DESIGN EDUCATION AND PEDAGOGY

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CONNECTING ETHICS AND EPISTEMOLOGY THROUGH METAPHOR

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1 ABSTRACT

It has been argued that metaphor is the basis for conceptual thinking and it has been shown that metaphor can aid learning. It has also been demonstrated through experimentation and historical studies that using different metaphors to describe the same problem can lead to different goals for improvement and, subsequently, to different courses of action. As such, uses of metaphor can greatly influence planning and design outcomes. This paper considers a narrow use of metaphor for design development through a framework that establishes and advances design as an argument for intentional change. The framework assumes a constructivist perspective in which a student gains new knowledge and synthesizes understanding by building upon prior experiences and understanding. In this framework, metaphor is used to provide a strategy to manage overall change and link concerns of ethics and concerns of epistemology. This connection calls for interrelated examinations of subjective and objective aspects of design thinking within an internally consistent argument. Relevant theories of metaphor from linguistics, cognitive science, law, public health, planning, and design are employed. Emphasis is placed on methodological and heuristic uses of metaphor, rather than discursive uses. Implications of metaphor as framing device within ethical and epistemological concerns are discussed. Second year graduate-level student projects done over several years provide examples. The work offers a basis to observe patterns of use and challenges with some metaphors for design development.

1.1 Keywords
Metaphor, Ethics, Epistemology, Design Process

1   INTRODUCTION

At the start of every project, a designer faces uncertainties about parameters or values of variables and ambiguities about relationships among variables. Areas of concern include the state of current conditions, criteria for a satisfactory outcome, and the ways and means to bring about change effectively (Newell, Shaw, & Simon, 1962). To move forward, various methods or techniques are used to represent and structure facts and assumptions. Individual methods are often combined such that the results of one method provide data for another. Additionally, the combinations are typically applied recursively to provide a heuristic learning process about the problem and possible resolutions. As sequences of methods are applied and tested for their effectiveness across projects—that is, as they are used successfully with different facts and assumptions related to different problems—they become generalized frameworks. Such frameworks provide a designer with a structured approach to practice that is independent of the qualities of any individual design problem. Specifically and significantly, generalized frameworks assume established *a priori* stable relationships among kinds of variables and information. Examples of such frameworks for environmental design include those by Alexander (1964), Lyle (1985), Rowe (1987), and Steinitz (2012).

While it might be readily accepted that generalized frameworks are helpful, it must also be acknowledged that they can be very different from one another with regard to ways individual methods are employed or emphasized. Further, it can be argued that the choice of a framework reflects the designer's willingness and ability to engage kinds of ambiguity among variables or features of a problem (Schrader, Riggs, & Smith, 1994). In this light, the use of a given framework explicitly or implicitly reveals something about a designer's fundamental attitudes about problem solving through what might be considered the *contingent logic* of a given design process.

One common technique to manage some ambiguity in planning and design is the use of metaphor (Casakin, 2006; Gerber & Patterson, 2013; Picon, Ponte, & Lerner, 2003; Solesbury, 2014; Unwin, 2019). A metaphor is a way to focus attention or filter perceptions about problems and resolutions. This paper considers the use of metaphor in design to relate concerns about ethics and concerns about epistemology. It does so within a generalized framework that views design development as making a form of argument for intentional change. This framework is summarized below and presented in greater detail in another paper (Shearer, 2015). In part, the motive for providing an expanded discussion on connections between ethics and epistemology is an interest in advancing this approach to design and pedagogy. More significantly, the last few years have seen increased scrutiny on the ways shaping the environment contributes to matters of equity and justice. Within professions, there are also questions about the production and application of specialized knowledge in situations where facts may be uncertain, underlying values may be contested, and the consequences of results may be pervasive or long lasting (Functowicz & Ravetz, 1993). Some have anticipated that changes associated with the Anthropocene—including climate change, increasing extreme weather events, urbanization, human migration, and biodiversity loss—will result in new societal orders and exacerbate political disagreement (Hoffman & Jennings, 2021; Lövbrand, Möbjork, & Söder, 2020). Under such conditions, attention to relationships between what is good and what is true are heightened and it becomes increasingly important to help students learn how to recognize their own constructions of thought and learn how to share those understandings with others. As such, connections between notions about what ought to be done and notions of cause-and-effect relationships through which the designer might act have, rightly, taken on (even) greater importance in design education and professional practice.

2   DESIGN AS ARGUMENT FOR CHANGE

The proposition that design can be understood as making an argument for change follows from the position that many problems addressed through design are not simply difficult due to uncertainty and ambiguity, but that they are also "wicked," because there is rarely agreement on ways to prioritize public goods and benefits (Rittel & Webber, 1973). This situation is especially common in environmental design, which includes architecture, landscape architecture, and urban design. As such, a design proposal is not a solution in the sense of, say, a mathematical calculation with an unambiguously correct answer, but is a

reasoned opinion for change to be discussed, debated, and decided in contested and sometimes contentious circumstances. This positioning of design as argument for change can be considered part of a broader movement to address policy- and planning-level decision making (Fischer & Forester, 1993).

