Reference and Citation in Design Research

Ken Friedman
Professor of Leadership and Strategic Design
Department of Communication, Culture, and Language
Norwegian School of Management
Design Research Center
Denmark’s Design School

Research Writing Workshop
Third International Conference on Design Research
Rio de Janeiro
Brazil

October 2005
Abstract

Good referencing is central to the growing literature of design research for four main reasons: reasoned argument, access to common evidence, building the field, and improving the intellectual and practical quality of the discipline.

This article outlines the foundations of referencing and citation. It clarifies central issues in referencing and citation. It discusses literature review as an exercise linked to good referencing and it offers resources and tools for design research.

Most important, it discusses the role of evidence in analyzing and solving problems in design research. While some design problems involve taste and interpretation, most design arguments rest on statements of fact. Statements of fact have truth-value established by evidence. References make evidence accessible distinct from the person and claims of the writer. By providing evidence for reasoned argument, good referencing and citation serves both the field of design practice and the discipline of design research.

A challenge to the value of referencing and citations is sometimes heard in design research circles. This challenge questions the value of good referencing and citations to research and practice in design. This article will address the misunderstandings that give rise to these challenges.

About the Author

Ken Friedman is Professor of Leadership and Strategic Design at the Norwegian School of Management in Oslo, and at Denmark’s Design School in Copenhagen. His research focuses on knowledge economy issues and organizational learning, as well as design theory and the philosophical and scientific foundations of design research. Friedman has a long-term interest in curriculum development and problem-based learning.

Friedman is also a designer and artist who had his first solo exhibition in New York in 1966. He has been active in Fluxus, the international experimental laboratory for art, design, and architecture. His work is represented in major museums and galleries around the world, including the Museum of Modern Art and the Guggenheim Museum in New York, the Tate Modern in London, and Stadtsgalerie Stuttgart.

Copyright © 2005 Ken Friedman
Young field, recent literature

The field of design research is relatively new. The design research literature is also new, and most of the literature was written during the past five decades. Design history is a modest exception to this recent development, allied to the somewhat older literature of art history and criticism. This is a sharp contrast to literature in other fields.

The literature of some fields dates back thousands of years. Theoretical mathematics, for example, dates to the sixth or seventh century before Christ. While we have fragmentary knowledge of mathematical discoveries before Socrates, the first comprehensive mathematical treatise is Euclid’s geometry. Written in the third century BC, it is still in use today.

The literature of applied mathematics is far older. The Egyptians used numbers and geometry by 5,000 BC. They developed the first known calendar around 4,200 BC. By 3,500 BC, the Sumerians were inscribing clay tablets with cuneiform, documenting financial transactions and tax records. The arts of applied mathematics and geometry were taught in civil service schools and scribal schools, and rudimentary guides described the practical uses of applied mathematics (de Camp 1963 18-114; Ifrah 1998; Kline 1990: 30-79; Lloyd 1970, 1973; McLeish 1991: 29-51, 73-92; Ochoa and Corley 1995: 4-19; Wertheim 1997: 18-37). The literature of mathematics evolved from these rough and practical beginnings.

Other fields have a literature nearly as old. Philosophy, astronomy, physics, biology, medicine, literature, and music all date their literature to the centuries before Christ. So does civil law. Jewish theology began in the millennium before Christ. Christian theology began in the first century with the Gospels and St. Paul. Canon law began soon after. The literature of design, only fifty years old, has barely begun.

An integrative field with a vast literature

While our literature is young in one respect, it is old in another. The integrative nature of design and design research make us heir to a far larger literature than our own.

Friedman (2000: 10-12) describes design as an integrative field located at the intersection of several large fields. Design research involves pure research, applied research, and clinical research. In one dimension, design is a field of general thinking and pure research. In another, it is a field of practice and applied research. When applications are used to solve specific problems in a specific setting, it is a field of clinical research.
The field of design involves domains of theoretical study and domains of practice and application. The domains of theoretical study are linked to (1) the natural sciences, (2) the humanities and liberal arts, (3) and the social and behavioral sciences. The domains of practice and application are linked to (4) the human professions and services, (5) the creative and applied arts, and (6) technology and engineering.

This model (Friedman 2000a: 10-12) conceptualizes design and design research in a framework of practicing fields and research disciplines. Design projects – and design research – may involve any or all of the six domains in differing aspects and proportions depending on the nature of the project at hand or the problem to be solved.

This frame also raises the possibility of drawing on a vast literature across many fields. Design practice is eclectic and pragmatic, a goal-oriented process to 1) identify, find, and solve problems, 2) meet needs, 3) improve situations, or 4) create something new or useful. Solutions depend on problems, how we find and select them, how we frame and delimit them. In Jens Bernsen’s (1986) famous phrase, “the problem comes first.” In a vital sense, solutions are embedded in the problems they solve.

