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The Nature and Use of Precedent in Designing

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As a student, or as a practicing designer, you may have noticed that moment when, even if you are following a detailed model, you have to figure out what is this material, this experience, this system I am designing actually going to be? Whether you have consciously done so or not, you have turned to your own memories, your store of precedent knowledge, in order to tackle these questions. Precedent knowledge is a form of knowledge specific to the activities and goals of design—and you do have some, whether you realize it consciously or not. When you do understand what precedent is and think about how you obtain it and use it, you have increased both the discipline and the imagination that you bring to the act of designing.

Precedent as a Form of Design Knowledge

One of the fundamental elements of design knowledge is precedent (Lawson, 2004; Lawson, 2019). Unlike in law, where the term precedent refers to the accretion of decisions made over time and constraining future decisions, in design precedent refers to the store of experiential (episodic) memories each designer accumulates over time—expanding their future possibilities for actions or decisions. And unlike in science, where past discoveries or established facts form a solid foundation of knowledge which must be accepted or definitively proven incorrect, precedent knowledge in design is gathered by individual designers through their experiences of the world. Each designers' store of experiences is unique to that designer. Even when multiple designers share the same experiences, they do not necessarily pay attention to the same aspects of those experiences, or recall them later in the same way. Some designers possess more experience and some less; no single designer's store of experiences is comprehensive or the same as any other one, and none can be transferred in an abstract way to another designer. Consider something you have experienced yourself, something that left a vivid memory with you. If you want to share this memory with someone else, you will likely use concrete means to do so—photos, video, audio—providing you have those means. If you do not, it can be difficult to transmit to another person the quality of what you have experienced. Now think about how you might share a career full of design experiences with another designer. You might summarize your memories as principles, or as lessons learned, but this would not reproduce for that other designer what you know. Some design knowledge, like principles, can be stated in abstract form for the benefit of others. But precedent knowledge, a designer's store of experiences, cannot be communicated easily or completely to someone else.

In architecture education, building precedent knowledge has long been a highly structured activity, overtly and rigorously pursued by means of memorization (Lawson, 2019), and of the requirement to refer to celebrated structures from the past in support of, or in contrast to, decisions made in the present (Eastman, 2001). Conflict persists over the canon, the body of works deemed worthy of this intensive study. Some argue that the canon is narrow and discriminatory (Gürel & Anthony, 2006), while others bemoan moves in architecture education to eliminate the canon because they argue that the benefits of this form of education outweigh the drawbacks (Breitschmid, 2010).

Although fields like instructional design do not maintain a canon, less formal means of noting, storing, and applying precedent knowledge in architecture also exist. Reviewing publications across multiple fields in which design is the primary practice, it is possible to see that building and using precedent knowledge is common across all of them (Boling et al., 2019), although the term precedent is not always the term used and sometimes the references are just brief glimpses of how precedent is actually used. For example, Rowe (1987) talks about architects and other designers using literal analogies, “borrowing known or found forms” either in canonic form (“‘ideal’ proportional systems” as in the architectural canon), or iconic form (“objects from the natural world … imagery from some scene, painterly conception, or narrative account of real or imagined circumstances”) (p. 80-83).

In the canonic form of precedent use, an architect may use forms (columns, arches, proportions) from classic structures in a current design. Without an existing canon in instructional design, it does not make sense to offer an example of canonic precedent use by instructional designers. Consider, however, examples of the iconic use of precedent. Madhavan (2015) quotes engineer John Shepherd-Barron, inventor of the ATM cash dispenser as saying, “I hit upon the idea of a chocolate bar dispenser, but replacing chocolate with cash” (p. 70), and Zimmerman (2003) mentions in passing that the graphics in his widely-known video game SiSSY FiGHT were “inspired by Henry Darger’s outsider art and retro game graphics” (p. 178). And as an instructional designer, a co-instructor and I used our experiences with buffet restaurants to offer multiple mini-lessons on technology to our students, letting them choose a "plateful" of learning in the multimedia production class we were developing.

