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ledge created by esoteric investigations. Both the breadth of its content and the complexity of its techniques are beyond the scope of landscape architecture. Science requires quantitative analysis and is reported in language that is largely unintelligible to landscape architects. Consequently, it should be left only to experts.

These experts may be educated in disciplines which are related to landscape architecture but they are specialists not designers. The role of the landscape architect in academic and, rarely, in practice is to integrate the research results of others, the scientists, so that science becomes applicable to design.

However, few landscape architects are capable of independently posing research questions and conducting scientific investigations. They dilute their real strength as designers by attempting to do research. When landscape architects need to know about geology or wildlife biology, they can turn to science for information, but they are not well-advised and generally not qualified to do science.

## Bringing Science to Landscape Architecture

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“We are not a science; we are not a trade; we are dealing with a fine art. We want to hold our ideals to those higher levels.” (James L. Greenleaf, President ASLA 1923-26, address at 26th annual meeting, January, 1925)

The purpose of the Society shall be the advancement of education and skill in the art of landscape architecture as an instrument of service in the public welfare. (Article II., Section I., ASLA Constitution, 1982)

The purpose of the Society shall be the advancement of knowledge, education, and skill in the art and science of landscape architecture as an instrument of service in the public welfare. (Article II., ASLA Constitution, 1985)

Landscape architecture has only recently come to identify itself as a science. Even for those who acknowledge science as a legitimate and fundamental aspect of the profession, integration of science and landscape architecture continues to be problematic. For some, science stands clearly outside of design. Design is art. While science may provide information for design, it is a separate sphere of activity. Others see the science of landscape architecture as limited to research in university settings. It is motivated more by onerous institutional requirements than by its worth to the profession. A more expansive view is that all landscape architects, by using design processes, are doing research; science is intrinsic to design.

Posing the question of integration suggests that science is not opposed to art, and science in landscape architecture should not be isolated to universities, but that design process is not science. Rather, it suggests that landscape architecture is distinct from science and can be strengthened by borrowing from it. This implies that science is not only for academics but for the broadest spectrum of practitioners. Consequently, professional degree programs should foster the integration of science and landscape architecture.

### Three Views of Landscape Architecture and Science

Three widely held and divergent views dominate perceptions of the relationship of landscape architecture and science. The resolution of these views suggests new approaches to practice and new directions for curriculum and course design in professional degree programs.

1. *Landscape architects may be users, but not doers of science.*

In this view, science is a body of objective know-

2. *Some landscape architects do research, but they are not designers and may not even be landscape architects.*

In another view, some landscape architects do scientific research, but they are maverick academics, and as such, may not truly be landscape architects at all. The work they do may inform the content of design, but it is not design. Most often their research is motivated by expectations of the universities rather than by any real need of the profession.

Design is essentially art and conflicts with science in both techniques and content. While design communicates with images, science communicates with words and numbers. While design is intuitive, science is rational. While design is subjective, science is objective. Design seeks the unique, the rare. Science seeks the common, the generalizable.

Academics who do research may not be good teachers. They may substitute the abstractions of theory for the common knowledge of practice. Worse, they may stifle the creative impulse because they lack commitment to design as art.

While academic research may be about landscape architecture, the process of research is essentially different from design. At best, research may peripherally affect practice. At worst, it may provoke a schism between academics and practitioners.

3. *Landscape architecture is a science; the design process is a form of research.*

A third view has it that nearly all landscape architects do research, because the design process and the scientific method are much the same. Both approaches involve intuitive discovery of analogous relationships; both involve testing of intuitive concepts against sensed data.

It follows that nearly all environmental inquiry is the legitimate realm of landscape architecture. As new projects arise, the landscape architect may become familiar with a new literature and may gather a new kind of data, but professional expertise in problem-solving enables the designer to deal with even the most novel situations. He or she is a generalist *par excellence*.

### Strengths of Science for Landscape Architecture

These views tend to substitute limited ideals and stereotypes of science for its reality. If one moves from the paradigms of science or art or design to their actual practice, commonalities appear. The specialized knowledge of each endeavor must be respected, and their ends should not be confused, but their means are similar and could grow to be more so. Science speaks to design in useful and direct ways, and could address the need for more effective teaching and more widely credible practice.

The commonalities of science and design may be overlooked if research is confused with science. Research is a specific and fundamental aspect of science, but it does not define all scientific activity. Limiting science to the narrow confines of hypothesis testing in research excludes its cultural and philosophical base. If we strip the white lab coat and necessity for number-crunching from science, we may find that scientific procedures and, more broadly, the culture of science can reinforce design processes. Design does not become science as a result. Instead, design students may become more independently directed, designers may become more articulate advocates of their work, and the work itself may respond with greater sensitivity to its context.

