Reference, Argument, and Evidence

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Abstract

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.

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.

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.

Publishing Note

This document began as a working paper on reference and citation issues. After several different versions, I am revising and updating it for publication. The current version is an attempt to bring most of the earlier drafts together in one document. The effort has not been entirely successful. The section containing “Ten Principles of Reference and Citation” from earlier drafts does not appear here. The principles appear on page 21.


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Reference, Argument, and Evidence.

How good referencing and citation serve design research and professional design practice

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Young field, recent literature

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

Many bodies of literature extend back thousands of years. Theoretical mathematics, for example, dates back to the sixth or seventh century before Christ. We have fragmentary knowledge of mathematical discoveries before Socrates. The first comprehensive mathematical treatise is Euclid’s geometry, dating back to the third century B.C. It is still in use today.

The literature of applied mathematics dates back even further. Numbers were in use by the Egyptians as long ago as 5,000 BC, together with geometry. They developed the first known calendar around 4,200 BC. By 3,500 BC, the Sumerians were inscribing clay tablets with cuneiform documents, many of which were records of finance and taxation. Ancient mathematicians and geometers prepared rudimentary guides to describe the practical uses of applied mathematics, and they taught these arts in civil service schools and scribal schools (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 St. Paul and the Gospel writers. Canon law began soon after. In comparison, the literature of a field that goes back only fifty years has barely begun.

As young as design literature is, the field has a literature nevertheless.
An integrative field with an interdisciplinary 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 (2000a: 10-12; 2012: 144-151) 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 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.

A circular model represents the design fields (Friedman 2012: 149). A horizon bisects the circle with domains of theory and inquiry above over domains of practice and application below. Each of these domains is divided into three equilateral, pie-shaped wedges.

The wedges represent six general domains. Moving clockwise from the upper left-most wedge, these domains are (1) natural sciences, (2) humanities and liberal arts, (3) social and behavioral sciences, (4) human professions and services, (5) creative and applied arts, and (6) technology and engineering.

[Figure 1 somewhere about here. Copy Figure 1 from Figure 4 in Friedman 2012: 149.]

Friedman’s (2000a: 10-12; Friedman 2012: 149) model [Figure 1] 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 raises the possibility of drawing on a vast literature across many fields. Design practice is often described as eclectic and pragmatic, oriented toward solving problems. Solutions depend on problems. In Jens Bernsen’s (1986) famous phrase, “the problem comes first.” In a vital sense, solutions are embedded in the problems they solve.

To solve a problem, we must understand it. This requires analytical skill, a vocabulary of patterns, and a stock of knowledge. Some problems can be solved using clinical rules of thumb and behavioral modeling. A far larger range of problems can be solved through applied research. Applying scientific 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 leading to robust, sustainable solutions in contrast with the unsustainable or problematic solutions that frequently arise from incomplete analysis.
When he took on 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 scientific 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.

The growing number of peer-reviewed scholarly and scientific journals in design is a visible sign of the transition. None of these journals existed fifty years ago. Today, this growing group of journals includes: Design Studies; Design Issues; The International Journal of Design; Design Science and Technology; The Journal of Design History; The Journal of Design Management; She Ji: the Journal of Design, Economics, and Innovation; Art, Design, and Communication in Higher Education; Design, Business, and Society; Design and Culture; The Design Journal; and many more.

Fifty years ago, there were no regular research conferences in design. Today, several research associations host regular refereed conferences with well-edited proceedings. These include the design research societies of Japan, Korea, and Taiwan; the worldwide Design Society, the worldwide Design Research Society; and the International Association of Societies of Design Research to which they all belong. All hold regular conferences. There are regular thematic conferences for the Design and Emotion Society; International Conference on Design and Technology Education Research and Curriculum Development (IDATER); the International Workshop on Strategic Knowledge and Concept Formation (SKCF); the Design Thinking Research Symposium (DTRS); the Participatory Innovation Conference (PINC); the Conference on Human System Learning (CAPS); Computers in Art and Design Education Conference (CADE); Computational and Cognitive Models of Creative Design; Co-Designing; the European Association for Creativity and Innovation (EACI) Conference on Creativity and Innovation; and more. There has also been a rich series of thematic conferences on design research issues at universities around the world, including Aalto University, Ohio State University, Milan Polytechnic University, Swinburne University of Technology, Curtin University of Technology, and more.
This growth involves 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:

“1. Building a body of generalized knowledge,
2. Improving problem solving capacity,
3. Generalizing knowledge into new areas,
4. Identifying value creation and cost effects,
5. Explaining differences in design strategies and their risks or benefits,
6. Learning on the individual level,
7. Collective learning,
8. Meta-learning.”

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

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.

The literature of the field includes formal publications in journals, conference proceedings, and books, along with an extended literature of documents and information in many media. These include CD-ROM publications, doctoral theses; discussion lists; e-mail exchanges; Web sites and Web-based media, technical reports, government reports, corporate documents, patent files, and more. Access to this large and growing body of literature requires referencing and citation.

The problem of access grows when a field or discipline improves, and it grows because the field or discipline improves. Rich and increasingly vast information resources give rise to the challenge of information overload. Wilson (1996: 21-33) argues that information overload problems reshape the epistemology and social structure of a discipline while giving rise to inefficiencies. Hjørland’s (1996: 53-59) analysis of the meaning and consequence of these inefficiencies suggests that these are more than problems in their own right. They are 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.

Lyman and Varian (2000b, 2003) studied the quantity of information generated around the world to conclude that we now produce more 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:
The entire collection of printed materials stored in the United States Library of Congress is roughly ten terabytes (Lyman and Varian 2000a; 2003). We produce a full Library of Congress worth of new text materials every year and a fifth as much again. 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 one of the many threads on the PhD-Design discussion list, a well-known designer once 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.”

While this designer long ago changed his views to produce a major body of work documenting the design literature, these statements suggest several kinds of confusion that remain common the field.

This position fails to distinguish between studio teaching, research teaching, and research. It also suggests a failure to understand the purpose of research literature. This is troubling for two reasons. The first is that many successful and highly respected designers represent both advanced professional knowledge and the gaps in understanding that typify the professional field. 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.

It is easy to answer the challenges in this comment. 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, progress in not their central interest. Studio teaching has many components. First among these is skills development. 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 central to studio 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 how to apply research findings in professional 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 development with which progressive research yields its results.

Like scholars in most fields, scholars in every corner of design research have heard of Thomas Kuhn’s (1962, 1970) 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 nearly six centuries. The growth of western science took far longer, starting with theory-driven empirical research in the twelfth and thirteenth centuries 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,” – Don’t accept anybody’s word for a scientific fact: 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.” However, 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 or to falsification.
Designers demand direct experience. This should mean that they demand research. But designers are by nature impatient, and the same attributes that lead designers to seek solutions often impel them to seek swift solutions. They sometimes settle on solutions before they analyze problems.

The revolution in physics was not a swift affair. Rather, the revolution of classical physics spans four centuries from the birth of Galileo Galilei in 1564 to the death of Albert Einstein in 1955. Along the way, Kepler, Newton, Faraday, Maxwell, Planck, and many more made hard-won discoveries. We sometimes forget that Einstein was not merely one of the first great figures in the quantum revolution. He was also one of the last great figures in classical physics. The classical mechanics that Kepler and Newton built 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 revolutions of science look 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. This is far more important than remembering a group of disconnected facts.

Understanding the existing body of knowledge is one foundation of revolutionary science. Here, too, 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 a group, a community, a field, and a discipline. They believe that referencing is an inexplicable custom cherished by fussy academics. Given this perspective, it is difficult to demonstrate how the art of referencing to know – and understand – current and past knowledge 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 both explain why so many designers are wrong to believe that scholars are essentially troubled by inaccurate
quotations or poor scholarly mechanics. What troubles a serious researcher about 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. 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.

There are four common misunderstandings about the value and uses of literature.

