CHARACTERISTICS OF VIRTUAL EXPERIENCE IN ELECTRONIC COMMERCE: A PROTOCOL ANALYSIS

Hairong Li  
Terry Daugherty  
Frank Biocca

ABSTRACT
This protocol analysis examines the content of virtual experience in e-commerce, as concurrently verbalized by a sample of 30 participants while interacting with four 3-D products. Thirteen different types of psychological activities were observed and classified into five characteristics of virtual experience: active process, presence, involvement, enjoyment, and affordances. As a result, virtual experience is vivid, involving, active, affective psychological states occurring in an individual interacting with 3-D computer simulations. The study anchors the position of virtual experience on the spectrum of consumer experience with design implications in e-commerce discussed.

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Consumers learn about products through both direct experience, such as trial or inspection, and indirect experience, such as brochures or advertising. Researchers have long examined the relative impact of either type of experience on consumer learning (Deighton, 1984; Hoch & Ha, 1986; Hoch & Deighton, 1989; Kempf & Smith, 1998; Smith & Swinyard, 1982, 1983). Recently, Li, Daugherty, and Biocca (2001a) conceptualized a new and challenging type of consumer experience—virtual experience. They defined virtual experience as “psychological and emotional states that consumers undergo while interacting with products in a 3-D environment” (p. 1).

Virtual experience is similar to indirect experience in that both are a mediated experience (Heeter, 2000). It also resembles direct experience because both are interactive in nature (Hoch & Deighton, 1989). Thus, virtual experience should possess advantages of direct and indirect experience for consumer learning. Li, Daugherty, and Biocca (2001b) empirically tested the impact of virtual experience on consumer learning in terms of brand attitudes, product knowledge, and decision confidence and quality. They found that consumers learn better from virtual experience simulated in 3-D environments than from indirect experience created in traditional advertising when visual cues, without additional tactile cues, are sufficient for decision making.

There is little research, however, that addresses the content of virtual experience. It is uncertain what the characteristics of a virtual experience are exactly and how it is similar to and different from direct and indirect experience. Therefore, exploratory research is needed for theory development to understand how the experience of 3-D products, product simulations, and full 3-D shopping environments resemble or differ from physical malls, physical products, and conventional advertising and e-commerce environments. Therefore, this study explores what constitutes a virtual experience in an e-commerce environment, as concurrently verbalized by consumers interacting with products in 3-D simulations.

### Virtual Experience Conceptualization

Three-dimensional computer simulations of products and shopping environments suggest a different way of thinking about consumer learning. It is theoretically advantageous to consider product purchase as directed not necessarily toward a physical product but rather toward a consumption experience. A product purchase is in many ways not the purchase of a physical good itself but of an experience that the product affords (Pine & Gilmore, 1998). The actual physical product is a prop that affords the staging of the consumption experience. For instance, the purchase of a boat is a prop for the boating experience of freedom and sun on the water, a symbol in a status display involving others, a stage for family outings, or a combination of these experiential components. Thus, the role of consumer learning about a product prior to the purchase is mainly to assess what consumption experience the product can offer and how well it can meet the expectation of the anticipated experience (Hoch & Deighton, 1989).

### Types of Experience

Exploring consumption experiences necessitates answering a basic question first: What is an experience? An experience is more than simply the passive reception of external sensations or subjective mental interpretation of an event or situation. Rather, experience is the product of an ongoing transaction that gains in quality, intensity, meaning, and value integrating both psychological and emotional conditions (Mathur, 1971). Psychologists have identified three common states of an experience: mental imagery (cognitive), emotional responses (affective), and derived intentions (conation) (Richardson, 1984). At its simplest, an experience is an event or process that can occur spontaneously or voluntarily within everyday situations but always involves the internal awareness of something taking place (Lundh, 1979). Conceptually, every experience stems from the interaction between an individual and an object or environment.
The degree of such interactions in the range of options and the number of sensory aspects differentiates three types of experience: direct, indirect, and virtual experience. Direct experience occurs from an unmediated interaction between the consumer and a product with a person’s full sensory capacity, including visual, auditory, taste–smell, haptic, and orienting (Gibson, 1966). This physical, multisensory interaction leads to several advantages of direct experience. First, evidence in direct experience is self-generated and the most trustworthy for a consumer. Second, a consumer may manage the way a product is experienced by controlling the focus and pace of an inspection to maximize informational input. Third, such an interaction may result in more affective responses in a consumer than indirect experience (Millar & Millar, 1996). The characteristics of a direct experience enables consumers to anticipate the future consumption experience of a product better than an indirect experience, which is normally gained from traditional advertising.

Researchers exploring the implications of direct and indirect experience on consumer learning have reported strong support for both types under certain circumstances. For instance, direct experience from product trial has been found to influence higher-order affects on consumer judgments (Olson & Dover, 1979; Smith & Swinyard, 1983; Smith & Swinyard, 1988). However, indirect experience can mediate the effects of product evidence when presented with ambiguous information preceding trial and followed by repeated advertising exposure (Berger & Mitchell, 1989; Deighton, 1984; Hoch & Ha, 1986; Kempf & Smith, 1998). Direct product experience is generally viewed as increasing belief confidence and advantageous when examining experience products, whereas indirect experience such as advertising is able to influence attitude for search goods and reduce the effects of unfavorable trial when preceding direct experience (Marks & Kamins, 1988; Smith, 1993; Wright & Lynch, 1995; see Table 1 for studies comparing direct and indirect experience).

