory
Architects tend to focus on a normative model. These models seek to provide the correct response in a given situation. They embody standards and seek the “location and merit of norms to be valued and aspired toward in the practice of architectural design” (Rowe, 1987 p. 115). In contrast, EDR conforms to a descriptive model which simply ‘describes’ the real world. In its positivist approach EDR describes the real world and develops “positive statements [or] assertions about reality” (Lang, 1987 p. 13). A normative theory is prescriptive and “consists of overly value-laden statements” (ibid., p. 16). According to Lang (ibid.) “[n]ormative theory is based on an ideology or world view” explicitly stated or not. It seeks to answer an ontological question: “What constitutes proper architecture?” which by implication necessarily involves a distinction between architecture and non-architecture (Rowe, op cit.). For example, suppose that we wish to understand the rational for the different designs by architects for the same project; their replies would involve giving reasons. Reasons are decidedly normative and they involve prescribing a right approach, one cannot confirm or refute them by data applying any objective tests. Positive theory does not prescribe a right approach.

People have spoken of “succumbing to the genetic fallacy;” a tendency to judge “the truth of an assertion on the basis of its source rather than by the evidence or argument available for it” (Kaplan, 1963 p. 12-13) or “confounding analysis of meanings with causal explanation of facts” (Kaufmann, ibid. p. 16). Environmental design research literature assumes the empirical basis of EDR, the origin of its proposition should be decisive in its use. However, as Meehan (1990, p. 12) has pointed out “[e]mpirical purposes are always contingent upon normative purposes; they are pursued
because they are necessary prerequisites to the fulfillment of a normative purposes.” He adds that “in a knowledge system meant to fulfill the requirements for directing actions, the principal justification for any empirical inquiry is that the knowledge sought or produced is needed to fulfill an established normative purpose” (ibid.). Schumaker (1950 p. 21) has noted “the difficulty of justifying rationally the valuations to which” we are “tempted by” our “analytic findings.” He adds that “analysis is qualitatively and procedurally quite a different thing from appraisal and that a good deal of hard thinking is necessary to establish an adequate relationship between the two” (ibid.). To address the applicability gap one can establish an adequate relationship between description and normative practice.

Architectural Design Review as Case Study

The normative approach arises in the architectural design review function of most local governments in the United States. Many communities in the United States want to enhance or control the aesthetic quality of the built environment. Design review represents an attempt by cities to address the “tragedy of the commons.”12 As a governmental process aimed at controlling the nature of development based on community design objectives (Scheer, 1994), design review brings to the fore, the problematic issue of how to provide a practical political answer to a normative question; how in a democracy do you resolve the tension between individual autonomy while maintaining the integrity of the commons? It is ultimately about the legitimization of

12 “Freedom in the commons brings ruin to all.” A "commons" is any resource used as though it belongs to all. A commons is destroyed by uncontrolled use – that is, when one can use land (part of our commons) any way one wants. The idea is based on the work of a little-known nineteenth century amateur mathematician William Forster Lloyd on population growth and control. It was first brought into contemporary public consciousness in 1968 by the biologist Garrett Hardin.
normative discourse. Our goal in normative discourse is to use language to make and justify our “evaluations and prescriptions” (Taylor, 1961 p. vii).

Stamps (2000, p. 18) claims “the postulated purpose of design review is about visual aesthetics.” It implicitly acknowledges the relevance of aesthetics “to urban and rural landscapes and planning regulation” (Punter, 1994, p.39). However, Punter (1999, p.1) claims that “design regulation, and the systems of review and control that implement them, constitute a complex and controversial issue in American planning practice.” The most fundamental problem in aesthetic control is the widely presumed subjectivity of aesthetic judgment, a commonplace claim in aesthetic discourse and captured by the ancient Horatian maxim “de gustibus non disputandem est,” in matters of taste there is no disputing. The widespread belief that there are no set of determinate and generally valid criteria by which we can judge that which is beautiful, first clearly enunciated by Kant has been a mainstay of aesthetic theory since Hume. If aesthetic judgment rests on no set of rules or rational principles, then aesthetic judgment has no objective basis, it is merely a matter of individual taste and design review decisions lack objective validity. This would make judgments of what makes good design subjective and as such discretionary and inherently capricious and arbitrary. This subjectivity becomes

---

13 I am not quite sure what this distinction is meant to accomplish. One can only assume that he means the focus of much design review is on external appearance. Historically, appearance has been the major concern of design review. For example, Habe (1989) found in a survey that 98% of the design controls in 66 communities in the United States concentrated on the visual properties of buildings.

14 In more contemporary discourse, this has been restated as meaning that aesthetic judgments are employed, not to make statements of facts, but simply to express certain feelings and evoke a certain response.” Therefore, “there is no sense in attributing objective validity to aesthetic judgments” (Ayer, 1948 p. 113).
problematic for a regulatory system based on the ideal or goal of objectivity with human-made and human-applied regulation.

When it comes to architectural design review there exists a dialectic between public values and professional expertise (Alcock, ibid.). Recall the tendency to view "design judgment [as] largely subjective," and architects as having “special competence in this area” and “the impression, carefully fostered in many circles, that environmental aesthetics is the preserve of the elite" (Punter, 1993 p. 14). The perception that the products of “design” have an inherent distinction, is accomplished by “shrouding design” in a “mystical aura” creating as it were, “an ‘asymmetry of ignorance’ and thus giving extra weight “to the uniqueness of the profession and the need for expertise in shaping the environment” (Weber, 1994 p3). As a group, designers tend not to specify what constitutes this distinction. Instead, they refer “to the ordinary indifferent attributes of non-artistic goods” (Mossetto, 1993 p. 52-53). Yet, non-designers may lack “confidence in their aesthetic judgment” and therefore, feel uncomfortable articulating design criticism and advice over design judgment (Punter, ibid.). Neighborhood groups, and often, the planners who staff design review commissions and do the bulk of design review, need to develop the necessary design judgment that will enable them to address visual quality issues with a certain degree of confidence.

To utilize the information and knowledge from EDR, design review board members and planning department staff require a tool that assembles and formats new and existing research results into packages that are usable by planners, design review board members, and other decision-makers so that they are able to reasonably predict the
future aesthetic effects resulting from different development options. The project that forms the basis of this dissertation has sought to provide just such a tool. The prototype of IMMEDRIS as deployed has a tutorial and a decision aiding subsystem installed as a pilot project and evaluated in their function supporting the decision making process required by aesthetic-control regulations; the architectural design review process.

**Project Objective**

To meet planners need for accurate and precise information with which to manage and regulate the built environment, Stamp (1996) suggests the use of scientific protocols that use public environmental preferences. This requires the distillation of the public’s “preferences for what is “liked or disliked and most importantly why” about their environment. Design review decisions on visual quality must respond to the typical and ordinary conditions of life and not to theoretical and academic arguments about aesthetics. An alternative input to design review decision-making is needed that provides objective information on how specific modifications of the physical environment will affect its appearance (Stamps, 1996; Stamps & Nasar, 1997).

When I first conceptualized this project, no centralized database of environmental design research information existed. Since then, InformeDesign “research and communication tool for designers” (www.informedesign.umn.edu) has come on line. It provides access to behavioral research to interior designers and other interested users. However, unlike IMMEDRIS, it does not focus on those conditions which are necessary for the generation of environmental design knowledge that one can translate into situated knowledge for practical environmental design and decision-making. As Churchman
(1971, p. 10) has noted, “[t]o conceive of knowledge as a collection of information seems to rob the concept of all of its life... Knowledge resides in the user and not in the collection. It is how the user reacts to a collection of information that matters.”

Therefore, in the conceptualization of IMMEDRIS, I sought to sidestep a central question implicit in the literature on research use noted above; how to get knowledge, for the most part a particular kind of knowledge, to and used by environmental designers and decision makers. Instead I focus on how to translate EDR information into actionable knowledge. I have sought to locate the goal of objectivity and the methodology of quantification of much EDR within a broader normative framework to give their findings meaning.

The dissertation has six chapters. The first chapter lays out some of the central concerns and foreshadows some of the arguments that will need elaboration in subsequent chapters. In the second chapter, I outline the empirical and philosophical framework for the design of IMMEDRIS. My third chapter describes the design and implementation of (IMMEDRIS). It outlines the objectives underlying the design of IMMEDRIS, introduces the technological issues relevant to its design. The chapter also describes the thinking and design of IMMEDRIS. In Chapter four, I discuss the procedure used for testing IMMEDRIS. In chapter five, I discuss the results of the evaluation and discuss the implications of the findings. Chapter six attempts to draw some conclusion from the study including policy implications and suggests directions for future research.
CHAPTER 2

THEORETICAL FRAMEWORK

This chapter weaves together ideas borrowed from a number of sources in an attempt to provide the theoretical framework for the conceptualization of IMMEDRIS. The premise that learning and communication are central to any field of study and the fundamental importance of categories to both learning and communication underpins the theoretical framework (Patton, 1997). The chapter outlines the parallel but contrasting theories of category formation from philosophy, cognitive psychology or cognitive science, social science, and linguistics. Current theory suggests that human acts of categorization fall roughly under three models: classical, prototypical, and exemplar. I supplement this account with theories of learning in cognitive science and educational instruction. These discussions led to the adoption of the concept of visual learning as the underlying design idea for IMMEDRIS. The chapter draws on accounts by Kant and Wittgenstein on the role of examples in learning concepts and making judgments. Ideas developed from these discussions are applied to a hypothetical design review situation at the end of the chapter.
Categorization and Knowledge

According to Rosch (1981, p. 89) “[a] category exists whenever two or more distinguishable objects or events are treated equivalently.” Therefore, at a basic level, categorization represents “the process of dividing the world of experience into groups of entities whose members have some perceptible similarity to each other” (Jacob, 2004 p. 518). Similarly, Sloutsky (2003, p. 246) claims “[c]ategories are equivalence classes of different (i.e. discriminable) entities and categorization is the ability to form such categories and treat discriminable entities as members of an equivalence class.”

Categorization plays a central role in all classification and knowledge. It represents one of our basic cognitive tools; it is part of our “ability to classify objects as being of a certain kind on the basis of information provided by sense experience” (Zalabardo, 2000 p. 29). For example, to classify a structure as Gothic by looking at it is to have carried out an act of empirical classification. These are “episodes in which we exercise our ability” to classify objects or events (ibid.). Our ability to classify objects “has a linguistic correlate in the ascription of empirical predicates.” The decision to ascribe based on sense experience, the term Gothic to the structure in our example, involves an act of “empirical predication” (ibid., pp. 29-30).

Lakoff, (1987, p. 5) claims “[c]ategorization is not a matter to be taken lightly. There is nothing more basic than categorization to our thought, perception, action, and speech.” Humans have a good reason to categorize the world, it enables us “to react to different objects in the same way and to make inferences about how novel objects should be treated” (Milton and Wills, 2004 p. 407). For example, if we see an unfamiliar
structure, classifying it “Gothic,” allows us to deal with it in an appropriate manner (ibid.). Spalding and Murphy (1996, p. 525) claim “equivalence is a central reason why categories are so useful.” They argue that “[c]ategories allow people to treat new things as if they were familiar” in that “[m]embers of the same category can be treated as equivalent for many purposes” (ibid.). In other words, categories enable us to “forge new relationships and thus to create new information whose value exceeds the simple grouping of objects in the environment” (Jacob, ibid., p. 519; cf. Barsalou, 1987).

Yamauchi and Markman, (1998, p. 124) claim “[c]ategories serve a variety of purposes including classification, inference [extending knowledge from known to novel instances, communication, visual perception and complex reasoning Hogg and Abrams (1988, 72) claim that “[c]ategorization is a fundamental and universal process precisely because it satisfies a basic human need for cognitive parsimony.” Similarly, Van Mechelen and Michalski (1993, p. 1) state that “the acquisition of concepts and categorical structures is a fundamental part of any learning process. … Actually, a significant part of any human communication consists of an exchange of categorical information.”

**Categorization**

Uses of the term category suffer from rampant ambiguity. In philosophical discourse, Ryle (1938, p. 189) has noted how “exploration of [categories and theories of types] is at present handicapped by certain vocabulary differences between philosophers, which hinder them from reading one another’s work.” In the present context, philosophers use the word “category” in a different way than psychologists and cognitive
scientists although both are related to a common usage. Hacking (2001, p. 476) notes that “[p]hilosophers traditionally use the term “category” far more narrowly than cognitive scientists and developmental psychologists.” Melland (1995, 108) defines a category as “[a]n ultimate class. Categories are the highest genera of entities in the world.” By contrast, in cognitive psychology, categorization is regarded as a process of determining what things “belong together,” and a category is a group or class of stimuli or events that display cohesion. In the psychological literature, the cognitive structures underlying categorical judgments are generally referred to as concepts. For example, Smith and Mendin (1981, p. 8) claim “concepts are used to classify novel entities and to draw inferences about such entities” which in turn facilitates the categorization of “novel objects.” In short, concepts serve the “twin function of categorization and inference” (ibid., p. 9; cf. Barsalou, 1991, 1992).

There have been proposals for categorization rules in the philosophical and psychological literature. A classical example is Aristotle's theory of necessary and sufficient conditions (cf. Smith and Medin, ibid.). Lakoff (1986) characterizes the philosophical account of categorization as the “traditional view” and the more recent contribution from cognitive science and developmental psychology as the “new view.” He acknowledges that both accounts “take categorization as the main way that we make sense of experience” (ibid., p. xi). The philosophical account is tied to the classical theory of categories and the new view of categories with prototype and exemplar theories.
The "Classical" Theory of Categorization

The classical theory of categorization regards categories as rigid and logically limited domains. On this account, an entity is either a member of a category or it is not – it is an all or none proposition. Since a category is defined by a set of attributes, the classical theory of categorization is considered to be the "defining attributes" theory. In addition, each attribute is singly necessary and sufficient – an object which does not have one of the attributes is not a member of that category even if has many other attributes. If category membership is determined solely in terms of necessary and sufficient criteria, then, membership gradation fuzziness cannot exist within categories. Three basic assumptions characterize the “classic” approach to categorization and which Jacob (2004, p. 520) describes as: (1) The intension (description or set of properties) which describes a category is a summary representation of an entire category of its extension (the set the things that it applies to); (2) the intension of a category consists of essential features that are “individually necessary and jointly sufficient to determine membership within the category;” (ibid.) and (3) a category which is nested within a category that is superior in rank, class, or status, has its features defined by the category within which it is contained (cf. Smith & Medin, ibid.; Taylor, 1989).

The theory has several implications: 1) Category membership is all-or-none; a structure is either a house or it is not. It cannot be a kind of a house; 2) all members of the category are equally representative – this is implied by the first point – a two room shack is just as much or as little a house as a four bedroom bungalow or a huge mansion; 3) the boundaries are clear cut – again this point follows from the all-or-none nature of the
classical theory – there can be no straddling the boundary; and 4) people are able to able to apply these attributes to novel items to determine category membership because they have knowledge or mental representations of them.

The theory has met with several criticisms. As Lakoff (1986, p. 6) writes, “from the time of Aristotle to the later work of Wittgenstein, categories [i.e., kinds] were thought to be well understood and unproblematic . . . . Things were assumed to be in the same category [i.e., of the same kind] if and only if they had certain properties in common. And the properties they had in common were taken as defining the category.”

