



# Consumer responses to high-technology products: Product attributes, cognition, and emotions<sup>☆</sup>

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## ABSTRACT

The present study investigates how high-technology attributes influence consumer responses. Based on Mehrabian and Russell's Stimulus–Organism–Response (S–O–R) framework (1974), this study proposes that high-technology product attributes elicit consumers' cognitive (attitude) and affective states (pleasure and arousal), contributing to their approach–avoidance behavior. High-technology product users ( $N = 408$ ) participated in surveys. The results provide support for the model. Among six factors of high-technology product attributes (usefulness, ease of use, innovativeness of technology, visual appeal, prototypicality, and self-expression), the latter four have major influences on approach behavior through attitude (cognitive state) and pleasure (affective state). Supplemental analysis shows that attitude and pleasure influence approach–avoidance behavior directly, but that arousal affects approach–avoidance behavior indirectly via pleasure.

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## 1. Introduction

Attributes of a product contribute to the success of product marketing (e.g., Meyers-Levy and Tybout, 1989). Technology products are “products that are the result of technology and which require substantial shifts in behavior of at least one member of the product usage channel” (Gardner, Johnson, Lee, and Wilkinson, 2000, p. 1053). Examples of technology products include, among many, mobile phones, PDAs, netbooks, high-tech TVs, e-readers, and GPS devices. Compared to other products, technology products tend to have short product life cycles (Riggs, 1983) and provide consumers with noteworthy changes in such product functions as technology-driven functions, designs, and/or services (Gardner et al., 2000). Technology products, typified by convergence, also require a technology-enabled functionality, which provides the product with manifold qualities (Gill and Lei, 2009). Accordingly, consumers evaluate certain functionalities of the product differently, and have thus different attitudinal and behavioral responses (Hong and Wyer, 1998; Ko, Sung, and Yoon, 2008).

The continual growth of the high-technology product marketplace is evident irrespective of the sluggish economy. According to

Packaged Facts (2006), women in the U.S. spend \$55 billion annually for technology purchases, and experience significant changes in their lives due to technology. Given the rapidly evolving technology and ceaseless development of new technology products, a key for success in the high-technology product business is to improve current knowledge about users' behaviors, particularly in response to multiple functions of technology products (Cooper and Kleinschmidt, 2000).

Previous marketing research of technology product attributes has a few distinctive patterns. First, many studies focus on a few attributes which mainly pertain to performance functions (e.g., price, brand, quality) (Chang and Wildt, 1994; Nowlis and Simonson, 1996), leaving out other aspects such as design (appearance) and social qualities of technology products. Second, conceptual studies which develop the dimensionality of technology product attributes call for empirical examination (Horváth and Sajtos, 2002; Rindova and Petkova, 2007). Third, prior research mostly examines outcomes of product attributes such as brand choice (Nowlis and Simonson, 1996), preference persistence (Muthukrishnan and Kardes, 2001), purchase intention (Chang and Wildt, 1994; Ko et al., 2008), and value (Gill and Lei, 2009), thereby not providing an understanding of the psychological process underlying the relationship between product attributes and consumer behaviors.

The current study aims to extend and complement existing research by: (1) identifying a comprehensive set of technology product attributes that play a role in consumer adoption of technology products, and (2) investigating the underlying process whereby product attributes influence consumer behavior (approach–avoidance behavior) based on the Mehrabian and Russell (1974).

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## 2. Literature review and hypothesis development

### 2.1. Mehrabian and Russell's Stimulus–Organism–Response (S–O–R) framework

This study builds on Stimulus–Organism–Response (S–O–R) framework (Mehrabian and Russell, 1974) proposing that when an individual encounters a stimulus (S), he/she develops internal states (O), which in turn dictate his/her responses (R) (Mehrabian and Russell, 1974). That is, stimuli (e.g., object stimuli and social psychological stimuli) develop individuals' cognitive and emotional states, which in turn determine behavioral responses of approach or avoidance. The validity of the model has received support from research as a robust and parsimonious framework for predicting consumer responses to variations of formats of products (Bloch, 1995; Lai, 1991), services (Foxall and Greenley, 1999; Jang and Namkung, 2009), traditional brick-n-mortar stores (Baker, Levy, and Grewal, 1992), and online stores (Eroglu, Machleit, and Davis, 2001; Mazaheri, Richard, and Laroche, 2010; Mummalaeni, 2005).

Stimuli embrace object stimuli and social psychological stimuli (Slama and Tashchian, 1987). In the context of technology product use, stimuli consist of a user's perceptions of different product characteristics such as design, performance, and communication surrounding his/her experiences with the purchase and consumption. Stimuli then contribute to the consumer decision process regarding the technology product. Applying the S–O–R model to the technology product use setting, this study posits that object stimuli which reflect attributes of high-technology products (Stimuli) trigger consumers' internal states (Organism), leading to avoidance–approach behavior (Response). Two aspects of internal states are: (1) attitude toward technology products reflecting cognitive state and (2) pleasure and arousal of affective state.