In the larger sense of the term, a “problem” may be any of several things: “a question raised for inquiry, consideration, or solution,” “a proposition in mathematics or physics stating something to be done,” “an intricate unsettled question,” “a source of perplexity, distress, or vexation” (Merriam-Webster’s 1990: 937). A problem may not be an undesirable situation, but rather a frame for invention or creation. In both cases, we seek to improve current situations through design.

To solve problems, we must understand them. This requires analytical skill, a vocabulary of patterns, and a stock of knowledge. We can solve some problems using clinical rules of thumb and behavioral modeling. We can solve a far larger range of problems through applied research. Applying large-scale principles to understand objects and processes in a more general way can solve even more problems. This larger understanding does not negate the direct, situated knowledge of clinical practice. It does not contradict the professional knowledge of applied practice. Rather, it permits a deeper, richer inquiry that leads to robust, sustainable solutions in contrast with the unsustainable or problematic solutions that frequently arise from incomplete analysis.

When he accepted the presidency of MIT in 1930, Karl Taylor Compton (quoted in Simon 1982: 131) emphasized the need for a scientific approach to the kinds of applied and clinical problems that engineers and other designers frequently address. Compton’s inaugural address stressed the fundamental sciences, calling for a close examination of engineering and design courses “to see where training in details has been unduly emphasized at the expense of the more powerful training in all-embracing fundamental principles.”
This concept is central to Herbert Simon’s (1982, 1996) concept of the design sciences. One need not adopt all of Simon’s views on the method and epistemology of science to recognize the value of a systematic approach to design.

Friedman (1997) applies the concept of design science to design education and research. Design sciences are technical or social sciences that focus on how to do things to accomplish goals. Design sciences emerge when skills-based professions move from using traditional rules of thumb or trial-and-error methods to using theory and scientific method. Many forms of design are at this point now. This trend is visible in an emerging transition from an arts-and-craft field to a theory-based field that draws on techniques from the arts and crafts as well as drawing on the techniques of other fields and disciplines.


Fifty years ago, there were no regular research conferences in design. Today, a growing body of research associations host a regular series of refereed conferences, each attended by well-edited proceedings. These include the Design Research Society, the Design Society, design research societies in China, Taiwan, Japan and Korea, the new International Association of Societies of Design Research, the European Academy of Design, and more. All of these host regular conferences.

There are also regular thematic conferences such as the International Conference on Design Research taking place here. Others include Design and Emotion, Doctoral Education in Design (DED), International Workshop on Strategic Knowledge and Concept Formation (SKCF), Conference on Human System Learning (CAPS), Computers in Art and Design Education Conference (CADE), Computational and Cognitive Models of Creative Design, Co-designing, European Association for Creativity and Innovation (EACI) Conference on Creativity and Innovation, Participatory Design Conference (PDC), the International Conference on Design and Technology Education Research and Curriculum Development (IDATER), and more, as well as research and education conferences for Cumulus, the International Congress of Societies of Industrial Design, and other educational and professional societies.

There has also been a rich series of thematic conferences on design research issues at University of Art and Design Helsinki, Ohio State University, Milan Polytechnic University, La Clusaz, and elsewhere. These have grown so numerous in recent years that a comprehensive list would be impossible.
This growth suggests a growing literature and a growing understanding of why developing a literature is important.

Tore Kristensen (1999: unpaged) articulates the concept of a progressive research program for design. A progressive research program involves eight characteristics. Progressive research requires us to:

1. Build a body of generalized knowledge,
2. Improve problem-solving capacity,
3. Generalize knowledge into new areas,
4. Identify value creation and cost effects,
5. Explain differences in design strategies and their risks or benefits,
6. Learn on the individual level,
7. Generate collective learning,

(Kristensen 1999: unpaged; Friedman 2000a: 23-24)

The literature plays an important role in this program. It makes specific results and findings available to the field as a whole. It builds a stock of generalized knowledge to improve problem-solving capacity for the profession as a whole. It helps to generalize specific knowledge into new areas. A robust, accessible literature is a foundation for the individual learning of design scholars, researchers, and practitioners. It is a central medium of collective learning and meta-learning.

Literature today includes documents and information in many media: traditional books, journals and printed documents; on-line journals and digital document collections; CD-ROM, DVD, and digital media; discussion lists; e-mail exchanges and documentation; Web sites and Web-based media. Access to the large and growing body of literature requires referencing and citation.

The problem of access grows when – and because – a field or discipline improves. Rich and increasingly vast information resources give rise to the challenge of information overload. Wilson (1996: 21-33) notes that these problems reshape the epistemology and social structure of a science at the same time that they give rise to inefficiencies.