If this proposition is accepted, how is the basis for an argument started and advanced through a process of design development? An argument is a claim supported by evidence and logical reasoning (Toulmin, 1958). An important part of presenting any argument is explicitly revealing connections among facts, assumptions, and opinions. Doing so allows transparency for discussion and shared decision making. Reasoning for design is often highly contingent on an array of interconnected speculations in addition to whatever facts are available. Further, a particular challenge is that because design problems are ill-defined when initially presented to the designer, the process of making an argument begins with an initial best guess or generative proposition about how to proceed. Formally, this guess is an *abductive conjecture*. This conjecture is only "something [that] may be" (Peirce, 1934, p. 106), but it nevertheless serves to structure subsequent thought about the design problem (Cross, 2007). Developing the complete argument for change involves extending, testing, and aligning the abductive conjecture with the other kinds of thought that support a reasoned outcome. This process involves active construction and recursive reconstruction of the problem and its possible resolutions across levels of abstraction and methods of representation.

The abductive conjecture can be considered a speculative, "What if…?" question. The framework used in this paper posits five basic questions. Each question addresses a different aspect of problem definition and resolution. No matter which question is used to begin a design project (that is, which is the initial abductive conjecture), all five questions are asked and answered. Further, the questions are interrelated such that each serves as a sub-framing device for the others. When using this framework, a well-made design argument displays consistency of thought across questions and levels of abstraction.

This approach of making and extending an abductive conjecture is constructivist. There are many constructivist approaches to learning and understanding (Geelan, 1997), but it is sufficient for this paper to say that it is assumed the designer or design team actively builds on known schema to understand novel problems and possible resolutions. Abductive thinking has been positioned as reflexive and interpretive in the context of constructivist approaches to design (Deming & Swaffield, 2011). The framework has been considered by others for design thinking in different disciplines ranging from business (Rindova & Martins, 2021) to linguistic composition (Jones, 2021) to higher education (Catteral, Mickenburg, & Reddick, 2019).

Table 1 lists the five elements of the framework, the phrasing of the associated "What if…?" question, and dominant forms of representation for each element and question. The column on the right provides the emphasis of each element, which may be important relative to planning student exercises or for a designer's self-awareness.

Table 1: Elements of a Framework for Design Thinking to Make an Argument for Change.

Framework Element	What if … is/are changed?	Dominant form of representation	Emphasis of thought
Image of the World	Core Beliefs	Statements of facts and assumptions	Mysticism
Challenges • Opportunities	Transformable aspects of site and program	Context maps	Materialism
Vision	The comprehensive strategy for directing change	Metaphor	Idealism
Objectives	Availalbe means to act and intended outcomes	Cause-effect models and systems diagrams	Pragmatism
Forms	Locations, dimensions, materials, and sequences of objects	Orthographic drawings, geometric models, and renderings	Realism

       A diagram of the framework is presented in Figure 1. The outer arcs are labeled with the dominant kind of reasoning that link the elements. Labels on the inside of the arcs provide the underlying topic of philosophy that is engaged. Labels on the outside of the arcs provide a common language understanding. As indicated by the double-headed arrows, conjectures for each element directly influence consideration of the two adjacent elements and are reciprocally influenced by them. Moves along arcs provide bases for supporting claims of the argument. As indicated by the dashed lines that cross in the center of the diagram, conjectures in answer to each, "What if…?" question also indirectly influence and are indirectly influenced by the remaining two elements.

       Starting near the top and right of the figure, the most abstract element of conjecture is one's image of the world. It includes all the facts known and beliefs held in the mind. It is accepted that one's image of the world is complex and may not be internally consistent. It provides a foundation for all other conjectures. Moving clockwise and through concerns of ontology or awareness, challenges•opportunities are fundamental elements in the world that could be changed. As the title suggests, they are neither inherently positive or negative. Water, sound, texture, and periodicity are examples. A given project may involve several challenges•opportunities. They are represented as context maps. Continuing clockwise and through concerns of ethics or normative principles, vision is a single overarching strategy to manage change that is possible by acting on the challenges•opportunities. A vision is represented by a metaphor and will be discussed below. Continuing clockwise through concerns of epistemology or responsiveness, objectives are specific aspects of the current situation that will be improved through designed change. That is, objectives reflect how the vision can be made operative with regard to social or biophysical aims. Objectives require the specification of cause-and-effect relationships. Systems dynamics diagrams provide an effective form of representation. Objectives may be assessed in quantitative or qualitative terms. Next, continuing through considerations of aesthetics or expressiveness are concerns of form. Least abstract, forms involve the composition of the design proposal including locations, dimensions, materials, and sometimes temporal sequences. Forms are represented by conventional design drawings and iconographic models. Forms are related to the image of the world through concerns of phenomenology or experience.
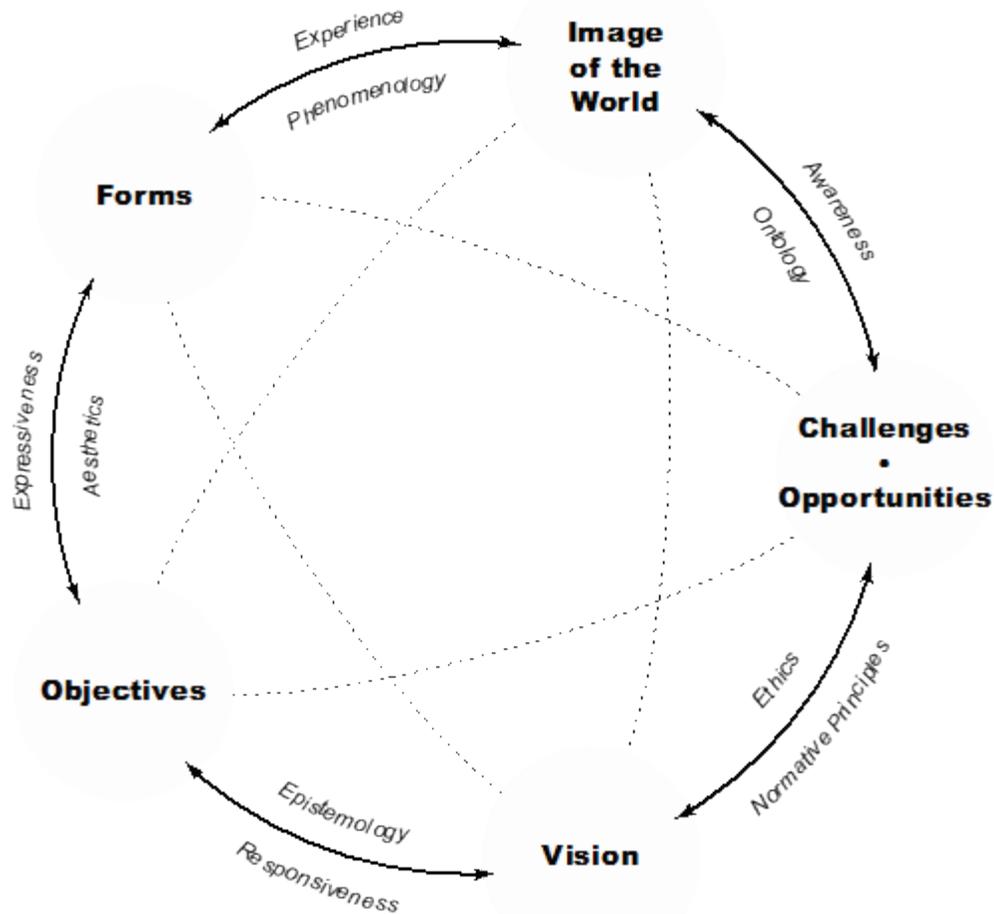
Figure 1. Framework for Design Thinking. Originally published in Shearer, A.W. (2015). Abduction to Argument: A Framework for Design Thinking. *Landscape Journal* **15(2), p. 130. Copyright 2015 by the Board of Regents of the University of Wisconsin System. Reprinted courtesy of the University of Wisconsin Press.**