Both virtual experience and indirect experience are from media and, thus, a mediated experience. In most cases, however, virtual experience from interactive media such as 3-D virtual environments should be richer than indirect experience derived from traditional advertising. Many 3-D virtual products and shopping malls are not just a representation of physical products and malls; instead they are simulations of the consumption experience. What sets them apart from traditional print and television representation of products are a new set of interface features called “affordances.”

Affordances
To understand the characteristics of a virtual experience, it is necessary to examine the conditions under which it can be simulated and enhanced. Consumers inspect products in the conventional store following norms. When they select a computer, they may turn it on to see the color of the monitor screen or launch a program; however, they normally do not request to open the case to see what is inside. When consumers select chairs, they are likely to sit on them but less likely to stand on them. This type of expected interaction between consumers and products is called affordances. Norman (1998) traced the origin of the concept of affordances to Gibson’s (1966) study of human perception. Norman wrote, “A rock can be moved, rolled, kicked, thrown, and sat upon—not all rocks, just those that are the right size for moving, rolling, kicking, throwing, or sitting upon. The set of possible actions is called the affordances of the object. . . . In the design of objects, real affordances are not nearly so important as perceived ones; it is the perceived affordances that tell the user what actions can be performed on an object and, to some extent, how to do them” (p. 123).

There are various affordances common to product inspection in conventional stores that come from the ability of the senses and motor systems to interact with products. The ability to visually inspect a product contains some of the most common types of affordances. Consumers learn about the shapes, texture, and perceived functions of a product by moving their bodies or the product to visually inspect it from different angles. This type of information and inter-
<table>
<thead>
<tr>
<th>Author(s) (Date)</th>
<th>Type of Study</th>
<th>Key Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olson &amp; Dover (1979)</td>
<td>Experiment ($n = 38$ women)</td>
<td>Product trial experience was found to have a powerful effect on consumer judgments with advertising reducing post-disconfirmation ratings.</td>
</tr>
<tr>
<td>Holbrook &amp; Hirschman (1982)</td>
<td>Literature Review</td>
<td>Contrasts between the information-processing and experiential view of consumer behavior is presented with emphasis placed on the multisensory aspects of products and methods of communication.</td>
</tr>
<tr>
<td>Smith and Swinyard (1983)</td>
<td>Experiment ($n = 79$)</td>
<td>Direct experience produces higher-order affects in consumers than advertising.</td>
</tr>
<tr>
<td>Hoch &amp; Ha (1986)</td>
<td>Two experiments ($n = 64; n = 48$)</td>
<td>Consumers faced with unambiguous evidence rely on product experience; however, advertising affects perception when ambiguous evidence is presented.</td>
</tr>
<tr>
<td>Marks &amp; Kamins (1988)</td>
<td>Experiment ($n = 220$)</td>
<td>Belief and attitudinal confidence are higher for product sampling, yet attitude change is greater when advertising precedes product sampling.</td>
</tr>
<tr>
<td>Smith &amp; Swinyard (1988)</td>
<td>Experiment ($n = 80$)</td>
<td>Advertising produced lower-order responses for belief strength and confidence while product trial produced higher-order results.</td>
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<tr>
<td>Assael &amp; Kamins (1989)</td>
<td>Experiment ($n = 143$)</td>
<td>Exaggerated advertising claims increases disconfirmation with two-sided refutational ads moderating these effects.</td>
</tr>
<tr>
<td>Berger &amp; Mitchell (1989)</td>
<td>Experiment ($n = 104$)</td>
<td>Attitudes formed from repeated advertising exposure are similar to those formed from direct experience.</td>
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</table>
action can be simulated vividly within a 3-D environment, where consumers can freely examine, zoom in or out, and rotate a product.

Another set of affordances stem from the tactile or haptic interaction with a product (Burdea, 1996; Durlach & Mavor, 1994). Human hands can gain additional information by feeling the warm/cold, soft/hard, smooth/rough, and light/heavy properties of surfaces, edges, and textures that compose products. For certain products that come in touch with skin, such as bed linens and clothes, consumers always try to touch them to get a feel. With a computer mouse using newly invented “force-based technology,” consumers may feel a limited range of textures on a product in 3-D simulations (Grossman, 2000). In addition, related to the tactile sensation is the desire to taste or smell, which is difficult to simulate in a virtual environment (Biocca, Kim, & Levy 1995).