The strengths of science for landscape architecture can be summarized by the following concepts:

- CONNECTEDNESS
- CONVENTIONS
- COMMUNICATION
- CREDIBILITY

#### CONNECTEDNESS

Connectedness is the most key attribute of science for landscape architecture. In science, one's work is explicitly connected to historical and contemporary work. Three devices for making connections are: 1) thorough referencing of work, 2) peer review, and 3) building on models presented by past work.

#### Referencing

Referencing, at its best, allows work to respond not only to current conditions but to be a dialogue with the past. Landscape architecture references include both built works and literature. The value of their use goes beyond stylistic trends. References may not immediately reveal themselves in form, as in post-modern design. Their more fundamental value is in providing a context for design.

Since the Renaissance, design has valued originality.

Science, in contrast, has valued advancement. The difference is in working from a platform of past achievements. While both design and science seek novelty and expansion, science probes new frontiers with maps and diaries of past travelers in hand. Landscape architecture more typically sets afoot with great gusto for the adventure but little preparation.

The onus for providing landscape architects with references and the knowledge of how to use them falls on educators. Yet the traditional studio, the most familiar and comfortable format for design education, does not support this task. While it may be an efficient setting for transmitting process, it is not suited for transmitting information. A different format, one communicating a consistent, shared vocabulary, is implied. Instructional media from lectures to videos might be appropriate.

The use of references calls for a basic shift in the role of educators, one that emphasizes the accumulation of knowledge and expertise rather than the exercise of master judgments. Consistent with that shift, referencing also presents a clear opportunity for educators to reduce their reliance on project evaluation as a form of learning. Recognizing and using a shared knowledge base, educators can emphasize specific guidance throughout the design process. The knowledge base becomes a foundation for enabling students. The studio instructor becomes a source of information, of design options, and a helping critic rather than only a neutral guide in process or an apparently subjective judge.

#### Peer Review

Scientists are connected to the ongoing work of their colleagues by a second important device: peer review. While review of research proposals and proposed publications is intended for evaluation of work, its effect is less that of a final judgment than that of a helping dialogue. The reviewer attempts to show his or her colleague how the work can be improved. In the process, the reviewer learns about ongoing work related to his or her own research.

There is little concern for protecting one's own proprietary interests here. Scientists view their work as a team effort in the broadest sense. Communication between individuals working on similar problems is recognized as beneficial to all the participants.

Both the design cult of originality and the marketplace setting for most landscape architecture work against this kind of sharing in practice. But in design studios, formal peer review sessions have proven extremely valuable.

One example is the use of work groups. Typically, 25 students in a design studio might be divided into 5 work groups; each group working in its own section of the studio space. Group members formally review each others work at several points throughout the term. They also brainstorm and do some group projects together. In the end, the students develop not only their abilities to generate ideas but also their abilities to critically evaluate and articulate their ideas. Interestingly, stylistic and conceptual similarities of design become apparent within work groups. The students seem to become increasingly open to learning from each other.

Finally, scientists typically use past research projects, their own or others, as methodological and theoretical models for their own work. The use of models not only allows the scientist to make meaningful improvements or adaptations without “reinventing the wheel”, it also provides a test of the models themselves. A technique or theoretical explanation that succeeded in one situation work can be tested in another. Once again, both the work of the individual adapting the model and the state-of-the-art are strengthened by purposeful use of the past.

Emphasizing design process, educators have often avoided providing students with models for their work. The argument has been that the creative process might be polluted by this kind of intervention. Rather, presenting students with excellent past work as models for their own, specifically related to a design studio project, can be a springboard for their own creativity.

Similarly, project critiques which present students with positive options for their work may be more instructive than critiques which only react to students’ work. The implicit assumption is that the educator has not only experience with process but real knowledge to share with the student.

### *Implications*

The American Society of Landscape Architects (ASLA) has recognized the value of connectedness in adding “the advancement of knowledge” to its purpose (1983) and in its policy on research (1980). But the implications for education are only beginning to be realized.

Design studios must continue to allow students to practice design processes and create formal solutions. But students’ explorations can be strengthened by connectedness to others’ work. Pedagogical techniques designed to transmit knowledge (lectures, media presentations, reduced emphasis on evaluation, work groups, the use of model projects, content-oriented critiques) present students with a platform for their learning and to bring into practice. At the same time, these techniques are likely to make for a more efficient, more carefully planned curricular structure – one that clarifies curricular relationships and allows educators to build knowledge and expertise over time.

### COMMUNICATION, CONVENTIONS, CREDIBILITY

Other aspects of the culture of science support its connectedness. The popular image of the scientist as an eccentric individual isolated in the laboratory misleads in this respect: the scientific method and conventions for communication are widely shared. While the individual may work alone, he or she does not work in isolation from the clear standards and expectations of colleagues. Science’s strong internal models and standards present a credible public image, one of expertise and nearly uniform high quality.