In broad terms, a final argument that results from this framework is: here are the designer's core assumptions about the world; given core assumptions, here is how a particular site and site use are open to change; given what is open to change, here is an overarching strategy to improve the current situation; given the strategy, here are the ways change can be effected to meet specific desired outcomes; given ways of change, here are proposed reconfigurations of things in space and in time; and given the reconfigurations, here is how the reconfigurations conform to or modify core assumptions. A final argument might also be done in reverse order: here are the designer's core assumptions about the world; given core assumptions, here are reconfigurations that conform to or modify them; given reconfigurations, here is how they are a response to the ways change can be effected to meet specific desired outcomes; given desired outcomes, here is how the set of objectives contribute to an overarching strategy to improve current conditions; given the strategy, here is how it engages aspects of the site and site use that are open to change; given the ways change is possible, here is how they relate to core assumptions about the world. Regardless of the direction of thought (or presentation), propositions or claims at one level of abstraction are used as rationale for claims about the others.

These descriptions of a final argument do not require that a process of design development follow either sequence. To the contrary, it is assumed that the initial abductive conjecture used to structure an ill-defined problem might be made based with any of the five "What if…?" questions. The actual choice of where to begin can stem from the preference or experience of the designer, the nature of the problem, or,

in instances of design education, the learning objectives of a course. Once made, the conjecture informs how the other four elements are defined and understood as the designer moves around or across the diagram. Like with other generalized design frameworks, working to align ideas and kinds of representation requires continual reexamination of all earlier conjectures. This process can, and often does, include revision of the abductive conjecture.

An important note on the initial abductive conjecture is that regardless of the starting point within a given project, the designer has great latitude with respect to sources of inspiration and degrees of originality. Conservatively, the answer to any initial "What if…?" proposition might be inspired by conventional practices or well-known precedents. Radically, the answer might be inspired by an unprecedented condition (or, phrased for the time of this publication, by a proposition for a "disruptive" practice or technology). A mix of conservative and radical impulses might transfer ideas from one social or environmental context to another community. Here, it must be emphasized—not simply restated—that this design framework is constructivist: The designer uses what is known as a basis to extend understanding about the problem and possible resolutions. Through exploration of the extensions, learning can occur. Applied in an educational context, this aspect of the framework requires instructors to consider the kinds and amounts of novelty students should engage over a single course or over a degree plan. Conservative design propositions can result in societally beneficial outcomes and demonstrate preparedness to enter professional practice, but they might not be sufficiently intellectually challenging for all advanced students. Radical design propositions can excite and may lead to resolutions needed to tame "wicked" problems, but they can also become overwhelming with attempts to work out details. With respect to this framework, untested questions include how students at different stages of a degree plan might be helped or hindered by different required starting points (different "What if…?" questions) or by instructional expectations about degrees of novelty. Also, of note for education and for professional practice, should an individual design project aim to dramatically change someone's image of the world? Answers have been decided differently across cultures and historical eras (Kluber, 2008).