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<tr>
<td>Kamins, Assael, &amp; Graham (1990)</td>
<td>Experiment ((n = 411)). A model is proposed and tested to examine the effect of advertising exposure and trial upon product evaluation.</td>
<td>Counter-arguments show a negative relationship to posttrial evaluation with advertising serving more influential in the formation of product evaluation in the high-involvement condition.</td>
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<tr>
<td>Smith (1993)</td>
<td>Experiment ((n = 21)). Investigated how consumers combine information from advertising and trial as well as the effects after trial.</td>
<td>Advertising can reduce the negative effects of an unfavorable trial; however, the influence of advertising is significantly reduced when trial precedes ad exposure.</td>
</tr>
<tr>
<td>Wright &amp; Lynch (1995)</td>
<td>Two experiments ((n = 60; n = 184)). Measured the effect of search and experience attributes after exposure to advertising and direct product experience.</td>
<td>Direct product experience is advantageous for communicating experience attributes while advertising is more effective when communicating search attributes.</td>
</tr>
<tr>
<td>Padgett &amp; Allen (1997)</td>
<td>Literature Review</td>
<td>A series of propositions are presented linking narrative theory with the cognitive comprehension of consumer experience and communication via advertising.</td>
</tr>
<tr>
<td>Kempf &amp; Smith (1998)</td>
<td>Experiment ((n = 150)). Developed and tested a structural model of product trial processing.</td>
<td>Advertising can predispose consumers to form stronger experimental beliefs during direct trial.</td>
</tr>
<tr>
<td>Klein (1998)</td>
<td>Literature Review</td>
<td>A marketing communication evaluation model of consumer information searching for new media is presented grounded in the search vs. experience paradigm.</td>
</tr>
<tr>
<td>Moore &amp; Lutz (2000)</td>
<td>Experiment ((n = 72 children)). In-depth Interviews ((n = 38 children)). Investigated how advertising and product trial interrelate to form brand perceptions and attitudes in children.</td>
<td>While the combination of product trial and advertising yields a range of persuasive impact, advertising proved to frame later usage experience in older children.</td>
</tr>
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</table>
The levers, buttons, and handles of products are affordances that suggest behavioral interaction. For instance, a consumer may want to turn on a Palm Pilot to see the screen or examine how to write an address entry using a stylus. A consumer may also want to engrave a name on the inner side of a wedding ring to see what it looks like or change the colors of a comforter and sheet on a bed to see how well both match. To a certain degree, these behavioral interactions between consumers and products can be simulated to produce a virtual experience. A set of common interface features in 3-D product simulations, revised from Li et al. (2000b), are presented in Table 2.

The key issue of a virtual experience is the difference between affordances a consumer is likely to seek in physical environments (physical affordances) and affordances that a virtual environment can provide (virtual affordances). Consumers have different affordances for different products, as well as different affordances for the same product. For instance, in shopping for a laptop computer, two consumers may value different attributes and try different features. In the end, consumers may learn better in a virtual experience than in direct experience if virtual affordances either match or exceed physical affordances.

Presence
What is the purpose of adding affordances to interfaces and simulations of product interaction? In a word, presence. Presence is the experience established in a represented environment by means of a communication medium (Steuer, 1992). All media and telecommunication systems generate a sense of being in another place by bringing the experience and objects closer to us, allowing us to indirectly meet and experience other objects, other people, and the experiences of others. A medium functions best when it delivers not only information but also a mediated experience.

According to Biocca (1997, Section 5.3), “When we experience our everyday sense of presence in the physical world, we automatically generate a mental model of an external space from patterns of energy on the sensory organs. In virtual environments, patterns of energy that stimulate the structure to those experienced in the physical environments are used to activate the same automatic perceptual processes that generate our stable perception of the physical world.” Thus, it is reasonable to expect that visual, tactile, and behavioral simulations in 3-D visualizations are likely to create a sense of presence, which in turn can enhance richer consumption experiences. In other words, presence may be a mediating factor; affecting the degree of a virtual experience simulated in 3-D environments.

Virtual Experience
By considering the preceding discussion, it becomes apparent that what separates virtual experiences from indirect experiences and resembles direct experiences are the virtual affordances a 3-D object or environment provides. Whereas an indirect experience often takes place in traditional media via print and television advertising, a virtual experience occurs primarily in 3-D computer simulations because they are able to render virtual affordances. Virtual affordances are the means through which consumers can interact with a product in 3-D visualization in much the same way as direct experience.

RESEARCH QUESTIONS
The literature suggests several characteristics of a virtual experience in electronic commerce that this exploratory study is interested in investigating. Specifically, we seek empirical answers to the following research questions:

1. How do consumers form product knowledge in virtual experience?
2. How do consumers perceive presence in virtual experience?
3. How do consumers treat affordances in virtual experience?

METHOD
Qualitative research methods have made significant contributions in marketing and advertis-
ing research over the last ten years (Kates, 1998). When the purpose is to explore consumer experiences, one technique central to qualitative research has been protocol analysis (Gould, 1999). This method, also known as cognitive response, thought verbalization, and thinking aloud, is generally used because of the message-evoked thoughts it inspires in consumers (Wright, 1980). Essentially, protocol analysis involves participants verbalizing thoughts, ei-