**Prototype Theory**

Several alternative theories have been developed within cognitive psychology. The two major alternative and apparently opposing psychological accounts of how individuals assign membership into categories have been formulated: a prototype-based account and an exemplar-based account. The most well known is prototype theory. (cf. Rosch 1975, 1978, Mervis and Rosch 1981, Lakoff 1987). Prototype theory rejects the classical view of human categorization abilities as based on definitions, and provides a range of experimental evidence against it. Prototype theorists argue that concepts do have an internal structure, but that this does not take the form of a definition. Prototype theory argues that within the class of objects falling under a concept certain members are judged to be more representative of the concept than others. The most representative exemplars of a concept are called prototypical members. A given set of prototypes for a class of concepts can be used for generating a categorization by the rule that a stimulus is classified according to which prototype it is most similar to.
Simply, the term “prototype” refers to the most typical member or members of a category. Conceptually, it means most phenomena have typically effects. Typically effects show that categories have an internal structure — all category members are not equal — empirical findings suggest that category boundaries are not always clear cut — membership in a category are fuzzy and graded rather being all-or-none. Instead of categories with clear cut boundaries and fuzzy middles, boundaries are fuzzy, and the centres clear (prototypes) (McCloskey and Glucksberg, 1978). Empirical research has also shown that people not only make yes-no decisions about category membership, but they also rank category members for typicality (cf. Smith and Mendin, ibid. p. 34). Decisions about category membership are fastest and most accurate for typical rather than non-typical category members (Rosch, 1975a, 1975b; Rosch and Mervis, 1975). The research shows that when asked to name members of a category, people name high typically members first. In addition, people are able to list not only typical members of a category, but also typical attributes of category members. Typicality judgments seem to play a role in inference; typicality ratings seem to be more of a discrimination task than a categorization task. As Rosch and Mervis (1975, p. 575) put it, “[m]embers of a category come to be viewed as prototypical of the category as a whole in proportion to the extent to which they bear a family resemblance to other members of the category. Conversely, items viewed as most prototypical of one category will be those with the least family resemblance to or membership in other categories”
Exemplar Theory

An alternative view of category membership is the exemplar theory that holds that potential new members of a category are compared to all previously experienced exemplars, not to an abstract prototype. Exemplar-based models assert that rather than focusing on feature overlap, subjects encode individual information about actual category members and retrieve it when faced with a categorization task (Brooks, 1978; Hintzman and Ludlam, 1980; Medin and Schaeffer, 1975). Therefore, categorization decisions make use of contextual information which may be present at the time a category item is experienced (or encoded). The exemplar view states that a category is represented by particular instances that have previously been encountered. A new item is assumed to be judged an instance of a category to the extent that it is sufficiently similar to one or more of the instance representations stored in memory.

EDR has shown that some of these categories apply to the way we organize information received from the environment. Purcell (1992) has shown that typicality affects our preference for certain environments.

Given that categorization is a fundamental part of the learning process, then how people categorize information is of particular interest in the design and implementation of “the functional activities of an information system and its constitution as an information environment” (Jacob, 2004 p. 515).

Visual Representation and Learning

Visual Learning is the “permanent change in behavior brought about through visual simulation either from the environment or through self-imposed imagery, often on
a one-trial or single exposure nature (Mones-Hattal and Mandes, 1995 p. 889). The use of pictorial information in learning and instruction has a long tradition. Schnotz (2002, p. 101) notes how in the seventeenth century when Comenius published his “Didacta Magna,” he “emphasized that envisioning information is extremely important for effective learning.” Learning from verbal and pictorial information has generally been considered as (potentially) beneficial for learning. The acquisition and application of image categories are basic operations underlying the organization of human knowledge. Most traditional classification-learning paradigms reduce the learning process to a search for appropriate combinations of given, well-defined features.

Cognitive science research on problem-solving processes has generally found that the use of visual representations can facilitate problem solving, offering assistance at all phases of the process (Schnotz, 2002 p. 117). Larkin and Simon (1987) found that, for certain types of tasks, the use of visual representations can have advantages over the use of other representations in all three phases of the human information processing system: search, recognition, and inference. Similarly, research on learning from multiple external representations has found that people remember text information better when it is illustrated by pictures than with no illustration (Schnotz, ibid.). People process verbal information and pictorial information in different cognitive subsystems: a verbal system and an imagery system. They process and encode words and sentences only in the verbal system, whereas they process and encode pictures in both in the imagery and verbal system. Thus, dual coding may account for the memory-enhancing effect of pictures in texts (ibid).
**Descriptive and Depictive Representations**

Representations are objects or events that stand for something else (Peterson, 1996). Representations can differ from one another with respect to their informational content and their usability. The informational content of a representation refers to the set of information that one can extract from the representation with the help of available procedures (Schnotz, 2002 p. 103). Thus, the informational content of a representation depends on both its structure and on the procedures that operate on the structure (ibid.).

Peirce (1906) introduced a basic distinction between different sign systems: that between symbols and icons. According to Peirce, symbols have an arbitrary structure and are associated with the designated object by a convention. Examples are spoken or written texts, mathematical equations and logical expressions. Icons are signs that are associated with their designated object by common structural properties. Icons do not have an arbitrary structure. Instead, they are associated with the designated object by similarity. Similarity represents one kind of structural commonality typical for realistic pictures, pictorial illustrations, and geographic maps (cf. Schnotz, 2002 pp. 102-103). Thus, texts and visual displays belong to different classes of representations: descriptive and depictive representations.

Descriptive representations consist of symbols describing an object that have an arbitrary structure. Symbols are related to the content they represent by means of a convention (ibid.). Descriptive representations contain signs for relations. For example, in a sentence one uses nouns to refer to entities and verbs and prepositions to relate these
entities to each other (ibid.). A depictive representation consists of iconic signs, such as pictures, sculptures, or physical models.

Descriptive representations and depictive representations have different uses for different purposes. Descriptive representations have a higher representational power than depictive representations although it is possible to mention only a few geometric characteristics of a figure or to specify only the form of the object without providing information about its size or orientation in space. Depictive representations encompass a specific class of information in its entirety. For example, a picture of an object goes beyond information about its form to information about its size and its orientation in space. Accordingly, depictive representations have special value for gaining new information from already known information (Schnotz, ibid. pp. 103-104).

Emerging computers technology can exploit these recent developments in learning psychology. For example, good screen design can optimize visual impact, while information can be reiterated and images built up in ways which reinforce learning. In this next section, I outline the role of multimedia systems in enhancing information representation and learning.

**Multimedia Learning**

Multimedia allow flexible combinations of different forms of external representations such as written or spoken texts, static or animated pictures, sound and music (Schnotz and Bannert, 2002 p. 142). Researchers see multimedia instructional environments as holding great potential for improving the way that people learn (Mayer, 1999; Mayer and Moreno, 2002 p. 87). Mayer (1997) elaborated the dual coding theory
in order to explain why pictures support under specific conditions the understanding of
technical or physical phenomena. According to Mayer people process verbal and pictorial
information in different cognitive subsystems and that processing results in the parallel
construction of two kinds of mental models that get mapped onto each other (Schnotz,

According to Mayer and Moreno (2002, p. 91), the cognitive theory of
multimedia learning rests on three assumptions suggested by cognitive research:

“1) Dual-channel assumption – the idea that humans have separate channels for
processing visual/pictorial representations and auditory/verbal representations. 2) Limited
capacity assumption – the idea that one can actively process only a few pieces of
information at any one time in each channel. 3) Active processing – the idea that
meaningful learning occurs when the learner engages in cognitive processes such as
selecting relevant material, organizing it into a coherent representation, and integrating it
with existing knowledge.”

Starting in the early 1970s, a growing body of experimental literature based on
numerous experiments (e.g. Rosch 1975, 1978, Mervis and Rosch 1981, Smith and
Medin 1981) found the classical theory of category formation unrealistic as a cognitive or
psychological account of how people form and use concepts. Rosch (1973, 1975)
examined the notion of family resemblance as a natural basis of categorization, for
“grouping items with overall similarity to each other” (Rosch, 1975). She found that
people arrive at categorical decisions by comparing potential new exemplars to category
prototypes (Rosch, 1973). The naturalness of family resemblance category structures
seems intuitively plausible because items within a category are similar by virtue of the fact that each member of the category tends to share a large number of features with other members of the category without any of the feature being necessary for category membership (Brooks and Regehr, 1995 p. 347).

**Wittgenstein and Family Resemblance**

In his argument against the classical Aristotelian view of category membership, Wittgenstein (1953) proposed *family resemblance* approach to category membership. His analogy was that family members appear related because of a preponderance of a set of physical features. No one feature is necessary for people to appear related, but possession of several of a larger set of features causes people to appear related. Wittgenstein (1953) introduces the notion of Family Resemblance in his critique of how philosophy’s desire for generality erases the particular case. He rejects a notion of concepts as a priori constructions that provide a set of necessary and sufficient conditions for speech. Wittgenstein recommended the notion of family resemblance to people who look for definitions corresponding to our concepts. He suggests that for an important class of general terms there exits among the referents of a term no single common property, but rather “a complicated network of similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail” (1957, §66). He gives as example, the concept of a game. Wittgenstein argued that there is no common set of defining features that apply to all and only games, but that our various uses of the term resemble each other in the way family members do. His claim is that there are no necessary and
sufficient conditions for being a game, but we can list properties which most games have, and it seems sufficient to be a game to have a certain number of these properties.

**Learning by Example**

There is no consensus among philosophers on how or the range of application of Wittgenstein’s notion of family resemblances. The accepted and seemingly straightforward interpretation of Wittgenstein’s notion of family resemblance is illustrated by Bambrough’s (1960, p. 217) claim that a network of similarities which obtain among different objects objectively justifies the application of one and the same concepts to different objects. Similarly, Khatchadourain (1966, p. 207) says, “that some members are directly related by qualitative *resemblances* to other members, while some or all are also indirectly related to other members through their direct relations to members themselves directly related to the latter.” That is, particulars are correctly called by the same name because they share overlapping resemblances or similarities. Thus these interconnecting resemblances between games tie them together and make them all games. However, according to Gert (1995 p. 180) Wittgenstein does not prescribe that “these must be relations of resemblance.” He adds that Wittgenstein is at pains to point out that “even intrinsically identical things belong to different kinds in different contexts” (ibid.). Otherwise, using interconnecting resemblances as the basis of membership in a family or kind means nothing can be excluded from any kind (ibid., pp. 181-182). Thus, when Wittgenstein remarks about a kind being formed on the basis of relations, it is always on the basis of relations considered absolutely or without qualification (ibid.).
Gert (ibid.) further argues that “resembles” is not synonymous with “shares properties with.” Such an interpretation, he claims, relies on a technical understanding of resemblance. In his view therefore, “whatever Wittgenstein said about resemblances [cannot] be translated in a simple way into talk of shared properties” (ibid.). It is incorrect to assume all properties contribute to resemblance. “Sharing properties is not sufficient for any degree of resemblance” (ibid.). Otherwise, degree of resemblance would depend on something like number or percentage of properties shared. Counting properties is an impossible task, and there just isn’t any a priori reason to believe that the degree to which two things resemble each other depends on the number of properties they share. From a general perspective, it simply does not follow, a priori from the fact that A resembles B more than C that A has more properties (or a greater percentage of properties) in common with B than it does with C (ibid.). For our purposes, what is important is that people generally pick up on the same resemblances. Family resemblances are those salient resemblances which are fairly common to or distinctive of, the members of a kind, and which we often use to identify members of that kind (Gert, ibid. pp. 182-183).

Gert (ibid., p. 184) claims from his pervasive discussion of ostension and examples, Wittgenstein believed we “learn by examples.” Wittgenstein calls this teaching by ostension. (Gert, 1995). The word 'ostentation' comes from the Latin 'ostendere', to show. As Gert (1995, p. 184) puts it, sharing a language requires enough similarity to allow the possibility of teaching by means of examples. Therefore, ostentation contributes

---

15 Ostention is one of four categories of physical labor necessary to produce signification, namely: recognition, ostentation, replica and invention. Our ability to label levels of consciousness is largely the result of ostentation. Ostention means that I convey what I mean by “x” by saying “x” when pointing to n objects, and “not x” when pointing to m others. A problem with ostentation is that it does leave considerable room for misunderstanding.
both to our having some common understanding and to our uncertainty about (and
disagreement with) what others mean. Wittgenstein claims the meaning of a term is often
taught by presentation of examples.\textsuperscript{16} For example, we cannot teach an architectural
student about Gothic architecture by presenting every member of its kind. An important
part of learning what constitutes Gothic architecture is to recognize resemblances
between the examples she has been given and new instances. Family resemblances are
those resemblances which help us to identify something as belonging to a kind or family;
there is an intimate connection between family resemblance and ostention, or the giving
of examples. If we are unable to recognize family resemblances, then we could not make
use of examples. Therefore, if the fact that we learn by examples is important, family
resemblances are important (ibid.).

Presenting a particular of the relevant kind represents the most basic way to give
an example; although not the only way. While not “strictly speaking, ostensive
definitions” pictures and verbal descriptions have much in common with such definitions.
Therefore, “whether examples are given by means of pointing, pictures, or descriptions,
awareness of the relevant resemblances is often essential to learning the meaning of a
term, even when those resemblances are not necessary for membership in the terms
extension” (ibid., p. 185). In spite of some inevitable ambiguity, ostention works, not
only for people but also for artifacts.

\textsuperscript{16} In (§69) Wittgenstein states: “How should we explain to someone what a game is? I imagine that we
should describe \textit{games} to him, and we might add: “This \textit{and similar are called ‘games’}. And do we know
any more about it ourselves? Is it only other people whom we cannot tell exactly what a game is? – But this
is not ignorance”
G.E. Moore recounts Wittgenstein’s remarks in a lecture on critical reasoning in aesthetics as follows: “*Reasons*, he said, in Aesthetics are ‘of the nature of further descriptions’: e.g., you can make a person see what Brahms was driving at by showing him lots of different pieces of Brahms, or by comparing him with a contemporary author; and that all Aesthetics does is ‘to draw your attention to a thing,’ to ‘place things side by side.’ He said that if, by giving ‘reasons’ of this sort, you make another person ‘see what you see’ but it still doesn’t appeal to him, that is ‘an end’ of the discussion” (Moore, 1972, p. 88).

In a somewhat similar vein, on the question of how validity in critical reasoning is assessed, Schusterman (1986, p. 102) notes Wittgenstein’s answer is “extremely simple and pragmatic.” He argued that “validity is success, success in inducing the desired perception of the work, if not the desired critical verdict.” Moore (ibid.) claims that for Wittgenstein “aesthetic discussions were like discussions in a court of law,” where the objective and measure of success is that “what you say will appeal to the judge.” Wittgenstein (1932, p. 18) states “[t]he answer in these cases is the one that satisfies you” He claims “[t]hat explanation is the right one which clicks” noting that “if he didn’t agree, this wouldn’t be the explanation” (ibid, pp. 19-21). He seems to be suggesting “that criterion for adequacy of argument and correctness of explanation is acceptance or satisfaction” (Schusterman, loc. cit.).

**Immanuel Kant on Judgment and Understanding**

In the *Critique of Pure Reason* and the *Critique of Judgment*. Kant assigns judgment a “distinctive and vital role” in his epistemology because he views it as “central
to the discursive knowledge we have” (Kemal, 1992 pp. 23-24, p. 5). To provide some context for Kant’s definition of judgment that is to follow, we should note that in the *Critique of Pure Reason*, Kant makes a fundamental distinction between the faculties of sensibility and understanding; that is between our sensible and conceptual representations of the world (Burnham, 2000 p. 5). According to Kant, all that our senses and understanding contribute to knowledge is preconditioned by the “forms of our sensibility” (space and time) and by the “categories of our understanding” that are not learned from experience, but enable us to make sense of our experience. Kant claims the understanding is "[t]he faculty . . . which enables us to think the object of sensible intuition" (A51/B75). He defines intuition as a mode of cognition, which "relates immediately to the object, and is single" (A320-B377). Thinking is the ability to representing a thing through the use of general concepts as opposed to the function of sensibility, which represents individual things which are given in intuition. Sensibility is the faculty of the mind which is affected by objects. Among them are space, time, quantity, quality, relation, modality, and their subforms. To make judgments about our experiences, these concepts are essential. The twelve categories form a sort of minimum conceptual apparatus for making sense of the world.

In Kant’s overall critical enterprise judgment plays a mediating function between the faculties of understanding and reason. A judgment is a relation between the faculties of understanding, which yields concepts – or the formal, organizing or classifying principle or rule – and sense, which gains intuitions, representations, or the content of claims (Kemal, ibid. p.5). A concept is a *general* presentation of a thing (Burnham, ibid.
p. 12) and are rules or tools for ordering and organizing our impressions, classifying these into appropriate groupings (Kemal, ibid.). Kant maintains also that without the use of concepts one could not make any judgments. Judgment, then, is a general phenomenon; a judgment happens every time we think something about something (Burnham, 2000 p. 26). Concepts are used not only to organize particulars in experience but also the association between concepts. It occurs in the form of a judgment that some relation subsists between the concepts (Kemal, 1992 p. 4). Furthermore, as it is through judgments that concepts are applied and objective claims are made about the character of items and events in the world, the ability to conceptualize in given manners is presupposed in making actual objective claims about the world.