Hjorland’s (1996: 53-59) analysis of the meaning and consequence of these inefficiencies suggests that they are not merely problems in their own right, but symptoms of a deeper problem in many fields. While scholars debate the nature of the problem and its possible solutions, the challenge of overload continues to increase.
When Lyman and Varian (2000b) studied the quantity of information generated around the world five years ago, they concluded that we produce two exabytes of data every year. An exabyte is roughly 1,000 times the contents of all the research libraries in the United States. Ninety-three percent of all information produced each year is digital, but we still produce 1,200 terabytes of printed information. Of this, 12 terabytes is text (Lyman and Varian 2000b: 11). The entire collection of printed materials stored in the United States Library of Congress is roughly ten terabytes (Lyman and Varian 2000a). Five years ago, we produced a full Library of Congress worth of new text materials every year and a fifth as much again. With the increasing growth of new media products, these figures have grown since that time. Between text resources and text-based digital resources, a lot of looking is needed to understand and put our information to effective use.

**Why referencing and citation are misunderstood**

In a thread on the PhD-Design discussion list, a leading design professional (Curedale 2001 unpaged) wrote, “teachers are sometimes more concerned about the traceability or accuracy of statements rather than whether statements present progress in ideas. Teaching is about understanding the existing body of knowledge. Teaching is about knowing the past to prepare students to deal with the future. There is no greater crime for a teacher than to quote inaccurately or to show poor scholarship.”

This short paragraph suggested several kinds of confusion. It failed to distinguish between studio teaching, research teaching, and research. It also suggested a failure to understand the purpose of research literature. This lack of understanding is common in many fields of professional practice. It is troubling for two reasons.

The first reason is that a successful and highly respected practicing designer represents both advanced professional knowledge and the gaps in understanding that typify many design professionals. The second is that this statement was published on a research list. PhD-Design is a forum for the exchange of ideas on research and research training. This is the last place one would expect a failure to understand the value and use of literature.

While the author of that post was an active contributor to many lists in design education and research, he comes to an interest in research without a research background. This flavored both his interest and the gaps in his perspective. Five years later, Rob Curedale is a professor and chair of product design at the College of Creative Studies in Detroit. He has also been developing bibliographies and using the research literature. Nevertheless, many of the ideas in the post to PhD-Design remain common in the field.
It is easy to answer the challenges implicit in that long-ago post.

First, there are many kinds of teaching. These include studio teaching and research teaching. While studio teachers are not concerned about traceable and accurate statements, neither is progress in ideas their central focus. Studio teaching has many components. The first of these is developing skills. Progress in applied or developmental research is secondary to most studio education and pure research is irrelevant. This is one of the major problems facing studio education today.

The challenge of training tomorrow’s designers for the tasks they will face represents a core issue for the future profession. Compton addressed these challenges and distinctions for university administration in the 1930s. Simon raised these issues for professional education and practice in the 1970s. There is a growing consensus that these issues are becoming central to studio design practice and training practitioners (Byrne and Squires 2001; Byrne and Sands 2001; Friedman 2000b, 2001; Swann and Young, 2000). The ability to conduct, understand, and interpret research is an increasingly important skill for the professional designer in a global economy built on information and industry.

Medical practice and medical research offer a useful comparison. These are distinct fields, and relatively few physicians are working researchers. To practice successfully, however, physicians must learn the research basics. They must know how to understand and interpret research. They must be able to follow the literature and adapt research findings into practice.

Progress in ideas is one goal of research. Progress in practice is another, and they are related. Traditional practice is communicated by traditional means. Individual skills are developed through training and honed through repetition. Improved practice rests on the ideas and theories developed and tested in research. This includes clinical and applied research as well as pure research. Some designers fail to recognize research as a source of progressive ideas and practice. They do not understand how research leads to progress, and why.

Progressive research in many fields resembles Kristensen’s progressive research program in design: developing a body of generalized knowledge, improving problem solving, generalizing knowledge into new areas, creating value and reducing costs, understanding differences in design strategies and their risks or benefits, increasing individual learning, increasing collective learning, and increasing meta-learning. Few designers would argue against the value of these goals. What bothers them about research is the apparent slow time-scale on which progressive research yields results.
Many designers impatient with the slow progress of research argue that we need better answers urgently because designers face urgent situations. The fact that we need answers urgently does not guarantee us the answers we need. In many cases, we must design our way to solutions by making repeated and wasteful mistakes along the way. In many cases, these wasteful mistakes create new problems, and some of these problems exacerbate the initial situations that required urgent answers.

The painful reality of professional practice in every field of human activity is that we struggle with real situations. Sometimes we succeed. Sometimes we muddle through and survive. We often fail. History teaches us that failure and extinction are the most common fates of products and services, companies and organizations, governments and nations, societies and cultures, species and the environments in which they live.