<table>
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<th>TABLE 2</th>
<th>Interface Features in 3-D Product Simulations</th>
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<tr>
<td><strong>Domain/Interface</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Visual Simulation</td>
<td>Motor immersion and control via the mouse allows the product to be moved in 3-D. This changes the sensory properties of the product, most typically to increase or decrease the size of a product. For instance, a wristwatch can be zoomed in to appear larger than its actual size for visual inspection of its details.</td>
</tr>
<tr>
<td>Visual Translation</td>
<td>Unlike 2-D representation, motor control via the mouse allows the user to rotate the product or environment to view from any angle. For instance, a laptop computer can be viewed from the front, back, side, and with the screen open or the docking adapter attached.</td>
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<tr>
<td>Rotation</td>
<td>The placement of a product in the context to simulate how the product can be consumed. For instance, a set of furniture is in an elegant room or trucks are on a rugged mountain road. It is much easier to contextualize a product in 3-D environments than in physical environments. Contextualization is related to customization (see below).</td>
</tr>
<tr>
<td>Contextualization</td>
<td>The addition of stereopsis via 3-D glasses (i.e., a different viewpoint is presented to each eye) provides increased sensory information and fidelity, making information about the depth and shape of products and their settings more vivid and realistic.</td>
</tr>
<tr>
<td>Stereopsis</td>
<td>Motor control and force feedback allows the consumer to feel haptic forces (i.e., weight, inertia, resistance) when manipulating a product to feel product properties such as the texture of a product, the smoothness, edges or softness of a product with the mouse or other devices.</td>
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<tr>
<td>Tactile Simulation</td>
<td>Products, sensory features are tied to their behaviors: they move in certain predictable ways. For instance, car doors open on hinges when pulled. In virtual environments behaviors can simulate direct experience or be enhanced or fantastic. In addition, animations trigger prescribed feature descriptions or product behaviors (i.e., demonstration) upon some user action such as approaching the object in a 3-D space or moving a mouse cursor over it.</td>
</tr>
<tr>
<td>Touch and Manipulation</td>
<td>The ability to allow the shopper to modify the form or content of a product. For instance, using a computer mouse, a consumer may change the colors of a bed sheet and comforter to see how well both match.</td>
</tr>
<tr>
<td>Behavioral Simulation</td>
<td>People move through environments. Products are demonstrated in a commercial “space” such as a virtual mall to allow users to “window shop” by strolling through a 3-D or other simulation of physical shopping behavior.</td>
</tr>
<tr>
<td>Animation</td>
<td>People interact with products with other people. Using either agents or avatars for a shopper to interact with salespeople in virtual environments.</td>
</tr>
<tr>
<td>Customization</td>
<td>People move through environments. Products are demonstrated in a commercial “space” such as a virtual mall to allow users to “window shop” by strolling through a 3-D or other simulation of physical shopping behavior.</td>
</tr>
<tr>
<td>Spatial Navigation</td>
<td>Social Simulation</td>
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</table>
ther concurrently or retrospectively, when exposed to a stimulus. The benefit of using protocol analysis when examining consumer behavior is the introspective nature of the method. Introspection forces participants to search their own mind in order to report their thoughts and feelings about a message, event, or product (Gould, 1999).

Participants
Thirty undergraduate students at a major Midwestern university participated in the study. The sample consisted of a diverse number of academic majors, of which 40% were female. Student participants were considered appropriate for this experiment because they are high in Internet literacy and likely to represent potential early adopters of e-commerce in 3-D visualization.

Stimulus
Given the exploratory nature of the study, four products (bedding material, laptop computer, ring, and watch) from the Metastream website were identified as suitable 3-D test objects (see Figure 1). The products constitute a "theoretical" sample selected on the basis of their apparent design interfaces applicable to create a virtual experience (moveable, rotate, zoom, animation, or customization). Metastream Corporation, recently acquired by Viewpoint Corporation, was a provider of Internet visualization technology and 3-D rendering services for online retailers (Viewpoint, 2001).

Procedure
Since participants had no prior experience in examining 3-D visual products combined with the difficult nature of concurrent verbalization,
each of them took part in two training sessions totaling 5 minutes. The first training session was designed to make the participants feel comfortable with verbalizing their thoughts. Participants were instructed to examine a magazine ad for a unisex fragrance while continuously communicating their thoughts and feelings. The second training session allowed participants to familiarize themselves with the keyboard and mouse controls needed to examine 3-D products through rotating, zooming in and out, and moving a 3-D-rendered lightweight jacket.

The research was conducted in a laboratory setting with each participant accessing a computer containing four icons hyperlinked to the corresponding 3-D products. Participants were instructed to examine the products individually, taking as much time as needed to verbalize what they “think and/or feel.” In addition, each participant was instructed to continuously verbalize his or her thoughts and feelings as he or she examined each product. Concurrent verbalization was utilized in order to minimize memory loss since four separate products were evaluated and the entire session could last as long as 30 minutes (Wright, 1980). If participants were silent for more than 10 seconds, they were prompted: “Please tell me what you are thinking or feeling.” As a result of the training, however, prompting was rarely needed.