According to Kant, understanding is the faculty of rules and judgment is the faculty of subsuming under rules; that is, of distinguishing whether something does or does not stand under a given rule (casus datae legis) (A132/B171). Therefore, judgment is the source of our decisions as to whether things are this or that. All judgments are defined as the thinking of a particular under a universal – that is, a presentation that applies to more than one particular (Burnham, 2000 p. 12). The ability to find appropriate rules for given materials makes judgment distinctive. However, Kant maintains “[g]eneral logic contains, and can contain, no rules for judgment” (A133/B172).

As “a cognitive process,” one of the characteristics of “judgment (the act of judging)” is that it “is not simply a calculation, or the application of a given rule” (cf. Newell, 1968 pp. 5-6). Kant understood the “the philosophical problem” “associated with the notions of thought and judgment” (Bell, 1987 p. 222). That is, how to resolve “the
seeming impossibility of ascribing to subjectivity an ineliminable role in judging, without thereby imperiling the very possibility of judgments that are objective” (ibid.). As Bell (ibid., p. 226) notes, “[i]f we are to avoid the incoherence of a regressive infinity of acts of judgment, or identification, interpretation, understanding, or thought, then at some point we must judge immediately, spontaneously – and this means without having already judged, identified, understood, or grasped a thought on the basis of any prior such act.” Kant was concerned with the possibility of infinite regress. Therefore, he insists our judgments relating concepts to sensibility cannot be on the basis of rules for judgment.17 Kant concludes that “judgment is a peculiar talent which can be practiced only, and cannot be taught. It is the specific quality of so-called mother-wit; and its lack no school can make good” (A134/B173-4). Kant believes even though we may have excellent command of the rules, we “may easily stumble in their application” (A134/B173-4). In other words, it is possible to “comprehend the universal in abstracto, and yet not be able to distinguish whether a case in concreto comes under it” (A134/B173-4). Besides, he believes “the error may be due to [our] not having received, through examples and actual practice, adequate training for this particular act of judgment. Such sharpening of the judgment is indeed the one great benefit of examples. … Examples are thus the go-cart of judgment; and those who are lacking in the natural talent can never dispense with them” (A134/B173-4).

17 In the Critique of Pure Reason, Kant maintains that if general logic “sought to give general instructions how we are to subsume under these rules, that is, to distinguish whether something does or does not come under them, that could only be by means of another rule. This in turn, for the very reason that it is a rule, again demands guidance from judgment”
In the *Critique of Judgment* (1790) Kant makes a fundamental distinction between determinate (logical) judgments and aesthetic judgments. The class of aesthetic judgments includes judgments of taste and judgments of subjective like and dislike (judgment of the merely agreeable). A judgment is aesthetic if its determining basis cannot be other than subjective’ (§1.1). A logical judgment is grounded in a cognition of the object; an aesthetic judgment is grounded in a subjective feeling of pleasure or displeasure. A judgment of taste is a judgment of the form “x is beautiful”; taste is the faculty of estimating the beautiful. Kant commits himself to the thesis that judgments of taste display no use of determinate concepts. He also holds that nothing but the exclusive use of determinate concepts makes for objectively valid judgments.

Based on Kant’s formulation of an aesthetic judgment, a judgment about X “cannot be a judgment of taste” if X is cognized as falling under some concept or concepts” (Janaway, 1997 p. 465). He claims no such list of concepts the object satisfies could be sufficient to enable one to make a judgment of taste about it. In addition, there “are no principles of taste because there could be no intersubjective rules anyone could use to prove the thing’s beauty” (Janaway, 1997 p. 465). As Kulenkampff (1990, p. 100) has argued, “it is impossible that inductive generalizations from instances of aesthetic experience will give us rules of taste. Of course the singularity of aesthetic judgments does not preclude generalizations based on them.” In the *Critique of Judgment* Kant remarks parenthetically, “we cannot determine *a priori* what object is or is not according to taste; that we must find out by experiment” (§ 28). Kemal (1986, p. 137) has written that “for want of a general standard against which to evaluate works of art, one needs to
arrive at a judgment of taste for each individual work. In other words, we cannot, from judgments, deduce the sort of characteristics which will be found beautiful.” “Our defense of judgments will be a matter of adumbrating the features of a particular piece in demonstrating by example and comparison how its unity is achieved.” And such an “explanation cannot be applied equally to other works as if it were a generalization about objects on the basis of their empirical characteristics” (Kemal, ibid.). Thus, an evaluation of the built environment such as an architectural design review decision could only be called an aesthetic judgment if and only if: it is not be based on rules or principles, and if it a singular judgments. It cannot be based on “generalizations which ascribe beauty to objects in a certain class” (Janaway, 1997 p. 466).

According to Zalabardo (2000 p. 30) “[a]cts of empirical classification and predication represent objects as being a certain way.” Borderline cases aside, empirical classifications derive their “representational power” because we they can be deemed to be “correct or incorrect” (ibid.). That we can claim acts of empirical classification and predication as right or wrong is because we construe them as involving universals. The explanation of this feature in terms of universals “is motivated by the idea that a universal is supposed to effect a classification of objects in a certain range that is objective, i.e., independent of our classificatory verdict” (ibid.). In this next section, I outline one attempt in the philosophy of art to use the notion of categorization to give objective validity to aesthetic judgment.
Walton’s Categories in Art

Walton (1970) claims an appropriate aesthetic appreciation of a work of art is guided by knowledge which enables us to perceive it in the correct category, such as cubist, impressionist or post-impressionist. Then, the critic or evaluator is better able to determine whether it is a good work of art or not. He considers the view that perception of form, design and color alone is sufficient for the interpretation and evaluation of a work of art, narrow formalism. On his account, a work of art cannot be judged simply by what is perceived in it. Walton uses Sibley’s (1959) distinction between aesthetic and non-aesthetic properties to support his argument. According to Sibley, aesthetic properties depend on the non-aesthetic. He argues, however, that aesthetic concepts as a class are not condition governed; in the sense that there are no necessary and sufficient conditions for their application. In other words, knowledge of the presence of the non-aesthetic is not evidence of the presence of specific aesthetic qualities. Aesthetic qualities are evaluative and make an art work the subject of criticism. Sibley claims the discernment of aesthetic properties requires a special sensitivity or taste. Any normal perceiver can discern non-aesthetic properties; it requires only normal perception. Non-aesthetic qualities are value neutral (their presence or absence is not in itself good or bad). Sibley identifies three groups of aesthetic properties: Evaluative terms such as ‘good’ and ‘bad,’ descriptive merit and demerit terms such as ‘sharp’ and ‘dull,’ and evaluation-added (both descriptive and evaluative) property terms such as ‘elegant’ and

---

18 Walton is concerned with the merits of the Anti-Intentionalist approach in art criticism. Walton’s thesis is that that certain facts about the origins of works of art have an essential role in criticism; that aesthetic judgments rest on them in an absolutely fundamental way.
‘garish.’ Sibley also recognizes emergent or Gestalt properties in addition to these three groups of aesthetic properties, such as the Gothicness of Gothic architecture. However, Sibley does not count them as aesthetic properties because they do not involve any evaluation of the object.

Walton distinguishes among three types of non-aesthetic properties: standard, variable, and contra-standard. He argues that features (aesthetic properties) of works depend upon which of that work’s non-aesthetic properties are “standard” (those features that define the work as belonging in a particular category; absence of the feature would tend to disqualify), which “variable” (the presence or absence of that feature is irrelevant to whether it belongs to the category), and which “contrastandard” (the presence of that feature tends to disqualify it from category). These categories are perceptually distinguishable in terms of their perceptual properties. The aesthetic properties a work actually possesses are those that are to be found in it when it is perceived correctly (Walton, 1970 p.154). Hence, it takes exposure and practice to perceive aesthetic properties and practice to perceive works in a given category. Unlike Sibley, however, Walton argues against an approach which claims aesthetic properties are in the work – that they are discoverable, if at all, simply by examining the work – but may require special training or a kind of sensitivity. For him, perceiving a work to be of a certain category is non-inferential but a matter of perceiving a number of perceptual properties characteristic of (standard for) these categories combined into a single gestalt (Carlson, 1981 p. 19).
To perceive a work in a certain category is to perceive the ‘Gestalt’ of that category in the work. Thus recognizing an impressionist painting by its impressionist Gestalt, is recognizing the impressionist look about it, which we are familiar with from other impressionist paintings; not applying a rule we have learned for recognizing it from its features. He claims that to perceive a Gestalt quality in a work – that is, to perceive it in a certain category – “is not, or not merely, to recognize that Gestalt quality” (Walton, 1970; Carlson, 1981). To decide whether certain properties of a work are “standard”, “contra-standard”, or “variable” one “must know which category of art the work correctly fits into.” Walton (ibid., pp. 354-363) argues that there are four criteria for determining if a work “W” is being perceived in the correct category “C.” First, the presence in W of a relatively large number of features standard with respect to C. Second, the fact that W perceived in C is more interesting, pleasing, worth experiencing that it is perceived in other ways. Third, the fact that the artist intended or expected W to be perceived in C. Fourth, the fact that C is well established in and recognized by the society in which W was produced. Walton gives as an example, Picasso’s painting Guernica. The four circumstances which count toward it being correct to perceive Guernica as a cubist painting are (i) that it has a relatively large number of properties standard with respect to cubism [or that category]; (ii) that it is a better painting when perceived as a cubist painting; (iii) that Picasso intended or expected it to be perceived as a cubist painting; and (iv) that the category of cubist paintings was well established and recognized by the society in which Guernica was produced. It follows from Walton’s account that in “order to determine the truth value of an aesthetic judgment such as ‘Guernica is awkward,’ it
will not do simply to look at *Guernica*, as it will if we wish to determine the truth value of ‘*Guernica* is colored.’ Rather, we must perceive *Guernica* in its correct category. This requires two kinds of knowledge: first, the knowledge that certain factors make cubism its correct category and consequently that cubism is its correct category; that is, certain factual knowledge about the history and nature of twentieth-century art. And second, the knowledge how to perceive *Guernica* as a cubist work; that is, certain practical knowledge or skill which must be acquired by training and experience in regard to the category of cubist painting and other related categories of art” (Carlson, 1981 pp. 16-17).

According to Carlson (ibid) “Walton's position embodies both a psychological and a philosophical” position. His psychological thesis rests on the claim that the aesthetic effect a work has on us often depends (in part) on which of its features are standard, which variable and which contra-standard for us. His philosophical claim is that aesthetic judgments are relative to the category the object is perceived in. Walton offers an objectivist account of aesthetic judgments about art; on his account there is objectivity in aesthetic judgments because (at least) some works should be perceived in certain categories. A judgment is objective if the perceiver happens to perceive the object on a particular occasion in the correct category. Therefore, aesthetic judgments which *are* true or false of a work are a function of the perceived status of its perceptual properties given that the work is perceived in its correct category or categories (ibid., pp. 15-16).

While Walton gives the four circumstances which count toward it being correct to perceive a work of art in a certain category, he never explains how his categories are formed.
Evaluation of IMMEDRIS is best described in the context of it use to make decisions in a hypothetical design review situation. In the next section, I show how learning by example in inference and judgment can be applied to a hypothetical design review situation.

**A Decision Procedure for Aesthetic Value Judgment in Urban Planning**

A number of planning theorists (Reiner, 1962; Davidoff, 1965; Fagin, 1967; Branch, 1970; Gans, 1970) posit a view of planning as basically a set of procedures for making decisions about the future in accordance with certain established goals. Such a view, leads to the conclusion that what makes urban planning a discipline – and its practice, a profession consists in what planners do and how and “not where or to what it is done” (Robinson, 1972 p. 26). He argues further that “if planners are to claim a special capability for planning a city’s future, then this claim is justified, not because they are experts on the city, but because they are experts on determining what is the most desirable and feasible future to seek and what needs to be done to achieve” (ibid.). Therefore, I offer a decision procedure; a method of deliberation that relies on a perceptualist argument and the objectivity of rightness of categorization. As Beck (1947 p. 337) defines it, “[a] method is a repeatable series of operations aimed at an end” and a decision procedure is a method of deliberation.

Decision procedures are helpful because in particular cases and under an immediately helpful description they help us signal out which decision is the correct one. There is, in urban planning a pervasive function of quantification and measurement particularly the focus of much planning practice on computerized mathematical models.
and other quantitative techniques as an instrument for the “conditional prediction” of urban change (Harris, 1972 p. 115). This requires in practice decision-making procedures which are usually formalistic or logical, game-theoretic, and statistical decision functions. These conceptual schemas when utilized can be used to solve some decision problems largely due to the fact that a mathematical formulation of the problem and its solution can be given. The result is that “the decision problem can be fed into a computer which grinds out an answer for each particular set of parameters” (Bales, 1954 p. 326). In such formal systems, if a certain query is considered, the procedure will lead to a definite answer; and the question and procedure can be so stated as to lead to a ‘yes’ or ‘no’ type answer” (ibid.). However, in soft-domains the precise mathematical formulation, in general, has been wanting; and indeed it may be impossible due to the great complexity (ibid.). Yet these are precisely the areas in most need of some method of making decisions; that allows for intuitive and semi-intuitive procedures.

**Urban Planning, Objectivity, and Normativity**

Although the ideal or even the possibility of rationality is a contested notion in philosophical discourse (cf. Nathanson, 1994; Bernstein, 1983), rationality is still, according to Friedmann (1987, p. 97) the “one theme that runs through all the discussions and debates on planning.” Irani (1986 p. xi) defines rationality as “that characteristic of human beings which makes their thinking consistent and reliable, that aspect in particular which deals with inferences, judgments and decisions.” Rescher (1988 p. vii) claiming there is “an overly narrow conception of what ‘rationality’ is all about” defines rationality as “a matter of the intelligent pursuit of appropriate ends. Here, ‘intelligence’ bespeaks
knowledge, ‘pursuit’ indicates action, and ‘appropriate ends’ call for evaluation” (ibid, p. 126). Rescher (1997 p. 3, p. 9) claims rather emphatically that “rationality is inherently ‘objective’” and objectivity in turn, “pivots on rationality.”

Reade (1985 p. 83), however, claims that in urban planning thought, there is a “confused use of the concept of rationality in [planning] literature.” He notes that for writers on planning “the assertion of the rationality of planning is in effect a claim that the planners’ recommendations are objectively valid, and cannot therefore be questioned in terms of political or other values” (ibid). In urban planning, objectivity and rationality are typically equated with the prevailing model of public decision making; that of the instrumental rationality of scientific assessment and policy analysis.19

The need to avoid arbitrary and capricious decisions in land use control processes is fundamental in urban planning practice; one that is circumscribed by certain constitutional principles (cf. Blaesser & Weinstein, 1998; Blaesser, 1999). The twin notions of “objectivity” and “rationality” in decision-making processes remain prevalent in planning discourse. As Friedmann (op cit., p. 97) has noted, rationality is still “one theme that runs through all the discussions and debates on planning.” Reade (1985 p. 83). Rescher (1997 p. 3, p. 9) claims that, “rationality is inherently ‘objective’” and objectivity in turn, “pivots on rationality.”

19 This is not meant to indicate that the only legitimate conception of rationality in planning is instrumental. Nevertheless, even more contemporary discourses in planning theory; such as communicative planning – a dialogical alternative to the instrumental rationality of rational planning based on the Habermasian formulation of communicative rationality, is a critique of instrumental and strategic rationality of synoptic and strategic planning and continues the preoccupation of planning theorists with the basic philosophical and socio-political debates around rationality (e.g. Healey 1996, Sager 1994, Nylund 1995).
Any theory which acknowledges the distinction between “validity and invalidity”, “objectivity and subjectivity”, “rationality and irrationality” is ipso facto normative, since “valid”, “objective”, and “rational” all have normative content. Bowen (1977, p. 202) claims objectivity is a value deployed as a normative standard. Similarly, Ellis (1990, p. 228) claims that “[t]he value of objectivity is a social value which has particular relevance to epistemology; although it is also important in ethics and aesthetics. It is the value of reaching an accommodation in matters of opinion, attitude and preference.” In other words, objectivity is “a characteristic called upon to elicit our approval or consent in many decision contexts”; it is an “implicit call to trust” (Douglas, 2004 p. 454). The claim to objectivity offers an answer to the question: “by what authority do you speak?” (Megill, 1994 p. 7). Therefore, the “ideal of objectivity is a political as well as a scientific one” (Porter, 1995 p. 74); it “derives its impetus, and also its shape and meaning, from cultural, including political, contexts” (Porter, 1995 p. 89-90). An alternative view of objectivity represents it as having “more to do with the exclusion of judgment, the struggle against subjectivity” (Porter, 1995, p. ix). Similarly, Daston and Galison (1992, p. 82) have shown how the suspicion of certain aspects of subjectivity – namely, “interpretation, selectivity, artistry, and judgment itself” – became in the nineteenth century a prominent feature of objectivity in science.

