Design Thinking and the Experience of Innovation

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An Overview of Innovation

Discussions on creativity, creative thinking techniques, social psychology, geography, and economic development inform much of the commentary on innovation. Such work usually focuses on techniques for achieving innovation; enhancing its role in increasing productivity, and contributing to the economic betterment of a given group or region. For instance, in economics, "clusters" often are associated with innovation. These are the "geographic concentrations" of companies and services that collectively link to focus on meeting the overall needs of a given industry sector.[1] Often, such companies both compete and cooperate, enhancing the cluster. The California wine cluster is an example which includes several vineyards, wineries, and those companies that contribute to all aspects of productivity in winemaking. This list covers those we might expect to be involved with wine production such as the manufacturers of bottles, corks, labels, and barrels; and also those who can provide a specialized advertising and media presence, offering linkages to related agribusinesses, the restaurant industry, and winery tourism.[2]

Due to geographic proximity and a linked focus, clusters are useful in enhancing the microeconomic capability of a given region. This occurs through improvements in the productivity of cluster members which enables them to compete effectively in both regional and global markets. The geographic concentration allows for access to capabilities, information, expertise, and ideas. They allow members to quickly perceive new buyer needs, and new technological, delivery, or operating possibilities. This allows members to quickly recognize and identify new opportunities far more readily than those residing outside the cluster. Pressure also exists within clusters. Competition and peer pressure can drive an inherent need for participants to distinguish themselves, and proactively force the pursuit of innovation. Also cluster participants tend to contribute to local research institutes and universities, and may work together to develop local resources collectively and privately in a manner beyond the mandate of local governments and other organizations. Activities such as these can enrich the work experience, and enhance innovation and the quality of life within the cluster community. In

1 Michael E. Porter, "Clusters and the New Economics of Competition," *Harvard Business Review* (November-December 1998): 78.

2 Michael E. Porter, "Location, Competition, and Economic Development: Local Clusters in a Global Economy," *Economic Development Quarterly* 14:1 (February 2000): 15–34, 17.

providing an economic focus, clusters provide a succinct context for idea generation and economic development through a variety of means.[3]

Categories of Innovation

An early writer on innovation, Joseph Schumpeter, distinguished it from invention, and saw it as a far more potent contributor to prosperity. In Schumpeter's estimation, inventors only generated ideas, while innovation occurs as the entrepreneur is able to implement and introduce the new idea into a form of widespread use. He referred to this as the entrepreneur's ability to "get things done," and saw it as a definitive aspect of the innovation process.[4] In this, Schumpeter discounts the need to reinvent the wheel and allows for nonradical innovations, such as the introduction of Deerfoot sausage.[5]

Others have focused on the degree of newness evident in innovation. Thomas Robertson proposed three classifications for innovation: "continuous," "dynamically continuous," and "discontinuous."[6] "Continuous" can be considered incremental or evolutionary in character, a small improvement over what already exists, such as a new flavor of chewing gum. Indicative of a general lack of newness in its manifestation, lesser forms of continuous innovation are more truly thought of as imitation. "Dynamically continuous" refers to the manner in which an existing functionality can be dramatically improved, such as the introduction of flat-screen monitors over older and larger cathode ray tube monitors. "Discontinuous innovation" is seen as the introduction of significantly different technology or infrastructure that, in turn, leads to unprecedented uses and functionalities.[7] It also is known as disruptive innovation because it can interrupt, disrupt, or otherwise interfere with concurrent use and behavior patterns facilitated by existing technologies.[8] Consider the introduction and subsequent widespread adoption of the Internet, and the attending boom in information technologies, as providing for a wholly new manner of user interaction and interface with technology that simply did not exist before. These categorizations are useful in such things as risk assessment. Here, a continuous innovation might seem less risky, being a simple variation on something that already exists and proven in its widespread use; versus the greater risks associated with the potential failure of a new discontinuous innovation, which can require significant and expensive development work.

Innovation Triggers

At the scale of the individual, certain conditions can be seen to enhance the pursuit of innovation and creativity. The psychologist Teresa Amabile proposes a componential framework for creativity. She identifies three main psychological components: domain-relevant skills, creativity-relevant skills, and task motivation. Domain-

3 Michael E. Porter, "Clusters and the New Economics of Competition," 83–89.

4 Joseph Schumpeter, "The Creative Response in Economic History" in *Essays on Entrepreneurs, Innovations, Business Cycles, and the Evolution of Capitalism,* Richard V. Clemence, ed. (Piscataway, NJ: Transaction Publishers, 1989): 221–224.