Fifteen years ago, The Design Journal published an article challenging the value of rigor (Wood 2000a). 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. He adds that “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.” Wood 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 scientific and scholarly communication have done this for the past four centuries. (Wood’s article contained numerous factual errors about the history of research literature and the evolution of universities. He based much of his argument of errors of fact. This must be one the least accurate articles ever published in a peer reviewed journal, an example of careless reviewers who were impressed by the show of false erudition arguing about historical facts they did not themselves know well enough to question.)

The final three misunderstandings are anecdotal, but common enough that most of us have experienced them.

First is the superstitious notion that scholars cite prior scholarship as a practice oriented toward the past, rather than toward the progressive development of the field. In this view, referencing and citation are tribal rituals that resemble cargo cult practices. In this view, researchers perform these rituals to attract scientific or scholarly rewards.

Second is the view that referencing and citation constitute little more than argument from authority. In this view, authors use references to overwhelm
the reader with a sense of authority that makes an author’s 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. Research students soon move beyond these notions. Practitioner students often move into practice without realizing the purpose, value and usefulness of research. They do not understand the value of references and citations in providing access to research literature.

The third notion is stated as a cynical joke revealing a misunderstanding 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, not the practice of reference and citation.

It is useful to recognize that we do not refer and cite for these reasons. Let us now consider the real basis for 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. 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.

Research guides generally address at length the mechanics of locating and developing evidence. 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 blurbs 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).

Design research scholars 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 of the design fields, it offers a perspective that will be helpful to scholars in other areas. The book offers a good, general overview of the literature review, a helpful discussion of seeking sources, and a basic discussion 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 some aspects of this book focus on 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 this 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 references. 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 developed a series of relational indicators for citations. Lipetz (cited in Cronin 1984: 37) structured these indicators 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. 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. 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 involve truth claims or validity claims. We establish truth or validity by evidence. References make evidence accessible to readers as 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 is not the place to consider a comprehensive philosophy of science. Neither will this article establish a philosophy of design research. It is nevertheless worth stating that the issues in this article are important to researchers who agree in some general sense on three propositions.

(1) Research involves objective facts and subjective positions external to the individual consciousness of any one person.
(2) Information about these objective facts and subjective positions is 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 argue 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 speaker has the unquestioned right to state his or her tastes, feelings, and beliefs. Assuming that 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 statements we encounter in research – including design research – are of another nature. Sentences that state, “is,” “is the case that,” “was,” or “I believe BECAUSE . . .” involve recourse to a 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. Well-known arguments from authority have included the claim, “It’s so because Aristotle says it” or “It’s so because it is written in the Bible.” More recent variations of appeal to authority involve such statements as, “It’s so because Latour says it.”

Another unacceptable argument in research, scholarship, and science is an argument that makes claims to evidence without demonstration: “You can rely on my account of the evidence without checking for yourself.”

The worlds of research, scholarship, and science are based on a radical democracy of ideas. Individual researchers, scholars, and scientists hold different jobs and positions with differing stature and rank. Despite this fact, all researchers, scholars, and scientists are equal in one important way. None is above the judgment of the field.

All research claims, all scholarly and scientific claims are appeals to the judgment of the field. Any researcher, scholar, or scientist may challenge the claim of any other at any time. While there is rarely a single vote as there is in a formal debate or an election, the members of all research fields nevertheless engage in a continual debate. Their votes are recorded in the shifting currents of consensus and opinion that define any field. As it is in ordinary politics, some people have greater access to the press. Some voices are heard in grander forums. And some of us have bigger campaign budgets. Nevertheless, as it is in every democracy, each of us has only one vote. While the process is slow, the cumulative power of that vote makes scholarly and scientific research communities a radical form of durable and reasonably effective democracy.
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
3. Building a field
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. Some forms of reasoned argument do not require empirical data, but they require evidence nonetheless. Logic and mathematics are cases where the evidence required for reasoning is a statement of assumptions or premises.

But some forms of logical argument require both assumptions and evidence if they are to permit responsible truth claims. As Lewis Carroll (2000 [1887]) demonstrated with amusing results, it is possible to reach logically valid conclusions that are utterly ridiculous when we start with false premises.