Following from this overview, the vision—overarching strategy to manage change—is typically represented by a metaphor. The vision does not exist in isolation. It is informed by its adjacent elements. On one side, the vision is informed by the fundamental ways the world is open to change by the designer and stakeholders. Connecting these possibilities and the vision are matters of ethics—values and associated kinds of conduct that are considered to be morally right or correct. Some matters about how to address any transformation will be proscribed by regulation or code, but these will not cover all possibilities (Van Gorp & Van de Poel, 2008). On the other side, the vision is informed by objectives and associated measures or indicators of impact. Connecting these models and the vision are matters of epistemology—knowledge about how the world works and how people can bring about change. The assumption underlying this three-part linkage is that wanting to do what is right or good is not sufficient to actually do what is right or good. Also, acting without a sense of what is right or good can result in unintended harm. Before looking at examples, the next section of this paper discusses relevant aspects of the theory of metaphor.

A final note on this section is that while the strategy for managing change might be the designer's abductive conjecture used to start the design process (such as an instruction to students at the start of the semester, "We will begin with the *The Green New Deal*"), the emphasis of this paper is examining how the strategy (the metaphor) is used as part of the larger design development process. The examples that will be given follow from the arguments for change as articulated at the end of the design explorations.

3   METAPHOR

3.1   Conceptualizing Metaphor

Metaphor is so widespread and so important to thought that it is studied across many disciplines including linguistics, literature, cognitive philosophy, psychology, and artificial intelligence. It has also received considerable attention in planning, design, and art (Chupchik, 2003; Gerber & Patterson, 2013; Hausman, 1989; Unwin, 2019). At a most basic level, metaphor is a kind of figurative language in which one term, the *source*, is applied to understanding of a second term, the *target*. Source and target are usually understood in the context of different fields or aspects of life, so the comparison is across domains of

knowledge (Lakoff, 1993). Features of what is explicitly known about the source are conveyed for an implicit understanding of the target (Lakoff & Johnson, 2003). While new understanding or insight may be the intent, it is not guaranteed. Metaphors are context dependent, so without some basic understanding of the source term, new understanding of the target will not occur (Martinich, 2001). Further, metaphors are linguistically slippery, since source and target are not identical objects or concepts. The inherent linguistic falsehood of metaphors has prompted warnings against their use (Horsburgh, 1958). Such cautions have also been made within the design fields (Scott, 1914). Nevertheless, it has been demonstrated that strong metaphors aid efforts to grapple with topics that are currently not understood by a person or group (Secchi, 2013). For this paper, metaphors are viewed as a form of conceptual models (Barbour, 1974). In application, they are directed, but relatively open-ended (that is, not unbounded) heuristics for discovery and learning.

Before discussing the kinds of metaphor that can enable insight, two notes should be made. First, metaphor is not the only kind of figurative language or literary trope, but distinctions with allegory, metonymy, synecdoche, and irony are not needed for all discussions (Burke 1941). In the context of this paper, all forms of figurative language can be considered as functionally equivalent with metaphor. Second, it is recognized that while some thinking is done with verbal language, thinking can also be done without it. In this light, it is accepted that metaphors are not necessary for thought, but they can aid it (Katz, 1998).

Not all uses or applications of metaphor are the same and distinctions can be made in several ways. Two approaches are highlighted to expand on their use for framing discussions that can advance arguments for design. The first approach distinguishes uses in terms of explanatory power. At the lowest level, a metaphor might denote a phenomena or practice with traces of linguistic flourish. An example is "the firm's body of work." In some of these instances, the metaphoric expression has become a literal expression over time. An example is "to curry favor" (Muir, 1985). These utterances occur frequently in everyday conversation, but do not extend or expand considerations about the world. A second kind of metaphor is comparative and is used draw out similar features between the source and the target. In these instances, the deliberate use of the word or phrase exploits some form of situational novelty to invite comparison between the source and the target. Examples are "boiling mad" and "cold as ice." Finally, a third kind of metaphor draws attention to systematic similarity between source and target. That is, more than what might be considered surface-level commonalities, there are relational similarities among features (Black, 1962; Black, 1977). Examples are "an atom is like a solar system" (with electrons orbiting nuclei like planets orbiting a star). Extensions across domains can project physical, perceptual, or spatial properties to abstract concepts and render them more understandable (Bergen, 2012). Since such comparisons happen across otherwise distinguishable entities, they can provide a basis for learning (Steen, 2008). It has been offered those abilities to make analogical comparisons of this sort are a leading reason that humans are "so smart" relative to other animals (Gentner, 2003). In this approach to categorizing metaphors, the first two types are used in professional-level discussions, just as they are in conversations about other topics; however, since they do not explicitly challenge understanding, they do not contribute to problem framing or resolution. The third kind of use, which emphasizes systemic relationships, could be the basis for design development.

A second approach to categorize the use of metaphor distinguishes the level of belief the speaker has in the strength of the relationship between source and target (De Coster, 1978). Minimally but still significantly, *discursive metaphors* provide a basis for rhetoric and means to convince. *Methodological metaphors* offer rhetorical value, but also serve as heuristics to advance a line of inquiry. That is, these metaphors do more than set a tone for discussion, they influence the structure and understanding of sub-topics. Finally, *theoretical metaphors* express an *a priori* position on first principles. Methodological and theoretical metaphors differ by degree. While a methodological metaphor might be applied to approach one or a few problems, a theoretical metaphor is applied to all problems. Minimally, metaphors for planning and design are discursive. While this use might cynically be reduced to marketing and sales ploys, it remains the case that competing designs are alternative "courses of action aimed at changing existing situations into preferred ones" (Simon, 1996, p. 111). Strong metaphors for design development are also methodological because they offer a basis to extend and test thinking about means and ends. It is also possible that metaphors for design can be taken as theoretical. Kevin Lynch's observed prevalent theories to shape cities provide examples: city as model of the cosmos, city as machine, and city as living organism

(1987). The use of theoretical metaphors, though, raises a question about overreach. If the metaphor frames the problem and possible resolutions, it necessary limits or even blinds its users in terms of goals and options for action. Christopher Alexander's essay, "A City is not a Tree," (that is, a city is not a tree diagram like the ones used in computational modeling algorithms) provides a lesson that methodological metaphors and related techniques for analysis present only limited perspectives and that metaphors are not ends in themselves (1965).

