The Core Competencies of Design:
The Basis of a Broadly Applicable Discipline

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Introduction

What are the core competencies of design? When asked, many designers and design educators might respond, "Creativity;" "Helping others innovate;" "The ability to draw;" "Making things work well and look good." There is some validity to each of these statements and the others that could be cited given a bit longer to come up with a list. However, as I have dealt with this question over the past 15 years, first as a design student, and then as a design educator, these suggested core competencies do not seem to capture the essence of what designers really do. Some of them are far too general, like "creativity." All disciplines require creativity—design does not hold a disciplinary right to it. Other suggestions are often skill based, like "the ability to draw." Certainly designers need this skill, but drawing itself does not constitute design competence. Young designers may be able to draw, but their ability to design remains lacking. What then does constitute the ability to design? In this paper, I propose seven competencies that are at the core of design expertise. Currently, they are based only on reflection of design practice over the past 15 years. I have presented them in a few informal gatherings of design educators and practitioners and they have been well received. Their value lies in the degree to which they remove the mystery associated with "creativity" and the lack of depth suggested by craft-based competence such as "drawing."

It is important to establish how we define design in this paper. To paraphrase Herbert Simon who wrote the seminal book, *The Sciences of the Artificial*, design is "devising ways of turning existing situations into preferred ones." Design is far broader than the architectural, industrial and graphic design traditions embodied in the majority of design programs around the world. For example, design would include the areas of engineering that are concerned with conceiving of new systems and technologies. This broader definition of design pushes us beyond the strong visual bias of the traditional design disciplines to include any activity where the specific form and arrangement of elements is used to create value.

Why do we care about the notion of design competencies? Is it really necessary to identify what they are? Isn't part of the power of design its mysterious ways? The impetus to identify design's competencies grows out of the shallow rhetoric that exists around design's value to the world in general and business in particular. Ever since entering the field, I have observed designers and design advocates argue for an expanded use of the field. They have argued that design should be used more frequently, more broadly, and more strategically. Yet, when asked why, there is little to support the argument except for case studies that have often been selected because design was involved and the initiative was successful. Design advocacy currently rests on the very thin ground of "use it and they will come." To be more credible, design must understand its successes and, perhaps more importantly, its failures. "Understanding" means that principles and causality can be developed. Unfortunately, there are many in the design field who argue against the possibility of understanding or characterizing design in certain terms. This is dangerous and destructive thinking. As long as those who advocate this position are leaders in the field, the discipline will continue its glacial pace of growth and be at a significant professional disadvantage.

The benefits of understanding design and having a clear articulation of professional competence are significant. It will lead to significant growth of the discipline and achievement of goals that the field has argued for so long with little success. In spite of the last decade of decent growth, design remains a small discipline. Consider other fields such as marketing and computer science. They have the same or shorter histories than design and yet have grown and become central to the economy. One could argue that computer science was simply a benefactor of the invention of computers. One could argue that marketing is a clearer outgrowth of the field of business. But both these arguments would be missing the essential mechanism that led to their growth. *It is because marketing and computer science sought to develop disciplines that they flourished.* In spite of its name, computer science is no more a science than design. Have you noticed how bad software starts out? Have you noticed all the ways computer science has tried to make programming better and more reliable? Science does not guarantee certainty but, rather, the desire to understand a commitment to ways of working that lead to explanation.

Marketing, with its focus on understanding customers, markets, and competition, has no more or less potential as a discipline than design. Yet since its development shortly after the World War Two, marketing has flourished as a discipline. There are tens of thousands of members in the American Marketing Association and an equal number of companies. There are departments of marketing in every business college and robust graduate programs. Significant journals report on research in the field. New work and professional exchange happen at a variety of conferences around the world. These are the standard indicators and activities of an established discipline. Unfortunately, design is just getting started. It took until 1992 to establish the first PhD program in design, when the GE Foundation funded its development at the Institute of Design in Chicago. It is over a decade later and PhD programs continue to struggle for significant funding and growth. Discussion of the slow development of the design field is beyond the scope of this paper. However, the historical stance of design as being beyond understanding and explanation needs to be challenged. Design's goals of growth, broader use and relevance can only come from the belief in and development of a vibrant field of study.

The Competencies

"Enough background and criticism of our nascent field! Name these competencies of which you speak!" Currently there are seven competencies. After the list, each is discussed briefly to clarify their meaning.

The Core Competencies of Design

1. The ability to recognize a broad range of potential in a given problem statement.
2. The ability to work at varying levels of abstraction.
3. The ability to model and visualize solutions before all the information is available.
4. An approach to problem solving that involves the creation and evaluation of multiple alternatives.
5. The ability to add or maintain value as elements are integrated into a whole.
6. The ability to identify and respond to relationships between a solution and its context.
7. The ability to use form to embody ideas and communicate their value.

