Consumer-Based Assessment of Product Creativity:
A Review and Reappraisal

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ABSTRACT

In the current value-based economy, organizations compete to match customer needs and requirements by adding various types of value to products or programs. One example of this added value is product creativity, which is defined as the originality and appropriateness of a product that elicits a positive affect compatible with the consumer or judge. In this article, the authors review current research on creativity, product development, and consumer behavior and reappraise the current tools to measure product creativity. The overall conclusion of this review and reappraisal is that whereas product creativity shows relevance to consumer behavior, a more detailed model of product creativity and measurement tool needs to be developed and validated before fully understanding the impact of product creativity on consumer attitudes and purchase intentions. © 2006 Wiley Periodicals, Inc.

1. INTRODUCTION

The changing market demand structure has caused a transition from the product-based to value-based competition. Companies are forced to compete through marketing and product strategies that not only offer appropriate services but also provide value to the consumer. This shift creates the need for a better understanding of consumer values and demands. Various business strategies, such as customer relationship management and total quality management focus on capturing consumer requirements to produce products that provide consumer satisfaction, engagement, and acceptance (Hart, Hultink, Tzokas, & Commandeur, 2003; Rodriguez, Ricart, & Sanchez, 2002). Productivity methods and product decisions focus on consumer expectations and perceptions of value; namely, how consumers actually view the value of products. Several types of opportunities contribute value to the consumer’s overall product experience, such as product ergonomics, quality, aesthetics, emotion, identity, impact, and core technology (Cagan & Vogel, 2002).

In addition to these value opportunities, most would also agree that creativity also adds value to products and that creative products have made a positive impact on society. Product
creativity offers potential value for consumers by not only adding quality and aesthetics to product features, but product creativity also allows consumers to feel an emotional impact and identity with the product. When researchers or organizations attempt to examine the impact of product creativity, however, there is much disagreement primarily because of the lack of a precise definition for product creativity. This confusion deters organizations from better understanding how product creativity influences consumer attitudes and purchase decisions as well as how to enhance the creativity of products further. Current research has stressed the need for, yet lack of appropriate measures of product creativity (Alber & Runco, 1999; Christiaans, 2002). To measure product creativity, one must be able to define product creativity; hence, the debatable definitions have not provided a solid foundation for the development and validation of product creativity measures.

Creativity researchers emphasize the need for more encompassing outcome measures of creativity to better develop the knowledge and theory in the field of creativity (Mayer, 1999). The necessity for outcome measures of creativity stems from three major justifications: to better understand the process of creativity, the outcome must first be measured; enhancement of creativity is explained through measurement of creativity outcome; and fundamentally the concept of creativity does not exist without a measure of its outcome (Besemer & O’Quin, 1987; Plucker & Renzulli, 1999). This research addresses product creativity as an outcome of creative people and creative processes. This study does not concentrate on the components of the creative process or the attributes of the creative persons involved but specifically looks at the final creative product. The purpose of this study is to review current research on creativity, product development, and consumer behavior to develop a more precise definition of product creativity and better understanding of how to measure the impact of product creativity.

2. CREATIVITY

2.1. What is Creativity?

In keeping with the unstructured nature of creativity, researchers have not agreed upon a clear-cut definition and model of creativity. Although this construct is sometimes said to be nonmeasurable and indefinable, we will attempt to better understand creativity by concentrating on how creativity is reflected in products. We chose this approach because creativity is generally associated with the judgment of a product, such as thoughts, writing, art, or inventions. To begin this challenge, literature and previous studies on the theories, dimensions, and measurements of creativity must first be reviewed.

Two attributes, original and valuable, are commonly mentioned in most studies of creativity. In The Handbook of Creativity, Mayer (1999) concludes from a review of the various authors’ definitions that creativity is the “creation of new and useful products, including ideas as well as concrete objects” (p. 450). He proceeds to highlight a few major issues that are necessary to develop the definition of creativity. First, creativity can be viewed as a property of a person (a trait or characteristic), cognitive process (a set of common processes), or product (a result of a process). Second, creativity can be seen as a personal or a social phenomenon, meaning that a creative product is with respect to the individual’s judgment or to the society’s judgment. Third, creativity can be associated with abilities that only a select group of individuals possess or can be associated with common cognitive processes, making all humans capable of creativity. Finally, creativity
can be domain-general (an ability that can be used in a range of settings) or domain-specific (different abilities are required in different settings). Support for the different sides of each issue is shown throughout the *Handbook of Creativity* (Sternberg, 1999). Researchers select different combinations of these issues depending on the problem studied and the method selected to investigate the problem.

For the purpose of this study, creativity is broadly defined *as the individual or group process that results in an artifact (solution, thought, product, art, music, etc.) that is judged as original and useful*. Therefore, the definition of product creativity begins with the involvement of the product’s novelty and appropriateness. The focus of this study is not on the origination or process of creation, but more on the outcome. Thus, the following review of literature will primarily focus on the results associated with creativity and not the process. Although one cannot exist without the other, the main justification for this reverse-engineering approach is that to understand the process better one must first have a solid grasp of the nature of the outcome. Before further defining product creativity, a review of the creativity and product development literature creates a framework for developing the construct to be assessed in this study.