How Precedent Is Collected

Goldschmidt (2014, p. 1) addresses the way informal, or iconic precedent is collected, saying the “designer possesses a ‘prepared eye’ which is able to take advantage of stimuli it encounters, randomly or intentionally, in any environment.” In other words, building precedent knowledge is a disciplined practice in which the preparation of experience allows designers to notice more that is potentially useful and relevant to them than novices or non-designers do. To picture this, imagine that an instructional designer working for an insurance company takes her children to a theme park where employees explain to guests, quickly but clearly, how to enter each ride and buckle themselves in safely. This designer is experiencing a happy day with her kids as many parents do, but because she is a designer, she is also noticing these just-in-time instructions. Without knowing when she might retrieve and use this memory, she stores it automatically; she has developed the habit of noticing and remembering experiences that may be relevant to her work.

Within the mind of each designer, precedent knowledge is structured over time into multiple schemata; “precedent stored in the form of episodic schemata is used by experts to recognize design situations for which gambits are available” (Lawson, 2004, p. 1). Lawson does not imply that precedent knowledge becomes, or should become, abstract knowledge by being transformed into generalized principles. He discusses schemata as patterns in which the original experiential elements remain intact as potential “gambits,” or design actions, recognized as possibly applicable to the immediate design situation. Considering the instructional designer who took her children to the theme park, it is likely that when she noted park employees giving instructions to guests as they boarded rides, she did not simply store that memory. This memory probably joined memories of experiences she had stored previously as part of a schema that might be thought of as, perhaps, "super-condensed instructions." It may also have joined other schema, possibly "scripted instructions easy for employees to learn," or "minimal scripts."

The Nature of Precedent Knowledge

Drawing on the discussions of precedent in the literature, and the ways in which designers refer to precedent, it is possible to consider the nature of this special form of knowledge.

Precedent Is Concrete

As noted, precedent knowledge is composed of the memory of experiences, not the abstract meaning we impose on those experiences. These experiences can be ones in which an object was held and used, a building walked through or

lived in, a class taken or taught, an ocean beheld or sailed upon. They may, with equal validity, be vicarious, formed through encountering pictures, diagrams and narratives that represent designs to those who are not interacting with the designs directly. Whatever way this form of knowledge has been acquired, it is stored the same way that memories of a vacation trip or a day at school would be. It contains the details that struck the designer at the time of the experience, making it flexible in the ways that it can be used because more than one aspect of the experience can be related to a new design situation.

Precedent Is Neither Good or Bad; Its Value Is Determined When It Is Used

Precedent knowledge is neutral. The original precedent experience may have been a positive or negative one, and the designer recalling that experience may have thought at the time, “That’s a weak design,” or “That’s a great design.” We call the knowledge itself neutral, however, because later it will not be confined to use as an exemplar or as a cautionary tale. A weak, or even a failed, design can yield an affordance or an analogy that proves useful in a future design situation. In some situations, therefore, a designer might need to know whether an instructional design was proven to be effective when it was implemented. However, in many more designs its value as precedent is dependent on what it offers as part of a schema, or of multiple schemata, as inspiration for a design action or as a way to frame a new design problem.

Precedent Is Relevant When It Is Used; It May or May Not Be Relevant When It Is Collected

The relevance of any precedent memory to the work of the designer who holds that memory is determined at the time the precedent is used. As we will see in the discussion of precedent knowledge in use, designers sometimes seek examples of design intentionally to use them right away as models or inspirations for the work at hand. However, they also notice and store memories of designs continuously without knowing how they are going to use those memories later. This means that the exact relevance, even the vague relevance, of much precedent knowledge cannot be assessed in advance. In order to have precedent knowledge available when it is needed, designers who have been trained and encouraged to do so form the habit of attending to their environments with a generalized focus on potentially useful experiences, but also with a productive lack of boundaries as to which experiences they should note.

Precedent Can Be Used Repeatedly, and May Be Used Differently Each Time

As a form of knowledge that is simultaneously detailed and non-specific, precedent offers rich possibilities that can be connected by the designer to multiple design situations. Unlike case-based problem-solving-in which there is a match between the problem and the case being used to solve, or illuminate, it-design precedent does not have to be well-matched to the situation where it is being used. In some cases, there may be little to indicate that the precedent is related to the design situation at all. As we will see during the discussion of precedent in use, it is the designer who perceives the possibility that precedent knowledge affords an insight, a possibility for addressing a design problem (a gambit), or a bumper that pushes their thoughts in a new direction. Therefore, the designer's perception may be different in a precedent memory based on the current design situation than based on a previous one. Because this knowledge has not been abstracted into a fixed, declarative form, the designer is free to use it differently each time they recall it.