1. The ability to identify a broad range of potential in a given problem statement. This has been one of the more difficult competencies to articulate, but it is critical to the value design provides to a given engagement. Perhaps, more simply, this competency could be called, "reframing the problem." But in reflecting on this simpler definition, it is not really the problem that

the best designers reframe, but the recognition of the possibilities inherent in the problem statement itself. How often have you observed a team, student or professional, tasked with a new problem talk about how it is not an interesting problem? A typical response to this uninspired point of view is to change the problem statement. "I know we were supposed to come up with a less costly printer design, but we decided that incorporating RFID would lead to more interesting results!" Changing the problem statement does not require design expertise. What *does* require design expertise is to see the familiar in a new way; to see the potential that others overlook or do not recognize. What might be at the basis of this competency? Simply put, this design competence involves the identification of the elements and relationships inherent or possible in the problem statement. Presented with a new problem, the experienced designer doesn't jump to possible solution ideas, but instead, begins to break the problem down. "Design a new bridge" immediately begins to expand into "where?", "for what kind of traffic?" "with what kind of structure?", and "for whom?" In addition, this competence demands an openness to the range of ways a solution could be formulated. Any problem statement, because of existing experiences and examples in the world, suggests solution paths that already exist. The competent designer not only questions solution paths that suggest themselves, but also identifies new paths, thus opening the solution space.

2. The ability to work at varying levels of abstraction. Abstraction is the elimination of detail. In art, it is known for having shifted the field from literal representation and opening a whole new world of exploration. In design, it's value lies in its ability to simplify and to focus attention. A bubble diagram that represents six key areas of communication with customers helps the development team "see" an aspect of an infinitely more complex problem. A few lines connecting those circles, labeled with one or more characteristics can become the imperfect but highly useful representation around which the project activity is organized. The value of using abstraction productively, a core visual principle most designers take for granted, should not be underestimated. The identification of this value can be attributed to Dave Poole, a vice president of engineering at Zebra Technologies, the leading maker of bar code and RFID label printers. His engineering team took part in a two-day workshop along with sales, marketing, and business-development team members. The two days consisted of reviewing user research, tearing down products, brainstorming, and prototyping with foam core and other lightweight materials. After the workshop, in which a fundamental new product platform was created, Poole was being interviewed about the experience. The interviewer suggested that perhaps the tangible nature of prototyping was a real catalyst to the team's productivity. "On the contrary," Poole replied, "normally my engineers are too tangible, too worried about what will work and how. The prototyping, while tangible, was at a level of abstraction appropriate to where we are in the process. It allowed them to consider new relationships that they would have never considered working in the detail that they are used to."

3. The ability to use modeling as an analytic tool. Where does the making of models, visualizations, and prototypes stand in design today? What was once seen as a core skill is used less frequently and is being driven toward a service bureau function. Designers should not give up the ability and propensity to model. But this is no sentimental call for the return of Bondo, rubber cement, and nifty tricks that simulate produced artifacts. That misplaces the emphasis on the literal representation of a final design solution. And this misplaced emphasis is one reason why model shops emerged separate from the design office and the rapid prototyping industry focuses on the fidelity of 3-D printing. What really makes modeling and visualization powerful, however, is its use early in the process, when it seems the team does not know enough to make something. In fact, most teams argue against making things when they are just beginning to discuss potential solutions. The core competence of a designer is not in the fidelity with which she can fabricate a model, but in her ability to generate new information about the solution through

making. This is the use of modeling as an analytic tool—similar to using a spreadsheet for financial models. Few would argue that everyone should wait until all the financials are known before a spreadsheet is created. It is the creation of the initial model that helps the analyst better understand the problem. And so it should be with the designer's physical models. Physical embodiments of ideas, no matter how abstracted, are able to communicate in ways text and image simply cannot. A good example here comes from one of my mentors, Dale Fahnstrom—a particularly effective designer because he thinks by visualizing and making things. In one of his packaging design projects, the design brief called for a new package that held 10 ounces. One of the first things he did was to cut a series of differently proportioned blocks of wood, each representing a perfect 10 ounces. Lined up next to each other and photographed, the 10 or so blocks ranged in height from less than 1 inch to almost 1 foot. The cross section of each one also varied, but the variation was far less noticeable than the height. These volume studies were a powerful analysis of what 10 ounces could mean to the packaging project. As a result, the team, especially the business managers, understood fundamentally more about the critical role proportioning would play in the perception of their new package.