The hope and value of research is that we may learn more and do better than we have done in the past. In many cases, the urgency of our situations requires that some of us muddle through, succeed, or fail, while others engage in research to learn how to reduce the failure rate. This is not a happy situation. It is the human situation. We are able to do better than we have done. We can work on meaningful problems. This is our basis for what psychiatrist and philosopher Viktor Frankl so movingly described as tragic optimism.

Most scholars in design research have heard of Thomas Kuhn’s (1962, 1970) path breaking work on the structure of scientific revolutions. In every field – and design is no exception – this work is more often cited than read.

It is easy to imagine scientific progress as a rapid cascading flow of revolutionary change. The reality is that the scientific revolution spanned five centuries. The growth of western science took far longer if we start with the first appearance of theory-driven empirical research in the twelfth and thirteenth centuries. That is when Robert Grosseteste, Pierre de Maricourt, Roger Bacon, and others undertook their pioneering work. The scientific revolution was launched in earnest by the seventeenth century when the first scientific journals and learned societies were formally established.

These were typified and embodied by the Royal Society, chartered in 1662 to pursue knowledge in purely scientific terms (Boorstin 1985: 386-417). Their motto was a celebration of inquiry “Nullius in Verba,” -- Take nobody’s word for it. See for yourself. According to Boorstin, (1985: 394) “The new currency of knowledge was the product of a special form of experience, to be known as experiment.”
Experiment was not sufficient by itself. The growth of science from imitation to exploration required critical inquiry and the free exchange of ideas among colleagues. The appeal to empirical validation remains a central process in science today, and it is through documentation that we open every claim to empirical validation. To the degree that designers demand direct experience, they should demand research. This is not often the case. The quality of temperament that leads designers to seek solutions often impels them to seek swift solutions, sometimes before they analyze the problems.

Revolutions take many years, and swift solutions are rarely swift. The revolution in physics is a good example of this. The revolution of classical physics spanned four centuries from the birth of Galileo in 1564 to the death of Einstein in 1955. This revolution required the hard-won discoveries of Kepler, Newton, and all the rest along the way.

Einstein was more than one of the first great figures in the quantum revolution. He was one of the last great figures in classical physics. The foundation of classical mechanics built on the work of Kepler and Newton remains valid physics to this day. Each step toward “progress in ideas” is won by building on the foundation of what comes before. The durable revolution of science looks backward and forward at the same time. Literature plays a subtle, complex role in the revolutionary venture.

To understand an existing body of knowledge means more than memorizing facts. It requires a robust knowledge of issues and relationships. The reason that past knowledge prepares students to deal with the future involves developing a sense of relevant issues and patterns more than it involves remembering a group of disconnected facts.

This is why understanding the existing body of knowledge is so often a foundation for revolutionary science. Referencing is central to accessing a body of knowledge and making appropriate use of the past.

Many design practitioners seem to view proper referencing as irrelevant to design practice. Worse, they fail to see how referencing supports the growth of individual knowledge on a basic level and the generalized growth of knowledge at the levels of the group, the community, the field, and the discipline.

Given the notion that referencing is no more than an inexplicable custom cherished by fussy academics, it is difficult to demonstrate how the art of referencing enables us to know and understand current and past knowledge. This understanding paves the way to revolutionary ideas.
Jeremy Bernstein (1993: 15-27) writes that a mastery of current and past knowledge helps to explain why the physics community of 1905 realized that Einstein was not a crank. While many physicists questioned or disagreed with Einstein’s revolutionary ideas, few dismissed him. Bernstein explains this as a consequence of two vital distinctions between crank research and innovative science. One criterion is “correspondence.” The other is “predictiveness.”

Correspondence involves the ways in which a new proposal melds with prior art. Correspondence means that a new theory explains earlier theories and models at a deeper and richer level. “I would insist,” writes Bernstein (1993: 18) “that any proposal for a radically new theory in physics, or in any other science, contain a clear explanation of why the precedent science worked. What new domain of experience is being explored by the new science, and how does it meld with the old?”

Correspondence and predictiveness explain a mistaken notion that many designers hold about scholars. Contrary to the belief of those who do not understand the value of good referencing, scholars are not essentially troubled by inaccurate quotations or poor scholarly mechanics. What troubles a scholar in the inaccurate use of material is the failure to correspond effectively with empirical reality. Since cited material constitutes evidence. The problem of an inaccurate quote is a failure to deal responsibly with evidence.

A quotation does not belong to the quoting scholar. It belongs to the cited body of evidence. It belongs to what we sometimes describe as the knowledge of the field. Responsible scholarship demands respect for evidence. The problem of poor scholarship is related to predictiveness. Every software designer knows that bad input yields bad output. Garbage in, garbage out. When poor scholarship puts garbage in, garbage will come out.