### 2.2. Theories of Creativity

Three major types of theories explain what combination of elements is necessary for creativity to exist. The first major type of theory, *implicit theory*, claims that individuals hold certain constructs, such as cognitive and personality elements, which in combination lead to creative production (Plucker & Renzulli, 1999). Depending on the type of field or activity, variations occur with the constructs selected to judge creativity.

A second theory, *system theory*, involves explicit factors such as environmental or social aspects, with examples as follows. Amabile (1982) proposes that task, motivation, domain-relevant knowledge and abilities, and creativity-relevant skills link with stages in creative problem solving. Gruber and Davis (1988) suggest that the development and deviation of purpose, knowledge, and affect lead to creative products. A third type of system theory developed by Csikszentmihalyi (1988, 1999) states that creativity results from the interactions between the individual, the field (society or judges of creativity), and the domain (culture or environment where creativity exists). This system theory claims that creativity cannot exist without the combination of these three elements.

Finally, investment theory, compares creativity to an investment strategy, where an individual or group uses the strategy to buy low (hold onto an unknown idea with potential) and sell high (persist until the idea becomes accepted, then goes to another idea) (Sternberg & Lubart, 1996). The individual uses resources such as intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment to select and invest in appropriate ideas. Of these three major types of creativity theories, the systems theory approaches the concept of creativity from the product or outcome point of view. Csikszentmihalyi’s systems theory shows that creativity is dependent on not only the individual but also the environment and society, which goes alongside the definition of creativity selected for this study.

### 2.3. Measurement of Creativity

The measurement of creativity is dependant on both the measurement tool as well as the perspective one takes to view creativity. When constructing any type of creativity
measurement, one must first determine what aspect needs to be measured; only then can the appropriate type of measurement tool be selected.

As briefly mentioned, creativity is divided into four major components: person, process, product, and press (Rhodes, 1961; Richards, 1999). A person’s creative nature is obtained through observation of specific personality traits or characteristics (for example: active imagination, flexibility, or curiosity). The process of creativity refers to the combination and demonstration of specific cognitive processes that are associated with producing creative thoughts or products (for example, divergent thinking or problem recognition). A product is often the basis for comparison of processes and environments that lead to or influence creativity production. The level of creativity in a product is often studied and related to the environmental or personality features of an individual. The press of creativity refers to the circumstances in which a person or product exists that influences creativity. Table 1 lists the major attributes and general dimensions associated within each of the four categories of creativity (Cropley, 2000; Plucker & Renzulli, 1999; Rhodes, 1961; Richards, 1999).

Numerous methods for measuring creativity exist: psychometric, experimental, biographical, biological, computation, and contextual (Mayer, 1999). The different measurement tools are used to capture specific goals or aspects of creativity; most tools, however, are utilized separately. Comparisons of measurements only generally occur within the type of measurement tools. The selection of measurement tools is also relevant to the underlying assumptions of the definition of creativity. Some measurement tools such as biographical methods often assume that high-level creativity is limited to a select group of individuals. Thus, in the conclusion of the Handbook of Creativity Handbook, Mayer

<table>
<thead>
<tr>
<th>Category</th>
<th>Associated dimensions</th>
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<tbody>
<tr>
<td><strong>Person</strong></td>
<td>Active imagination, flexibility, curiosity, independence, acceptance of own difference, tolerance for ambiguity, trust in own senses, openness to subconscious material, ability to work on several ideas simultaneously, ability to restructure problems, ability to abstract from the concrete</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td>Fluency of ideas, uncensored perception and encoding of information, problem recognition and construction, unusual combination of ideas, construction of broad categories, recognizing solutions, transformation and restructuring of ideas, seeing implications, elaborating and expanding ideas, self-directed evaluation of ideas</td>
</tr>
<tr>
<td><strong>Product</strong></td>
<td>Originality, relevance, usefulness, complexity, understandability, pleasantness, elegance</td>
</tr>
<tr>
<td><strong>Press</strong></td>
<td>Supervisory encouragement, workload pressure, freedom of choice, sufficient resources, organizational impediments</td>
</tr>
</tbody>
</table>

(1999) states that further study of creativity should combine methods of measurement to capture a broader understanding of creativity.

3. PRODUCT DEVELOPMENT

In general, products are defined as any good, service, place, organization, idea, or resource that is produced or created. With respect to this study, a product refers to objects that are manufactured primarily for the end user to consume. Ideas, concepts, and services are not the main focus of this research; the primary concentration is on physical consumer products. Product development then alludes to the process of creating, improving, and producing such products. The main objectives of product development from the business point of view include lower production costs, higher quality, and quicker time to market, which contribute to consumer satisfaction and profit (Cagan & Vogel, 2002; Roozenburg & Eekels, 1995).

3.1. Product Development Process

The objectives of product design are achieved through five major stages of product development: planning, design, testing and verification, production, and marketing and evaluation (Cushman & Rosenberg, 1991; Wickens, Gordon, & Liu, 1998). The planning stage includes activities such as front-end analysis, need identification, problem definition, and information gathering. The design stage involves the conceptualization and synthesis of information to produce a product and support materials for that product. Ballay (1987) claims that the process of designing includes criteria formulation, space organization, details and structure placement, appearance decisions, and release packaging. Testing and verification occur alongside the design stage, which provides feedback to the design development. The production or implementation of preferred designs is followed by marketing and evaluations of the product.