#### *The Scientific Method and the Design Process*

Scientists recognize that the linear progression repre-

sented by the scientific method is frequently inconsistent with the real process of research. Discovery can come at odd and unplanned times. The real value of the scientific method is not in rigidly prescribing process but in evaluating and communicating research. The method is a universal standard which clarifies the research process.

The design process, on the other hand, lacks a single, specific paradigm. Rather than communicating their own design work within the limits of a broadly defined process, landscape architects are more likely to define their own processes – not very different from the one their colleague might have described on a similar project, but their own nevertheless. What landscape architects gain in individuality, they may well lose in credibility.

Educators cannot presume to impose a generalized design process on the profession; but an exchange which defines that process in specific terms is basic to building a knowledge base. In teaching, clear description of a process, without rigid adherence, gives students a basis for testing and communicating their creative ideas.

#### *Problem-Solving Focus*

Scientific communication is characterized by its clear and widely recognized conventions. At a basic level, some disciplines have their own style books for journal articles and reports. Most have a few widely respected journals for the communication of new knowledge (sometimes with many lesser lights). Within a discipline, scientists know which journals, organizations, and meetings have certain content emphases and which have certain stylistic requirements.

The advantage of this kind of predictability is that it takes care of the mundane aspects of finding information and organizing ideas to make room for more pivotal issues. Rather than thinking about how to walk, the scientist can consider which door to go through.

In landscape architecture, the focus of problem-solving is sometimes dominated by the form of communication at the expense of content. Without conventions for communicating either design or research, each landscape architect must solve a new communication problem with each project, and the public must recognize landscape architecture work in widely varying packages. Even within the profession itself, communication is more difficult without conventions.

The profession’s first academic journal, *Landscape Journal*, this journal, and interest group sessions at ASLA annual meetings have been fundamental steps toward introducing predictability in both the format and fora of landscape architecture communication. These are vital. But the where and how of communicating much landscape architecture literature and built work remains unclear. Consequently, it is often unreported, and sometimes misunderstood.

By using the conventions that have been begun and providing conventions for their students’ work, educators set up a means of communication and comparison. For example, graphic conventions can be set up for a studio. Or students can be required to document and record their

work in a uniform format at the end of each term. As a result, landscape architecture may move toward more complete and credible communication.

### *Words and Images*

While landscape architects necessarily communicate with images, science and most of the rest of the world communicate primarily with words, spoken and written. The paucity and dryness of most scientific imagery leaves much to be desired, but science often pairs words and images for highly convincing effect.

The power of images is unmistakable. More than any other aspect of the profession, landscape architecture's use of images presents shared conventions and an aura of expertise. Yet, unless images are paired with equally articulate verbal presentations, they lose their credibility.

Beyond establishing public credibility, words are fundamental to evaluating design. Talking about his or her work, the designer is removed from it and gains a degree of objectivity. Words can strengthen the design process for practitioners and students.

As landscape architecture educators develop their students' graphic skills, they can also nurture facility with words. Traditional studio courses typically require little reading. As use of the knowledge base is integrated with studio work, students read more. Using the knowledge base can take the form of critical evaluation of design, an opportunity for students to write. Work group reviews require students to talk about their designs, not only in final format presentations but as a means of evaluating their work in process.

### **Bringing Science to Landscape Architecture**

What might be lost if landscape architecture adapts the culture of science? Some would fear losing the openness and flexibility which characterize design. But without a framework, flexibility can deteriorate into indecision.

Science presents design not with a rigid model of analysis but a rich model of preparation and evaluation. Using science in design does not mean avoiding the intuitive leap, it means training for it.

When design exhibits the connectedness of science, individual works are conceived as part of a larger structure. They respond to what the designer knows about the work of the past and of contemporaries. The knowledge base, conventions, and expectations of the profession are present in the designer's individual creative project, resulting in work that has individual completion but that opens and expands the discipline.

This conception of design responds to the three views of landscape architecture and science described initially. Design remains distinct from science in its objectives but borrows the connectedness of science. Design and research are recognized to have similar creative cycles of idea generation and evaluation, and the culture of science is adapted to strengthen the creative cycle for design. Research becomes a model for some aspects of design. It also becomes an important source of the knowledge which

guides design.

Landscape architecture educators, trained in research and design, can draw from both backgrounds to adapt the culture of science. Research can set up the framework for and expectation of connectedness on which the entire profession can build. Curriculum and course design create opportunities for implementing these concepts.

The joy and strength of landscape architecture is in its willingness to approach the new and even to imagine it. Yet a focus on innovation can obscure the value of using past records and making intelligible new records. Without these, wandering can be mistaken for exploration and charted territory can be mistaken for new frontiers. Used as guides, strong connections to a knowledge base and to colleagues can provide perspective and direction.

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