Three more misunderstandings on the value and uses of literature are common in our field.

Five years ago, an article by John Wood (2000a) challenged the value of rigor in design research. This article typified common misunderstandings. The argument against the culture of academic rigor mistakes names with substance. While the critique was written as a complaint against the nominalism of medieval scholasticism, it confused rigid scholasticism with rigorous research norms. Rather than understanding literature as a developing and shared discourse, the author conflated all academic literature into what he described as “the Book.”
Elsewhere Wood (2000b: unpaged) confuses “the reproducible accuracy of (alphabetical) text” with research validation, adding, “the practice of design does not usually call for something to be authenticated in this way. An intuitive or tacit knowledge version of this truth may therefore be more practically helpful if it is less bound by the rigours of the Book.” He calls for an “evolving digital networked culture [that] enables us to wake up a collective process of co-creation (shared re-invention) of the truth in a dynamic way.” He does not seem to understand that this is exactly what scientific and scholarly communication has done for the past four centuries.

The other two misunderstandings are common enough that most of us have experienced them.

One is the superstitious notion that scholars cite prior scholarship simply because it is what scholars do. In this view, referencing and citation lie somewhere between a tribal ritual and a cargo cult practice. This ritual is performed to attract scientific or scholarly rewards. It is sometimes intended to overwhelm the reader with the author’s authoritative knowledge to make an argument more acceptable than it otherwise might be.

These views are distortions and misunderstandings. They arise when teachers fail to explain the purpose and logic of citation to students. While research students soon move beyond this notion, practitioner students sometimes move into practice without realizing the purpose, value and usefulness of research – and of the references and citations that give them access to research literature.

The last notion is stated as a cynical joke that reveals a misinterpretation of citation. One sometimes hears that “stealing from one author is plagiarism. Stealing for many authors is research.”

This is nonsense. The point of referencing and citation is the exchange of ideas. Proper citation constitutes payment for a scholar’s work in the exchange economics of science and scholarship. These are exchange economies and attention economies. Using a scholar’s material and making it visible is an act of exchange that leads to attention. Since referencing and citation are the major payment in the exchange of ideas, there is no theft. The cynicism of the joke suggests an unhealthy attitude toward scholarship that leads me to question the joker who repeats it, not the practice of reference and citation.

It is useful to know what referencing and citation are not. It is valuable to recognize that we do not refer and cite for these mistaken reasons. Let us now consider the real basis of referencing and citation.
Understanding referencing and citation

References are guides to evidence found in publications and documents. A proper citation enables the reader to locate that evidence.

To understand referencing and citation involves three major issues. The first involves understanding how to use the evidence to which citations refer in developing an argument. The second involves the logic of reference and citation practice. The third involves mastering the mechanics.

Chris Hart’s (1998) book was the first large-scale contribution to the research literature on the specific art of using references to develop an argument. This skill is central to every field of research. Despite its importance, few authors explain how to do it. This skill has been transmitted from master researcher or teacher to apprentice researcher or student. Interestingly, the transmission has often involved the tacit knowledge of research as a practice in contrast with the explicit knowledge of research subject fields.

Most of the discussion on using and citing references is found in the context of other topics, especially books on research methods and the growing literature on earning a research degree. In their book on evidence and argument, Phelan and Reynolds (1996: 110-126) ask, “What counts as evidence?” To answer the question, they discuss documentary sources and how to use them. Similarly, Redman et al. (1998: 36-45) discuss how to support an argument and Denscombe (1998: 158-171) provides a chapter on documents.

Many research guides address the mechanics of locating and developing evidence at length. Books on earning a research degree generally do not. These tend to focus on personal development issues, career management, and related themes. Some books suggest that finding and using literature effectively is a self-evident process can simply be mentioned in passing. Francis (1997: 26-27) mentions literature search in a discussion of how to develop an argument without discussing why – or how – to use the literature. While the book in which Francis writes is a guide to “working for a doctorate” (Graves and Varma 1997), the brief comment that Francis makes in passing and several items in an annotated bibliography appended to a chapter on writing (Hartley 1997: 109-112) are the only comments in the book. Like many such books, this book is useful though far less comprehensive than its title and cover comments suggest.

Some excellent books on earning a doctorate and writing a dissertation focus on the scholar’s personal needs and personal development without discussing research skills (Bloom, Karp, and Cohen 1998; Bolker 1998; Ogden 1993). Some offer selected notes on developing and using the literature review (Fitzpatrick, Secrist, and Wright. 1998: 11-14; Mitchell 1996: 110-115, 119-120; Peters 1997: 200-201). Others discuss the role and purpose of literature review without discussing the mechanics (Sternberg 1981: 92-97).