The stages of product development can be viewed as sequential (one activity must be completed before the next one occurs) or iterative (activity or processes overlap or occur at the same time). Currently, the trend is to take a more iterative approach that involves concurrent activities from various departments with dynamic consumer information systems because the iterative approach is argued to contain a more realistic reflection of design (Bailey, 1996).

3.2. Customer Centricity

When viewing the process of product development, customer requirements play a crucial role in several stages of development. The concept of customer centricity comes from the shift in product-based competition to value-based competition (Mello, 2002). Organizations are focusing beyond manufacturing efficiency and cost reduction methods to the customer demands and expectations. By incorporating customer requirements into the design process, the associated value is added to the design. Several business strategies and methods that attempt to reach this goal of customer centricity exist. Total quality management is a process of capturing and incorporating user requirements into product design through a series of associations between the consumer demands and product characteristics (Soin, 1999). Six sigma approaches product design by aiming to reach certain levels of quality based on consumer demands (Barney & McCarthy, 2002). Customer relationship management is another strategy that integrates customer behaviors and
expectations into the center of all business operations (Peppers & Rogers, 2001). User-centered design focuses on enhancing human abilities, overcoming limitations, and encouraging human acceptance in product development (Rouse, 2001). As these examples show, customer centricity plays an important role in design development and selection.

Capturing consumer requirements involves decisions about how much and what type of information to gather. These decisions are based on segmentation, strategy, and resources available. Customer information includes customer experience (previous relationship with the product/company), expectations (what the customer wants from the product/company), and environment (the customer context). Numerous methods for gathering customer data exist, these include interviews, questionnaires, feedback, databases, and scenarios (Rouse, 2001). Selection of the methods depends on both the type of information desired and the perspective of the customer. Once the customer requirements have been captured, the analysis and integration of that data produce knowledge for design constraints and problem formulation as well as criterion for design selection. One limitation to capturing consumer needs is the consumer’s difficulty expressing opinions about technologies or products unknown to the consumer (Bruce & Cooper, 2000). This limitation serves as a reminder that capturing user needs is only one of several information sources feeding into the product development process.

3.3. Product Classifications

Current product classification systems exist for various purposes. For example, the European Union utilizes the Classification of Products by Activities for input and output analysis, the Common Procurement Vocabulary for procurement transactions of similar products, and the NACE (Nomenclature generale des activites economiques dans les Communautes europeennes [General Industrial Classification of Economic Activities within the European Communities]) to classify economic activities and production (Russow, 2003). The North American Industry Classification System (NAICS), which replaced the U.S. Standard Industrial Classification (SIC) system, is used by the United States, Mexico, and Canada for statistical analysis of industry activities. This list of manufacturing sectors includes food; beverage and tobacco; textiles; textile product; apparel; leather and allied product; wood product; paper; printing and related support activities; petroleum and coal products; chemical; plastics and rubber products; nonmetallic mineral products; primary metal; fabricated metal product; machinery; computer and electronic product; electrical equipment, appliance, and component; transportation equipment; furniture and related products; and miscellaneous (U.S. Census Bureau, 2003). Consumer Reports, the host of the largest nonprofit educational and consumer product testing center in the world, has nine classification of products: autos, appliances, electronics and computers, home and garden, health and fitness, personal finance, babies and kids, travel, and food (Consumer Reports, 2004).

3.4. Product Characteristics

Products are thought to have certain perceived characteristics that contribute to product success or failure. Such characteristics include good value (financial), excellent product quality, meet user’s need, unique features or solve problems others do not, visible benefits, safe, efficient, satisfying to use, durable and serviceable (Cagan & Vogel, 2002; Cooper, 1996; Cushman & Rosenberg, 1991). These characteristics are thought to provide
value to the product. One classification system for the values that consumers expect in products is called value opportunities (Cagan & Vogel, 2002). This system explains six major components that contribute to value, which include emotion (sensuality, power, and sense of adventure), aesthetic (visual, tactile, and auditory), product identity (personality, sense of impact, and social), ergonomics (ease of use, safety, and comfort), core technology (enabling and reliable), and quality (craftsmanship and durability).

In addition to these value opportunities, product characteristics can be described in other ways. Product form and function are two characteristic dimensions associated with product usability (Han, Yun, Kim, & Kwahk, 2000; Han, Yun, Kwahk, & Hong, 2001). Product form includes the image and impression of the product, while product function describes more of the product performance. Product form and function lead to satisfaction of needs and creates values for consumers (Roozenburg & Eekels, 1995).

Alongside the different methods for classifying product characteristics, numerous measures exist for monitoring the success of products. Four types of product-related measures include problem formulation, appropriateness of solution, product performance, and finally consumer response (Rouse, 2001). These types of measures are employed by marketing, engineering, and sales and service involvement in the development process. Common examples of product measures related to consumer response include consumer satisfaction, usability, safety, aesthetics, quality and overall value.

4. CREATIVITY IN PRODUCT DEVELOPMENT

4.1. Four P’s in Product Development

Creativity plays a crucial role in product development. As previously described, the four P’s of creativity (person, process, product, and press) each have different perspectives of creativity. As with most processes, product development incorporates the need for creativity in various ways. Creativity of a person in product development includes the individual developers/designers as well as the characteristics of the team. Creativity as part of the process of product development involves both problem and solution generation. The level of product creativity has both internal (developers) and external (consumers) evaluations. Finally, characteristics of the press or environment of product development such as the communication structure and level of risk play a role in facilitating creativity.