5 Ibid., 223.

6 Thomas Robertson, "The Process of Innovation and the Diffusion of Innovation," *Journal of Marketing* 31 (January 1967): 15.

7 Ibid., 15–16.

8 P. Thmond and F. Lettice, "Disruptive Innovation Explored" in *9th IPSE International Conference on Concurrent Engineering: Research and Application* (CE2002), (2002): 1–2.

relevance refers to areas of knowledge and skill embodied by an individual, such as factual knowledge and expertise in a given topic.[9] This could include the computational skills of a mathematician, the listening skills and manual dexterity of a pianist, and the drawing and visualization skills of an artist.

Creativity-relevant skills include the typical cognitive styles, work styles, and personality traits that influence how one approaches a particular problem-solving task. Creativity-relevant skills inform the way an individual may perceive, comprehend, navigate, manipulate, and otherwise consider issues and problems in novel and useful ways.[10] These skills influence the degree of novelty in a particular creative insight or product. Such skills are further influenced by personality traits such as self-discipline, the ability to entertain ambiguity and complexity, the capacity to delay gratification, an autonomous outlook on the world, and a willingness to take risks. If the domain-relevant skills constitute the knowledge that an individual applies in conducting a task or solving a problem, then the creativity-relevant skills inform the manner as to how those skills are applied, ultimately influencing the degree of creativity in the response.

While more traditional forms of education would inform the development of domain-relevant skills, creative heuristics can be used to develop one's creativity-relevant skill set. This is the focus for many of Kelley's insights in his book *The Art of Innovation.* Kelley offers many techniques that inform the process, activity, and consideration of innovation. He notes that observation, laterally organized group work, brainstorming, prototyping, the manipulation of environments, aspects of set-breaking, the role of chance (and by default the ability to allow for failure), and a certain perceptive quality which he refers to as "coloring outside the lines" all represent important cognitive devices that can be used to effectively enhance the occurrence of innovation.[11] Indeed, if Amabile's research seeks to establish more concrete means for the evaluation and prediction of creativity, Kelley's work focuses on specific techniques and ways of thinking that ultimately will enhance the process of achieving innovation.

Task motivation addresses the motivational state in which the creative act is pursued. Intrinsic motivation, is understood as those factors which exist from within the individual's own personal view. One can be seen as intrinsically motivated in a given task when engagement in that task is perceived as a meritorious end in itself. Extrinsic motivation or external factors such as deadlines, payment, aspects of supervision, etc. are understood as mitigating factors external to the task itself and are imposed externally to the person completing the task.[12] Amabile's research into the social-psychology of creativity is rooted in the hypothesis that intrinsic motivation represents a stronger positive influence in the pursuit of creativity

9 Teresa Amabile, *The Social Psychology of Creativity* (New York: Springer-Verlag 1983): 67–70.

10 Ibid., 67–69.

11 Tom Kelley, *The Art of Innovation* (New York: Doubleday, 2001): 231–246.

12 Teresa Amabile, *The Social Psychology of Creativity,* 76.

than extrinsic motivational. Her efforts examine the social environment in which creativity is pursued, and how that in turn might be manipulated to enhance the creative result.

Towards the Idea in Innovation

The discussion above spans various scales of inquiry regarding innovation, but is a more elemental understanding of innovation possible? A departure point to pursue such an understanding begins with a definition for the term "innovation." Schumpeter saw innovation as the domain of the entrepreneur who "gets things done." He defines the activity as "simply the doing of new things or the doing of things that are already being done in a new way."[13] The *Oslo Manual* defines innovation as "the implementation of a new or significantly improved product (good, or service) or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations."[14] *ITP Nelson* simply defines innovation as the "act of introducing something new."[15] And the anthropologist H. G. Barnett considered innovation as the result of a process in which a new "thought, behaviour, or thing" is conceived of and brought into existence.[16]

Each of the definitions above note that to achieve innovation requires an action or process of some type that introduces something new. Evident here are the constituent elements of innovation, which can be identified as the new thing to be introduced, the act of introducing it, and some type of arena where the introduction occurs. However there can be some ambiguity in understanding what exactly constitutes the new thing and its introduction. A buyer for a given retail chain might view a new, fully developed product as the "new thing," and its subsequent adoption into market distribution as its "introduction." Others, more technically-minded, might view the development process of that product as its "introduction" and the idea behind the product as the "new thing." The introduction also could occur at the level of the individual, such as with early adopters of emerging technologies. Indeed, it could take place in a variety of ways.