The verbal reports for each product averaged 5 minutes and were ended by the researcher if the session extended beyond 8 minutes per product. Once all four products were evaluated, participants were asked to describe how they think and/or feel about the ability to examine interactive 3-D products. The results provide distinctly identifiable responses common to direct and indirect product experience as well as uniquely specific virtual experience characteristics. Excerpts from the verbalizations are presented verbatim in this section, with gender and product references in parentheses. The percentage of participants who indicated a given category of psychological activity is reported as descriptive information. Because a small nonprobability sample was employed, the findings of this study are not intended to generalize to a larger population but

Data Analysis

The verbal protocol tapes were transcribed and analyzed using a qualitative data analysis software program (N5 2000) in accordance with established content analytic procedures (Riffe, Lacy, & Fico, 1998). First, the content of each subject’s verbal report was divided into “units of thought” (Gardial, Clemons, Woodruff, Schumann, & Burns, 1994; Rook, 1987). A “unit of thought” is defined in this study as a smallest set of words that are meaningful out of its context. Hence a coder is able to interpret the meaning of the statement, without reading the text before and after the statement. If it were further divided, a unit of thought would become meaningless. As a result, a total of 993 units of thought were identified from the transcribed data.

The second step involved coding each unit of thought into one or more of 13 categories. Coding categories were derived a priori as well as from emergent themes interpreted inductively, with the intent to characterize a virtual experience (see Table 3). Initial categories were pre-tested using a 10% randomly selected subsample of the units of thought and were identified as suitable training material. Category definitions were revised if needed, and a second randomly selected subsample appropriate for measuring coder reliability was selected. Two coders independently analyzed 14% (142 out of 993) of the units of thought, which resulted in only 12 intercoder disagreements. Thus, an acceptable overall reliability of 92% was achieved, with a Scott’s Pi accounting for chance agreement of .90 (Riffe et al., 1998). In addition, individual category reliabilities ranged from 80% to 100% (see Table 3).

RESULTS

Participants were asked to continuously verbalize what they were “thinking and/or feeling” while examining four 3-D interactive products. The results provide distinctly identifiable responses common to direct and indirect product experience as well as uniquely specific virtual experience characteristics. Excerpts from the verbalizations are presented verbatim in this section, with gender and product references in parentheses. The percentage of participants who indicated a given category of psychological activity is reported as descriptive information. Because a small nonprobability sample was employed, the findings of this study are not intended to generalize to a larger population but
to discover and theorize aspects of a virtual experience.

**Involvement – Self**

For any consumer to perceive and evaluate a product actively, that product must hold some form of personal relevance. Krugman (1965) referred to this as a type of involvement. With 93% of the participants indicating personal engagement, examining a product within a virtual experience actually initiates this involvement:

I’m not a big fan of watches with a leather band just because my experience with them is that they usually always deteriorate like after a year so. Then you have always got to replace it. (male, watch)

I like blue so these look fine with me, but I thing there are too many squares. I don’t like that. For me, a ring should be more like a circle so I don’t like that really much. (female, ring)

This is a pretty good one right here. I am familiar with the think pads and this seems quite equal to it so far. It looks to be a little lighter than the think pad so this would be one that I would consider. (male, laptop).

The ability to personally relate to a virtual product suggests that a certain level of cognitive processing is involved during a virtual experience, which is more than simply interest or curiosity.

**Involvement – Third Person**

In addition, 60% of the participants referenced the potential importance of the product to someone else:

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Agreement</th>
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<tbody>
<tr>
<td>1. Involvement–Self</td>
<td>Perceived relevance of the product or product attributes to oneself.</td>
<td>95%</td>
</tr>
<tr>
<td>2. Involvement–Third person</td>
<td>Perceived relevance of the product or product attributes to others.</td>
<td>100%</td>
</tr>
<tr>
<td>3. Product attribute attention</td>
<td>Attention to specific product attributes such as brand name, color, size, etc.</td>
<td>88%</td>
</tr>
<tr>
<td>4. Product attribute evaluation</td>
<td>Comment, either positive or negative, on the product or product attributes.</td>
<td>94%</td>
</tr>
<tr>
<td>5. Product attribute association</td>
<td>Connecting a product or product attributes to other objects to make sense of it.</td>
<td>100%</td>
</tr>
<tr>
<td>6. Questioning about product attributes</td>
<td>Uncertainty about a produce attribute (but no desire or intent to figure it out).</td>
<td>87%</td>
</tr>
<tr>
<td>7. Information Seeking</td>
<td>Desire or intent to seek more information about product attributes</td>
<td>100%</td>
</tr>
<tr>
<td>8. Purchase intention</td>
<td>Expressed intent to either purchase or not purchase a product.</td>
<td>100%</td>
</tr>
<tr>
<td>9. Presence–Physical</td>
<td>Feeling as if he or she is with a physical product or perception of no difference between a physical and a virtual product.</td>
<td>100%</td>
</tr>
<tr>
<td>10. Presence–Natural</td>
<td>Describing the virtual representation of a product as natural, real, or believable.</td>
<td>100%</td>
</tr>
<tr>
<td>11. Enjoyment with virtual product inspection</td>
<td>Feeling of pleasure or enjoyment of interacting with a virtual product.</td>
<td>80%</td>
</tr>
<tr>
<td>12. Expectation of richer virtual experience</td>
<td>Desire for more design features such as more customizable items, more brands, or more colors to choose from.</td>
<td>100%</td>
</tr>
<tr>
<td>13. Affordances</td>
<td>Recognizing the lacking of tactile affordances.</td>
<td>100%</td>
</tr>
</tbody>
</table>
It seems like something that people would want to buy. I guess just by the colors and the way the sheets go with the comforter. (female, bedding)

It’s like it might be for someone who is really into sports or something because it has a lot of different measurements on here. (male, watch)

I used to work at Staples and we used to secure these down so no one would lift them up or touch them. They’d always be looking at the kind of slots in the back. The product right here is kind of a neat idea. They can look at it and if they don’t like it they just go to another one. (female, laptop)

Similarly, participants seemed to perceive the product realistically enough in a virtual experience to evaluate the potential benefit for another individual.