4.2. Perspectives of Product Creativity

So what does “product creativity” really mean? David Garvin (1984) asked this same question about product quality. He utilizes several approaches to defining quality: transcendent, product-based, user-based, and manufacturing-based. He emphasized the need for concurrent definitions to capture the multiple components involved in producing quality products. Recognition of the different perspectives of quality throughout the design process reduces the potential for conflicting communication among collaborators. Generally emulating this comprehensive approach, in the following section we attempt to define product creativity systematically.

From the transcendent approach, product creativity is said to be innately imaginative. Product creativity is absolute and universally identifiable, a reflection of high originality and resolution. However, this approach also supports the notion that no precise definition...
of product creativity exists. Product creativity can only be understood after one is exposed
to product with such characteristics.

According to a product-based approach, product creativity is an exact and quantifiable
variable. Variations in product creativity are directly related to differences in levels of
specific attributes or characteristics of a product. This approach leads to the development
of vertical dimensions in product creativity and ranking of desired attributes. Differences
in the quantities of attributes produce differences in levels of product creativity. The over-
all implication in this approach is that product creativity is not exclusively a subjective
evaluation, but has measurable objective attributes.

The user-based approach centers on the premise that individuals have varying experi-
ence with and expectations of products, which, in turn, influence their assessment of prod-
uct creativity. This approach coincides with consensual assessment of product creativity,
which proposes that judgments of product creativity can only be subjective. For example,
Amabile’s (1982) concept of knowing a creative product when one sees it reflects this
view of individual judgment, which is also similar to the belief that “beauty is in the eye
of the beholder.” One difficulty that results from this approach is how to combine indi-
vidual judgments of product creativity into a functional definition practical to the design
process.

While the user-based approach views product creativity from the consumer demand
perspective, a manufacturing-based approach looks at product creativity from the product
supply point of view. With this approach, the primary concern moves from customer opin-
ions to developer judgments. Product creativity is defined in terms of constraints and
available resources. The level of problem solving and divergent thinking associated with
the design process also plays a role in determining the product creativity. Both technical
and physical aspects of the design process are judged against the manufacturers or design-
ers standard of innovation. The manufacturing approach focuses more on the process that
leads to cost reduction or enhanced production.

Garvin’s (1984) conclusion to defining product quality is also appropriate to defining
product creativity: The need for concurrent definitions exists because of the dynamic
nature of product development and the need to shift approaches throughout the develop-
ment process. Thus, to study and measure product creativity, the context and perspective
of interest must be determined so that the true nature of creativity can be understood. This
research focuses on determining the consumer perceptions of product creativity; hence, a
more user-based approach is taken. Product creativity is defined in terms of user percep-
tion of products, based on experience and expectations. In sum, product creativity is then
further defined to be the subjective judgment of products to be novel and appropriate.

4.3. Innovation

Alongside defining the construct of creativity, innovation can be explained in terms of the
process, product, person or environment. For example, the process of innovation is said
to be the behavioral and social processes that enable individuals or groups to make desired
changes or avoid results of inaction (West & Rickards, 1999). Whereas the innovative
person is defined as the degree to which the individual adopts new ideas relatively early
compared to others in the social environment (Rogers, 2003).

As noted by researchers in the field, the operational definition of product innovation
(as opposed to the process or personal characteristics) and the associated dimensions that
characterize innovation are not made clear in the literature (Danneels & Kleinschmidt,
2001; Gatignon & Robertson, 1991). The assumption that product innovation is a subjective assessment of a unidimensional construct is sometimes made, whereas the measurement of innovation is often seen in terms of newness such as the typology developed by Booz, Allen, and Hamilton (1982), which distinguishes between newness to firm and newness to customer. Product innovation is defined in various ways as shown below. The last definition listed by Rogers is the definition of innovation adopted in this study. Innovation is defined as

“new things and ideas and new ways of behaving and interacting with things” (Arnould, Price, & Zinkhan, 2002, p. 573); “a new product or service that is perceived by consumers within a market segment to have effects upon established consumption patterns” (Gatignon & Robertson, 1991, p. 323); “a measure of the potential discontinuity a product (process or service) can generate in the marketing and/or technological process” (Garcia & Calantone, 2002, p.113); and “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers, 2003, p.12).

Two major types of classifications exist for product innovation. Robertson (1971) claims that innovation is based on a continuum, where continuous innovation causes a minor change in user behavior; dynamically continuous innovation either causes minor changes in very important behavior or major changes in unimportant behavior; and discontinuous innovation causes major changes in very important behavior. Hirschman (1981) distinguishes two types of innovations: symbolic (producing new social meaning) and technological (producing new tangible features in a product category). Different combinations of the level of these types (high and low) lead to different adoption processes and meanings.

Innovation is also assessed in terms of impact on the user. Rogers (2003) explains the need for five dimensions to evaluate innovations: the relative advantage; compatibility with users’ needs, values, and behaviors; ability to try without risk; observability in society; and complexity. These dimensions are associates with the consumer diffusion paradigm. In this paradigm, several factors influence the rate of diffusion and adoption of the innovation across time and space, which include the value, cost, and uncertainty of the innovation; marketing strategies; competitive activities; as well as the communication, resistance, and integration of the society in which the innovation exists (Arnould et al., 2002; Gatignon & Robertson, 1991).