From the definitions, new things can take on a variety of forms such as a product, behavior, system, process, organization, or business model. At the heart of all these "new things" is an idea which is deemed meritorious and, when acted upon, ultimately affects the innovation. To describe an idea as "innovative" suggests that it should be acted upon. Given this distinction, there is a point where the innovation can be seen to exist only as an idea. Initiating some action inspired by the idea starts the process through which the eventual "introduction" can occur, and thus initiates the innovation process which can encompass any subsequent activity necessary to further the idea's development along.

13 Schumpeter, "Creative Response," 223–24.

14 *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data* (3rd Edition) (OECD/European Communities, 2005): 46.

15 *ITP Nelson Canadian Dictionary of the English Language* (Toronto: ITP Nelson, 1998): 702.

16 H. G. Barnett, *Innovation: The Basis of Cultural Change* (New York: McGraw-Hill Book Company, 1953): 7, quoted in Thomas Robertson "The Process of Innovation and the Diffusion of Innovation," *Journal of Marketing* 31 (January 1967): 14.

The Idea Experience

Some insight into the experience of an idea is evident in Scruton's discussion of aesthetic perception and the experience of architecture. The description of this experience can be used to inform a more general insight as to how ideas are generated. Scruton notes that one applies imagination to perceive form, order, balance, etc. in a given architectural piece.[17] At a base level, one might easily see that a building is constructed from various materials, however, it is our imagination that allows us to see forms in the arrangement of these base components, such as the semicircular composition of brick in an archway. As a cognitive mechanism, this is very similar to the ability to see a face in the clouds. Imagination allows us to entertain the notion of the shape of a face evident in the outline of clouds, just as one might see a pattern in the arrangement of bricks on the façade of a building. The viewer cognitively matches the shape of the cloud or the arrangement of bricks to a previously understood concept, that of a particular animal or geometric form such as a circle. Scruton refers to the acquisition of such insight as an act of imaginative perception.[18] *ITP Nelson* defines idea as the "conception existing in the mind as a result of mental understanding, awareness or activity."[19] With this, it can be argued that Scruton's notion of imaginative perception, as evident in the aesthetic experience of architecture, represents the genesis of an idea. Thus, in comprehending the semicircular arrangement of the bricks, one is effectively arriving at an idea about those bricks and the building constructed from them.

From this brief discussion on the occurrence of an idea, its constituent elements can be noted. These include a stimulus of some sort, that is, something that could arrest or hold the attention of a potential viewer. The examples above suggest something seen or physical, however, it could be otherwise such as a musical note or the spoken word. Such stimuli exist in settings or contexts, such as a cloud in the sky, a brick in a wall, or a musical chord in a song. And, of course, there must be a viewer, someone who can then perceive and consider the stimulus. It is in the consideration of such stimuli that one can cognitively nest perception within a body of experience and learning that then can inform the comprehension of a particular stimulus and make sense of it in an imaginative way.

The key to the interplay of these idea elements is the capacity of the stimulus to hold one's attention and engender its consideration. For example, an arresting piece of architecture can hijack one's focus, requiring that the viewer make sense of the building observed. In an instant, the mere presence of architecture (or any other stimuli) has the potential capacity to interrupt one's thoughts. At times, such an interruption can be leisurely, a building may simply command attention during a casual stroll. At other times, the experience is more pressing, such as the need to navigate the interior of a foreign train station to ensure one's timely arrival at the right platform.

17 R. Scruton, *The Aesthetics of Architecture* (Princeton: Princeton University Press, 1979): 76–78.

18 Ibid.

19 *ITP Nelson Canadian Dictionary of the English Language,* 674.