**Product Attribute Attention**

During the evaluation, participants were consistently paying close attention to the virtual product, with 100% making at least one reference to a specific attribute:

Looks like probably a leather band, which is a little more comfortable than a metal band. (male, watch)

I don’t like the quilt, yuck, it looks like it’s a nice quilt and everything but these colors they offer here are pretty horrible. (female, bedding)

The colors right away catch my eye and I am definitely a big fan of blue and crystal colors. Looks like a silver band and I am a big fan of silver so that’s cool. (male, ring)

While each participant was instructed to express their thoughts about the product, at no time were they instructed how or what to evaluate. The close attention to detail and specifics is likely to be a result of examining a 3-D product, suggesting that the virtual experience can generate active thoughts about product attributes.

**Product Attribute Evaluation**

Evaluations are common measures to articulate attitudes, opinions, and feelings about an object. When consumers find a product more pleasing, the potential is greater for a positive transfer effect resulting in a behavioral response (Batra & Ray, 1986; Fazio, Powell, & Williams, 1989; Mackenzie & Lutz, 1989). While examining the four products, all 30 subjects made some type of spontaneous evaluation reference, either positive or negative, regarding a specific product attribute:

I like laptops and I’d like to have one so I always check the features out. I like the screen, it looks big and there isn’t much border around it, which is nice. (male, laptop)

That looks like it is a nice leather band. Looks like it would probably be durable. Overall, I like the design of the watch. (female, watch)

I don’t like the setting. The setting looks kind of different because it is really square. These little knobs and stuff seem like something that would get caught on something even though they might not stick out that far. (male, ring)

The importance is not whether they made a positive or negative comment about a product but that the participants were actively engaged in evaluating specific product attributes much the same way they would if asked to evaluate actual products.

**Product Attribute Association**

The act of associating products or specific attributes with other items signifies a mental connection between one’s thoughts and previous experiences. Forty percent of the participants related the virtual products they examined to other objects:

It looks like a watch you could wear with casual clothes or with dress clothes. (male, watch)

It’s pretty thick; it looks like the thickness of a couple of notebooks put together which is nice. (female, laptop)

In many instances, mental imagery was used to associate the product or attribute to a remembered sensation or concrete object:

That right there would match up to something you would throw on in the fall because it looks
like the leaves on the comforter and the bed skirt. (male, bedding)

**Questioning About Product Attributes**

A common element within any type of active processing during product evaluation is the discovery of questions or missing information. Likewise, 80% of the participants indicated some form of uncertainty about a product attribute:

I don’t know what kind of a cut that is but it kind of stands out at you. (male, ring)

I can’t tell if this is like a full size bed or a twin bed. I’m not sure if that is oak or what but I like the color of it. (female, bedding)

Microphone, jack, and headphones, I don’t see a line end jack but I guess a microphone could be used. (male, laptop)

The significance of these comments resides in the similarities between examining a virtual product and inspecting a physical product.

**Information Seeking**

A logical extension of raising questions about a product when actively processing information is indicating the desire to seek out answers. Indeed, 43% of the participants demonstrated this desire:

I’m not sure if this is stainless steel or what. I’d like to know more about the materials that it’s made of. (female, watch)

It looks pretty nice but I’m not really sure what kind of stones these are. I’d probably want more information about that. I think that might prompt me to go to the store. (male, ring)

I want to know how much that costs. That’s an issue that I want to know, even though that’s very good and very comfortable to me. (female, bedding)

Although information seeking is also common when examining physical products, perhaps this area is where a virtual experience represents a relative advantage over direct experience. For instance, a virtual experience is able to easily call attention to certain product features, frame messages effectively, and offer a wide breadth of information not easily available by direct experience.

**Purchase Intention**

Purchase intention is one of the most common characteristics measured in advertising and marketing effectiveness research and is used to anticipate a behavioral response (Beerli & Santanta, 1999). Here is how some participants indicated their intention to either buy or not to buy something:

I think it gives you time in other countries possibly. I would buy it. I feel good about it so I would think about buying it. It depends on how much it costs. I would buy it. (male, watch)

I don’t know if it’s anything I would buy but it kind of looks like a women’s ring. Just for the simple fact it’s kind of small and the band is kind of narrow. (male, ring)

I would definitely buy this combination over the other one just because I tend to like bright colors and the green looks more natural. (female, bedding)

Over half (57%) of the participants reported some type of purchase intention—either to buy or not to buy—when examining the products even though they were never questioned about purchasing. This implies the participants were engaged in active processing and evaluating the product within the virtual experience.