3.2   Metaphor within an Argument for Design

The framework for design thinking presented in this paper employs metaphor as a conveying an overall strategy to direct and manage change. By doing so, it follows from ideas that have been, perhaps, best articulated by Donald Schön on resolving problems. Schön is very much aware that a critical challenge in addressing social challenges is problem framing. To him, this framing is done through metaphors that underlie the stories told about the problem. He emphasizes that metaphor reveals a person's or group's perspective on the world—"how we think about things, make sense of reality, and set the problems we later try to solve" (Schön, 1993, p. 137). He refers to these perspectives as *generative metaphors*. An example is a mayor saying that, "crime is a cancer in the city." Alternative "crime is …" metaphors could include: a disease, a plague, a beast, or a war. The generative metaphor not only calls attention to aspects of the present moment, it sets a direction for possible action (Schön & Rein, 1994). Notably, because generative metaphors can be so strongly connected to a person's or group's attitude about a problem, competing metaphors may contribute to an inability to reach a consensus about how to address it. For example, what is a negatively "socially uncoordinated" condition to some might positively allow for "personal autonomy" to others. The impact of alternative or competing metaphors (whether referred to as *generative* or not) to provide a cognitive stimulus for framing deliberations and plans for action has been examined in topic areas including climate change (Flusberg, Matlock, & Thibodeau, 2017), economics (Arrese & Vara-Miguel, 2016), health (Semino, Demjen, & Demmen, 2018), law (Glenn, 2006), and public safety (Thibodeau & Boroditsky, 2011). In situations where current metaphoric frames are in opposition, employing a new metaphor can provide a means for reconciliation; however, doing so may be easier said than done. More than a semantic re-mapping of conventional terms onto new expressions, a novel generative metaphor demands not just new vocabulary, but a restructuring or reconfiguration of the problem (Schön, 1993).

One aspect of the metaphors that warrants additional scrutiny for design is that they can provide a conceptual tool for how multiple aspects of a problem are combined. That is, metaphors provide a "calculus for *and."* The need for such a model can be understood by considering some simple combinations. One grain of sand and another grain of sand yields two grains of sand. Each grain maintains its own physical integrity and the pair can be easily disaggregated. By comparison, one drop of water and another drop of water yields one drop of water—it is just a bigger drop. One grain of salt and one drop of water yields one drop of saltwater. The salt can be removed, but only at the expense of loss of water through evaporation. "Hybridity" has become an often-mentioned term to describe landscapes and landscape architectural practices (Amoroso, 2016; Bowring & Swaffield, 2004; Way, 2016). Assuming the word is not just as a decorative metaphor, what are the bases for the combinations? Also, what are the consequences of the combinations? In reference to the expression, some hybrid plants produce seeds, but others do not.

3.3   Metaphor and Ethics in Design

Efforts to improve a current situation require a notion of goodness. In this paper, goodness is understood as based on professional ethics and personal morals. It is uncontroversial to note that opinions about what is good vary by society and change over time (Malik, 2014). Beginning in the 1960s and 1970s, as concerns about pollution and ecological degradation became widely evident, the environment became a (more) formal referent as a topic within the study of ethics (Kawall, 2017). Attitudes towards these concerns continue to evolve and untangling relationships between ethics and morals is often difficult. For example, Oles has called landscape architecture an "uneasy discipline," because of competing expectations between conventional, market-driven professional practice and more democratic co-design through public-participation (2015). Nevertheless, part of professional education is helping students understand their own beliefs and positions relative to changing areas of practice.

A comprehensive review of ethics as applied to design is beyond the scope of this paper, but two general concerns for design education and professional practice often pervade studio discussions. First are considerations regarding goodness for whom or for what. Perspectives on the former considerations can range from egocentric ethics, which are based on notions of individual self-interest, to homocentric or anthropocentric ethics, which are based on utilitarian interests of a society, to ecocentric, which are based on the intrinsic value of all living and non-living things. Positions might be combined, such as Merchant's "partnership ethics," which bring together ecocentric and social justice positions to advance human and non-human interests (1982). Second are considerations regarding goodness on what logical grounds. Perspectives range from dutiful ethics, which emphasize obligation to culturally significant places, to contract ethics, which emphasize responsibilities to legal and regulatory constraints, to pragmatic or utilitarian ethics, which emphasize the consequences of actions (Fisher, 2016). These perspectives, too, might be combined or operate within a hierarchy of preferences.

The premise that a metaphor can present ethical positions is demonstrated by everyday examples such as cleanliness being associated with morality and uncleanliness with immorality; up being associated with good or better and down with bad or worse. References to some terms, actions, or events in metaphoric constructions have been critiqued as culturally insensitive or politically exploitative (Fraser, 2018). Examples include imagery of the Holocaust or of physical disability. These points underscore that the successful use of metaphor can be dependent on the shared ethical and moral beliefs of the speaker and of the audience, not just shared content awareness.