There is another aspect that can be derived from Scruton's discussion on imaginative perception, and that is the malleability of the perception itself. One can choose, at will, different ways of seeing, comprehending, or experiencing a given piece of architecture. Scruton refers to the upper story row of columns of the Palazzo Pisani-Moretta in Venice. Here, one can perceive that neighboring columns end in an aedicule (a pointed arch), or that every third column anchors a semicircular arch. There is an inherent ambiguity where one can perceive either one or the other compositions in the architecture. Further, if someone does not immediately see one or the other version of the columnar endings, another bystander in the vicinity could point it out, thus providing insight as to other ways of imaginatively perceiving the composition.[20] This ability to flexibly generate different imaginative responses to stimuli is open to influence from a variety of sources, anything that could then prompt one's reconsideration of the stimulus.

Idea Elements

The idea elements described above can be seen to act within a cognitive mechanism that engenders an idea. Certain historical instances are useful in illustrating how these idea elements work in different ways. For example, Archimedes' sudden insight into the relationship between an object's volume and water displacement is one of these. In noticing the water level of his bath rise as he lowered himself into it, Archimedes realized that water, displaced in such a fashion, could be used to measure the volume of an irregularly shaped gold wreath, a task he was under commission to determine. Here, the water level serves as the stimulus, and its relative position against the side of the tub is its physical context. In the consideration of this as a stimulus, Archimedes imaginatively contextualizes his observation within his pressing query, and the idea was formed.[21] In this instance, the previous experience is not explicit; rather it is knowledge in the form of a perplexing question known to the idea progenitor.

A similar experience can be found in the description of Kekulé's discovery of the molecular structure of benzene. In this story, Kekulé had been pursuing this question for some time, yet an accurate theory as to benzene's structure remained elusive. One day, he dozed off in his study with the fire burning in the fireplace. In his dozing state, he contemplated the flames, imaginatively seeing them first as snakes and then as snakes biting their tails, forming circles with their bodies. When he fully awoke, he realized that the molecular structure for benzene was indeed circular, or rather it formed a six-sided ring shape.[22] Such a structure allows for a greater number of molecular bonds than would be possible otherwise, a notion later confirmed by his student W. Körner.[23] The constituent idea elements are at play here. The fire provides the initial stimulus in this mix, and one can postulate that Kekulé's state of relaxation might well enhance his willingness to make sense of the flames imaginatively

20 R. Scruton, *Aesthetics of Architecture,* 85–87.

21 E. J. Dijksterhuis, *Archimedes* (Princeton, NJ: Princeton University Press, 1987), 19.

22 M. A. Boden "What Is Creativity?" in *Dimensions of Creativity,* M. A. Boden, ed. (Cambridge, MA: The MIT Press, 1994): 82–83.

23 David Knight, *Ideas in Chemistry: A History of the Science* (New Brunswick, NJ: Rutgers University Press, 1992), 123.

as writhing snakes. The idea of a circular snake can be seen as a new stimulus which, when considered in light of his research, is contextualized within the problem of benzene's structure. Upon his reveille, he is able to consciously put the pieces together and explicitly table the new idea. Moving from the idea of snakes dancing in the fire to that of circular snakes represents a cognitive micro-step which is similar to the flexibility noted above regarding architectural ambiguities. This is illustrative of how newly formed ideas can nest as stimuli to inform the genesis of subsequent ideas.

The Considered Idea

The examples noted above echo Krippendorf's discussion regarding product semantics. Krippendorf postulates that in viewing a given product, one imaginatively contextualizes the perception of that object as a means of comprehending significance.[24] In this, the viewer formulates ideas about the object, cognitively placing it into contexts that allow her to formulate an understanding of it. For instance, she might consider how a chair could look in her living room while seeing it in a store. Krippendorf notes that "Meaning is a cognitively constructed relationship. It selectively connects features of an object and features of its (real environment or imagined) context into a coherent unity." [25] The ability to comprehend a totality of meaning in this is seen in the summation of all potentially imaginable contexts by an individual. That potentially there is a limitless variety of contexts which can be used to construct meaning is indicative of the degrees of potential quality evident in any resulting idea about an object. Some ideas are more easily arrived at than others. Perceiving a horse in the sky or the circular arrangement of bricks can happen in an instant. One can arrive at scores of such ideas in the course of the day. Other ideas require more work. Often, the genesis of a useful idea requires that one work through the generation of sequential or chained ideas as evident in Kekulé's contemplation of the ringed snakes.