The distinction between product innovation and product creativity is seen in the comparison of the construct definitions and the factors associated with each construct (see Table 2). Comparing the definitions shows that both product innovation and creativity are generally associated with the newness of the product. The distinction between the innovation newness and creativity newness is better understood when looking at the factors for each construct. The list of product innovation factors in Table 2 comes from Garcia and Calantone’s (2002) review of empirical literature on product innovation measurement.

Factors relating to the newness of product innovation address the product’s newness to the customer (firm or market), the newness of technology, and the customer’s level of experience with the product. In contrast, the factors relating to the newness of product creativity address the product’s originality and surprise as well as how the newness is expressed or the style associated with the newness (elegance, organic nature, expertise of design). Thus, the newness measures of product innovation are much broader and do not require the specific newness measures of product creativity. For example, at one point in time the hand sanitizers that do not require water could be considered innovative in part because the product was new. However, the hand sanitizers may not have been considered creative because the product newness may not be elegant or have an imaginative design.
Another distinction between the product innovation and product creativity factors is the measurement of behavioral or societal impact. Innovative products are associated with a certain level of societal change; whereas the judgment of a creative product does not depend on societal impact. For example, Web sites could easily be described as creative, but not necessarily innovative because the creativity of the Web site does not require an impact on society or change in behavior. In conclusion, the main argument for developing a product creativity measure as distinct from product innovation is to capture a more-specific consumer perception of product newness (not dependent on the societal impact) that is related to the originality and imagination of the product design, not simply a measure of being different.

5. CONSUMER BEHAVIOR

5.1. Perception

Measurement of product creativity cannot be fully discussed, without review of research on consumer behavior with respect to how consumers perceive and interact with products. Consumer’s perception of product quality has been a recent focus of attention in consumer behavior literature. The major dimensions of product quality include: performance, features, reliability, conformance, durability, serviceability, aesthetics, tangibles, assurance, empathy, value, involvement, and responsiveness (Chueh & Kao, 2004; Crosby, DeVito, & Pearson, 2003; Parasuraman, Berry & Zeithaml, 1991). Crosby et al. (2003) stress the importance of time-based measurements to capture perception of quality. These studies generally support that consumer perception is a contributing factor to consumer behaviors such as purchasing or word of mouth, as well as consumer attitudes such as satisfaction, loyalty, and trust.

<table>
<thead>
<tr>
<th>TABLE 2. Comparison of Product Innovation and Product Creativity</th>
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<tbody>
<tr>
<td><strong>Product innovation</strong></td>
</tr>
<tr>
<td>“an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers, 2003, p. 12).</td>
</tr>
<tr>
<td>Innovation factors</td>
</tr>
<tr>
<td>• Product newness to firm</td>
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<tr>
<td>• Product newness to customers</td>
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<tr>
<td>• Product newness to market</td>
</tr>
<tr>
<td>• Technical uncertainty</td>
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<tr>
<td>• Technical inexperience (newness)</td>
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<tr>
<td>• Technical cost</td>
</tr>
<tr>
<td>• Discontinuity of benefits</td>
</tr>
<tr>
<td>• Customer benefits</td>
</tr>
<tr>
<td>• Product superiority</td>
</tr>
<tr>
<td>• Change in behavioral patterns</td>
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<tr>
<td>• Business experience</td>
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The information-processing model explains the general flow of how consumers perceive product characteristics, which begins with exposure to the stimulus or product (Mower & Minor, 2001; Proctor & Van Zandt, 1994). The consumer captures information about the product from visual, auditory, haptic, and other senses. This sensed information then goes through a manipulation stage, which is controlled by the consumer’s allocation of attention, memory, and level of involvement with the product. The information is organized and the consumer forms meaning of the product. Product comprehension is a result of both perceptual organization and interpretation of information. This perceptual processing then leads the consumer to respond and make decisions about the product.

5.2. Expectation

Expectations influence the consumer’s overall product evaluation and assessment. The expectancy/disconfirmation model compares actual (perceived) performance to expected performance. This paradigm claims that three possible outcomes: zero discrepancy is when products perform as expected; positive discrepancy is when products perform to be greater than expected; and negative discrepancy is when products perform less than expected, which leads to dissatisfaction (Oliver, 1980). Thus, a contributing factor to achieving emotional satisfaction is if the product performs above what is expected. A meta-analysis of academic studies on customer satisfaction reported that disconfirmation is one of the most strongly related factors to customer satisfaction (Szymanski & Henard, 2001). Product expectancies are influenced by the nature of the product, promotional factors, effects of other products, and individual characteristics of the consumer (Mower & Minor, 2001). Cue utilization and heuristics influence the formation of expectations (Van Raaij, 1991). The expectancies towards a product also influence the consumer decision-making process.

5.3. Decision Making

The consumer decision process begins with problem recognition, then search, alternative evaluation, choice, and finally postacquisition evaluation (Bettman, Luce, & Payne, 1998). Decision-making hierarchies of effect explain the formation order of consumer beliefs, attitudes, and behaviors. The four hierarchies and the order of effects include high-involvement (beliefs, attitude, behavior), low-involvement (beliefs, behavior, affect), experiential (affect, behavior, beliefs), and behavioral influence (behavior, beliefs, affect) (Ray, 1973). These hierarchies illustrate that consumer interactions with products are dependent on the type of involvement with products and influence the order of how consumers form beliefs, attitudes, and behaviors towards products. These hierarchies also help explain the influence of persuasion methods on attitude, belief, and behavior changes.