Precedent Knowledge in Use

In a current study of precedent knowledge across the literature in multiple fields of design, Boling et. al. (2019), have identified several primary modes of precedent use.

Linear

A linear use of precedent is one in which the bridge between precedent and a design decision or action (Lawson, 2019) is conscious, direct, and simply connected to the design. A designer might face a situation in which a particular style of design is required and look for examples of that style in order to perceive and reproduce its key elements. An instructional designer may have framed a project as one for which many precedent examples already exist and decide, appropriately, that drawing on one or more prior designs known to be effective will provide a reasonable template. Similarly, designers may seek, or draw upon, precedent knowledge to understand what a class or type of design looks like, sounds like, or how it is constructed. This happens when, for example, an inexperienced designer is preparing to develop a student workbook and collects examples of existing workbooks to learn more about how this class of design is put together. This is a kind of deliberate reverse-engineering in which the application of the precedent experience is determined in advance.

Field-Specific Sources and Validation of Judgment

Using the architectural canon, or less systematized bodies of recognized precedent (sometimes the bodies of work produced by famous designers), designers can draw on precedent knowledge that they share with many other designers and use it to guide or validate their own design decisions or actions. In this type of use, schema within the body of precedent knowledge may be less personal to an individual designer than understood across a professional community. A majority of precedent experiences for many of these designers may be vicarious-gathered through photographs and descriptions made available during their studies, found in curated collections published in books and periodicals. A product designer, for example, may be well aware of a shift toward rounded surfaces and complex "dashboards" of buttons on household appliances because designs like these appear in trade magazines and win professional design awards. They do not refer to any single prior design when they develop a dishwasher for the manufacturer employing the designer, but the widely-known schema informs their design and they refer to that schema to support their decisions. It may be difficult to picture this form of precedent use among instructional designers because the field does not now build, or disseminate, organized bodies of precedent, or acknowledge individual practitioners to the extent of making them famous.

Direct Model for Invention

Engineers in particular use precedent knowledge in a combinatory way, incorporating precedent designs directly into new ones when subsystems are required for a complex situation and existing examples can be used with minimal adaption. In what is termed *normal design*, when the requirement for invention is low, Vincenti (1990) describes a special form of precedent termed *normal configurations*, in which the designer's experience includes both the elements directly usable for the situation and examples of how those elements will work together. Every engineer who needs to include a pump in a design does not re-invent the pump if there is an existing pump design compatible with the larger system being created. It is easy to observe a similar form of precedent use among program designers who maintain, share and draw upon libraries of code. Instructional designers may recognize that this form of precedent use shares characteristics with reusable learning objects.

Abduction/Analogic Reasoning/Inspiration

Cross (2011) explains that abductive thought suggests "what may be," instead of figuring out what must be (deduction) or determining what is (induction) (p. 33). The abductive use of precedent involves allowing the experience of what exists to suggest possibilities for that which is still to be designed. To understand this use of precedent, consider an instructional designer who is a relay runner in their off-time. They are working on a web-based design for a high-enrollment college course in which undergraduates are supposed to be learning collaboratively. As they consider that students are not always excited about group work, it occurs to the designer that the feeling of handing off a baton during a relay race is both intense (motivating) and positive (satisfying). Without literally building the course as a relay race, the designer decides to try dividing the class into small teams and incorporating "hand-off-ness" into the process of working together. The students will set a goal for their final assignment together, then use an online collaborative writing tool that is open to each of them sequentially for additions and revisions until they complete the assignment.

Still inspired by their running experience, the designer builds in some practice in sequential writing ("handing off") as part of smaller assignments during the semester.