Given this mechanism of stimulus and context, a variety of factors can be seen to influence the occurrence and generation of ideas. This can include knowledge, experience, and one's capacity to fully consider and contextualize stimuli, echoing Amabile's components of creativity. Nesting stimuli within contexts is informed to some degree by the conceptual space where that contextualization takes place. Psychologist Margaret Boden states: "The dimensions of a conceptual space are the organizing principles that unify and give structure to a given domain of thinking."[26] The extensive knowledge base of a given profession or discipline (as evident in Amabile's notion of domain relevance skills) provides an example of such conceptual space, where there are accepted normative concepts, standards, and language that underlie the conduct of the discipline. Indeed, even language forms a type of conceptual space where the rules of spelling and grammar allow one to make sense

24 Klaus Krippendorf, "On the Essential Contexts of Artifacts or on the Proposition That 'Design Is Making Sense (of Things)'" in *The Idea of Design*, Victor Margolin and Richard Buchanan, eds. (Cambridge, MA: The MIT Press, 1995): 159, 156–184.

25 Ibid.

26 M. A. Boden "What Is Creativity?" 79.

of individual letters and words. As Krippendorf notes, the act of naming something immediately places it within a linguistic context, subsequently making it subject to the rules of language as part of the sense- making process.[27] Conceptual space also is interesting, because sometimes that space can limit or preclude the occurrence of an idea. Prior to Kekulé's epiphany, available experimental data might have been interpreted as describing a circular chemical structure for benzene. And yet if one is locked into a particular way of viewing such data, it can occlude other interpretations.

The Idea in Innovation

The expression "thinking outside the box" is commonly used in reference to new ideas and innovation. This colloquialism reflects an intuitive understanding of the idea generation process: cognitive contextualization can be seen as a space (or box) for the consideration of a stimulus. Given the intent of the expression, thinking "inside the box" refers to a more pedestrian form of sense-making. The need to make sense of things via fresh contexts and/or stimuli is necessary to break out of the "box." There is a significant duality to the nature of contexts in this. On the one hand, they provide the means by which one makes sense of a given stimulus, but if this becomes staid it then can interfere with the achievement of more useful ideas. More accurately, in thinking "outside the box," one is effectively thinking in a very *different* box. If the role of contextualization is true in the formation of an idea, then some kind of cognitive context or "box" always will be required to comprehend a particular stimulus, even if it is a radically different context.

Insights into the idea mechanism and the need to think outside of the box can inform the discussion on innovation. For instance, clusters allow individuals to work closely with others in contextually matched endeavors. In this clusters play to chance and serve, through proximity and convenient connectivity, to increase the likelihood that one might consider a given stimulus within a related, yet new and useful, context. This, in turn, can engender a new idea, cultivating the likelihood of any follow-through innovation.

The quality of a given innovation also is influenced through the idea mechanism. To move beyond imitative and continuous innovations, greater originality is required in the generation of new ideas. This entails the consideration of stimuli in increasingly disparate contexts. It also requires the continued motivation to reconsider fresh ideas as new stimuli. Towards this end, the use of heuristics and other innovative techniques, as noted by Kelley, address the capacity to catapult one's thinking into wide-ranging contexts. For example, in brainstorming the type of people included, the inherent structuring of the session, the suspension of judgment, and the use of various media to capture ideas, comments, and notions all can be seen as significant in the generation of new ideas. Brainstorming members who come from different backgrounds (sociologists,

27 Klaus Krippendorf, "On the Essential Contexts of Artifacts," 159.

psychologists, designers, engineers, etc.) are able to draw upon differing creativity-relevant and domain-relevant skill sets. Such differences can be very wide-ranging: in a discussion of "lead users" von Hippel (et al.) notes how 3M brought together their researchers, veterinary specialists, and makeup and special effects industry people to explore new product ideas for controlling infections after surgery.[28] Brainstorming members inherently will bring different approaches to considering stimuli, both in terms of willingness and capacity. Further, such breadth allows both for the discipline specific rigor necessary to fully comprehend sophisticated problems, and yet provide for various "boxes" of consideration that can lead to quite unexpected and useful ideas.