Consumer situations, or the context of consumption, also influence the decision-making process. Such environmental factors include physical surroundings (physical and spatial aspects of the environment), social surroundings (influence from other people), time (amount of time), task definition (reason or need for consumption), and antecedent states (mood or physiological state of consumer) (Belk, 1975). Consumer behaviors and decisions are influenced by the situations in which products are consumed.

5.4. Affect

As mentioned above, affect functions in the decision-making process. Research indicates that the affective process also influences the product evaluation in that consumers may
tend to overlook weaknesses or have a less analytical assessment because of positive feelings (Cohen & Areni, 1991). Concerning the present study, affect refers to a valance feeling state (which includes emotions and moods) that consumers may experience from the product. Emotions are intense, psychological urges as compared to mood, which is a less intense, more fleeting state associated with a specific situation (Mower & Minor, 2001).

Both the associated arousal level and the degree of pleasantness experienced from the product influences emotions (Cohen & Areni, 1991; Gardner, 1985; Liu, 2003). Research shows that these two dimensions are correlated to product evaluation and purchase (Sherman & Smith, 1987). There are four combinations resulting from the two dimensions: pleasant-high arousal (e.g., joy, delight, excitement), pleasant-low arousal (e.g., serene, contented, and relaxing), unpleasant-high arousal (e.g., anger, disgust, annoying), and unpleasant-low arousal (e.g., depressing, gloomy, shame). In conclusion, affect is a contributing factor of that leads to consumer attitudes.

5.5. Consumer Attitudes

Two models explain the prediction of consumer attitudes. Attitude-toward-the-object model states that overall attitude is the summation of the strength of the belief that an object has a particular attribute multiplied by the level of goodness or badness of that attribute (Fishbein & Ajzen, 1975). This model implies that consumer attitude is formed from salient attributes, belief that products possess attributes, and the extent to which attributes are good or bad. The model does not include a specific measure of importance because it assumes the evaluation ratings become more extreme as importance increases (Mower & Minor, 2001).

The behavioral intentions model also known as the theory of reasoned action claims that behavior results from intentions to behave (Ajzen, 1988). This theory includes a construct called subjective norm, which is what a consumer believes what others think that the consumer should do. The model assesses consumer attitude towards the act of purchasing the product, not on the product itself. This difference focuses on how the consumer perceives the consequences of the purchase, not the attributes of the product (Mower & Minor, 2001). With knowledge of consequences of purchase, impeding factors may be more easily understood. The formation of consumer satisfaction–dissatisfaction is a result of the general flow of usage, expectancy confirmation–disconfirmation (product performance–quality evaluation) and emotional response. Traditional measures of consumer satisfaction utilize Likert scales and include both satisfaction and dissatisfaction statements to eliminate bias (Mower & Minor, 2001).

From this review of consumer behavior literature, product creativity is defined as the subject judgment of a product to exhibit novelty and appropriateness that elicits arousal and pleasure and is compatible with the judge’s preferences. The assessment of product creativity is dependent not only on the attributes of the product, but also the impact and involvement that the product has on the consumer (or judge of the product).

6. MEASURING PRODUCT CREATIVITY

6.1. Methods of Measurement

As briefly discussed before, the measurement of creativity depends on the type of tool and method utilized to capture creativity. When specifically looking at measuring the
creativity of a product, three types of approaches exist: indirect measurement, global judgments, and criterion-based measurement (O’Quin & Besemer, 1999). Indirect measures of product creativity include peer and teacher nomination, measures of eminence, self-reported achievements. These types of measurements often associate the judgment of outcomes or activities with the overall assessment of the person’s creativity. The global judgment of product creativity is not concerned with the specific reasons or factors that determine how creative a product is, but more focused on the overall assessment and relation to other items such as the creativity of a person or potential success of a person in a particular field. Measurements with specific criteria that determine product creativity focus more on the characteristics that make a product creative. Criterion for assessment of product creativity has been proposed for both specific domains, as well as general criteria applied to various domains.

6.2. Theoretical Development

Before describing current tools that measure product creativity, a review of the theoretical progress for creativity measurement provides added understanding of the approach to measuring creativity. The theoretical expansion begins with Guilford’s address to the American Psychological Association in 1950 with his emphasis on the need for research on creativity and the association between creativity and divergent thinking (Guilford, 1950). In the 1960s, research began to focus on developing structural approaches to investigating creativity. Rhodes’ (1961) proposed four P’s of creativity (as previously described): person, process, press, and product. He suggested that the object approach begins with the product then the person, process, and press, meaning that to understand the person or process, the product must first be addressed. Donald MacKinnon (1968) proposed five criteria of product creativity: originality, adaptiveness (solve a problem), elegance and other aesthetic quality, transcendence (transform reality), and realization (development and communication to others). He also supported the implicit judgment of creativity or the thought that humans can implicitly assess the creativity of a person or object.

Then in the 1980s, specific classifications and measurement tools for creativity of products began to develop. Briskman (1980) proposed that creative processes and persons depend on the product or outcome evaluation. Two major approaches to measuring creativity of products were developed during this period. Amabile (1982) proposed and tested the consensual assessment technique (CAT) for measuring creativity of the product. This measurement is based on the concept that creativity is understood when one sees, and that no universal criterion exists. Thus, creativity is a subject judgment that is independently assessed by judges.