**Objectivity and Evaluative Judgment**

According to Rescher (1997, p. 6-7) “[o]bjective judgments are those that have a cogency compelling for everyone alike (or at least all normal and sensible people), independently of idiosyncratic tendencies and inclinations.” Therefore, when it comes to
establishing the objectivity of aesthetic value judgments the real problem is “less their alleged objectivity or subjectivity than their universality: so that we can say that anyone who understands and apprehends a particular work of art will ipso facto make certain judgments about it” (Pleydell-Pearce, 1959 p. 31). While “quantification provides a high-road to objectivity in science and rational inquiry in general” (Rescher (1997, p. 75), in another very important sense objective judgments, assessments, or evaluations do not require quantification. Rescher (ibid.) contends that, “[q]uantification in and of itself is no guarantor of objective”, noting that although “actual measurement” is “sufficient for objectivity, [it] is certainly not necessary to it.” Rather, what is important and desirable is that “their adequacy, accuracy and veracity” be “dependent upon the particular object and the properties of the object about which they are made” (Carlson, ibid. p. 164). In other words, they should be “independent of the particular individual by whom they are made and the particular time at which they are made” (ibid.). Judgments, assessments or evaluations which meet these requirements “will yield knowledge about their objects and be repeatable regardless of individual and time.” (ibid). In ethics, I think Rawls (1952, p. 177 ) is making a similar point when he points out that “[t]he objectivity or the subjectivity of value judgments turns, not on the question whether ideal value entities exist or whether value judgments are caused by emotions or whether there is a universal criteria of value judgments, but simply on the question: does there exist a reasonable method for validating or invalidating given or proposed aesthetic value principles and those decisions made on the basis of them?”
Thus the claim made by Kant and others that there are never any acceptable standards or principles by which one can judge an object beautiful is not reducible to claiming that there are no acceptable procedures one may use in judging. My decision procedure can be shown to be both reasonable and reliable, at least for deciding in some cases of aesthetic disputes.

**Decision Procedure Applied to Architectural Design Review**

Take the hypothetical case of a design review staff member who is charged with the task of reviewing the architectural merits of a new project without the benefit of specific rules. The question we wish to address is how substantive knowledge in the form of EDR can be used to guide and justify his aesthetic value judgment. Many communities in the U. S. have attempted to codify “good design” by adopting guidelines which employ terms such a ‘harmonious,’ ‘compatible,’ or ‘maintain existing urban fabric.’ Such a vocabulary necessarily restricts “the response, usually to a set of largely visual characteristics, (Punter, 1993). In urban planning such visual concepts are problematic because of the difficulty of translating them into a language that is understood by all interested parties in the develop process. However, Hungerland (1948, p. 94) has noted that in art criticism, for example, critics often deploy such terms as “order”, “coherence” or similar terms, “to express and justify value judgments.”

The term “coherence” is assumed to describe a “relationship between two or more components” and there is an implicit assumption of an awareness of the kinds of composition described as coherent. The same applies to an artwork deemed incoherent or disordered. In other words, there exists a presupposition “that one knows what a coherent
composition looks like” (ibid., p. 95). How can the term “coherent” be clarified? It can be done verbally or even mathematically. However, to be the only fully explicable means is “ostensive definition” (ibid.). Hungerland (ibid.) argues that “[w]henever we want to clarify to others, or to ourselves, what the word really stands for, we will have to refer to an actual object – or, possibly, to a combination of several of them – which according to scientific study, exhibits relations which we describe[s]” the term coherent. In which case, the object is held against another aesthetic object considered as exemplifying “the best instance of a consistent composition” (ibid.). Therefore, the judgment that this building is good because ‘x’ is consistent with ‘y’,” is analyzable into the sentence: the formal composition of this building is sufficiently similar to that exemplified” by the example considered to have coherence “such that it justifies my judgment (ibid.).

According to Basch (1972, p. 42) “the central problem facing planners [and designers] in the field of aesthetics: [is] the definition and identification of aesthetic value. Issues about the subjectivity of aesthetics aside, the requirement in such decision contexts, is what makes a “good” building? What makes one building more appealing? How do you create a sense of place? And Why do some cities and not others have a strong sense of place? (Weber, 1995 p. viii).

Under my procedure, all the design reviewer has to do is characterize an instance appropriately because the decision problem becomes one of first, identifying the (non-aesthetic) perceptual properties which the object actually has based on examples from EDR. In other words, the procedure helps us to signal out, in the particular case and under an immediately helpful description, whether the object belongs in the correct
category; again based on examples from EDR. There is an advantage to this procedure; it allows us to accept subjectivity into evaluation, which combined with the quantitative inclinations inherent in EBR, serves the purpose of bridging “the gap between the intuitive\(^{20}\) and judgmental evaluations and the more quantitative kind” (Edwards and Newman, 2000 p. 18). It short, the “coexistence of judgment and objective measurement within the same evaluation [is made] easy and natural” (ibid.).

\(^{20}\) We should not confuse the term ‘intuitive’ with ‘impulsive’ and ‘instinctive.’ Rawls (1950, p. 183) claims that “[a]n intuitive judgment may be consequent to a thorough inquiry into the facts of the case, and it may follow a series of reflections on the possible effects of different decisions”
CHAPTER 3

THE DESIGN AND IMPLEMENTATION OF IMMEDEIRIS

This chapter describes the design and implementation of the Interactive Multimedia Environmental Design Research Information System (IMMEDEIRIS). It outlines the objectives underlying the design of IMMEDEIRIS, offers the reasons for the choice of the Internet as the mode of delivery. Then, a description of the design and deployment of a prototype of IMMEDEIRIS follows. The theoretical framework for the tutorial and decision subsystems was outlined in the preceding chapter. The design for the tutorial subsystem is based on the idea of visual learning developed in cognitive science and the notion of ostension explicated by Wittgenstein. Therefore, I have adopted the methodology that architecture schools have used for over a century – teaching by examples. MacGilvrary (2004, p. 6) notes how “we cannot entirely escape the contingency of our judgments.” Therefore, for the decision aiding subsystem, I rely on Kant’s theory of judgment and Wittgenstein’s notion of family resemblances to locate evaluative judgments in urban planning within a framework defined by contextual practice and as such, on that is contingent, rather than being guided by determinately fixed categories.
What is IMMEDRIS?

IMMEDRIS is an Internet-based information gateway (portal) for environmental design research information system (EDR). It consists of a database with a listing of research articles that can be accessed by author, keyword, or research category search. In this sense it conforms to a digital library (DL) system. It is also a Web-based application in that it combines “navigation through a heterogeneous information space with operations querying or affecting that information” (Schwabe and Rossi, 1998, p. 207). Furthermore, IMMEDRIS provides for the teaching and learning of EDR concepts in a subsystem configured along the lines of Computer-Aided Learning (CAL) systems. Finally, the system supports decision making in a decision-aiding subsystem that exposes the decision maker to EDR knowledge in the form of a multimedia tool. In short, IMMEDRIS is a hybrid system that combines the search and retrieval aspect of information systems with the teaching and learning of EDR concepts as well as decision making in a Web-based application.

Design Objectives of IMMEDRIS

In the design of IMMEDRIS I sought to accomplish a number of objectives:

1) Information processing, dissemination and retrieval objectives focused on the utilization of Web technologies to extend traditional structured information system capabilities to provide easy access to EDR information to a wider disparate user base than it may otherwise reach.
2) Information objectives addressed at a conceptual level, the kinds of information resource and level of functionality to provide. The information may be structured, unstructured, text, or multimedia.

3) Functional objectives addressed the capabilities that IMMEDRIS should provide. These include key word searching, hypertext linking and traversal, downloading capabilities, and other functionalities.

3) Useability objectives addressed such issues as ease of use, user productivity and user interface design.

User Groups and Scope of IMMEDRIS

Explicitly defining the scope of IMMEDRIS prevents its growth beyond the original objectives that defined its design – the problem of encroaching scope. It also prevents subsequent development stages from taking on new objectives, although they can be reinterpreted in light of a changing environment. Therefore, I have kept IMMEDRIS fairly modest in scope; overall, IMMEDRIS was developed specifically to make EDR available to researchers, students, environmental designers, decisions makers, and neighborhood groups. As envisaged, the communication of EDR includes communication amongst researchers and mediated communication to the other user groups defined.

How the application will be used by each end-user group to achieve their work objective brought different considerations to bear on the design of IMMEDRIS. To meet the requirement of the different user groups, a number of subsystems were designed to facilitate different sets of views of EDR information for different contexts and
applications. Emerging technologies of the Internet and the World Wide Web allows for the search and retrieval of EDR information from a computerized database while the Web browser is used as the common interface to create Web pages and computer-aided learning materials for environmental design and planning students as well as neighborhood groups. For example, for the student user, the system provides a tutorial subsystem which can be configured to present EDR for particular purposes. It is designed to help students understand concepts derived from environmental design research. The decision-aiding subsystem was designed to help designers and decision makers make more effective decisions. However, the knowledge base stores information in a context independent manner. The goal is to facilitate the organization and retrieval of information objects in order to enable context sensitive views of units of information to help support different uses.

IMMEDRIS is not a traditional planning information system. Many computer-based analytical tools are categorized as Planning Support Systems (PSS). Traditional information systems utilized in planning are more suited for the analysis of specific, well-defined problems. They are premised on a static and 'syntactic' notion of knowledge, are primarily technical in orientation and its traditional modeling approaches are primarily deterministic. According to Geertman and Stillwell (2004, p. 291) PSS “consist of a wide diversity of geo-information tools that are dedicated to support public or private planning processes (or parts thereof) at any particular spatial scale and within a specific planning context.” They are generally regarded as systems in which technologies dedicated to the planning profession are brought together (ibid.). Harris and Batty (1993) consider the
integration of computer-based methods and models into a system used to support
selective planning functions central to the concept of a PSS. Others (Brail and
Klosterman; 2001; Klosterman, 1997, 1999a, 1999b) characterize PSS as information
technology based tools used by urban planners to support the planning process. These
tools are used by planners to communicate “information as well as to generate solutions
(Geertman and Stillwell, 2004 p. 291). Such tools might include Geographic Information
Systems (GIS), database management systems, spreadsheet models, and a number of
other specialized tools that support planning and analysis (Rubenstein-Montano, 2000;
Klosterman, 1992; Brail, 1987).

IMMEDRIS is not a traditional PSS; it does not present formalistic or logical,
game-theoretic, and statistical decision functions. These conceptual schemas are utilized
to solve some decision problems when a mathematical formulation of the problem and its
solution can be given. As a result, “the decision problem can be fed into a computer
which grinds out an answer for each particular set of parameters” (Bates, 1954 p. 326) in
a way that can be interpreted by planners. In such formal systems, if a certain query is
considered, the procedure will lead to a definite answer; and the question and procedure
can be so stated as to lead to a ‘yes’ or ‘no’ type answer (ibid.). IMMEDRIS is also not
strictly a web-based decision support system; that is, a computerized system that delivers
decision support information or decision support tools to planners using a “thin-client”
web browser like Netscape Navigator or Internet Explorer.

IMMEDRIS uses World Wide Web technology – specifically the multimedia
hypertext paradigm based on the TCP/IP protocol suite – to provide easy access to a wide
variety of EDR information on a wide variety of platforms in a distributed manner. In this next section, I outline the evolution of the Internet and the World Wide Web and discuss some current Web technologies relevant to the design and evolution of IMMEDRIS.

The Internet and the World Wide Web

The Internet is a collection of inter-connecting computer networks which offer global connectivity for data communication. It evolved from a project originally conceived in 1973 by the U.S. Advanced Research Projects Agency (ARPA) as a research program to develop a suite of communication protocols to allow networked computers to be connected transparently across multiple, linked packet networks. Communication between these computer networks is defined by a common language through a standard protocol called transmission control protocol/internet protocol (TCP/IP).

The Internet has grown substantially to become a world-wide network providing a dynamic and distributed platform for interactive applications for business, education, and many other uses. It is revolutionizing business by providing an affordable and efficient way to link companies with their partners as well as customers. Gaedke and Turowski (2000, p. 117) have noted how the Web “has moved far beyond its originally anticipated scope and changed from a distributed system for knowledge-interchange” to “become an environment for distributed applications of all kinds.” Gellersen and Gaedke (1999) claim the Web has become a runtime environment for small-scale to large-scale distributed collaborative services and interactive applications for business, education and training, manufacturing, and other information-based services. Similarly, Fuentes, Troya, and

The World Wide Web

The advent of the Web in the mid-1990s and the proliferation of computers made it one of the fundamental structures of the Internet. The Web is a distributed information retrieval system with the ability to integrate multiple media formats (CERN, 1994). It is an enormous distributed database, which can be universally accessed using a single software application known as a browser. It takes the form of hyper-media documents, combining text, images, sound and video into a seamless, hyper-linked user-interface. By imposing a universal organization on the variety of formats in which data resides around the world, the Web allow each piece to be viewed as a uniquely addressable data source – treating the entire Internet to be as a single structured document (Berners-Lee, et al., 1992). The subsequent introduction of different browsers, with their extensions has moved Internet beyond its originally anticipated scope as a distributed system for a text-only knowledge-interchange towards a new application environment.

The Internet and the World Wide Web are not interchangeable concepts. The Web is one of a number of information retrieval systems available on the Internet, the others being WAIS (Wide-Area Information Server), Gopher, FTP (File Transfer Protocol), and Telnet. The PC interface should not be confused with the technology that drives the information which appears on a web browser. The Web is unique in that documents presented to the client are hypermedia, a subset of hypertext. Web hypertext documents are ASCII or text files which contain links to other documents, which in turn may contain
links to other documents. These linked documents can be located on any computer around the world which can be accessed by the client programs. These linkages are termed hyperlinks (Berners-Lee, 1994a). Hypermedia is a hypertext document with links to other media such as sound, images, and movies. Hypermedia usually utilizes digitized multiple media with graphic/sound devices. It also offers a powerful user interface for rapid and convenient access to a great amount of multimedia information (Shneiderman, 1989 p. 115).

Conceptually, hypermedia involves access to information, embodying the notions of context-sensitive navigation, annotation and tailored presentation. Hypermedia systems operate on the assumption that sets of data are highly interconnected. On the Internet, most hypermedia applications are based on the WWW infrastructure for hypermedia. It consists of WWW browsers, servers, and HTML as the document language. All forms of hypermedia allow users to choose their own path through a body of information by following links to view nodes of information. More sophisticated techniques can be applied to a hypermedia system to guide users and to provide radically different views of information for different types of user adapting to their needs (Utting and Yankelovich, 1989; Lundeberg et al., 1992).

**Rationale for the Delivery of IMMEDRIS via the Internet**

The Internet is widely accessible and continues to grow rapidly, a NUA Internet Surveys offers an "educated guess" of 605.60 million Internet users worldwide (182.67 million in the US and Canada) as of September 2002. Wireless communication now makes Internet access completely portable as well. With continuous progress in computer
technology and the pervasion of network environments, the Internet has become a major channel for acquisition of information on demand by providing access to hundreds of software programs, and multimedia information. Yang, Yen, and Chen (2000) claim that the estimated amount of information stored on the Internet doubles every 18 months. However, the rate of increase in the number of home pages is even faster, doubling every six months or even sooner.

The Web’s initial success can be attributed to its main characteristics:

1) The consistent navigational strategy provided by hypermedia paradigm allows for easy navigation. Unlike traditional software applications, the Web is very forgiving (one cannot make unrecoverable errors). In addition, because it does not depend on proprietary software, it allows for the ease publishing of content.

2) HTML-compatible browsers are installed on virtually all desktop workstations. The common controls and format dictated by HTML provide a standard user interface platform on which developers can build. Multimedia (graphics, text, sound, etc.) can be easily incorporated into user interfaces based on Web browsers when appropriate – providing a straightforward common multimedia interface which users can use to publish and retrieve information easily.