The brainstorming session provides an interesting example as to how the idea mechanism can play out. One member might table a topic for consideration and discussion. This serves as an initial stimulus. Any one of the group members can cognitively nest this into a context to arrive at new idea. This idea, in turn, can become a stimulus to another member, who can then contextualize it and arrive at another idea; and so on, initiating an idea chain. Within this dynamic, the deferment of judgment is useful because it allows members to continue nesting new ideas as stimuli to subsequent ideas, a process which judgment might interrupt or divert. Further, contributions to the discussion made in a prescribed order also can muzzle the free association between stimuli and useful contexts. According to Kelley, in an effective brainstorming session, ideas are not only verbally expressed but captured via notes, sketches, the quick model, etc.[29] These media are useful because they play to people's different capacities in their individual domain or creativity-relevant skill sets. People will respond to sketches or notes, as stimuli, in differing and original ways leading again to more unique ideas.

Introducing the New Idea

Amabile proposes a creative process in which components of creativity influence activities in different phases. One can see how the execution of domain- or creativity-relevant skills might occur in this, and how motivation can influence the creative result.

Her theoretical process also is intended to provide a framework indicative of how the overall creative process occurs, and this can be seen to correlate with a basic design process which might include the following steps: see Figures 1 and 2 on page 12.

In comparison to Amabile's process, the design brief and any relevant background research undertaken can be seen to correlate to the preparation step. Sketches and aspects of CAD are similar to the response generation, while prototyping and user testing correlate with the response validation. Amabile's notion of creative outcome corresponds to the resulting design itself, which takes form through specification documents and, ultimately, in the launch of a product.

28 E. von Hippel, S. Thomke, and M. Sonnack, "Creating Breakthroughs at 3M," *Harvard Business Review on Innovation* (2001): 31–53 and 44–46.

29 Tom Kelley, *The Art of Innovation,* 61–62.

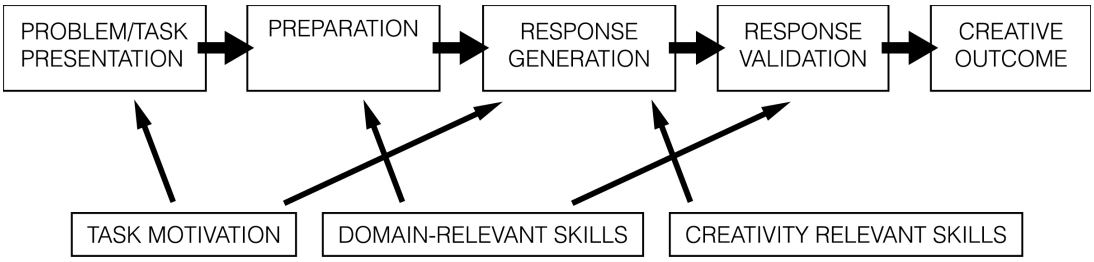

Figure 1
Proposed Creative Process
(from Amabile).[30]

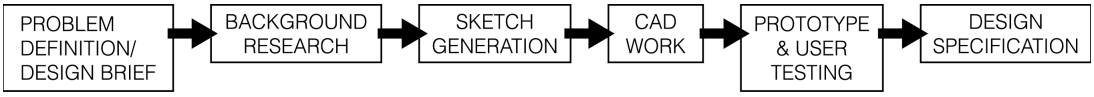

Figure 2
A Suggested Process for Design.

Such similarities are useful because design can be thought of as a professionalized version of the creative process and significant in the achievement of innovation.

Amabile's componential theory also is useful in understanding how smaller aspects of the design process, such as sketches, might be completed. A designer can prepare for this through the perusal of a couple of magazines or surfing-relevant Websites. Subsequently, the completion of any number of rough, initial sketches represents a response generation. Response validation is evident in any evaluation of these sketches, and the designer may then pursue more-polished sketches as an outcome. It becomes apparent in this that the application of Amabile's theory is *scalable* to the type of tasks undertaken, whether they are small interim steps or the entire process. Even within the completion of a single sketch there are aspects of preparation, validation, and outcome, and so the completion of any interim step can be seen as an execution of the larger creative process in miniature. In turn, aspects of all the noted creative activities are apparent in each of the larger phases of Amabile's overall process. Responses will be generated and validated within the preparation phase, and there will be aspects of preparation in the subsequent phases.