The other major technique to measure the creativity of products, the Creative Product Semantic Scale developed by Besemer and O’Quin (1986, 1987) was based on the Creative Product Analysis Matrix (CPAM; Besemer & Treffinger, 1981). This matrix and scale proposed that perception of product creativity is in three dimensions: novelty, resolution, and elaboration and synthesis. Following the initial development, researchers have tested these tools with various products. These two measurement tools and other related tools will be discussed in more detail in the following section.

6.3. Examples of Product Creativity Measurement Tools

6.3.1. Rating scales. The first major type utilizes rating scales to score different dimensions or criterion of the creative nature of products. The ratings scales are generally anchored

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with semantic pairs or level-based (i.e., low — high) for each construct of creativity. The Creative Product Semantic Scale (CPSS), developed by Besemer and O’Quin (1986, 1987, 1999; O’Quin & Besemer, 1989, 1999) measures product creativity based on three main dimensions of the Creative Product Analysis Matrix: novelty, resolution, and elaboration and synthesis (Besemer & Treffinger, 1981). This matrix was developed from an analysis and synthesis of literature on general product creativity including creative art, writing, scientific work, and consumer products. Each of the three dimensions is measured with several semantic pairs. For example, originality is measured with 10 semantic pairs, including astonishing–commonplace, astounding–common, shocking–ordinary, startling–stale, surprising–customary, unexpected–expected. Table 3 provides a general comparison of the CPSS and other creative product measurement tools. Table 4 provides a more-specific comparison of these measurement tools by describing the empirical results of studies that utilized the tools. All of the studies shown in Table 4 indicated construct validity through literature support; however, none of the studies reported valid predictive validity.

As seen in Table 4, the CPSS was tested in several domains with small (one to four) sets of products. Nonexpert judges input ratings for each semantic pair for a set of products. The CPSS started with 110 single adjectives with 4-point scale ratings; it has been tested, however, and modified to 55 bipolar items with 7-point scale ratings (Besemer, 1998; Besemer & O’Quin, 1986, 1987, 1999; O’Quin & Besemer, 1989, 1999). The score for each subscale is calculated by averaging the scores from the semantic pair within each subscale. The CPSS has shown adequate internal reliability, with reported measures ranging from 0.69 to 0.91. The construct validity of this measure is only explained by the theoretical literature foundation. One further study (not listed in Table 5) tested the predictive validity of the CPSS, but reported poor-to-fair fit (from $R^2$ adjusted = 0.06 to 0.22) for ability to predict willingness to buy (Besemer, 2000).

The CPSS was derived from an earlier measurement tool called the Creativity Product Inventory (Taylor & Sandler, 1972). The Creativity Product Inventory was developed to measure the creativity of scientific products. The inventory contains seven dimensions: generation (the newness that the product produces or causes), reformulation (the introduction of significant change or modification), originality (infrrequency of the usefulness, uncommonness, or statistical occurrence), relevancy (solution to the problem), hedonics (attractiveness), complexity (intricacy of information), and condensation (simplifies and integrates) (Taylor, 1973). Each dimension is scored by expert judges based on a 7-point Likert scale, except generation, which was scored by the total number of items produced. Testing of this tool reported interrater reliability of 0.87 to 0.97, with no reported predictive validity (Taylor & Sandler, 1972).

Another example of a rating-scale measurement tool is the Student Product Assessment Form (Reis & Renzulli, 1991). This tool utilizes several dimensions (see Table 4) to assess the creativity of student products such as writing, art, or scientific work. The tool contains 15 items with 5-point Likert scales. Testing of this instrument reported interrater reliability of greater than 0.80 for all items except one. The instrument was also qualitatively evaluated from 50 national experts and experienced teachers for construct validity.