3) The presence of a standard user interface framework not only simplifies development efforts but also greatly reduces user training and support requirements for expert system developers – it allows for a network-centric computing paradigm based on new distribution models.
4) Compatibility with other existing protocols, such as gopher, ftp, netnews, and telnet provides users with the ability to browse multimedia documents in an open environment available on many different platforms, requiring little cooperation between information providers and users.

As noted above, IMMEDRIS presents a portal or gateway to environmental design research information. In this next section, I outline the core functions, applications and priorities of portals and their categorization into three major types.

**Web Portals – Information Gateways**

Simply, Web portals are gateways or entrances to Internet-based information sites or applications. They provide a flexible working environment for organizing, manipulating, and disseminating all kinds of information multimedia and learning materials. Portals can serve many purposes; for example, they are used by companies to provide customized online access to specific target groups such as company employees, project managers, and customers. America On-Line (AOL), Yahoo, Amazon.com, and other online shopping malls are examples of portals According to the LITA Internet Portals Interest Group of the American Library Association, a portal is a service that "facilitates organized knowledge discovery via information accessible through the Internet." Ketchell (2000) states that a web portal is the standard interface to aggregate resources and services through a single access and management point for users. The Joint Information Systems Committee (JISC) defines a portal as "a network service that brings together content from diverse distributed resources using technologies such as cross searching, harvesting, and alerting, and collate this into an amalgamated form for
presentation to the user." Morgan (2001) claims that portals are often defined as "user-driven" and "customizable" interfaces to web resources. However, portals do not have to create content themselves, they can host content from third-party providers, organize it suit their target audience.

**Features of Web Portals**

As one-stop entry and exploration of the Web, portals provide a user-centered approach to information gathering and dissemination. 1) Through their searching and information retrieval services, portals provide discovery functionality; 2) by providing descriptive and categorization of information and resources, portals allow for easy access through an intuitive, easy-to-use navigation system; 4) they allow users to develop a customized interface by enabling the adjustment of its ‘look and feel’; 5) portal allow for personalized content - selected by individual or through user profiles; 7) provide dynamic, ever-changing resources and information; 8) promote information sharing - rights to access, collaborative sharing elements – such as shared whiteboards, workspaces; 9) provide communication tools - email, forums, chat, video conferencing, calendars; 10) provide virtual reference services and assistance (Retrieved June 2005: http://www.eduscapes.com/sessions/portals/).

**Classification of Portals**

Roa (2001, p. 326) notes that “there is no single model of what constitutes a portal” although he claims “most offer a core set of functions involving” what he calls “the four Cs:” “Connection,” “Content,” “Commerce,” and “Community.” Issacs (1999) classifies portals into three major types: *Horizontal portals* embrace the model of
personalization. They feature customized start pages tailored to a user’s specific interests. Such personal touches filter information and narrow the content. *Vertical portals* appeal to a specialized segment of the market. They focus on specific areas and provide targeted users with in-depth rather than broad content. *Corporate portals* link company legacy systems with the Web. They use industry standard browsers to deliver an integrated view of corporate data documents, Web contents and business services to employees, customers, and others (Roa, 2002 p. 327). Similarly, Ketchell (2000), based on specific diversity of content, application or area, classified portals into commercial, corporate, and publishing. Corporate, enterprise and administrative portals are most often associated with large organizations using commercial portal software. Universities and libraries often use these integrated systems for complex portal systems that are used as front-ends for many services including electronic catalogs, information retrieval, corporate management, scheduling, and other applications. These portals offer "a customizable interface allowing users to tailor their website desktop to fit interests, needs, and personality" (Johnson and Lamb, 2003).

One of the primary goals of IMMEDRIS is to leverage the Internet as a channel to accelerate dissemination and sharing of environmental design research. The digital library (DL) plays an important role in the acquisition and dissemination of information. As noted above, IMMERIS might be considered a digital library (DL). This next section focuses on the technological aspects of digital libraries.
Digital Libraries (DL)

There is no consensus on the scope and concept of the term of the term digital library. Different perspectives have been brought to bear of the conceptualization of digital libraries. Based on dichotomy between researchers and practicing librarians, Borgman (1999, p. 227) claims there are two senses in which “the term ‘digital library’ is used” – “as content collected on behalf of user communities” (the view of researcher) and “as institutions or services” (the view of practicing librarians). Frumpkin (2004) claims A “digital library, at its core, is really a very simple thing; it is content, provided through digital services.” Croft (1995, p. 43) considers DLs to be “synonymous with a distributed, textbased, multimedia information system application.” Wilensky (1995, p. 60) conceives of a DL as “a collection of distributed information services” consisting of material made available for consumers “through the help of automated agents.” Schatz, (1995, p. 62) sees the digital library replacing the “distributed network of interconnected machines” of the Internet with “a distributed space of interlinked information.”

The ambiguity over conceptualization not withstanding, numerous definitions describing many different elements and concepts have been proffered. Lesk (1997, p. xix) defines digital libraries as “organized collections of digital information.” Koohang and Ondracek (2005, p. 408) define digital libraries as “a collection of digital information in various forms that is accessed electronically by the Internet and computer networks.” Wang (1999, p. 91) defines a digital library as “an integrated system which uses database, multimedia, and human-computer interface techniques to construct a complex supporting environment.” Kochtanek, Kassim, and Hein (2001, p. 31) note that “[w]hile these
definitions share similar characteristics, they all reflect a slightly different focus.” They claim “at its most basic level, a digital library may be defined as a collection of digital resources selected according to certain criteria, organised in a certain logical fashion, and made accessible for retrieval over distributed computer networks.” Based on summaries of workshops held by the Digital Library Initiative (cf. Fox, 1993b), Borgman (2000, p. 41) claims that a digital library consists of “(1) a service; (2) an architecture; (3) a set of information resources, databases of text, numbers, graphics, sound and video etc.; and (4) a set of tools and capabilities to locate, retrieve and utilize the information resources available.”

McCray and Gallagher (2001, p. 49) have noted that “[b]uilding a digital library is expensive and resource-intensive.” Similarly, Bhattacharya (2004, p. 166) has claimed that the implementation of a “digital library involves a massive investment for digitization of the existing collection and acquisition of digital resources” The type of information that “may be incorporated into the collection, [include] both retrospectively converted printed materials and materials that exist only in digital form, as well as a broad range of material formats, including books, journals, sound recordings, photographs, and video” (Kochtanek, Kassim, and Hein, ibid.).

Marchionini and Fox (1999, p. 219) state that “digital library work occurs in the context of a complex design space shaped by four dimension: community, technology, services and content.” To provide an integrated and coherent view of current developments and trends in digital library research, this next section addresses issues raised in all three categories.
The community dimension pertains to information policy and includes “co-operation and collaboration between information service providers, collection development, intellectual property protection, management and administration …, and public information services (user clients)” (Liu, and Zhang, 2001 p. 205). However, given the focus of this dissertation, I will focus on the technological aspects of digital libraries.

Technological Issues Pertaining to Digital Libraries

Technological Issues Pertaining to the Digital Libraries covers telecommunication infrastructure, …, information retrieval, digital information processing, digital information storage, digital information exchange, digital information organization, and interface design” (ibid.). According to Ali (2003, pp.198-200) technological issues fall into seven major categories

1) Architecture, systems, tools and technologies; digital content and collections, metadata; interoperability – all technical, infrastructural and algorithmic and system-related components of digital libraries fall under this category. Some of the key issues are: open networked architecture for new information environments; novel search and retrieval techniques and integrating links and ranking; multimedia information retrieval systems; content management systems; intelligent systems for indexing, abstracting and information filtering; harvesting and interoperability technologies; and collaborative, visual 2D and 3D interfaces.
2) Digital content and collections deals with individual digital objects and to collections of objects in repositories encompassing a variety of materials in different digital formats.

3) Metadata deals with how the diversity of digital information formats and the ways in which they should be described in different collections with different target audiences and uses. Metadata has been recognized as a significant component of the digital information environment with substantial effort put into creating complex metadata schemes for describing digital content. The Metadata Encoding and Transmission Standard (METS) schema represents a standard for encoding descriptive, administrative, and structural metadata regarding objects within a digital library (Liu, and Zhang, 2001).

4) Interoperability derives from the fact that different digital library systems wish to effectively interact. A digital library is based on a networking environment. It suggests that different systems, computers, information formats, and interfaces may be integrated. Towards this aim, standardization for information processing and organization is a necessary. Standardization is the core of digital libraries to some extent. Various digital libraries have different architectures, metadata formats and underlying technologies. This can be accomplished through a range of common protocols and standards. The most widely discussed and investigated standard for cross repository interoperability is The Open Archives Initiative (OAI) protocol (OAI, 2002). OAI-PMH provides access to the metadata and the metadata is provided in the OAI-Dublin Core format (Dublin Core Metadata Initiative, 2004).
5) Standards with the context of digital library research encompass all protocols and conventions that have been set for digital library architectures, collections, metadata formats, and interoperability.

6) Knowledge organization systems refer to a number of tools used for organization, classification and retrieval of knowledge in a general sense.

7) Users and usability deals with the need for digital libraries to be useable. To improve system design, researchers have addressed user behavior and user requirements in different contexts including academic environments, government departments and business.

According to Bhattacharya (2004, p. 166) “[t]he fundamental purpose of a digital library must be to provide access to information along with appropriate reference tools for identifying and evaluating the possible sources and types of information.” McCray and Gallagher (2001, p. 49) note that “though it is not a necessary attribute of digital libraries,” … “[m]ost digital libraries are made available over the Internet through Web technology.” The Internet provides great advantages – already outlined, and might explain why “most library systems today are designed to be Web-accessible” (ibid.).

In what follows, I describe Web-based applications and the main components of such systems.

**Web-Based Applications**

According to Schwabe and Rossi (1998, p. 207) “[t]he emergence of the World Wide Web has raised a new generation of information systems: those combining navigation through a heterogeneous information space with operations querying or
affecting that information.” Gaedke and Turowski (2000, p. 117) have noted how the Web “has moved far beyond its originally anticipated scope and changed from a distributed system for knowledge-interchange” to “become an environment for distributed applications of all kinds.” Web-based applications are application-oriented software delivered as a service over the Web (Norman, 2000; Nail, 1998). Similarly, Lu and Yeung (1998, p. 169) consider Web-based applications “as a special type of software development project with specific target user populations.” According to Mejuev (2003, pp. 913-914) “an application is considered to be Web-based if it relies on URL-addressable resources and may be accessed via a Web-browser providing integration with built-in browser facilities.” They are highly interactive and dynamic and play an increasingly important role in software technology related to online services, internet portals, online monitoring, personal information retrieval and storage systems (ibid., p. 913). Schwabe and Rossi (1998, p. 207) note how the “[t]he evolution of technology, most notably the phenomenal growth of the WWW, has given rise to applications that are constantly modified, that are enriched with new services” with “new navigation and interface features are added” to meet organizational needs. However, Gellersen, et al. (1997) note that “producing applications in which the user may benefit from the hypertext paradigm for navigating through Web-sites, while performing complex transactions over its information base, is a difficult task.” Schwabe and Rossi (ibid.) argue that “good web-based applications should, first of all, be good hypermedia applications.” Navigation, according to Schwabe and Rossi (ibid.) is what “distinguishes Web-based applications from traditional software applications.” One essential
distinguishing feature of hypermedia applications is the notion of navigation, in which “the user of an application in this domain navigates in a space made out of objects” (ibid., p. 208). They outline some of the problems encountered while designing large scale, dynamic web-based applications which “combine complex navigation patterns with sophisticated computational behavior” (ibid., p. 207). An essential feature of a successful hyper-media application is a navigational structure that is understandable by the user.

Hardman (et al., 1993) emphasize the need for the user understands where he can go, and how he can reach a desired target point, if they are enjoy maximum benefit from the application.

In the next section, I describe factors that impacted the design of IMMEDRIS including human-factors issues, search and note taking functionality, deployment of a prototype, and system use.

The Design of IMMEDRIS

An implicit assumption of computer-based information systems is that computerization, allows for the structuring of information into comprehensive and coherent systems that can improve and expand the usability of information.21 An important first stage in the implementation of this project is the transfer of existing documents into digital media for purposes of storage and retrieval. The prototype is designed to store, search and retrieve environmental design information and includes a computer-assisted instruction system for learning concepts in human-environment

---

21 There is of course, an underlying assumption that computer information retrieval has “value, and significance” (Humphrey and Melloni, p.vxii).
interaction. The first phase of the design process involved the collection, analysis, and
display of the relevant information in the form of a database system. The goal is to collect
and organize environmental design research information in order to use it as a knowledge
base for design evaluation and decision-making. The database includes stimuli sets
consisting of images, research descriptions of each study and the instrument type used for
each study. The second phase involved the presentation of the knowledge base in a
learning environment, presenting existing research in the form of a tutorial consisting of
images/stimulus set and a summary of key research findings, indicating possible
applications of research findings to a given situation.

An Information system can be stored and managed in one of two ways: centralized data storage and a distributed data management. Centralized data
management collects all such information and stores them in a centralized location. A
distributed data system stores data at the servers of the direct data providers at different
geographic locations. IMMEDRIS adopts a centralized approach because it makes the
construction of user interfaces more straightforward, provide local control over data
quality, and allows standardization of data format. The Internet user or client requests
data from a Web server, the Internet server then acts like a client to access data stored on
a server. The results are collated by the CGI script and formatted in HTML for the user to
review. The Web browser acts as a friendly user interface for the end-user to request
EDR data and for the server to present the data results to the users. This gateway
approach is used to access and download remote data from a digital library through the
clearinghouse for local use. It provides a simple solution to facilitate Web clients access to a centralized data server.

**The Prototype of IMMEDRIS**

It is crucial for all computing systems that are easy to use by the persons concerned. They should not need technical expertise not be necessary. The implemented system commences with a welcoming screen which, after a few seconds, moves into a main menu, the structure of which attempts to mirror the major categories of research areas in environmental design research (see Figure 1). The main menu items are represented by buttons which are active areas of the screen which, based on user actions such as mouse-over and mouse-click events, will carry out a given function as specified by the program. This menu provides the user with a variety of paths or links to specific environmental design research information and to explore, serving as the main starting point of the system. Icons, a highlighted word, or a set of words, a picture, or an image map may be used to represent other active areas. A network of “separate fragments of information” is created by this configuration of pages and links, linked in different ways. Therefore, the user interface can be designed in a simple and clear manner.

The construction of web-based user interfaces must rely on principles rooted in human-computer interaction. In the next section, I outline principles that have been suggested for the design of Graphical User Interfaces (GUI).

Schwabe and Rossi (1998, p. 207) note how the [t]he evolution of technology, most notably the phenomenal growth of the WWW, has given rise to applications that are constantly modified, that are enriched with new services” with “new navigation and
interface features are added” to meet organizational needs. However, Gellersen, et al. (1997) note that “producing applications in which the user may benefit from the hypertext paradigm for navigating through Web-sites, while performing complex transactions over its information base, is a difficult task.” Schwabe and Rossi (ibid.) argue that “good web-based applications should, first of all, be good hypermedia applications.” Navigation, according to Schwabe and Rossi (ibid.) distinguishes Web-based applications from traditional software applications. One essential distinguishing feature of hypermedia applications is the notion of navigation, in which the user of an application in this domain navigates in a space made out of objects (ibid., p. 208). They outline some of the problems encountered while designing large scale, dynamic web-based applications which combine complex navigation patterns with sophisticated computational behavior (ibid., p. 207). In the next section, I describe factors that impacted the design of IMMEDRIS including human-factors issues, search and note taking functionality, deployment of a prototype, and system use.

Interface Design

The user interface is formally defined as the communications link between an environment (a product or system) and a user (Hackos and Redish, 1998; Marchionini, 1995), and consists of objects or elements designed to communicate the function of the environment. The interface was, until recently, predominantly referred to as a graphical user interface (GUI) because of the highly visual or graphic nature of instructional icons, buttons, and toolbars. With newer technology, however, a wider range of media influence the interface (Nielson, 1993).
Regardless of the type of media used in an interface, the underlying design goal is to create easily recognizable signals, signs or cues that direct the user to information or tools that facilitate the instructional goals of the environment. When the elements communicate clearly, the user knows almost instinctively what type of performance is expected. The most effective interfaces allow the user to focus on the content rather than focusing on how to access the content.