The notion of scale in the creative endeavor is interesting: if the final creative outcome is based on a single idea, then (depending on the complexity of the outcome) this end-state is achieved from working through the genesis of many smaller ideas. Indeed, the quality of the end product can be enhanced if a number of smaller ideas are explored first; a principle design is predicated upon. The character of consideration for these smaller ideas is evident in Buchanan's thoughts on design thinking and, specifically, his discussion of *placements*. Buchanan uses the term "placement" as

30 Teresa Amabile, *The Social Psychology of Creativity*, 78.

something of a synonym for context with the qualification that the boundaries of consideration are less tightly defined than one might expect with the word context.[31]

For instance, a given sketch represents an idea for a product's design. The product does not exist, yet the designer will need to evaluate his or her intent within the idea. In considering whether the intended product appears attractive or ungainly, would be easy to manufacture, or comfortable to use, the designer is placing consideration of the sketched product into placements of aesthetics, manufacturability, and ergonomics. Even in creating the sketch, one drawn line will be considered within the placement of other lines and the product's overall form. The sketch is exploratory, effectively a mini-hypothesis in a what-if scenario used to establish relevance.[32] The use of placements here allows the designer to make sense of one's design intent without an undue commitment to the idea while it is still embryonic. There is an inherent flexibility in this where ideas evident in the sketch may be adopted, or they may be forfeited in favor of other ideas as captured in other sketches. Further, features in one sketch may be interwoven with ideas from additional sketches. In evaluating the sketch using placements, the designer can learn more about the extent of the design problem, his or her design intent, and the necessity for further exploration.

To move the process along, other characteristics of the placement dynamic come into play, namely aspects of temporality, commitment, scale, and notions of dominance. While a placement may be entertained initially on a temporary basis, if it is found to be significantly valid, a designer can commit to it as a premise for subsequent design work, effectively dominating the consideration of later ideas in the process. The idea of dominance is a familiar visual and spatial device for designers. It is evident in the Gestalt of figure/ground relationships, and is a principle of the design pedagogy espoused by Roweena Reed Kostellow.[33] What is interesting in this is that it is a spatial principle which is applied to the consideration of any idea (not only those of visual composition) evident in the process. It also is interesting to note that, as with visual composition, the perception of dominance is flexible depending on how one might focus in on a given placement. Further, a notion of dominance evokes notions of scale. Usually, larger ideas dominate smaller ones. For example, an understanding of a product's position in the market usually is established before the design of its overall shape, and the shape is established before the detailed design of features such as keys or buttons.

The idea mechanism noted above is evident in placements. Features of a sketch, model, CAD, or any other design deliverable can act as stimuli to further consideration within the flexible contexts of placements. It is interesting to note how Amabile's components of creativity inform one's engagement with placements. Domain-relevance is evident in design skills and theoretical basis for the

31 Richard Buchanan, "Wicked Problems in Design Thinking" in *The Idea of Design,* Victor Margolin and Richard Buchanan, eds. (Cambridge, MA: The MIT Press, 1995): 10, 3–20.

32 Ibid, 16.

33 Gail Greet Hannah, *Elements of Design: Roweena Reed Kostellow and the Structure of Visual Relationships* (New York: Princeton Architectural Press, 2002), 50.

consideration of design deliverables, while the inherent curiosity and discipline of the designer influences the promulgation of the design effort. Moving beyond skills, attitude, and motivation, it also is intriguing to note the spatial quality to the designer's thinking in the design effort, where aspects of temporality, dominance, and scale are at play in the weighing of issues and the contemplation of design problems.

Innovation often is seen as a process of finding solutions necessary to introduce a new thing. Yet the exercise of finding solutions can be deterministic, depending upon how the development effort is conceptually framed. The continued drive to use one idea as a stimulus to a subsequent one is indicative of curiosity. A significant lesson that can be drawn from design thinking and the consideration of placements is that it is more a process of raising (several) good questions versus one for finding the right answers. That one does not make an a priori commitment in the initial entertainment of a given placement means that it is used to learn more about the issues under consideration. Indeed, that one *entertains* a placement is indicative of the playful quality inherent in the design pursuit. Given the curiosity that drives such play, and the skill with which it is executed, an effectively broad range of issues can be raised and duly considered in the development and introduction of innovative new things.