### 6.3.2. Subjective assessments.

In addition to rating-scales, researchers have tested other approaches to measuring the creativity of products. The Consensual Assessment Technique (CAT) (see Table 4 and Table 5) developed by Amabile (1982) takes another method of capturing product creativity. This method is based on the consensual definition
<table>
<thead>
<tr>
<th>Method of measurement</th>
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<th>Output</th>
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<td>Creative Product Semantic Scale</td>
<td>Besemer, 1998; Besemer &amp; O’Quin, 1986, 1987, 1999; O’Quin &amp; Besemer, 1989, 1999; White, Chen, &amp; Smith, 2002</td>
<td>Novelty (surprising, original); resolution (logical, useful, valuable, and understandable); and elaboration and synthesis (organic, well-crafted, elegant)</td>
<td>Initially: 110 adjective scores on Likert-type scale (1–4)</td>
<td>Initially: Score from total of 12 subscales (110 word divided into 12 subscales), all evenly weighted</td>
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<td>Consensual Assessment Technique</td>
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<td>Creativity (alongside other dimensions such as liking, technical goodness, silliness, aesthetics, and liking)</td>
<td>Open criterion on Likert-type scale (1–7)</td>
<td>Mean score, distinct from other dimensions</td>
</tr>
<tr>
<td>Student Product Assessment Form</td>
<td>Reis &amp; Renzulli, 1991</td>
<td>Statement of purpose; problem focusing; level of resources; diversity of resources; appropriateness of resources; logic, sequence, and transition; action orientation; audience; overall assessment (originality of the idea, achieved objectives stated in plan, advanced familiarity with subject, quality beyond age/grade level, care/attention to detail, time/effort/energy, original contribution)</td>
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</tr>
<tr>
<td>Creativity Product Inventory</td>
<td>Taylor &amp; Sandler, 1972</td>
<td>Generation, reformation, originality, relevancy, hedonics, complexity, and condensation</td>
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</tr>
<tr>
<td>Method of measurement</td>
<td>Reference</td>
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<td>Number of judges</td>
<td>Number of products</td>
</tr>
<tr>
<td>---------------------------------------</td>
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<tr>
<td>Creative Product</td>
<td>Besemer &amp; O’Quin, 1987</td>
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<td>35, 18, 19, 18 Students</td>
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<td>Semantic Scale</td>
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<td></td>
<td>Besemer, 1998</td>
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<td>Novel chairs</td>
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<td>3</td>
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<td>Modified version</td>
<td>White, Chen, &amp; Smith, 2002</td>
<td>Advertisements</td>
<td>189 Students</td>
<td>15</td>
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<tr>
<td>Consensual Assessment Technique</td>
<td>Amabile, 1982</td>
<td>Paper and glue “silly” designs</td>
<td>22, 111, 95, 10, 40, 48, Students</td>
<td>1/Student</td>
</tr>
<tr>
<td></td>
<td>Brinkman, 1999</td>
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<tr>
<td>Student Product Assessment Form</td>
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<tr>
<td>Creativity Product Inventory</td>
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<td>Products constructed from selected materials</td>
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</table>
of creativity, which claims that a product is creative to the degree in which appropriate observers agree that it is creative (Hennessey & Amabile, 1999). In the CAT, expert judges rate products (produced for the evaluation) relative to one another with independently selected dimensions. The judges are asked to report creativity scores on a 5-point Likert scale for each dimension selected, as well as other items such as technical goodness. Analysis of correlations between creativity dimensions and other items allows the tester to make conclusions about relationships between the product creativity and other factors. Studies of the CAT report inter-rater reliabilities of .72 to .98 (Amabile, 1982; Baer, 1994; Brinkman, 1999; Chen et al., 2002). By the definition of product creativity the CAT claims to have construct validity with high interrater reliability. No predictive validity is reported in these studies.

### 6.4. Comparison of Measurement Tools

Comparison of the CPSS and CAT, which are the most predominate tools, reveals strengths and weakness for each method. Table 5 provides a comparison of the two tools. The major reasoning for and goal of the CAT is to connect product creativity with social conditions given that creativity is only a subject judgment. Unlike the CAT, the CPSS is not focused on the association with the person or process involved, but addresses more objective...
judgments of product creativity. The techniques are based on several assumptions. The CPSS assumes that product creativity is partially objective. The CAT makes several assumptions: given appropriate judges, product creativity can be assessed; creativity is recognizable, but not necessarily characterizable; people can agree on perception of creativity; and various levels of creativity exist, which observers can agree upon. The CAT is also limited to several constraints such as the requirement for expert judges.

Both tools also have distinct weakness. The overall arguments against the CAT include time-demand impracticality; lack of appropriateness for individual differences or cutting-edge technology; and high correlation with other factors. The CPSS main weaknesses are found in the instrument’s definition of creativity and its lack of criteria to assess creativity and in the defined constructs of creativity may be more subjective, than objective in nature and may cause judgment bias. The comparison of these two types of measurement tools for product creativity reveal that both are limited in application and utility for determining product creativity.

A recent study by Christiaans (2002) questioned the need for creativity as a design criterion. This study tested if both the CPSS and CAT techniques are valid and reliable methods for design evaluation. The study showed that creativity is highly correlated with attractiveness and interest but not significantly correlated with technical goodness when evaluating computer cabinets and telephone booths. Moderately high interrater reliability ratings were reported for the scores of creativity ratings using the CAT (0.79 to 0.88). The study showed that creativity is highly correlated with attractiveness and interest but not significantly correlated with technical goodness when evaluating computer cabinets and telephone booths. Using the CPSS, the study showed that the novelty dimension discriminates clearly between high and low product creativity. Further testing of the differences between high and low creativity obtained from oral descriptions resulted in five categories of explanations, which are described as follows. (a) Expectation pattern is the process of comparing product with an internal representation. (b) Integration of various relevant criteria is the successful synthesis and integration. (c) Form and function are distinct aspects of design creativity. (d) Impact on the observer is the design’s ability to illicit the attention and fantasy of the judge. (e) Finally, the commitment of the designer is the reflection of attention to details and careful consideration reflected in the design. This study concludes that assessment of creativity depends on subjective judgment as long as no absolute criterion of creativity exists. This study confirms the previously discussed weakness of current measurement tools.

7. CONCLUSION

In conclusion, this review and reappraisal of literature on creativity, product development, and consumer behavior defines product creativity as the subjective judgment of a product to exhibit novelty and appropriateness that elicits arousal and pleasure and is compatible with the judge’s preferences. The review of product creativity measurement method, theory, and examples reveals the need for more valid, applicable, and predictive measures of product creativity. Measurement of product creativity needs to go beyond just a measure of the perception of product creativity, but namely include more measurement dimensions to capture the consumer’s assessment of product creativity. The role of product creativity in consumer attitudes and the potential impact can only be seen through validated measurements of product creativity.
REFERENCES


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