**Presence – Physical**

The sensation of physical presence is perhaps one of the most difficult characteristics of virtual experience to establish. It is because the feeling of “being there” with a product indicates a state of consciousness that the consumer normally perceives in the physical environment (Kim & Biocca, 1997). In this study, only 23% of the participants indicated this type of sensation and they did so exclusively when examining the laptop computer. In fact, a feeling of physical presence with the product seemed to be tied to the specific action of pressing the power button:

I like that it just comes straight on like that, you don’t have to go through the whole process of it warming itself up when you turn the computer on. (male, laptop)
You can do that? Oh wow, actual resolution. (female, laptop)
That is a really nice high-defined picture because you know in older laptops the screens can look much duller. (female, laptop)

It seems the participants ignored the difference in screen resolution between an actual and a virtual laptop. The perception of screen resolution suggests that physical presence is able to offer a unique virtual experience. Perhaps the perception of exerting control over a product combined with animation simulating a consequence, such as the computer powering on, certainly increases physical presence.

**Presence – Natural**
The feeling that a mediated environment, or in this instance a product presented in a mediated environment, looks more real has also been identified as a component of presence (Lessiter, Freeman, Keogh, & Davidoff, 2000). Thirty-seven percent of the participants indicated this type of experience:

Just because you get a sense of it, I mean you really get the look or feel of something before you actually buy it. (male, watch)
I think that is pretty similar to looking at a bed in a real store. I just bought a bed and I mean you do kind of the same thing in that you look at it in different angles. (female, bedding)

An increased perception of reality or naturalness, induced by a virtual experience, places the consumer at the store or with a product, potentially impacting evaluation:

I think it makes it more real. When you go in a store and look at a watch or something you’re going to do the same thing. I just think making it interactive just makes it more real like your actually at the store. (male, 3-D products)

**Enjoyment with Virtual Product Inspection**
Holbrook and Hirschman (1982) contended that product use should incorporate enjoyment and fun into what they called an “experiential view” of consumption. This view supports a multisensory psychophysical perspective and could be represented within a virtual experience:

It’s definitely very interesting. I’ve personally never seen anything like this, you can actually rotate the product around and the coloring especially you can change stuff. I’d definitely like to see more stuff like that on the Internet instead of just seeing a flat 2-D object. (male, 3-D products)

With all participants indicating some type of enjoyment when interacting with the products, a virtual experience could potentially impact attitude and behavior: extfThat’s pretty neat because it gives you the impression that it can be yours and it puts more personality into the ring. They can actually do that to a ring if they buy it here and interact with it more. That’s definitely a nice thing to have the interaction. (male, ring)

This gives you more focus on the product than on an ad online or on a piece of paper because you can really almost kind of touch it and you’re focusing purely on this. You’re not just looking at whatever words and pictures. It kind of makes you think a bit more about the actual product. (male, watch)

**Expectation of Richer Virtual Experience**
Research has indicated that a negative shopping experience occurs when expectations are not achieved (Machleit & Eroglu, 2000). Considering 3% of the participants reported a desire for additional interactive features, a negative virtual shopping experience could reflect the same results:

I like the way it’s pretty realistic. I think it would be a little more fun if you could do some other things once it was on. (female, laptop)
It would be nicer if it had all the things that were on the laptop, you know the things that popped up as you went through the product. If I could somehow undo the watch so you could see it and lay it out and everything. (female, watch)
If they had maybe some different fonts, like if you could do it in different styles like how they do the cursive because a lot of people I guess get their wedding dates or messages engraved. (male, ring)
By incorporating all relevant interactive features for a specific type of product, advertisers and marketers may be able to minimize any negative feelings resulting from unmet expectations in virtual environments.

Affordances

A difference between virtual affordances and physical affordances is the tactile simulation. While a 3-D product is able to simulate many aspects of a physical product, consumers who prefer the tactile affordances of a product may perceive a hindrance within a virtual experience. In fact, 63% of the participants explicitly referred to this limitation:

In this kind of product the important thing is the softness of the bed so I want to feel texture. I want to go to the store so I can touch the bed so I can get the feeling and after that I will maybe decide to buy. (male, bedding)

This is virtually anything you would be able to do at a store besides trying it on so I think that would be the only thing that would really hinder me from buying it if it were for myself. (female, watch)

The perception created by a virtual experience exceeds indirect product experience by providing virtual affordances that tend to promote consumer learning. Although additional affordances are sought, a virtual experience can still reinforce a response:

I think the thing with rings is you have to see them on your finger to get a good idea. I think this is a good head start because you at least turn it around and see it from different angles. (female, ring)

SUMMARY AND DISCUSSION

This protocol analysis generated vivid evidence on what consumers think and feel when they “virtually” experience products. We see from the evidence a number of characteristics of a virtual experience in e-commerce. One characteristic is what we call active process, which largely addressed our first research question about how consumers form product knowledge and decisions in virtual experience. Five distinct yet related psychological activities occur in a virtual experience: product attribute attention, attribute evaluation, attribute association, attribute questioning, and information seeking. These activities demonstrate that consumers are active learners when examining virtual products. They consistently attend to and evaluate product attributes while interacting with a product, and associate a product or product attributes with familiar objects in order to assimilate new information into their existing knowledge. Occasionally, they are uncertain about some product attributes and desire to seek more information. As a result, they quickly form their behavioral intention to buy or not to buy a product. This dimension of the consumer mentality in a virtual experience resembles much of that in direct experience, where “the subject acts on the stimulus” and the “actions of the learner affect the content of the experience” (Hoch & Deighton, 1989, p. 2).