### 2.2. Stimuli: technology product attributes

Product attributes refer to tangible and intangible features of a product such as benefits, functions, and uses (Keller and McGill, 1994). A technology product is a multi-attribute object in which a combination of attributes may affect consumers/users differently.

Perhaps surprisingly, not many empirical studies on consumer evaluation of technology product attributes exist to date; though two conceptual studies propose a product attribute taxonomy of technology products (Horváth and Sajtos, 2002; Rindova and Petkova, 2007). In a study developing a conceptual model which describes product features of mobile phones, Horváth and Sajtos (2002) propose three groups of product features: judgment of utility (usefulness), experience (enjoyment of use), and communicative power (expression). More recently, Rindova and Petkova (2007) investigate product innovations, and suggest three product attribute dimensions, namely functional (technological novelty and congruity), symbolic (visual similarity to existing products), and esthetic (product appealing).

Based on these and related studies, this study conceptualizes three domains of product attributes that may play a critical role in the formation of consumer evaluation of technology products: (1) performance (how well a product fulfills its purpose/functions as expected), (2) appearance (how much a product appeals visually), and (3) communication (how well a product helps the user express him/herself). Additionally, this study conceptualizes two domains of product attributes (i.e., performance and appearance) as a multi-dimensional construct consisting of sub-components. That is, performance embraces three sub-components including usefulness, ease of use, and innovativeness of technology, while visual appeal and prototypicality explain appearance attributes of technology products.

#### 2.2.1. Performance attributes: usefulness, ease of use, and innovativeness of technology

Usefulness represents one's evaluation of how effectively a technology product and its system help a consumer perform the purpose and utility of the product, while ease of use represents a consumer's evaluation that the product and its system allow him/her to use them without putting a deliberate effort. Innovativeness of technology means “the creativity and uniqueness of technical functions of the product”, which distinguishes the product from any other products (Loiacono, Watson, and Goodhue, 2002, p. 302). As technology develops, the extent to which consumers perceive that a product is useful, easy to use, and/or innovative may change (e.g., Davis, 1989). Research demonstrates the significance of these three factors in enhancing competitive advantages for the success of product performance (Davis, 1989; Rindova and Petkova, 2007).

#### 2.2.2. Appearance attributes: visual appeal and prototypicality

The more visually attractive and/or atypical a technology product, the more favorable consumers' feelings and evaluation about the product. Visual appeal refers to one's perception of product esthetics derived from product design factors such as color, shape, proportion and material (Bloch, 1995). Superior product design distinguishes a product from its competitors, leading consumers to feel more favorably disposed toward the product and build positive brand impression (Bloch, 1995). Prototypicality, or typicality, indicates “the degree to which an object is representative of a category” (Veryzer and Hutchinson, 1998, p. 375). In general, avoiding typicality enables product designs to be more novel, exclusive, and/or prestigious (e.g., Veryzer and Hutchinson, 1998). Meyers-Levy and Tybout (1989) discuss that when a product is slightly different from the prototype, consumers' evaluations of the product become more positive.

#### 2.2.3. Communication attribute: self-expression

Communicative power is an important technology product attribute. Horváth and Sajtos (2002) mention that “most products hold messages that are meaningful to a particular group, and that its owner wants to communicate about him- or herself” (p. 237). Self expression denotes how and to what extent consumers use a technology product in order to display their own identity and values to themselves as well as to others (Thorbjørnsen, Pedersen, and Nysveen, 2007). The importance of communication power of technology products has gained support from researchers. Taylor and Harper (2001) describe mobile phones as an instrument in “family differentiation and symbol of individuality”, and Weilenmann and Larsson (2000) claim that the use and adoption of mobile services have the meaning of “social identifiers and a self identifier”. As such, technology products reflect personal lives, and deliver symbolic meaning which enables the expression of private experiences.

### 2.3. Organism: cognitive and affective states

Cognitive states refer to “everything that goes in the consumers' minds concerning the acquisition, processing, retention, and retrieval of information” (Eroglu et al., 2001 p. 181). In a technology product context, the cognitive state relates to how consumers evaluate the technology product, and thus, how they form their attitude toward the technology product based on product attributes they experience. Attitude in this context refers to a person's enduring favorable or unfavorable evaluations of technology products (Fishbein and Ajzen, 1975).

Mehrabian and Russell (1974) categorize the affective state along the pleasure, arousal, and dominance (PAD) dimensions. Russell (1979) further claims that, without the dominance dimension, only pleasure and arousal can adequately capture the emotional reactions to stimulus. This claim has gained support by empirical studies (Baker et al., 1992; Donovan and Rossiter, 1982; Ward and Barnes, 2001). Hence, this study examines two affective states (pleasure and arousal). Pleasure refers to the degree to

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