While a logical argument may in theory be valid, it is evidence that demonstrates the truth value of a statement about the state of affairs in the world. Albert Einstein’s (1906) paper on Brownian motion used logical and
mathematical analysis to demonstrate the physical reality of atoms in the well-known phenomenon of Brownian motion. Einstein himself did not empirical research: he presented the logically necessary conclusions that followed from an analysis of well-known facts. These were indeed well-known facts established over decades of documented experimentation. Einstein’s genius was to understand the necessary entailments of facts that others had long before seen and described. If these facts had been mistaken or inconclusive, Einstein’s article would not have had the revolutionary effect of demonstrating the physical reality of atoms at a time when many physicists thought of atoms as a heuristic device rather than a physical fact. Interestingly, Einstein’s article contained citations only to Einstein’s own prior work and to a standard physics text. The facts and formulas in his paper were so well established that they required no references. But Einstein did make an explicit mathematical argument from the formulas he used.

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.

Design is an integrative discipline that crosses several fields. Research in an interdisciplinary field such as this 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 research.

As researchers, 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. Our obligation to provide the evidence is absolute. Along with first-hand reports, 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 a 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 also faces a 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, nor 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
While idealized accounts of scientific research and practice fail to describe the reality of science, science and scholarship continue to 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.

Over a decade ago, Richard Buchanan attended a meeting of professional designers to discuss a new and emerging area of design where a leading professional designer discussed the benefits of referencing and citation for professional practice. Rick Robinson – now of Sapient and formerly principal of e-Lab. Buchanan wrote about this to an online discussion, stating that Robinson “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 rather than the earlier tradition of logical argument based on citation from precedent is one of the distinguishing differences separating modern science from medieval scholasticism. 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.
Ten Principles of Reference and Citation

1. Use citations constructively to substantiate the argument of an article.

2. Use citations creatively to advance the argument of an article.

3. Argue the case of the article in the explicit narrative. External sources support the argument.

   External support for the argument cannot replace the author’s argument. Do not confuse the two.

4. Use precise, fine-grained references that permit the reader to locate quoted material at the exact location in the source document. Fine-grained references allow the reader to examine, question, challenge and learn from cited sources.

5. Treat direct quotations, indirect quotations, and paraphrases the same way. Give precise references for all quotations and cited sources. This helps the reader while building and supporting the knowledge of the field.

6. Review and re-read cited passages from referenced sources. This ensures correct quotes and accurate paraphrasing. Reviewing sources helps the author to use the source text effectively. It allows the author to reflect on the quoted material for added depth and development.

7. Never use second-hand references from other articles. Always check cited sources first hand.

8. Never use loose or vague references


   Every item in the reference list must appear in the text.

10. Each source cited in the text requires an appropriate citation in the text and an entry in the reference list. Every entry in the reference list must be complete. All citations and all references must use the same style. All citations and references must be complete and consistent to be correct.

   (Friedman 1998)
References


About Ken Friedman

Ken Friedman works at the intersection of design, management, and art. His research focuses on strategic design and value creation for economic innovation. Friedman has done research in theory construction, research methodology, philosophy of design, doctoral education in design, knowledge management, and philosophy of science. He has done design policy studies for Australia, Estonia, Latvia, Lithuania, Norway, and Wales. In 2007, Loughborough University awarded him the degree of Doctor of Science, honoris causa, for outstanding contributions to design research.

Friedman is Chair Professor of Design Innovation Studies at Tongji University College of Design and Innovation, and University Distinguished Professor at Swinburne University of Technology Centre for Design Innovation, where he formerly served as Dean of the Faculty of Design. He is Adjunct Professor at the James Cook University School of Creative Arts, and Visiting Professor at the University of Technology Sydney Business School.


Friedman is a practicing artist and designer, active in the international laboratory of art, design, music, and architecture known as Fluxus. In 2015, James Cook University will tour an international exhibition of Friedman’s Events.

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An extended biography and bibliography of Ken Friedman is available in PDF format at:

http://swinburne.academia.edu/KenFriedman

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