**Human-Factors Design Guidelines**

Most of the direction available to the designer of an instructional interface falls outside the domain of Web application design in fields long involved in human-computer-interaction research including: human factors (Sanders & McCormick, 1993; cf. Lohr, 2000), human-computer interaction (Schneiderman, 1998; cf. Lohr, ibid.), cognitive science (Norman, 1988), graphic arts (Mullet & Sano, 1995; cf. Lohr, ibid.), and technical communications (Hackos & Redish, 1998; cf. Lohr, ibid.). The guidelines from these disciplines apply more to software environments than Web environments, which have fundamentally different user tasks. These discipline address general principles that have certain commonalities and certain differences: (cf. Lohr, ibid.)

1) Human factors design focuses on aesthetic principles such as clarity, compatibility, comprehensibility, configurability, consistency, efficiency, forgiveness, predictability, recovery, responsiveness, simplicity, and transparency (cf. Galitz, 1997; Lohr, ibid.); Nielson (1993) emphasizes usability heuristics; simple and natural dialog, minimization of user memory load, consistency, feedback, clearly marked exits,
shortcuts, good error messages, prevention of errors, help and documentation, and heuristic evaluation (cf. Lohr, ibid.).

2) In the disciplines of graphic arts, Mullet and Sano (1995) focus on achieved through unity, refinement, and fitness in order to achieve elegance and simplicity and clarity, harmony, activity, and restraint for scale contrast and proportion (cf. Lohr, ibid.).

3) In instructional design, Schwier and Misanchuk (1993) emphasize balance, harmony, unity as proxy the aesthetic considerations of simplicity, consistency, and clarity (cf. Lohr, ibid).

**Designing the Interface for IMMEDRIS**

The Interface was designed to overcome orientation problems of Web suffers resulting from the global hypertext structure of the World Wide Web. By utilizing the scripting capability of fifth generation browsers, it is possible to overcome this problem. It allows for the dynamic display of all relevant information in one central display area, reducing the need for hyperlinks. IMMEDRIS provides a basic Web-based Graphical User Interface (GUI) for its end users. The GUI was developed only to convey the functionalities of the system. There are a number of reasons for choosing a relatively simple interface: (1) The same functionality can be achieved with a simple interface. (2) It allows for more space for further modification if found necessary. (3) A basic interface allows different families of Web Browsers a higher chance to render the pages as expected.

The Interface is divided into four sections (see Figure 1). At the top of the browser are the search and other navigational tools. To the left of the browser screen are
clickable buttons for the research categories based on a review by my advisor and myself of EDRA conference proceedings. The arrangement of these buttons allows for the addition of other categories as the need arises. The center of the screen contains the space for the dynamic display of information. At the bottom of the screen is a text area that allows the user to take notes and save it their hard drive or other writeable media.

Figure 1: Entry page to the IMMEDRIS Portal.
The design for the display of information based on the research categories is modeled on the idea of a hierarchical menu, with one notable exception; the related menu items do not fold out like a tree. Instead, they are displayed at different but convenient locations on the screen. The objective was to prevent a cluttering of the screen. Clicking on each button triggers an event; in this case it displays related menu items at the same location on the screen for each category. This accomplished with a JavaScript that toggles the layer visibility capability of the browser. Each item on this sub-menu has a checkbox.
associated with it. Additional sub-menu items are revealed when a checkbox is selected or hidden if the checkbox is unchecked (see Figure 3).

Figure 3: Layout of the interface showing main menu items

The objective for this layout is to allow the user a more fine-grained control the kind of information they want. Unlike the general search function to be explained shortly, this method provides only the information relevant to the selected categories. For example, if a user selects the Visual Quality module, a menu of related options is displayed. If say, the user then selects Environment Type, another menu is displayed with
options for different types of environments. If the user selects Commercial Environments, another menu is revealed showing different commercial environment types. If the user selects office space and clicks on the Display Info button, the relevant information is dynamically written to the centrally located information display area. The information is made up of hypertext links to external HTML files containing more detailed information on the subject of interest. If the user clicks on a hypertext link, the HTML page is written to a modal window which is always on top until closed by the user. Again, this is meant to prevent cluttering of the users computer screen (see Figures 3).

Figure 4: Result page for information based on combined and specific variables selected.
Search Functionality

Owing to the huge amount of information of various types available and various users on the Internet and Web, efficient query and information retrieval as well as the management of Internet information have become a challenging and difficult task. Although users can acquire increasing amounts of information from Internet resources, but they also face the serious problem of information overload. Thus far, the search engine is the most popular tool for locating and managing information on the Internet. However, many unpolished data appear when keywords are used to locate information. Users must refine and retrieve information to obtain their actual requirements after utilizing a search engine. Thus, using a search engine cannot effectively solve such problems of information overload on the Internet. The manner of searching has changed as has the content of search results. Therefore, many large Web sites today are turning to database technology to keep track of the ever increasing amount of data. In the past several years, database technology has played a critical role in the information management field. The Web’s scalability problem can be overcome if established database techniques are adopted – they are quite effective at organizing, storing and retrieving data. Finding and retrieving data efficiently is essential for information access.

The search functionality in IMMEDRIS is provided to allow for a keyword search. As currently implemented, it accesses a flat file database with keywords structured around the research categories noted above, as well as author and research
article titles. For example, a search for Stamps, will return a dynamically written list of hypertext links to all relevant articles and books published by the author. A keyword search for say, complexity, will similarly return a dynamically written list of hypertext links to all relevant articles and books on the subject (Figure 5).

Figure 5: Search results dynamically written to central display area of interface.

**The Note Taking Functionality**

Web applications typically do not access to the local file system (depending on how well the user or the User agent trusts the web application, but it may need some form of permanent storage. This could be a virtual file system (one for each web applications),
provided by the webapp UA, or it could be a “cookie.” Nevertheless, the note taking functionality was accomplished using the programming language Java. For security reasons, direct access to system resources is not allowed via the browser unless the Web page is digitally signed. To enable this functionality, a digitally signed certificate is provided which a user on the Internet has to accept if want to save their notes to their hard drive (see Figure 1, p. 97).

System Use

The prototype of IMMEDRIS as deployed for testing and evaluation IMMEDRIS was hosted on a computer with Web Server software - the prototype uses the Xtami Web server software. Any user on a computer can link to the server via a network using the TCP/IP protocol. Most Web-based DSS support a three or four-tier architecture in which a Web browser sends hypertext mark-up language (HTML) requests using the hypertext transfer protocol (HTTP) to a Web server. The Web server processes these requests using a Common Gateway Interface (CGI) scripts. The script can handle Structured Query language (SQL) generation, post-SQL processing, and HTML formatting. For this prototype tools like Java and JavaScript were used to enhance the display of results and the interactive analysis of information.
CHAPTER 4

METHODOLOGY – EVALUATION OF IMMEDRIS

The evaluation of IMMEDRIS consisted of two parts: the first part evaluated the tool for usability. After people used the tool, they received seven questions which were designed to elicit their evaluation of the tool. Four of these questions parallel questions used on 2223 respondents by Yanklovich to evaluate people’s favorite Websites. Those items asked for level of agreement (Strongly Agree, Agree, Disagree, Strongly Disagree) for: This tool is fun and entertaining, This tool is a leader (original and ground breaking), This tool is easy to navigate, and I can believe everything I read and see using this Tool. Respondents were also asked to rate their level of agreement on the same four point scale for: This tool is excellent for Design Review. They were also asked to rate on a four point scale (Extremely Likely, Somewhat Likely, Slightly Likely, Not at all Likely): Likelihood to research further material presented in this tool. Finally, they were asked: Would you recommend this tool to others?: (1) Yes (2) No.

The second part of the evaluation of IMMEDRIS required respondents to make a design review decision that involved rank ordering the pictures of houses and streetscapes from 1 (for most preferred) to 6 (for least preferred).
In a two by two design, the analysis compared people using the tool with those not using it; and it compared people who received guidelines with those who did not. The analysis compared design review decision outcomes between subjects who received the customized environmental design research information using the multimedia interactive tool and those who used the tool but did not receive the customized environmental design research information. I expected exposure to the multimedia tool with research information and knowledge base to significantly improve design review decisions. I tested this in relation to houses and streetscapes. I expected the group exposed to material contained in the multimedia tool with written guidelines and the statement of design review objectives to make choices more similar to the research findings than choices made groups given only a statement of design review objectives.

Participants

159 graduate and undergraduate students enrolled in Architecture, Landscape Architecture, and City and Regional Planning at the Ohio State University signed up to take part in the study. 132 (83%) actually took part in the study. Of the 132, 7 (5.3%) were dropped because of incomplete data resulting in an actual sample size of 125 (78.6%). The testing took place over Winter and Spring Quarters, 2001. Participants agreed to sign-up for a 45-minute time slot. They each received an email reminder of their appointment. Those who missed the appointment received a follow up email to reschedule for a more convenient time.
Socioeconomic Characteristics of Sample

Table 4 shows the gender, education, profession, income and ethnicity of the sample. As you can see the sample had more males than females and more urban planners than architects and landscape architects. Most of the sample had an income of between $10,000 to $20,001; most had obtained a graduate level education; and most were white.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Percent</th>
<th>Profession</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>64.8%</td>
<td>Architects</td>
<td>20.0%</td>
</tr>
<tr>
<td>Female</td>
<td>32.8</td>
<td>City Planners (CP)</td>
<td>32.8</td>
</tr>
<tr>
<td>No Response</td>
<td>2.4</td>
<td>Landscape Architects (LA)</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CP and LA</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Response</td>
<td>5.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th>Percent</th>
<th>Income</th>
<th>Percent</th>
<th>Ethnicity</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School</td>
<td>1.6%</td>
<td>Under $10,000</td>
<td>47.22%</td>
<td>White</td>
<td>84.8%</td>
</tr>
<tr>
<td>Some Years of College</td>
<td>29.6</td>
<td>$10,001-$20,000</td>
<td>33.6</td>
<td>African-American</td>
<td>4.8</td>
</tr>
<tr>
<td>Community College</td>
<td>0.80</td>
<td>$20,001-$30,000</td>
<td>9.6</td>
<td>Native American</td>
<td>0.8</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>26.4</td>
<td>$30,001-$40,000</td>
<td>2.4</td>
<td>Asian-American</td>
<td>4.0</td>
</tr>
<tr>
<td>Graduate School</td>
<td>34.4</td>
<td>$40,001-$50,000</td>
<td>1.6</td>
<td>Other</td>
<td>5.6</td>
</tr>
<tr>
<td>Professional Degree</td>
<td>4.8</td>
<td>Over $50,000</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Response</td>
<td>2.4</td>
<td>No Response</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Socioeconomic characteristics of respondents (N=125).

Procedure

I assigned the participants at random to four groups; No Tool without written guidelines (NT_NG), No Tool with written guidelines (NT_G), Tool without written guidelines (T_NG), Tool with written guidelines (T_G). Table 5 shows the experimental design with intended n’s (actual n’s in parentheses).
<table>
<thead>
<tr>
<th></th>
<th>No Tool (NT)</th>
<th>Tool (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Guidelines (NG)</td>
<td>33 (31)</td>
<td>33 (32)</td>
</tr>
<tr>
<td>Guidelines (G)</td>
<td>33 (31)</td>
<td>33 (31)</td>
</tr>
</tbody>
</table>

Table 6: Experimental Design

<table>
<thead>
<tr>
<th></th>
<th>NT_NG Percent</th>
<th>NT_G Percent</th>
<th>T_NG Percent</th>
<th>T_G Percent</th>
<th>Total N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td>n = 31</td>
<td>n = 31</td>
<td>n = 32</td>
<td>n = 31</td>
<td>N = 125</td>
</tr>
<tr>
<td>Male</td>
<td>19.75 %</td>
<td>23.46 %</td>
<td>25.93 %</td>
<td>30.86 %</td>
<td>n = 81</td>
</tr>
<tr>
<td>Female</td>
<td>34.15</td>
<td>26.83</td>
<td>24.39</td>
<td>14.63</td>
<td>n = 41</td>
</tr>
<tr>
<td><strong>Profession</strong></td>
<td>n = 31</td>
<td>n = 31</td>
<td>n = 32</td>
<td>n = 32</td>
<td>N = 125</td>
</tr>
<tr>
<td>Architect</td>
<td>16 %</td>
<td>20 %</td>
<td>16 %</td>
<td>48 %</td>
<td>n = 25</td>
</tr>
<tr>
<td>City Planner (CP)</td>
<td>26.83</td>
<td>34.15</td>
<td>29.27</td>
<td>9.76</td>
<td>n = 41</td>
</tr>
<tr>
<td>Landscape Architect (LA)</td>
<td>26.32</td>
<td>26.32</td>
<td>42.11</td>
<td>5.27</td>
<td>n = 19</td>
</tr>
<tr>
<td>CP and LA</td>
<td>27.27</td>
<td>18.18</td>
<td>15.15</td>
<td>39.39</td>
<td>n = 33</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td>n = 31</td>
<td>n = 31</td>
<td>n = 32</td>
<td>n = 31</td>
<td>N = 125</td>
</tr>
<tr>
<td>Some College</td>
<td>24.32 %</td>
<td>16.22 %</td>
<td>24.32 %</td>
<td>35.15 %</td>
<td>n = 37</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>9.09</td>
<td>27.27</td>
<td>21.21</td>
<td>42.42</td>
<td>n = 33</td>
</tr>
<tr>
<td>Graduate School</td>
<td>32.56</td>
<td>32.56</td>
<td>27.91</td>
<td>6.98</td>
<td>n = 43</td>
</tr>
<tr>
<td>Professional Degree</td>
<td>33.33</td>
<td>50</td>
<td>16.66</td>
<td>n = 6</td>
<td></td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td>n = 31</td>
<td>n = 31</td>
<td>n = 32</td>
<td>n = 31</td>
<td>N = 125</td>
</tr>
<tr>
<td>Under $10,000</td>
<td>28.81 %</td>
<td>18.64 %</td>
<td>25.42 %</td>
<td>27.12 %</td>
<td>n = 59</td>
</tr>
<tr>
<td>$10,001 - $20,000</td>
<td>19.05</td>
<td>35.71</td>
<td>26.19</td>
<td>19.05</td>
<td>n = 42</td>
</tr>
<tr>
<td>$20,001 - $30,000</td>
<td>8.33</td>
<td>25</td>
<td>33.33</td>
<td>33.33</td>
<td>n = 12</td>
</tr>
<tr>
<td>$30,001 - $40,000</td>
<td>33.33</td>
<td>66.67</td>
<td>n = 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$40,001 – over $50,000</td>
<td>50</td>
<td>50</td>
<td>n = 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Race/Ethnicity</strong></td>
<td>n = 31</td>
<td>n = 31</td>
<td>n = 32</td>
<td>n = 31</td>
<td>N = 125</td>
</tr>
<tr>
<td>White</td>
<td>24.53 %</td>
<td>24.53 %</td>
<td>25.47 %</td>
<td>25.47 %</td>
<td>n = 106</td>
</tr>
<tr>
<td>Africa-American</td>
<td>16.67</td>
<td>33.33</td>
<td>50</td>
<td>n = 6</td>
<td></td>
</tr>
<tr>
<td>Asian American</td>
<td>20</td>
<td>20</td>
<td>40</td>
<td>20</td>
<td>n = 5</td>
</tr>
<tr>
<td>Other</td>
<td>28.57</td>
<td>57.14</td>
<td>14.29</td>
<td>n = 7</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Socioeconomic characteristics of respondents according to treatment condition.
Table 7 shows general similarities across the conditions, but a higher percentage of males, architects, dual degree (CP and LA), undergraduates for T_G. The conditions have similar distribution for ethnicity and moderate differences by profession, education and income.

The multimedia tool contains a database of research data and images from a number of studies by Nasar (1983) and Nasar and Devlin (1992). A set of guidelines, one for individual houses and the other for streetscapes were derived from the findings of these studies. These studies attempted to measure using "scientific protocols" public evaluative judgments of the built environment on such physical attributes as complexity, novelty, coherence, upkeep and ornateness.

All groups received a statement of design review objectives and were required to make a design review decision. Respondents assigned to the NT_G group received written design review guidelines. The T_NG group experienced material contained in the multimedia tool without written guidelines. Respondents assigned to the T_G experienced material in the multimedia tool and written design review guidelines.

The design review task involved ranking each house and streetscape from the most preferred to least preferred. The houses and streetscapes came from the same study as the houses and the streetscapes in the tool; and each had popular preference scores (not revealed to subjects).