While many fruitless forays may be conducted into one's store of precedent, or there may be only a tenuous connection between a possibility discovered there with the problem in hand, abduction is not just random exploration. Because precedent tends, with experience, to gather into schema (Lawson, 1994), analogic use of precedent is likely a key factor in the efficacy of abductive thought. Analogic reasoning "is a method of activating stored schema based on the identification of connections, parallels, or similarities between, what are typically perceived as dissimilar items" (Daugherty & Mentzer, 2008, p. 9). In the case of what we perceive as inspiration, analogic reasoning utilizing multiple schema may occur and, because these processes are not linear (not propositional or easily converted into rationalized form), they appear to be—or are experienced as—unexplainable leaps from what is known to something entirely new. Consider again the instructional designer inspired by their experiences as a relay runner. Let's suppose that in addition to being a relay runner currently, the designer also participated in improvisational theater as a high school student and performed in a short-lived jazz ensemble during college. Each of these experiences involves handing off from one participant to another (a baton, a story line, a musical theme), and by the time they begin designing this college course, the designer's use of the schema for handing off may not have been a conscious design act as described above. They may have experienced the idea of sequential authorship in this online class as something that "just came to them;" they drew on a schema for parallels between it and their design problems that are not obvious on the surface and were not deliberately sought.

Problem Framing

Dorst and Cross (2001) discuss how a "problem-solution pair is framed" (p. 435) by designers, defining the design situation by considering the insight that a possible solution can provide. Such possible solutions are drawn from, or suggested by, the designer's store of precedent knowledge. In this use of precedent, the designer's knowledge is not being used to guide specific design actions, but to explore, understand and define the situation overall. Many designers can bring to mind the point in a project where someone throws out an idea; "what if we put together something like a kit that the instructors in the field could use to assemble lessons on the fly? Like Ikea™ lessons!" The project may or may not follow this direction, but considering the idea can bring to light factors in the design situation that may or may not have been evident before—or suggest new information that a project team may need to gather which was not considered previously.

Design Talk

As designers work together, they engage in design talk, a specialized form of discourse described by Fleming (1989), of which a central component is discussion of the object (or system, or experience) being designed. Lawson (1994) offers a vivid description of such talk among architects in which they all used a single term derived from separate but overlapping, bodies of precedent knowledge and probably from experiential memories the team also shared. While a comparative lack of precedent dissemination in instructional design can limit this element of design talk, you may be able to recognize a discussion in which team members share an educational background and use terms like "WebQuest" or "MOOC" that carry an entire set of experiential meanings for the participants.

Design Models and Precedent

Design models are one of the most widely discussed forms of design knowledge discussed and used in the field of instructional design (Smith & Boling, 2009). These are a declarative form of knowledge, meaning that they are abstract and fixed; they can be passed from one person to another through explanation and memorization. Such models are useful (Branch, 2009), but they do not serve the same purpose for designers that precedent knowledge serves. In fact, without the judgment of designers (Archer, 1965; Holt, 1997; Merrill; Vickers, 1983; Gibbons et al. 2014; Smith and Boling, 2009) and their precedent knowledge, design models are not actually effective. Discussion of design judgment

may be found elsewhere (Boling et al., 2017; Dunne, 1999; Gray et al., 2015; Nelson & Stolterman, 2014). Here we will consider the role that precedent knowledge plays within design models.