4. An approach to problem solving that involves the creation and evaluation of multiple alternatives. The standard approach to problem solving we learn from grade school through college is surprisingly different than the approach needed in design. In the vast majority of educational environments, problems are well structured and they have a narrow solution space. In contrast, design problems are ill structured and have a wide solution space. The cognitive and methodological approach necessary for these two kinds of problem solving are significantly different. For a well-structured problem, the goal is to recognize the features of the problem that indicate which tools one should use to represent the problem so that is can be solved. More advanced students learn to recognize the "type of problem" it is and then proceed to use the right tools and thinking to work through the problem. In contrast, a design problem requires seeing the broad potential in the problem statement (core competency 1) and the creation of alternative and significantly different solution directions. Recall how often we lament the design student who comes up with a single direction in response to a problem statement and spends the rest of the semester working on it. There is a sense of missed opportunity. The creation of multiple viable alternatives as an efficient means of solving problems is both counter intuitive and counter to the typical organizational culture. Why? Since grade school, students have been rewarded for recognizing and solving the problem "correctly" and in a way that matches a previously established solution. Tests involve getting through as many of these well-structured and narrow solution space problems as possible. Search of the solution space is not valued. Unfortunately, these approaches and values only apply to well-structured problems and not to design problems. Design competence requires an ability to see problems in different ways and search solution spaces effectively. To do so, the pattern of activity involves rapid cycles of divergent and convergent thinking. This pattern is indeed explored in the product-development literature; however, it is most often represented in one cycle as a funneling down process. But this funnel needs to be repeated effectively both at the overall level of the design problem and at many smaller levels. The result is an expertise in divergent-convergent thinking that results in highly robust design solutions.

5. An ability to add or maintain value as pieces are integrated into a whole. This competence grows out of composition, a skill we begin to learn very early in design. Composition is the arrangement of elements in order to create value. In design, composition is thought of primarily in visual terms and the value that results can be described as harmony, balance, or dynamic asymmetry. While individual elements of a solution each have their own inherent value, their arrangement results in a gestalt, or a value of the whole. But composition can be thought of in broader terms beyond the visual value. There is not only a visual gestalt, but a functional one

as well. In practice, this functional gestalt often goes neglected. In organizations, the groups responsible for different parts of a solution are in different departments and they work on different aspects of the problem—marketing, mechanical engineering, electrical engineering, packaging development, and so forth. Sometimes, there is a system architect, but their responsibility is often technical and disassociated with the physical manifestation of the system. It is no wonder that designers are often used to design the housing of a product. It is the one way the final physical gestalt can be improved after the technical system is finalized. Designers can add significantly more value if they are willing to play a role in the functional gestalt of the system. This involvement must start early in the process before refined visual design is even necessary. When playing this role, designers work on the product architecture and add value by improving the quality of the product by how it is arranged, not only by how it is styled. There are countless business contexts in which the arrangement of elements and their interactions can add value. Think of establishing strategic alliances. The elements are companies and their arrangement is defined by what roles they each play in serving customers. To assess this, prototype it, and evaluate the value of different arrangements is fundamentally a design problem. There are certainly standard business tools to use here such as financial analysis, but there are also design tools to use here such as addressing the communication architecture, service architecture, and experience of the service from a customer standpoint.

6. An ability to establish purposeful relationships between the solution and its context. If the composition of elements within a solution establishes value, there is also a need to establish relationships between the solution and its context. Design has traditionally used human factors as the way to look at the relationship between a new design and something essential in the environment—a user. Of course, any aspect external to a new product or service holds potential value to relate to: how it is to be transported; other products and service in the context; the changing environmental conditions like light; who passes by to look at it. These potential relationships are often neglected. Existing day to day in comfortable consulting and corporate environments, organizations become more and more separated from the context in which their products and services reside. There is great value to be leveraged by getting into the contexts and identifying aspects that can provide insight to the problem at hand. Thought about more broadly, design competence can help an organization long before a design project exists. During market research, the tangible nature of the context can be studied. The nature and character of whole product categories can be analyzed from a design standpoint—not to give inspiration to the design team, but to inform the organization of the competitive context in which they compete. Design is just starting to broaden its ability to identify and analyze elements of context through research at the beginning of a design project. Currently it is user-oriented. But other aspects of the context are equally relevant and can add to discovery of issues to which the design can respond.