Scholars in design research will find two books particularly valuable for their discussion of the literature search.

The first is Gary Holt’s (1998) guide to successful dissertation study for students of the built environment. Developed for research candidates in one design field, it offers a perspective that will help scholars in other areas. The book offers a good, general overview of the literature review, a helpful discussion of seeking sources, and a basic discussing of reference and citation (Holt 1998: 52-78). Holt’s perspective is that prior work is the beginning of any research project. His book makes a good case for the relationship between literature review and the practice-oriented research that typifies design fields. While Holt’s focus is architecture and construction, the principles can be usefully applied to most areas of design research.

The second is Chris Hart’s (1998) guide to doing a literature review. Addressed to scholars in the social sciences, Hart presents a comprehensive perspective on the literature review as a research tool. He discusses the role of literature in research. He explains how reviewing earlier work releases the imagination rather than constraining it. He shows how to classify and read research literature, how to analyze arguments, and how to organize and express ideas. He also teaches the reader useful ways to map and analyze the ideas that each body of literature reveals. Finally, he demonstrates in careful, clear stages how to develop and write the literature review. At each point, Hart develops a serious, well-reasoned explanation that helps the scholar to understand why each step is important and how to do it well. While Hart (1998: 209-212) restricts his discussion of the reference and citation mechanics to a brief appendix, these issues are not central to the main topic.
Karl Weick (1989) describes theory construction as an act of disciplined imagination. Hart’s guide is a beautifully developed and genuinely comprehensive description of how effective use of earlier literature can release the research imagination to create new knowledge.

**The purpose of referencing and citation**

To understand the logic of referencing and citation, it is helpful to understand the goals of the practice.

Librarians and scholars in information science have conducted citation analyses and studies for many years. See, for example, Lipetz (1965), Duncan (1981), or Hodges (1978). This literature often discusses the reasons for citation and referencing. Cronin’s (1984) monograph on the role and significance of citation in scientific and scholarly writing builds on these three studies and others to analyze the reasons for reference citations.

B. A. Lipetz (cited in Cronin 1984: 37) suggested a series of relational indicators structured into four groups:

**Group 1 Original scientific contribution or intent of citing paper**

1. Description of observed phenomena
2. Data transformation
3. Explanation
4. Hypothesis or theory
5. Calculation from theory
6. Prediction
7. Definition or notation
8. Statement of experimental technique

**Group 2 Contribution of citing paper other than original scientific contribution**

9. Review article
10. Bibliography
11. Data cumulation
Group 3 Identity or continuity relationship of citing paper to cited paper

12 One or more authors in common
13 Same text
14 Abstract or condensation
15 Erratum
16 Continuation
17 Precursor
18 Inclusion

Group 4 Disposition of the scientific contribution of the citing paper to the cited paper

19 Noted only
20 Distinguished
21 Reviewed or compared
22 Applied
23 Improved or modified
24 Replaced
25 Changed the precision (plus or minus)
26 Changed the scope of applicability (plus or minus)
27 Questioned
28 Affirmed
29 Refuted
E. B. Duncan et al. (cited in Cronin 1984: 40) proposed a list of 26 reasons for citation:

1 Paying homage  
2 Background reading  
3 Historical  
4 Bibliographical leads  
5 Narrative  
6 Definition  
7 Clarification  
8 Illustration  
9 Example  
10 Experimental detail  
11 Theory  
12 Data  
13 Methodology  
14 Description  
15 Current concerns  
16 Development of ideas  
17 Disputing  
18 Criticism  
19 Corroboration  
20 Disclaiming  
21 Substantiation  
22 Similar research  
23 Contradictory research  
24 Further detail  
25 Same paper  
26 Statistics

Hodges (cited in Cronin 1984: 42) offers ten broad characteristics:

1 Evidential  
2 General informational  
3 Historical  
4 Sibling  
5 Oppositional  
6 Corroborative  
7 Specific informational  
8 Documentary  
9 Methodological  
10 Corrective
Reference and citation in design research

Design and design research always engage a world of experience external to the self. A designer accepts a problem on behalf of someone else. This is usually explicit. In the case of invention or creation, it may involve an implied user, client, or consumer. The success of a design solution is determined by how well it meets the needs of the person or people whose problem it attempts to solve or whose situation it attempts to improve. Design problems have a status independent of the designer and the designer’s tastes and personal desires.

While some design problems involve taste and interpretation, most design arguments rest on statements of fact. Statements of fact have truth-value established by evidence. References make evidence accessible distinct from the person and claims of the writer.

Interpretation and understanding are important to all debates – including scientific debate. Interpretation in these debates also rests on evidence. The distinction between interpretation and assertion in reasoned debate is that an author makes available the evidence that he or she interprets while presenting a well-developed foundation for the interpretive stance.