Each subject regardless of group assignment received the same explanation. I told each respondent that they were required to use a Web based tool to help evaluate the built environment by making an architectural design review type decision. The
evaluation took place on four PCs dedicated to the evaluation of IMMEDRIS. To start the process each subject clicked on a start button of the opening page which launched the page for the first part of the evaluation depending on group assignment (Figure 6). First consider the procedures for the No Tool (NT) groups).

![Figure 6: Intro page to Tutorial Subsystem of IMMEDRIS](image)

**Design Review for Houses – No Tool (NT)**

For each NT group clicking the enter button on the welcome page led the respondent to a full-screen page with some information shown in Figure 7. The information included a definition of design review, an explanation of what guidelines were without enumerating them, the objectives of design review, and instructions for the required task.
No Tool and No Guidelines (NT_NG). Subjects assigned to the NT_NG group were required to make a design review decision of houses and streetscapes by rank ordering the images of house and streetscapes from most preferred to least preferred. To make a design review decision of houses, the respondent had to click on a button labeled “Click to Make Design Review Decision of Individual Houses” (Figures 7 and 8). Clicking on this button brought displayed thumb-nail sized images of houses images of the houses arranged from left to right.
Figure 7: Design review of houses with NT_NG.
Instructions as to what was required were supplemented by explanatory text inside the row of six boxes in a ranking area located at bottom of the page as well as by an onMoueseover tool tips activated when the mouse is moved over an image. Thus each participant knew that to rank each image, they had to click on each image to create a
slightly larger instance of that image. These new images could then be dragged into the ranking area made up of six boxes arranged from left (most preferred) to the right (least preferred) (Figure 8).

To give participants the leeway to change their minds, any newly created image could be destroyed by being placed in a trash box. To provide participants with a better view of each image, a larger sized image is displayed in a postcard-sized window each time thumb-nail image is instantiated. Below each box in the ranking area is an input text box to which is written the name of each image after they have been dragged into a box for ranking. For example, House_F2_F1DIV indicates the image is House_F and the 2 indicates the number of times the respondent clicked on a thumb nail image of House_F before a final decision on ranking was made. Remember any instantiation of a thumb-nail image can be destroyed if participants changed their minds or are unsure about what to do. F1DIV is the name of the container holding that image. The ranking data could have been written to a hidden text input field. However, displaying the ranking data makes the respondent aware of their decision making process. Should respondents change their minds by destroying a new instance of an image, a change in the text input box makes clear the new choice. When the respondent completes the design review process, clicking on the “Submit” button (shown in Figure 8, p. 110) writes the data in the six text input boxes to a file. Figure 9 shows an enlarged view of the houses they ranked.
Clicking the submit button generated an informational page thanking the participant for finishing the first part of the evaluation process and instructing them to click on the next button to start the second part of the process (Figure 10).
The second part of the process involved making a design review decision of streetscapes. The procedure for the second part is repeated as in the first (Figures 11 and 12). Figure 13 shows enlarged views of the streetscape they ranked. At the completion of the second part and on clicking the submit button, another informational page thanked the participant for finishing the second part of the evaluation process and presented new instruction to click on the next button to start the third part of the process (Figure 14).

Figure 10: Thank You (First part of project).
Design Review

Design guidelines are standards that help property owners, architectural review boards, and municipal authorities ensure physical changes that keep a community or neighborhood attractive.

The authority which promulgates guidelines and regulates construction activities under them is known variously as a district review board, commission, or architectural or design review board.

Objectives of Design Review

Architectural design should:

- Promote those qualities in the environment that bring value to the properties, and
- Foster the attractiveness and functional utility of the community as a place to live.

Instructions

To make a design review decision, click on any thumbnail image to your right to create a larger copy of that image. To rate the image, drag it into the blue box below. If you change your mind, drag the image into the red box (with the image of a trash can) to delete it or just place another image over it.

Figure 11: Design review of streetscapes with NT_NG.
Figure 12: Design review of streetscapes with NT_NG.
Figure 13: Thumb-nail images of streetscapes.

Figure 14: Thank You (Second part of Project).
The third part of the process required the participant to fill out a Web based questionnaire aimed at collecting demographic information, their impressions of the tool, as well as any additional comments. The type of information collected varied with the group. Only demographic data was collected from the NT groups (Figure 15). After completing the questionnaire the participants clicked on the submit button which wrote the data to file. Participants were thanked for participating in the study and were taken back to the start page and the process ended (Figures 16 and 17).

Figure 15: Questionnaire collecting demographic information for NT_NG and NT_G.
IMMEDRIS

You have successfully completed the third part of this three part process.
Thank you for participating in this study.
Please click on the button labeled “End” to end your participation.

Evaluation Received

Thank you for Participating in this study

Figure 16: Thank You (Third part of project).

Figure 17: Final Thank You.
In addition to the definition of design review and an explanation of what guidelines were, participants in the NT_G group received a list of guidelines for houses and streetscapes derived from the studies noted above (Figures 18-21). They were then required to make a design review decision on houses followed by a design review decision on streetscapes following the same process as the previous group.
Design Review

Design guidelines are standards that help property owners, architectural review boards, and municipal authorities ensure physical changes that keep a community or neighborhood attractive.

The authority which promulgates guidelines and regulates construction activities under them is known variously as a district review board or commission or architectural or design review board.

Objectives of Design Review

Architectural design should

- Promote those qualities in the environment that bring value to the properties, and
- Foster the attractiveness and functional utility of the community as a place to live.

Design Review Guidelines for Single Family Houses

For this particular Review Board, all projects should comply with the following.

- Designs should reflect:
  - Moderate Complicity
  - Low Novelty
  - High Coherence - which means it should hang well together

Figure 19: Design review of houses with NT_G.
Design Review

Design guidelines are standards that help property owners, architectural review boards, and municipal authorities ensure physical changes that keep a community or neighborhood attractive.

The authority which promulgates guidelines and regulates construction activities under them is known variously as a district review board or commission or architectural or design review board.

Objectives of Design Review

Architectural design should:

- Promote those qualities in the environment that bring value to the properties,
- Foster the attractiveness and functional utility of the community as a place to live.

Design Review Guidelines for Streetscapes

For this particular Review Board streetscapes should have elements that reflect the following:

- Create or Diverse - meaning that they have some variation
- Well Kept - meaning that the houses, streets, vegetation, and other elements should be well kept
- Clear - which means that the users of the houses should be clear rather than ambiguous. In other words, an observer should be able to tell what buildings they are, how to get in and what might be inside
- The landscape should be open rather than enclosed

Instructions

To make a design review decision, click on any thumbnail image to your right to create a larger copy of this image. To rate the image drag it into the blue box below. If you change your mind, drag the image into the red box (with the image of a trash can) to delete it or just place another image over it.

Figure 20: Design review of streetscape with NT G
Design Review

Design guidelines are standards that help

property owners, architectural review boards,

and municipal authorities ensure physical

changes that keep a community or

neighborhood attractive.

The authority which promulgates guidelines

and regulates construction activities under

them is known variously as a district review

board or commission or architectural or

design review board.

Objectives of Design Review

Architectural design should

• Promote those qualities in the

environment fostering value in the

properties, and

• Foster the attractiveness and functional

utility of the community as a place to live.

Design Review Guidelines for Streetscapes

For the particular Review Board streetscapes should have elements that reflect the following:

• Creative or Diverse - meaning that they have some variation.
• Well Kept - meaning that the houses, street, vegetation, and other elements should be well kept.
• Clear - which means that the uses of the houses should be clear rather than ambiguous. In other words, an observer should be able to tell what buildings they are, how to get in and what might be inside.
• The landscape should be open rather than enclosed.

Figure 21: Design review of streetscape with NT G
Design Review with Tutorial Tool (T)

Now consider the two Tool (T) groups. Recall, the multimedia tool contains research data and images from the studies cited above. They are presented in the form of a tutorial. Designed like an image slide show with accompanying text, the tutorial uses onMouseover tool tips to provide additional information as well as onClick events to display additional information (Figures 22-24 for houses and Figures 27-29, pp. 129-131 for streetscapes). Each image from the study is accompanied by its ratings and some text explaining the rating and all relevant attributes investigated by the study. For example, the accompanying text might explain that the image was rated 3.05 for order on a scale of 1 (low order) to 7 (high order). The preference rating for each image shows its position on a scale of 1 (highly preferred) to 7 (not preferred). The accompanying text also explained the meaning of these ratings, such as, this house is moderately preferred because it had low complexity but medium order. The tutorial ends with a conditional statement, such as, if you want houses that will be preferred by the public, then designs with moderate complexity and moderate order should be encouraged.

**Tutorial Tool No Guidelines (T_NG).** For the T_NG group, clicking the enter button on the welcome page took participants to a page with the tutorial (Figures 22-24 for tutorial on houses). On completing the tutorial participants were required to make a design review decision of houses following the same procedure as the previous two groups. Like the NT_NG group, participants received information which defined design review, the objectives of design review, and instructions for the required task (see Figures 25 and 26).
After making the design review decision on houses, participants had to go through another tutorial on streetscapes (Figures 27-29 for tutorial on streetscapes, pp. 129-131). On completing the tutorial participants were required to make a design review decision of streetscapes (see Figures 30 and 31, pp. 132-133).
Figure 23: Tutorial on houses.
Figure 24: Tutorial on houses.

Findings:
This study found that the public preferred houses that are coherent, moderately complex and moderately novel. This suggests that shown other buildings with these attributes in different combinations, the public are likely to make similar judgments.
Figure 25: Design review of houses T_NG.
Figure 26: Design review of houses T_NG.
Figure 27: Tutorial on Streetscapes
Figure 28: Tutorial on Streetscapes
Figure 29: Tutorial on Streetscapes

Clarity

Clarity in the context of this study refers to the building’s use and its parts

This streetscape was Most Preferred and was rated:

- Ornate (Diverse)
- Well Kept
- Ambiguous and Closed

Clarity Rating: 4.25
Where 2.69 = Ornate... and 5.5 = Plain

Upkeep Rating: 4.20
Where 1.27 = Well kept... and 4.87 = Dilapidated

Ambiguity Rating: 4.47
Where 3.53 = Ambiguous... and 5.60 = Clear

Openness Rating: 3.07
Where 2.67 = Closed... and 5.07 = Open

Findings:
People preferred residential scenes which are ornate, well kept, open and clear in use.
Figure 30: Design review of streetscapes with T_NG.
Tutorial Tool and Guidelines (T\_G)

Participants in this group were also required to go through the tutorial after which they were required to make a design review decision of houses and streetscapes. In addition to the tutorial, participants in this group were given a list of guidelines derived from the studies used in the tutorial. Participants received the guidelines before they made their design review decision (see Figures 32-35).
Figure 32: Design review of houses with T_G.
Figure 33: Design review of houses with T_G.
Figure 34: Design review of streetscapes T_G.
Evaluation and Background Information

The follow-up questionnaire had two parts: questions aimed at collecting user evaluations of the tool and questions about respondent demographic characteristics.

Evaluation of the System as Deployed was Restricted to the Tutorial and Decision Aiding Subsystems to Determine How Well the Tool Accomplished Some of Its Objectives.
As you can see in Figure 36, the evaluation question asked each participant to rate the system on four-point scales for ease of navigation, whether tool is fun and entertaining, tool is a leader (ground breaking) and believability. I included these four items on this questionnaire because a Yanklovich poll of popular Web-sites asked similar questions and it allowed me to compare IMMEDRIS to Web user’s ratings of their favorite Web-sites. Participants were also asked to rate the tool for excellence of tool for design review, likelihood of use for further research, and if they would recommend the tool to anyone else. Participants were also asked for any other comments on the tool. The questions on respondent demographics asked for their gender, professional qualification, educational level, income, and ethnicity.
Figure 36: Evaluation questionnaire for T-NG and T-G.

<table>
<thead>
<tr>
<th>Evaluation Questionnaire for T-NG and T-G</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>This tool is an excellent tool for design review:</strong></td>
</tr>
<tr>
<td>- Strongly Agree</td>
</tr>
<tr>
<td>- Agree</td>
</tr>
<tr>
<td>- Disagree</td>
</tr>
<tr>
<td>- Strongly Disagree</td>
</tr>
<tr>
<td><strong>This tool is fun and entertaining:</strong></td>
</tr>
<tr>
<td>- Strongly Agree</td>
</tr>
<tr>
<td>- Agree</td>
</tr>
<tr>
<td>- Disagree</td>
</tr>
<tr>
<td>- Strongly Disagree</td>
</tr>
<tr>
<td><strong>This tool is easy to navigate:</strong></td>
</tr>
<tr>
<td>- Strongly Agree</td>
</tr>
<tr>
<td>- Agree</td>
</tr>
<tr>
<td>- Disagree</td>
</tr>
<tr>
<td>- Strongly Disagree</td>
</tr>
<tr>
<td><strong>I believe everything I learned in this tool is relevant:</strong></td>
</tr>
<tr>
<td>- Strongly Agree</td>
</tr>
<tr>
<td>- Agree</td>
</tr>
<tr>
<td>- Disagree</td>
</tr>
<tr>
<td>- Strongly Disagree</td>
</tr>
<tr>
<td><strong>Would you recommend this tool to others?</strong></td>
</tr>
<tr>
<td>- Yes</td>
</tr>
<tr>
<td>- No</td>
</tr>
</tbody>
</table>

**Education:**
- High School or Below
- Some College
- Undergraduate
- Graduate or Professional

**Profession:**
- Architect/Designer
- Landscape Architect
- Non-Designer

**Gender:**
- Male
- Female

**Ethnicity:**
- African American
- Asian
- White
- Mixed Race
- Other

**Income:**
- Under $10,000
- $10,000 - $20,000
- $20,000 - $30,000
- $30,000 - $40,000
- $40,000 - $50,000
- $50,000 - $75,000
- Over $75,000

**Comments:**
Please enter any information you think is relevant, perhaps to help improve this tool.
CHAPTER 5

RESULTS AND DISCUSSION

The tool performed well for usability. Respondents rated it better on several scales for usability than an independent rating of the public’s favorite websites. However, the tool did not improve performance in design review, nor did provision of guidelines. The results are presented in two parts. The first section presents the results for the evaluation of the tool. The second section presents the results for the design review decision of houses followed by the results for streetscapes.

Rating of Tool

How did users rate the tool? When asked if they would recommend it to anyone else, 91.7% said they would recommend the tool to someone else. Furthermore, when compared to the Yanklovich evaluation of people’s favorite Web sites, the results show that IMMEDRIS received higher ratings on each item and the differences achieved statistical significance. Recall, I obtained ratings of ease of use, of the tool as fun and entertaining, of the tool as leader (original and groundbreaking) and believability (where 1 is Believable and 4 is Unbelievable). Table 8 shows the result for each scale. As you can see IMMEDRIS received significantly better scores on each scale that did people’s favorite websites.
<table>
<thead>
<tr>
<th></th>
<th>IMMEDRIS (N=125)</th>
<th>Yanklovich Most favorite Website (N=2223)</th>
<th>F (1, 2346)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of Use</td>
<td>2.000 (1.397)</td>
<td>3.478 (0.566)</td>
<td>635.232</td>
<td>0.000</td>
</tr>
<tr>
<td>Fun Tool</td>
<td>1.552 (0.979)</td>
<td>3.365 (0.638)</td>
<td>892.940</td>
<td>0.000</td>
</tr>
<tr>
<td>Tool is Leader</td>
<td>1.624 (1.037)</td>
<td>3.466 (0.588)</td>
<td>1046.169</td>
<td>0.000</td>
</tr>
<tr>
<td>Believability</td>
<td>1.818 (1.147)</td>
<td>2.758 (0.757)</td>
<td>165.516</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 8: Scores for IMMEDRIS and Yanklovich most favorite Website.

Respondents also gave favorable ratings for excellence of tool for design review (m=1.512, SD 0.921) (where 1 = strongly agree and 4 = strongly disagree) and likelihood to use for further research (m=1.529, SD 1.009) (where 1 = extremely likely and 4 = extremely unlikely).