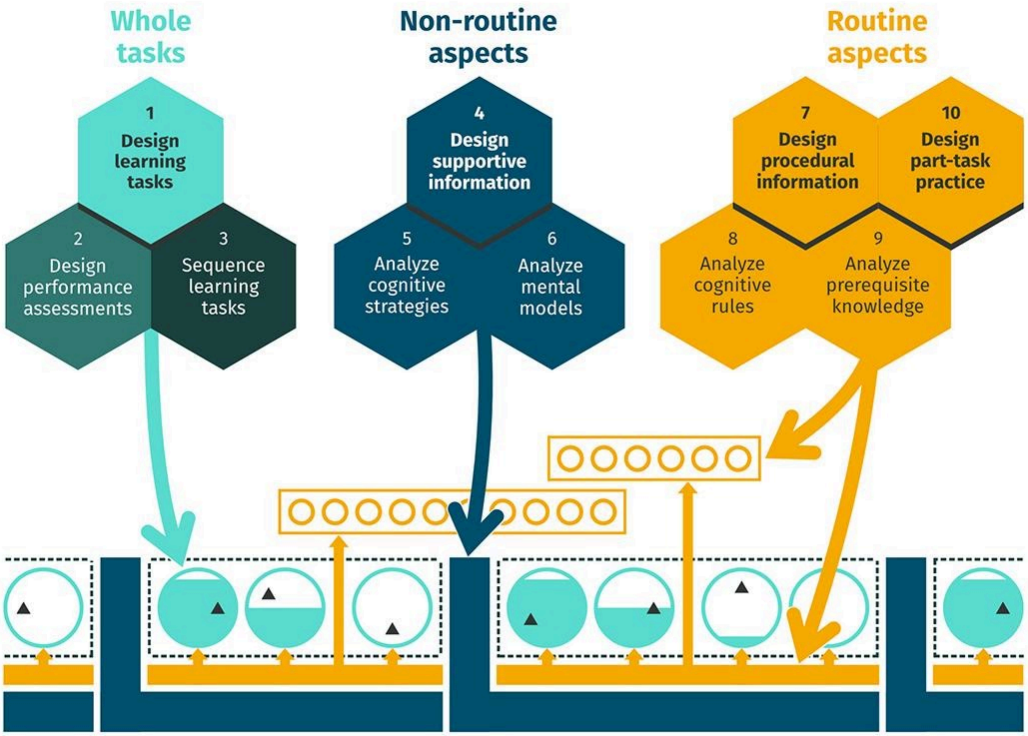
In each model of design that exists, and there are many (e.g.; Archer, 1965; Dick et al., 2000; Dubberly, 2019; Gustafsen & Branch, 2002; Lawson & Dorst, 2009; Morrison et al., 2012; Reigeluth & Carr-Chelman, 2009), close examination will uncover a point at which many aspects of a design situation may be known, but all the rational sources of knowledge and decision-making have reached the limits of their usefulness. The results of analysis, and the application of established principles or prescriptions, may have precluded some design moves, or implied fruitful directions for others (Krippendorf, 2005). But now—what to do precisely? What, exactly, will come to exist that did not exist before all the preparation was done?

Bruce Archer's (1965) early, influential, and detailed engineering design model, created at the start of high excitement regarding systematic design, was presented as a long diagram that extended for yards, and included a short text of fifteen pages explaining it. Of those fifteen pages, ten are devoted to discussing the human activity and perspective actually required to make the model function, pointing specifically to the one place in the model where nothing but the human designer can bridge from one step to the next by saying, "there is no escape for the designer from the task of getting his own creative ideas" (p. 11). And where do those ideas come from? Archer explains that looking at other people's end results (designs) "including phenomena and artefacts in … unlikely fields," and "a rich, wide and fruitful experience … as well as the capacity for flexibility and fantasy in thought" (p. 12) are required; in other words, building and using precedent knowledge.

Looking at a more recent and familiar prescriptive model for developing instruction, consider the 4C-ID Model, focused specifically on designing instruction for complex tasks, and summarized by van Merriënboer et al. (2002).

Figure 1

Ten Steps of the 4C/ID Model. Obtained From www.4cid.com



This model is quite detailed, focusing on prescriptions for breaking down complex skills, providing practice of part-tasks and whole-tasks, and providing materials for support and for just-in-time information. Explanations for using the model do not address explicitly, as Archer did, what is required from designers to carry out the steps of the model. If we examine it, though, we will see that the model can only be used when designers employ precedent knowledge.

For example, in the case example the authors provide, the complex task to be learned is literature searching. They describe a scenario in which a designer has, in step 1, broken down "literature searching" into several "task classes," and specified that "learners receive three worked-out (good) examples of literature searches (step 4). Each example contains an elaborate search query in which Boolean operators are used" (p. 56). Guidelines are offered as to what a task class may be, and the characteristics that practice items or informational materials should have. However, neither the model nor the explanation of it acknowledge the invention required to move from knowing what kind of example is to be offered, to actually inventing this example—or to deciding the nature of the event in which the examples will be introduced and used.

The very language—"learners receive"—masks what actually has to happen; unless the appropriate worked-out example of a literature search is readily available, one must be made to exist where previously it did not. Even if the appropriate example is readily available, its relationship to this instructional event must be created. While this is not a criticism of the model, it is important that designers recognize the additional forms of knowledge they need to use such models.