The framework in this paper asks for an explicit statement on what elements or aspects of the world, relative to the project, are open to change. These aspects are called out as challenges•opportunities and provide the fundamental context for thinking about what is possible within the given project. The act of selecting these elements, which stems from the designer's general awareness, is not inconsequential to ethical matters (Griffith, 2019). While each challenge•opportunity is like an independent variable, all are referenced or, at least referable, in the vision for managing change. It is in the progression of thought from the challenges•opportunities to the vision that questions of ethics or normative practices are highlighted, since the vision begins to establish how the elements are to be treated vis-à-vis how ways of combining or prioritizing may generally influence behaviors and thoughts of the design's users (Verbeek, 2005).

3.4   Metaphor and Epistemology in Design

In addition to a motive to do good, efforts to improve a current situation also require an understanding of agency and of the potential consequences of action. The underlying epistemological question of design is how can the designer know—or, in a more limited way, can know within reason—if the design will serve its purpose (Galle, 2011)? There is some merit in thinking of conceptual scientific models as akin to literary metaphors (Black, 1962; Ricoeur, 1975) and, indeed, the premise that metaphors can support epistemological inquiry has a long history in science (Human, 2021). Just as metaphors in literature are based on semantic falsehoods but can still contribute insight, in science, "all models are wrong, but some are useful" (Box, 1979, p. 202). However, because practices of environmental design can have profound consequences on health, safety, and welfare, the kinds or degrees of falseness or wrongness between source and target can matter. Simply put, the metaphor should accommodate relevant and available facts as well as reasonable assumptions. With regards to design education, a constructivist approach might be questioned as it has been by some in the science education for allowing untruthful ideas to proliferate (for example, Ogborn, 1997). In design, though, the metaphor is only a heuristic to advance a satisfactory resolution of the problem. There is no claim of absolute truth—only of usefulness to transform an unsatisfactory situation into a preferred one. Further, today's students will likely encounter professional challenges in their futures that present-day faculty have never confronted (or perhaps ever imagined). The rigorous use of metaphor—the mapping structural features and the projection of inferences—can improve their capacity to learn how to learn (Gentner & Markman, 1997; Wolff & Gentner, 2011).

Objectives of a design project are typically assigned by the client, but in most instances, designers must interpret what is intended. Also, some objectives may be at odds with others, so priorities must be established. Within the framework presented in this paper, reasoning about objectives is based on explicit relationships between cause and effect. Also, in line with Schön, the primary metaphor of the vision is used

to provide a frame for understanding each of the individual objectives. That is, any objective is imagined in terms of the overarching strategy to manage change. In part, the reasons to do are constitutive and the process provides a test of conceptual consistency. If the metaphor is truly generative, then it should provide a way to structure objectives within the ill-defined problem. But, if thinking about an objective—thinking of implementable ways to produce tangible improvements to the current situation—is difficult in relation to the vision, then the vision (metaphor) is insufficient or inappropriate for the task. Casting the objectives in terms of the larger metaphor is also done for reasons of rhetoric and persuasion. Referring to Section 3.1, methodological metaphors, which call attention to systemic similarities, are also discursive in that they are persuasive. It has been shown that extensions of metaphors contribute to a sense of the metaphor's level of sophistication and appropriateness. These effects reinforce an audience's understanding. The use of extended metaphors can also add to an audience's sense of speaker's competence (Oswald & Rihs, 2014).

The challenges•opportunities are also carried through the metaphor by being included in the cause-and-effect relationships, which are typically represented as systems models and shared through diagrams. Other topic-specific issues will also need to be included in these models. Ideally, these systems would be quantified and spatialized, such that adding or subtracting a measurable amount of some entity *here* will produce a measurable change *there*. Precise thresholds for success, which include how much of a "good" is needed or how much of a "bad" must be eliminated, are valuable for decision making; however, the complexity of coupled biophysical-social systems (or trebled biophysical-social-cyber systems) make it difficult to provide accurate parameterization. General concerns related to uncertainty might allow for only qualifiable change expressed as "greater/more" and "fewer/less."

4   APPLICATIOIN OF METAPHOR TO CONNECT ETHICS AND EPISTEMOLOGY

4.1   Introduction to Student Projects

Examples of the use of metaphor as a strategy for change come from a series of master's level, third-semester landscape architecture studios. The site for all of the examples is Waller Creek, which runs along the eastern edge of downtown Austin, Texas. The creek empties in to Lady Bird Lake, which is, itself, a dammed section of the Colorado River. Some of the studios considered designs for the lowest 1.25 mile stretch of the creek. In 1999, the City of Austin began studying the possibility of constructing a flood control tunnel under this portion to reduce threats to life and property and to encourage urban development on twenty-eight acres that would be removed from the delimited 100-year floodplain (Reis & Espey, 2008). Construction on the tunnel began in 2011 and was completed in 2014. The infrastructure circulates a managed flow along the lower mile of the creek. The controlled flow condition allows for stream restoration and the development of new parkland. These efforts are being undertaken by public-private partnership between the city and the Waterloo Greenway Conservancy (formerly the Waller Creek Conservancy). In 2011, and in anticipation of the tunnel's completion, the Conservancy sponsored an international competition to design a series of park spaces along the creek. After a winner was selected in 2012, the studio turned its attention to the roughly 1.5 mile stretch of Waller Creek that runs through The University of Texas at Austin campus. While the creek was once the remote eastern boundary of the original university district, it is geographically now the center spine. It and an adjacent street form a busy thoroughfare for faculty, staff, and students. The creek is also a focal point of the Dell Medical School part of the campus.