7. An ability to use form to embody and communicate ideas. The final competency should be the most familiar—the controlled use of form. Learning to create form and how form embodies ideas is how we spend most of our design education. Controlling form means to use line, plane, volume, surface, color, material, and finish to embody and communicate ideas. Controlling form allows the designer to give a product or service the right feel, an appropriate character. It can be used to communicate corporate identity, how a product is used, or familiarity. The control of form implies there is a goal to be achieved and a means of evaluating potential solutions. Unfortunately, there is still an art-oriented tradition in design that values stylistic search and even the development of a personal style. This limits the professionalism of the discipline and leads to the rise and fall of hot designers, rather than the regular and reliable use of design expertise. A competent designer should be able to control form to achieve an appropriate objective rather than advocate a singular style. When a designer chooses to focus on a particular formal language, it is

similar to a doctor specializing in orthopedics—the choice narrows the kinds of projects one may (or should) work on. While design may have somewhat less severe consequences when inappropriate methods are used the analogy will become stronger as the discipline understands itself, its capabilities, and the value it can actually add. The knowledge of how form embodies and communicates ideas is broadly applicable to activities outside of design projects. It is useful in competitive assessment, in strategic planning, and technology road mapping. How? In each case there are ways in which the core ideas of the activity can be embodied in form—diagrams and models. Traditionally, design is used when a manager asks for design's help in creating a diagram or model. And in this case, design is seen as a "service." But imagine a designer as a strategy manager or technology planner. This is when the role of design shifts from service to expertise. Moving out of the design department and being responsible for an aspect of business, like strategy, is the only way for design to realize its full value.

Implications of the Set of Competencies

The competencies previously described begin to capture a set of tangible, specific, yet broadly applicable skills that designers can bring to the professions. Each deserves debate, further study, and exploration to deepen our understanding of them. Despite this admittedly brief description of each, it is useful to explore how these competencies might impact education and practice. I'll discuss design education first. Design, as defined at the beginning of this article, is considered broader than the industrial (product), architectural, and graphic tradition with which most readers will be familiar. It encompasses any context in which the arrangement of elements is meant to provide value. There are two ways design education can be broadened. First, design education stands to be expanded, fundamentally changed or reinvented. Developing a pedagogical approach that incorporates these competencies explicitly has the potential to create a new way to teach design. The goal should be no less than to create a professional with expertise that can be characterized more explicitly than "creativity" and communicate more value than having a technical skill such as drawing and model making.

The second opportunity for design education is for it to be incorporated into other professional curricula. The design competencies open the possibility that business and engineering students can learn the specific and significant value of design, not through the traditional and time intensive process of doing design projects, but through lectures and exercises that focus on specific competencies. Clearly, the object would not be to teach them the skills of traditional visual design, but the principles of the design discipline and how it adds value to their profession. How can design be incorporated into other professions' curricula? Are we trying to make everyone a designer? In the same way some level of finance and economics makes it into an engineering curriculum, so design theory and methods can be incorporated. The current challenge of incorporating design content in other disciplines is that it is not well formulated and we only have skill, technical knowledge, and time-consuming studios to deliver the content. Most accredited curriculums haven't the time to deliver multiple project-oriented studios given their current requirements. And when project-oriented coursework is adopted, there is no pedagogical framework or theory to help guide a reliable and measurable experience.

Implications for Professional Practice

Beyond education, the design competencies hold the potential to break design out of its department-level existence into a full-fledged business discipline. The design department will always be necessary, but what has been tragic for the discipline is that designers have seldom ventured beyond the department or the design function. Not that every designer must leave the department level practice, but a good portion should. Many accountants become financial

strategists. Engineers become advanced technology planners. Marketing managers become senior leaders. A career path for a designer normally involves rising in seniority within a design department and when no more levels exist, leaving to take a senior designer or design manager position at another firm. Rarely does a designer leverage their core discipline to move into product management, marketing, strategy, or significant leadership positions. If they do move, seldom do the positions they take fully leverage their design expertise. The design competencies and their successful rollout into the discipline can change this situation. The design competencies are specific skills that other disciplines lack and that can be applied to business to create new capabilities. Consider Gravity Tank, a Chicago-based consulting firm, and their Integrated Definition™ service. (Full disclosure: The author is a principal in the firm) This service is used by companies when they are trying to figure out what to design and develop next, long before full development services are engaged. Integrated Definition™ uses design research in combination with conceptualization and prototyping to identify and explore possible directions. The service is built on design expertise, but does not provide, nor offer design services to client organizations. Think about that—is it possible for a service to be based on design, but not offer design services? It *is* possible because the design competencies are applicable to the goals and challenges of a business process that occurs before design and development, namely new product and service definition.

Summary

This paper introduces the notion that design is based on competencies that can be articulated in a tangible and meaningful way. The competencies provide more specificity than definitions of design skill that emphasize creativity. They also reveal the value of design better than articulating technical skills such as drawing. The competencies point to the improvement of design education and the broader value that design expertise can bring to areas of organizations beyond the design department. The value of being able to see potential in a problem; the value of being able to work at varying levels of abstraction; and the value of being able to make things tangible in spite of not having all the information. These competencies may look like a simple reframing of what we've always known design could do. That would be good. But they should also indicate that design has significant room for growth. This growth will be fueled by the academics and professionals willing to study the discipline, reveal its mystery, and apply design expertise beyond doing the next design project.