Conclusion

While precedent knowledge interacts with other forms of knowledge that designers possess (like their knowledge of guidelines, theories or principles), it is different in important ways. Designers need to understand those differences so that they can build and use this knowledge effectively.

Application Exercises

The Noticing Journal

The beginning of a disciplined practice in accumulating and using precedent knowledge is to develop the simple habit of noticing. Commit to a week of noticing and challenge yourself to notice as many kinds of instruction or performance support around you as you can for that week. Jot down a note about each one, or take a photo with your phone, so that you can see how many have built up over the week.

Not sure where to begin? Consider how many things you use or see in a day that carry instructions on them -- shampoo, instant noodles, fire extinguishers, bus and subway maps, vending machines. Pay attention to digital experiences like videogame and software tutorials, or website navigation instructions. Don't limit yourself to formal instruction either. Did you overhear a parent teaching something to a child or a child showing a parent how to use a smartphone app? It all counts!

Once you have spent a week on this exercise, consider continuing with it, adding items as you come across them. While noticing precedent becomes automatic at some point, there is no harm in remaining conscious of the discipline of noticing.

Exploring Your Existing Store

Set aside 30 minutes to an hour in a quiet place where you can bring to mind past experiences. Begin with the earliest learning experiences you can remember. From the perspective of an instructional designer, call up as many as you can. Don't worry if some of them are negative. Precedent knowledge is built from all experiences, not just exemplary ones. While I recall a great experience with the SRA Reading System in 4th grade, that same year yields the painful memory of "math races" in which two students had to run to the blackboard and solve a problem written there quickly, trying to beat each other to the answer.

As you bring these memories of learning to mind, resist the urge to try to turn them into lessons learned, to diagnose what happened, or to draw conclusions about what happened. What you are doing right now is just taking stock of how many experiences you already have in your store of precedent, and recognizing that it belongs to you. You have probably been using it; you may well be conscious of that. And if you have not been, then this exercise may prove illuminating!

As with the first exercise, consider spending 30 minutes this way more than once. You probably have more than 30 minutes of learning memories!

Deconstruct Your Present

If you are studying in school now, begin to take note of the way one of your courses is structured and of the materials you are using in this class. Don't stop there, though. The experience of a course is not the same thing as a syllabus or a textbook. It is the experience that you remember and that forms part of your precedent knowledge. Write the story of this class—take several pages to do so. While this is your experience, pretend that you are an observer trying to give someone else a vicarious experience of what it is like to be in the course.

As an example, a short time ago I participated in a square dancing club as a student for a year. While the structure of the lessons was straightforward—3-4 new calls introduced each week, with several repeated each time as a refresher, and each student dancing with an experienced partner—the experience of these lessons would take more time to describe. The experienced dancers were uniformly elderly and enthusiastic. Every student was greeted warmly at the start of the session, encouraged and praised throughout each dance, and treated to homemade goodies by the members of the club. Actually, concentrating on learning and dancing at the same time is surprisingly strenuous, so the goodies were welcome. So was the encouragement! While the steps we were learning were each pretty simple, they were not called out in a set order. The caller changed the

sequence constantly and more than one student stepped on more than one toe. Every so often the entire group came to a halt when one or more students swirled left instead of right. In these instances, I'm sure some of the experienced dancers were frustrated but no one complained and we all formed up to begin again. I could go on for several more pages, explaining in more detail about the sequence of the steps we learned and how the caller handled the dances, what the room was like, the "final exam." Once you get started on this exercise, you will find that you have plenty to say as well.

If you are not studying right now, you can choose a learning experience that, like mine, took place over an extended period. Or, if you teach, complete the exercise using one of your own courses, trying to keep that observer perspective. And no matter what experience you use for this exercise, once you have completed it, read it over and ask yourself what kind of schema this experience may be, or could be, part of. You are not trying to abstract this experience, but to consider what others come to mind and what patterns they might both be part of. There could be several or many.

NOTE: As you carry out these exercises, focus on the fact that you are building awareness of your design knowledge and thinking. These exercises are not intended to become part of your design process; although I have recommended repeating them for the sake of building awareness, they will not tell you what to design or how to design. They will strengthen abilities you already have and use.

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