An article on referencing and citation cannot present a comprehensive philosophy of science. Neither does this article present a philosophy of design research. It is nevertheless worth stating that the issues in this article will concern those who agree in some general sense with three propositions.

(1) There are objective facts and subjective positions external to the individual consciousness of any one person.

(2) These are accessible to all persons through a reasonable and reasoned combination of intellectual, emotional, and sensory awareness.

(3) Research has something to do with understanding these realities. The purposes of research range from pure understanding and interpretation to developing and shaping future reality.

To say that any interpretation is equal to any other is a weak foundation for research when it is transformed into the assertion that any statement, view, or position is so because its authors wishes it to be so.

Each author or speaker has the unquestioned right to state his or her tastes, feelings, and beliefs. If an account is honest, none of us has the right to challenge such a statement. When someone writes, “I want,” “I like,” “I prefer,” and “I believe,” the statement alone is sufficient evidence.
Many of the kinds of statements we encounter in research – including design research – involve other kinds of statement.

Sentences that state, “is,” “is the case that,” “was,” or “I believe BECAUSE. . .” involve reality outside the work and ideas of the writer. Such claims rest on evidence.

In contrast, argument from authority – “It’s so because I say it” – is unacceptable in scholarship and science. (Other well-known arguments from authority have included the idea that “It’s so because Aristotle says it” or “It’s so because the Bible says it.” A more recent variation of appeal to authority seems to be, “It’s so because Foucault says it.”)

Argument without evidence – “You can rely on my account of the evidence without checking for yourself” – is equally unacceptable in scholarship and science.

The worlds of scholarship and science are based on a radical democracy of ideas. While individual scholars and scientists clearly hold differing positions, with differing stature and rank, all scholars and scientists are equal in one important regard. None is above the judgment of the field.

All scholarly and scientific claims are appeals to the judgment of the field. Any scholar or scientist who offers an appeal based on evidence or argument from evidence may appeal any claim at any time.

In a research field, there is rarely a single vote on any topic as there is in a formal debate or an election. Nevertheless, every field of progressive research involves debates. The voting behavior of the community in each field is recorded in the shifting currents of consensus and opinion that define a field.

As in ordinary politics, some have greater access to the press, some voices are heard in grander forums, and some have bigger campaign budgets. Nevertheless, as in every democracy, each member of a research community has one vote. As slow as the process is, the cumulative power of individual votes make the scholarly and scientific communities the most radical, durable, and reasonably effective democracy known to us.

To make this democracy work, we must weigh the evidence and judge the evidence on which we base our conclusions. These cumulative judgments establish the consensus of a field. References provide evidence that enable us to judge for ourselves.
Evidence

Scholarly and scientific evidence takes several forms. Most involve reports of first-hand experience and discovery. This includes reports of experience and discovery by persons other than the writer. When these reports take the form of second-hand reports, the writer must provide a reference that allows the reader to locate and use the earlier report in original form.

In theory, these reports should offer rich enough detail that others may share or reconstruct the experience in a way that allows each reader to judge evidence and the degree to which an author has used appropriate method.

This is also the case with interpretive methods where the subject of interpretation is the author while the object of interpretation lies outside the author. Interpretive research is obliged to demonstrate sources so that others may reach their own conclusion.

Good referencing is central to the growing literature of design research for four main reasons:

1. Reasoned argument,
2. Access to common evidence,
3. Building the field, and
4. Improving the intellectual and practical quality of our field.

The first and most important reason for good reference practice is reasoned argument.

Reasoned argument is first of all argument from evidence. We apply reasoning to evidence to adduce findings. This allows us to reason out our debates without regard to personal position or authority. It also means that we are not required to rely on the common understandings that cultures, sub-cultures, or groups within a field may share.

Common understandings are vital to communities of practice. Professional development requires them. In many cases, they are good. In research, however, argument from evidence requires a foundation in explicit knowledge. Research in an integrative discipline that crosses several fields demands a foundation in explicit knowledge. The understandings that a scholar shares with colleagues in a home discipline will not be common to some of his or her readers. Common understanding therefore demands explicitly developed arguments from evidence.

This is only possible when all have access to evidence. Good referencing and citation make evidence available to all on equal terms. It also helps to develop the common understandings of a developing field.
There have been occasional suggestions on design research discussions lists, in conference papers, and even in some journal articles that good reference and citation practice is a form of academic elitism that excludes one constituency or another from debate. This is not so.

Good reference and citation practices in a research community serve precisely the opposite goal. Referencing and citation are the foundation of the most radical democracy there is: the democracy of science and scholarship.