In both the downtown and campus versions of the studio, teams were comprised of three or four students. Students self-selected their teams based preliminary visits and exercises that gave a rough sense of similar attitudes about the project. While the site boundaries were pinned to the creek along its north-south orientation, east-west boundaries were determined by each team. Three general programmatic objectives were assigned: engage the creek, enhance the environment, and expand access. Teams had to provide precise definitions for each objective, measures of performance, and the relationships to one another (such as prioritization or inter-operability of the objectives). Teams were also asked to identify one challenge•opportunity related to site conditions and one challenge•opportunity related to site use.

As mentioned above, the examples reflect the final articulation of arguments for change, so what will be discussed is how the metaphor enables matters of ethics and of epistemology to be aligned. The initial abductive conjectures that led to the line of reasoning for the argument varied by team and are not

discussed. The members of each team had what can be considered concordant, but not identical, images of the world. Positions and priorities that served as platforms for team formation often engaged professionally challenging issues related to how nature in an urban environment is conceptualized (or how biophysical functions and social purposes are reconciled). Nevertheless, even with similar core beliefs, differences of opinion occurred within teams and commonly acceptable positions had to be negotiated. The ability to refer to the framework and consider points in relation to the overall logic of the argument, rather than an opinion in isolation, aided the design development process. Sometimes it resulted in quick evaluation of competing stances. Other times it prompted reconsideration of critical assumptions. To the degree students were aware of the role of the framework in their deliberations, both outcomes contributed to constructivist pedagogy. It can be reported that no student group's metaphor remained unchanged over a semester. Some metaphors were changed only slightly, but all evolved as the understanding of the problem and possible resolutions increased.

4.2   Student Projects

A selection of student projects illustrates the kinds of connections described above. As might be expected, not all metaphors were equally easy to extend to the challenges•opportunities and the objectives.

Liquid Infrastructure (Harding et al., 2011) took its prompt from the creek and the (then) anticipated tunnel. As an assembly of concrete, water, and vegetation, it could be considered gray-blue-green infrastructure. The metaphor was also informed by discussions on the work of the cultural theorist Zygmunt Buaman, who has used the concept of *liquid* to describe fluidity of life in the early twenty-first century (Bauman, 2000). In this sense, the metaphor engaged something of the spirit of the place and the spirit of the times. The site challenge•opportunity was the creek's floodplain, and this idea was extended to other kinds of plains that might be exposed to different forms of inundation. The program challenge•opportunity was meander. Here, the team exploited a word that can be both a verb and a noun. As a noun, it is located within a floodplain, so it allowed for considerable interplay of spatial and movement ideas. As a verb, it suggested a kind of informal recreation or willingness to explore. The reimagining of the objectives was treated very abstractly. Engage the creek was redescribed as *comfort*, enhance the environment as *service*, and expand access as *open*. Here, familiarity with Bauman and his notion of liquid allowed the phrasings to be not only apt, but also evocative and potentially compelling. Within the context of this literature, the individual systems models of three objectives were "liquid" in that they shared many of the same elements. The use of different aspects or qualities the same elements supported a consideration that any one thing was useful or significant in several ways. That is, for this group (literally) making the landscape and making sense of the landscape required multiuse and multivalent entities. Without such bibliographic knowledge, though, the objectives as reimagined can seem unrelated to the primary vision and, therefore, they may not significantly advance the argument for change. This observation points back to the earlier statement that the effectiveness of metaphors is context dependent.

Acequia: Channels for Learning (Duggan et al., 2013) referred to the drainage and irrigation structures built during Spanish colonization of semiarid regions within Texas (Meyer, 1983). The intentional use of the word was not to impose a new system of colonialism on the landscape, but an effort to help carry parts of the past into the future through some degree of transformation. That is, the aim was not to extend a tradition of hierarchy and exclusion, but to open up a new form of common practices (Hobsbawn, 1983). The site challenge•opportunity was basins, broadly considered to be any area that might collect some kind of flow and included basins for water, people, plant nutrients, and vehicles. The program challenge•opportunity was flows. As with the first example of student work, the two challenges•opportunities had close conceptual affinity. Engage the creek was reimagined as create rooms, enhance the environment as connect habitat, and expand access as conduct flows. While elements of the two challenges•opportunities contributed to defining the cause-and-effect relationships within the systems models, the phrasing was less influenced by the vision. Connecting habitat is something done in some landscape architecture projects, but while acequias can connect habitat, that was not the primary reason for their construction. Similarly, making outdoor rooms is an important professional practice skill, but acequias do not have rooms. As a result, while the systems analysis was very sound, some of the potential rhetorical value of the metaphor was not fully exploited.

String of Moments (Gilbertson et al., 2014) built on the common *partii* metaphor "string of pearls" for projects that involve the array of nodes along a line. The creek provided the string, and the pearls were recast as moments to evoke the combination of space, time, and experience—same place at different time yields a unique moment. The site challenge•opportunity was the moment itself. Some existing locations within the site were latent with "moment potential," but the features of other locations needed to be changed to have that quality. The program challenge•opportunity was pulse, the insertion of energy that sparked the moment. Engage the creek was reimagined as *pool* (as in gather), enhance the environment as *cycle*, and expand access as *pulse*. The repetition of pulse as the program challenge•opportunity and the rephrasing of an objective, somewhat clouds the argument for change by conflating a fundamental feature or aspect of the environment open to change with an objective. Simply put, this dual use does not allow for an easy distinction between what can and what ought to be done. Clarifying requires not just a simple word substitution, but a much closer consideration of the ideas of temporality within the project.