**Decision Review Judgments of Houses**

Recall, the design review decision involved the participants rank ordering the pictures of houses from 1 (for most preferred) to 6 (for least preferred). Respondents differentiated the houses for preference. Table 9 shows mean scores and rank order sums in order of preference from most preferred (D) to least preferred (B). A Friedman Two-Way Analysis of Variance shows a statistically significant difference for the rank ordering of houses – Friedman (5(df) = 41.758 p<.001). Pairwise comparison revealed that houses D, A, and E did not differ as most preferred. House B differs from all the others as least preferred. Houses A, E, F, and C have various overlaps in the middle. In addition you can see the observed rankings of the houses did not match those obtained in a previous empirical study.
Neither the provision of written guidelines nor exposure to research knowledge in the multimedia tool affected the ratings. Table 10 shows the mean scores and rank sums for houses in each of the four conditions. Test of main effects for Guidelines and Tool and of the interactive effect of Guidelines by Tool did not achieve statistically significant differences. A Kruskal-Wallis One-Way Analysis of Variance to see if the provision of guidelines made a difference to the rank ordering of each house did not show any statistically significant effects. Similarly, a Kolmogorov-Smirnov two-sample test did not show any statistically significant interactive effects for each house by guidelines. Similar tests for the effect of the tool showed no statistically significant main or interactive effects. Table 11 shows the obtained rankings for each house by treatment condition and the expected ranking from a previous experimental study.

The results show that the provision of guidelines made no difference in the rating of the houses. Overall, individuals exposed to the tool did not rate the houses differently from those not exposed to the tool. While people exposed to the tool correctly ranked House E the most preferred, they missed other rankings.

I also tested for any interaction effects of Guidelines and the Tool on rank ordering of the houses. Were there any significant effects of Tool, Guidelines or the interactive effects of Tool and Guidelines on the rank ordering of the houses? The results show there was no statistically significant differences in the ranking of the houses by Tool or by Guidelines.
<table>
<thead>
<tr>
<th>Houses</th>
<th>Rank by previous empirical study</th>
<th>Design Review Mean (SD)</th>
<th>Rank Sum</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>4</td>
<td>2.901 (1.635)</td>
<td>365.0</td>
<td>a</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>3.008 (1.656)</td>
<td>378.5</td>
<td>ab</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>3.207 (1.727)</td>
<td>402.5</td>
<td>ab</td>
</tr>
<tr>
<td>F</td>
<td>5</td>
<td>3.306 (1.892)</td>
<td>414.5</td>
<td>bc</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>3.661 (1.754)</td>
<td>457.0</td>
<td>c</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>4.215 (1.794)</td>
<td>523.5</td>
<td>d</td>
</tr>
</tbody>
</table>

Table 9: Mean scores for houses arranged from most to least preferred (houses with the same small letter do not differ significantly from one another).

<table>
<thead>
<tr>
<th>Houses</th>
<th>NT_NG</th>
<th>NT_G</th>
<th>TN_G</th>
<th>TG</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.710 (1.387)</td>
<td>3.069 (1.387)</td>
<td>3.233 (1.569)</td>
<td>3.032 (1.703)</td>
</tr>
<tr>
<td>F</td>
<td>2.839 (1.895)</td>
<td>3.655 (1.895)</td>
<td>3.500 (2.030)</td>
<td>3.258 (1.949)</td>
</tr>
<tr>
<td>D</td>
<td>3.194 (1.646)</td>
<td>3.069 (1.646)</td>
<td>2.500 (1.592)</td>
<td>2.839 (1.485)</td>
</tr>
<tr>
<td>E</td>
<td>3.323 (1.830)</td>
<td>3.276 (1.830)</td>
<td>3.133 (1.756)</td>
<td>3.097 (1.640)</td>
</tr>
<tr>
<td>B</td>
<td>3.613 (1.677)</td>
<td>4.207 (1.677)</td>
<td>4.267 (1.780)</td>
<td>4.774 (1.647)</td>
</tr>
<tr>
<td>C</td>
<td>3.968 (1.645)</td>
<td>3.724 (1.645)</td>
<td>3.767 (1.654)</td>
<td>3.194 (1.759)</td>
</tr>
</tbody>
</table>

Table 10: Mean scores and SD for each house by treatment condition.
Table 11: Obtained rankings for each house by treatment condition.

Table 12 shows the mean scores arranged in order from most liked to least liked for both No Guidelines and Guidelines. Respondents who received the design review guidelines and those who did not rated **House D** most preferred (expected ranking = 4) and **House B** the least preferred (expected ranking = 6).

Table 12: Mean scores and SD for Guidelines and No Guidelines.

Table 13 shows the mean scores arranged in order from most liked to least liked for both No Tool and Tool. Respondents who were exposed to the tool rated **House D** the most preferred (expected ranking = 4) and those not exposed to it rated **House A** the most preferred.
preferred (expected ranking = 2). Both rated House B the least preferred (expected ranking = 6). Respondents who received the guidelines and those exposed to the tool rated the house in the same order (Tables 12 and 13).

<table>
<thead>
<tr>
<th>Houses</th>
<th>No Tool</th>
<th>Houses</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td></td>
<td>M (SD)</td>
</tr>
<tr>
<td>A</td>
<td>2.883 (1.688)</td>
<td>D</td>
<td>2.672 (1.535)</td>
</tr>
<tr>
<td>D</td>
<td>3.133 (1.712)</td>
<td>E</td>
<td>3.111 (1.684)</td>
</tr>
<tr>
<td>F</td>
<td>3.233 (1.817)</td>
<td>A</td>
<td>3.131 (1.628)</td>
</tr>
<tr>
<td>E</td>
<td>3.330 (1.778)</td>
<td>F</td>
<td>3.337 (1.976)</td>
</tr>
<tr>
<td>C</td>
<td>3.850 (1.783)</td>
<td>C</td>
<td>3.475 (1.719)</td>
</tr>
<tr>
<td>B</td>
<td>3.900 (1.829)</td>
<td>B</td>
<td>4.525 (1.719)</td>
</tr>
</tbody>
</table>

Table 13: Mean scores and SD for Tool No Tool.

Recall, respondents were given an unlimited opportunity to change their minds about their design review decision by being allowed to create and destroy an instance of the thumb-nail image. Each time a respondent clicked on a thumb-nail image of each house it created a recorded instance of that house. It is assumed each creation and destruction of an instance represented some reflection on the decision to be made, for convenience I have termed this Look-Time. I ran a pairwise comparisons to see if Look-Time correlated with rank ordering of houses. The results showed no statistically significant effect.

**Decision Review Judgments for Streetscapes**

For streetscapes the design review decision had the participants rank order images of streetscapes from 1 (for most preferred) to 6 (for least preferred). The rankings of the
streetscapes differ. Table 14 show the mean scores and rank sum arranged in order of preference from most preferred (Streetscape A) to least preferred (Streetscape D). A Friedman Two-Way Analysis of Variance also showed a statistically significant difference for the rank ordering of streetscapes – Friedman (5df) = 256.058 \( p<.001 \). Pairwise comparison of the means revealed that streetscapes A and F do not differ as most preferred. Streetscape B differs from all the others as least preferred and streetscapes C, E, D, have various overlaps in the middle. Table 15 show scores (SD) sums for streetscapes in each condition. Test of main effects for Guidelines and Tool and of the interactive effect of Guidelines x Tool did not achieve statistically significant differences. Table 16 shows the actual different ratings for each streetscape by treatment condition and Table 17 shows the ranking and expected rankings did not match those from a previous empirical study.

Did the Guidelines or Tool make a difference? Not really. People did not rate five of the six streetscapes differently with or without them. A Kolmogorov-Smirnov two-sample test for Guidelines by each house showed only one statistically significant effect – Streetscape F by Guidelines \( (p=0.028) \). Table 17 shows the mean scores arranged in order from most liked to least liked for No Guidelines and Guidelines. NG respondents ranked F as second most preferred while G respondents ranked it first. Respondents did not rate five of the six streetscapes differently with or without the Tool. A Kolmogorov-Smirnov two-sample test for tool and streetscapes showed only one statistically significant effect – Streetscape E by Tool \( (p=0.028) \).
Table 14: Mean scores for streetscapes arranged from most to least preferred (streetscapes with the same small letter do not differ significantly from one another).

<table>
<thead>
<tr>
<th>Streetscapes</th>
<th>Design Review Mean (SD)</th>
<th>Rank Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.878 (1.120)</td>
<td>246.5</td>
</tr>
<tr>
<td>F</td>
<td>2.065 (1.253)</td>
<td>271.5</td>
</tr>
<tr>
<td>C</td>
<td>3.130 (1.324)</td>
<td>402.5</td>
</tr>
<tr>
<td>E</td>
<td>4.146 (1.823)</td>
<td>527.5</td>
</tr>
<tr>
<td>D</td>
<td>4.390 (1.697)</td>
<td>557.5</td>
</tr>
<tr>
<td>B</td>
<td>4.537 (1.410)</td>
<td>557.5</td>
</tr>
</tbody>
</table>

Table 15: Mean scores for Streetscapes by Treatment Condition.

<table>
<thead>
<tr>
<th>Streetscapes</th>
<th>$NT_{NG}$</th>
<th>$NT_{G}$</th>
<th>$TN_{G}$</th>
<th>$T_{G}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.742 (1.032)</td>
<td>1.767 (1.073)</td>
<td>1.742 (1.094)</td>
<td>2.258 (1.237)</td>
</tr>
<tr>
<td>F</td>
<td>2.290 (1.395)</td>
<td>1.733 (1.143)</td>
<td>2.323 (1.166)</td>
<td>1.903 (1.248)</td>
</tr>
<tr>
<td>C</td>
<td>3.290 (1.419)</td>
<td>2.833 (1.289)</td>
<td>3.226 (1.383)</td>
<td>3.161 (1.214)</td>
</tr>
<tr>
<td>E</td>
<td>3.710 (1.716)</td>
<td>4.167 (1.621)</td>
<td>4.581 (1.911)</td>
<td>4.129 (1.996)</td>
</tr>
<tr>
<td>D</td>
<td>4.323 (1.376)</td>
<td>4.867 (1.570)</td>
<td>4.323 (1.376)</td>
<td>4.645 (1.305)</td>
</tr>
<tr>
<td>B</td>
<td>4.968 (1.538)</td>
<td>4.233 (1.736)</td>
<td>4.129 (1.708)</td>
<td>4.226 (1.746)</td>
</tr>
<tr>
<td>Streetscapes</td>
<td>Expected Ranking</td>
<td>NG</td>
<td>G</td>
<td>T_NG</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------</td>
<td>---------</td>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 16: Obtained rankings for each streetscape by treatment condition.

<table>
<thead>
<tr>
<th>Streetscapes</th>
<th>No Guidelines</th>
<th>Streetscapes</th>
<th>Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td></td>
<td>M (SD)</td>
</tr>
<tr>
<td>A</td>
<td>1.742 (1.055)</td>
<td>F</td>
<td>1.820 (1.190)</td>
</tr>
<tr>
<td>F</td>
<td>2.306 (1.275)</td>
<td>A</td>
<td>2.016 (1.176)</td>
</tr>
<tr>
<td>C</td>
<td>3.258 (1.390)</td>
<td>C</td>
<td>3.000 (1.252)</td>
</tr>
<tr>
<td>E</td>
<td>4.145 (1.854)</td>
<td>E</td>
<td>4.148 (1.806)</td>
</tr>
<tr>
<td>D</td>
<td>4.323 (1.364)</td>
<td>B</td>
<td>4.230 (1.726)</td>
</tr>
<tr>
<td>B</td>
<td>4.548 (1.666)</td>
<td>D</td>
<td>4.754 (1.434)</td>
</tr>
</tbody>
</table>

Table 17: Mean scores and SD for Guidelines No Guidelines.

<table>
<thead>
<tr>
<th>Streetscapes</th>
<th>No Tool</th>
<th>Streetscapes</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td></td>
<td>M (SD)</td>
</tr>
<tr>
<td>A</td>
<td>1.754 (1.043)</td>
<td>A</td>
<td>2.000 (1.187)</td>
</tr>
<tr>
<td>F</td>
<td>2.016 (1.297)</td>
<td>F</td>
<td>2.113 (1.291)</td>
</tr>
<tr>
<td>C</td>
<td>3.066 (1.365)</td>
<td>C</td>
<td>3.194 (1.628)</td>
</tr>
<tr>
<td>E</td>
<td>3.934 (1.672)</td>
<td>B</td>
<td>4.177 (1.713)</td>
</tr>
<tr>
<td>D</td>
<td>4.590 (1.487)</td>
<td>E</td>
<td>4.355 (1.951)</td>
</tr>
<tr>
<td>B</td>
<td>4.607 (1.666)</td>
<td>D</td>
<td>4.484 (1.340)</td>
</tr>
</tbody>
</table>

Table 18: Mean scores and SD for Tool No Tool.

Table 18 shows the streetscapes arranged from most liked to least liked for No Tool and Tool. People have E ranked higher in NT than the T condition.
An analysis of effects of Guidelines and Tool on rank ordering of the streetscapes did not show statistically significant effect for Guidelines, Tool or significant interactive effect for Guidelines x Tool (F(df)= 0.304 p=0.582) or Guidelines by Streetscapes (F(df)= 1.651 p=0.145).

As with the houses, a pairwise comparison to see if Look-Time correlated with rank ordering of streetscapes showed no significant effect.
CHAPTER 6

CONCLUSION

The project that formed the basis of this dissertation had two main purposes: First I wanted to develop and implement a distributed information system integrated with a learning and decision aiding tools for environmental design research. I accomplished that goal, developing and deploying a prototype system called IMMEDRIS. I also sought a user friendly system that would improve design decision tasks.

The results showed the system was user friendly, but it did not improve design decision making. Various reasons might account for the lack of improvement in design review decision making for the tool. Perhaps the system should have evaluated respondent assimilation of provided research knowledge before they were required to make design review decisions. Perhaps respondents did not use the tool for a sufficiently long period of time. Perhaps it did not have a diverse enough range of examples. If you think of the typical architectural history course, students are exposed to a series of lectures and examples for at least one or more quarters/semester. Perhaps the results were presented as a series of fragmentary valuations based on characterization of properties as aesthetically valuable. Maybe such fragmentary valuations cannot enable a total evaluation (Schumaker, 1950 p. 25). Perhaps because respondents were not in a real
design review decision context, they may not have focused on the task. Perhaps because they received the guidelines after using the tool, the guidelines could not help guide the use of the tool.

Future research could expose respondents to a broader knowledge base for a longer period of time. It could test the provision of good and bad examples with comments explaining the differences. Once testing in the lab shows that the system works, a broader test in the field using the different user groups identified should be carried out before the tool is applied. On-going refinement, testing, and refinement should continue to improve the functioning of the tool. As the tool improves, it can help real users improve the human aspects of environments for all of us. The fact that the provision of research knowledge did not improve decision task provides a feedback for the continuous refinement of the system. Perhaps the provision of “empirical evidence” does not necessarily “lead the mind from a recognition of observable properties to a judgment of the value of the properties” (Schumaker, 1950 p. 22). In other words, there is the problematic issue of how much inductive or deductive procedure “is necessary to establish the judgment” (ibid.). Future research might investigate how an adequate relationship between description and evaluative judgment can be established – one that does not presuppose an unsustainably clear separation between normative and non-normative factors in the evaluative process. For example, commonplace concepts in environmental design research such as “moderate complexity” “coherence”, “moderate order”, and similar terms are typically phrased as descriptive terms. However, such terms
also “have value connotations because they presuppose that the phenomena to which they refer ‘demand’ a positive value judgment (Pleydell-Pearce, 1959 p. 32-33).

The test centered on aesthetics, which more often than not requires intuitive responses. In this regard, IMMEDRIS allows for normative teaching of environmental design. If completely implemented it may well provide an information-rich learning environment by giving the learner more control over the information presented. However, the system is configured for many kinds of environmental behavior research knowledge including, cognition and perception, post occupancy evaluation, behavior in different settings, universal design, and visual quality. When fully implemented, the system can be used by neighborhood groups to provide input into extant environmental design decision making. The system can also be used to study evolutions in public preference judgments over time. As Hempel (1965, p. 87-88) has noted, “value judgments accepted [even] without further justification in a given context” do not have to “be accepted once and for all.” They do not involve “a commitment never to question them again” (ibid.). In short, with refinement and testing the system can become useful for both educators and planners to learn and guide environmental design decisions.
LIST OF REFERENCES


Loudon, J. C. The landscape Gardening and Landscape Architecture of the late Humphry Repton, Esq (1840 Reprinted 1969). Gregg Internations