As scholars and scientists, we are obliged to make evidence available to anyone who wishes to examine it. It does not matter whether they wish to examine our evidence to support us or to challenge our views. The right of our colleagues to examine our evidence is central to research. We are obliged – required – to provide the evidence that warrants our claims. First-hand reports are one form of evidence when we ourselves have done all aspects of the work. Careful reports with full description document our claims. Since we document these claims in the report we present to our readers, evidence is internal within the document. When evidence is not internal, proper citation and referencing makes the evidence available to all.

The second reason for good referencing and citation flows from the first. Access to common evidence is vital to open and free discussion in any field. This would be true even if design research were an axiomatic field such as mathematics, with its long history and a broad range of common agreement on valid proofs and established foundations. It is even more vital in a young field still struggling to develop philosophies, methods, and research programs.

Design research faces a specific challenge that characterizes several interdisciplinary and multidisciplinary fields. Design and design research involve professional practitioners and scholars with many backgrounds. We must share evidence – information, ideas, issues, and facts – to build a common body of knowledge.

We have among us experts in many fields who do not share a common expertise. References demonstrate the basis of arguments that do not depend on personal experience. They also serve as a form of evidence that frees us from the kinds of logical argument that may reasonably be adduced from shared experience. While logical argument has a place in research, it must begin with an explicit premise. The kinds of logical argument that rest on the tacit knowledge of shared experience are inappropriate in research, at least for research in a developing and transdisciplinary field.

The third reason follows from the first two. It involves developing our field and our discipline. The field and discipline of design research are new and emerging. They are integrative. Scholars and scientists, researchers and professional practitioners from many backgrounds are constructing the field and discipline of design research.
For the field and the discipline to develop, we must eventually develop a common language across our pluralities of background, practice, and knowledge to begin an integrative knowledge base for design research.

Fourth and finally, presenting evidence for truth statements and interpretive validity raises the level of debate, improving the intellectual and practical quality of our field and discipline.

Far too much debate in design rests on assertion. Conference debates, seminar debates, and discussion list exchanges often take the form of “Is.” “Isn’t.” “Is too!” “Is NOT!” This is also implicit in a considerable number of publications that operate on the level of assertion despite taking the form and structure of research papers. This does not build the field. Neither does it improve the effectiveness of design practice. It constitutes a kind of solipsism that leads to little more than a contest between individuals based on what Jan Verwijnen (1999) has called “position without discourse.”

To demonstrate evidence for an argument shifts the foundation of debate from a contest between individuals to an argument among competing positions. Each position has the possibility of merit. Evidence enables us to determine the merits of an argument.

The radical democracy of research

Even though idealized accounts of scientific research and practice do not describe the reality of science, science and scholarship rest on critical inquiry, reason, and argument from evidence.

Only a field that relies on evidence can develop a radical democracy of research. Argument from evidence makes intellectual democracy possible.

Good citation practice is not a form of academic elitism. It is the evidence of intellectual humility and reverence for truth.

However, referencing and citation mean more than this. They lead not merely to a better academic discipline. They open the way to better and more effective professional practice.

Richard Buchanan once reported a conference of professional designers that discussed a new and emerging area of design. In this conference, a leading professional designer discussed the benefits of referencing and citation for professional practice.
Rick Robinson of Sapient and a former principal of e-Lab “observed to the group that citation has not been a cultural practice within the professional design community. He went on to explain that this is a serious weakness. In essence, by failing to cite the origins of an idea or a distinction in terms (usually emerging in a published article or in a conference presentation) the design community seems to be forever reinventing the wheel – and failing to give encouragement to shared ideas and methods. Whether from a misguided sense of competition, misguided ideas about pragmatics of design practice, or simple neglect, professional designers miss the opportunity to develop the field. He explained the cultural practice of citation and reference in academic research – why it is done, how it is done, and with what consequence. He also pointed out how other fields of professional practice do, indeed, have a cultural practice of citation and reference and how that has strengthened those areas” (Buchanan 2001: unpaged.)

Buchanan (2001: unpaged) views this change as “a sign of coming maturity in design, recognized by a leading practitioner.”

The empirical tradition of argument from evidence is anchored in practice. The requirement of demonstrating evidence is as firmly rooted in the tradition of professional practice as in the tradition of academic science and scholarship.

Robust argument from evidence is one of the distinguishing differences that separate modern science from medieval scholasticism. Citation and referencing point to evidence, in contrast to the earlier tradition of logical argument based on citation from precedent. Generalizing and demonstrating evidence for the widest possible review is what distinguishes the evidence of a sound argument from the evidence of private experience.

Referencing and citation make this possible.

This builds our field of practice just as it builds the discipline of design research.
References


Curedale, Rob. 2001 [010206]. “Silly” PhD-Design [Discussion list on doctoral education in design hosted at JISCMAIL]. Date: Tue, 6 Feb 2001 00:59:25 –0500.