Terracing Time (Lei et al., 2015) represents an example of an effort to employ a novel metaphor, since the phrase did not appear to have been used for any earlier environmental design projects. Further, while there are what might be related linguistic expressions that modify the continuity of time, such as *cut time* in music and *time slicing* as part of multi-user computer systems, terracing time does not appear to be strongly connected with any discipline. The advantage of such a term is that the designers do not need to worry about being compared to other projects that might share its use. The disadvantage is that they cannot rely on the audience possessing any awareness about design (landscape architecture) implications of the idea. The site challenge•opportunity was pool and the program challenge•opportunity was flow. The three objectives were defined to help explain the vision. Engage the creek was reimagined as *sculpt for speeds*, enhance the environment as *slow the momentum*, and expand access as *split the currents*. While "terracing time" is novel, the team's focus on time can be understood as an engagement with a prominent—perhaps the preeminent—theme of landscape architecture. Garden historian David Coffin noted (here by paraphrase) that the Italians of the sixteenth century ignored the passage of time, mixing old with new (for example, the inclusion of ancient statuary and new building elements within Villa D'Este); the French of the seventeenth century tried to arrest the passage of time and make the perfect moment last for eternity (for example, Versailles); and the English of the eighteenth century reveled in the passage of time, planting dead trees and building fake ruins (for example, the Leasowes) (Shearer 2013). Perhaps extending Coffin, terracing time could be taken as emblematic of the late twentieth century Western notion of "making time." Also, the metaphor and its accompanying re-worded objectives are in line with J.B. Jackson's notion that landscape "is a space deliberately created to speed up or slow down the process of nature" (Jackson, 1984, p. 8). The idea of terracing can also be understood in relation to precedents of agricultural practices that allow crops to be grown on steep hillsides. From this perspective, there is benefit in finding a way to make productive use of otherwise unusable land. Unlike the other examples of student projects, terracing time offers a vision of process or of practice (that is, terracing) rather than a vision of product (that is, infrastructure, acequias, or strings). As applied in the studio project, the metaphor certainly provoked thought, but did it provide a strategy to manage change will result in a better landscape? Answers to this question hinged on the acceptance of an image of the world (including an image of design practice) in which creating new open-ended future opportunities and choices, rather than new specifically defined conditions, are sufficient criteria for "better." Part of an assessment might also ask about opportunity costs: if the undefined opportunities created are, somehow, sufficiently beneficial given that resources were used to make the terraces might be better used on a more clearly defined or tangible outcome.

5   DISCUSSION AND CONCLUSION

The examples shared in this paper were selected because they are representative of the issues that have arisen when thinking explicitly about metaphor for landscape architectural design. The underlying challenges are not just the stuff of classroom exercises, since metaphors are also used in professional practice. For example, the four finalists in the international competition to design the lower portion of Waller Creek also employed metaphors. One team presented, *Waller Creek: The Oasis* (Turenscape & Lake|Flato, 2012). Another urged the city to *Keep Waller Wild* (Smith, TenEyck, & Rogers Marvel, 2012). The

combination of *Regeneration and Curation* provided a novel construction (CMG & Public Architecture, 2012). The winning entry was *Waller Creek: A Chain of Parks* (MVVA & Phifer Architects, 2012). These proposals could have been a basis to compare metaphors.

From the perspective of an educator working with the students to think about design as an argument for change, it can be observed that the concept of metaphor is well known both through formal education and through experience. Using a metaphor with rigor has advantages, but exploring the ambiguity is establishes and testing the limits of its extension can be difficult. It can even sometimes be frustrating for students. Referring to the premise that a metaphor is a conceptional tool, if all goes well in the design development process, the metaphor will elucidate the finished product. If all does not go well, it can be tempting to say, "It's just a metaphor. Let's get on with the real work." But an important part of design is establishing a frame that gives order to ill-defined problems. Working with and through generative metaphors is very much a part of the "real work."

By way of a concluding comment, a character in a Sir Walter Scott novel quipped, "Metaphors are no arguments" (Scott, 1863, p. 160). The point is well observed since metaphors are based on semantic falsehoods. Nevertheless, a metaphor is meaningful if it can be used to inform a decision and, more narrowly, if "its meaning is analyzable in terms of the difference it makes to the decision taken" (Kaplan, 1964, p. 43). Across numerous aspects of society, metaphors establish frames for description, discussion, debate, and decision-making. The selection of an effective metaphor to help argue for change is, in part, rhetorical, since its use is intended to help persuade. It must also be constitutive and help organize an argument for direct actions that can lead to a better future. This aspect engages ethical questions about the kinds of places designers and members of a society want to create (Throgmorton, 1993). It also engages questions of epistemology and how designers can test the possible success of proposals.

It was noted that design frameworks serve to manage ambiguity for ill-defined problems. The use of metaphor in the design framework described here makes productive use of the ambiguity that exists between knowing why and knowing how, between ought to do and can do. More strongly, it follows a line of thinking in which, "the relation between elements themselves ambiguous to some degree generates a new and larger range of significance. And the relation serves at the same time to as a mechanism of integration, indicating the direction along which unification of the multiple meanings is to be achieved" (Kris, 1952, p. 258). By making connections between issues of ethics and of epistemology, metaphors in this framework aim to sit between strict positivistic, rational-actor decision making systems in which all disagreements can be settled by facts and relativistic turmoil in which no preference for an outcome can be made (Rein & Schön, 1993). This kind of thinking is needed to address the challenges of our age in which greater scientific knowledge, environmental change, and accompanying social transformations can be anticipated.

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