The active process of virtual experience is often accompanied and heightened by three other characteristics: presence, involvement, and enjoyment. We consider that these characteristics largely answered our second research questions about how consumers perceive presence in virtual experience. We see presence as the perceptual base of a virtual experience because 3-D simulations of products and shopping environments render mental images that are traditionally created by consumers in conventional stores. This characteristic provides the sensation and feeling of “being there” with a product, in a store, or potentially even communicating with a salesperson. As observed in this study, at a low level of presence, the participants feel that simulations appear “real” or “realistic,” signifying a conceptual awareness of the simulation. At a high level of presence, virtual product attributes and physical product attributes are perceived equally and participants treat the virtual product just as they would a physical product. This is obviously the mode that will greatly facilitate consumer learning and, thus, the goal for any design of virtual products in e-commerce.

Another characteristic of a virtual experience is involvement. We observed spontaneous comments indicating a participant’s perception of
the relevance of a product or product attribute to themselves or other individuals when examining the 3-D products. Product involvement is not unique to a virtual experience and is often associated with traditional advertising. However, the high frequency of mentions for self-involvement and third-person involvement suggests that virtual experience is quite similar to direct experience in this regard.

Enjoyment of virtual experience per se represents a characteristic of this new kind of consumer experience, which may come from two sources. First, many participants had never interacted with 3-D virtual products like the ones in this study. The innovative nature of the design and interactive experience indeed pleased many of them. As 3-D simulations become popular in e-commerce, this innovativeness may fade. The second reason for enjoyment of a virtual experience may reside in the fact that virtual affordances exceed physical affordance. When consumers shop for a wedding ring in the store, they do not expect to see what the engraving will look like on the inner side of a ring. However, when some participants experienced the customization ability and interface in this study, they were pleasantly surprised. Such affordance-based enjoyment will endure as virtual experience has potentials to induce it.

The findings of the study also indicate that participants have different physical affordances for different products. The total units of thought were relatively proportionately equal for 8 of the 13 coding categories. However, there were noticeable differences for the bedding material (product attribute attention; product attribute evaluation), laptop computer (presence-physical), and watch (enjoyment with virtual product inspection; expectation of richer virtual experience). For instance, fewer product attribute attention statements were reported for the bedding material (17%) than the laptop computer (32%), ring (23%), or watch (28%). Likewise, fewer product attribute evaluation assertions were stated for the bedding material (20%) than the laptop computer (27%), ring (25%), or watch (28%). As previously mentioned, a feeling of physical presence was only reported for the laptop computer (100%). Yet, statements indicating enjoyment from the virtual inspection were substantially lower for the watch (9%) than the bedding material (34%), laptop computer (32%), or ring (25%). This was followed by fewer expectations of a richer experience for the watch (11%) compared to the bedding material (35%), laptop computer (27%), or ring (27%) as well.

These differences enhanced our belief that different affordances, both physical and virtual, exist among consumers and that the design of 3-D visualized e-commerce needs to take into consideration these differences. Specifically, if visual inspection is the determining cue, consumer learning should be enhanced over indirect experience by examining 3-D virtual products. If tactile experience is the primary evaluation criterion, such as the case with the bedding material, the effectiveness of virtual simulations is limited. Yet, when behavioral simulations are salient for inspection, virtual experience may offer a unique opportunity for marketers to simulate action through animation and customization.

It is prudent to note that the lack of tactile affordances within a virtual experience represents a characteristic deficiency. Touch and feel is an important experience when consumers inspect physical products and an aspect of affordances that is not simulated in the present study. With the invention of a computer mouse using “force-based technology,” tactile affordances may be simulated to a degree in the near future. Until then, the lack of tactile affordances should be considered a feature of a virtual experience. These findings addressed our third research question about how consumers treat physical affordances and virtual affordances.

These identified characteristics of a virtual experience help us define it and anchor its position on the spectrum of consumer experience. We come to conclude that virtual experience consists of vivid, involving, active, and affective psychological states occurring in an individual interacting with three-dimensional computer simulations. We see that virtual experience is closer to direct experience than to indirect experience in terms
of effective consumer learning. In addition, we notice virtual experience is even advantageous over direct experience when, for instance, animated product attributes capture the consumers’ involuntary attention and frame a different perception of the product than that purely based on direct experience.

This exploratory study is not without limitations. It employed a concurrent verbalization method for qualitative data collection. Participants were asked to continuously verbalize what they were thinking and/or feeling. This method itself may have artificially increased the level of active processing about virtual product attributes. Although the method serves the research purpose quite well and we have acquired rich information, we speculate that typical consumers in a normal 3-D e-commerce environment may not experience so intensive psychological activities. Thus, alternative research methods, such as experiments, surveys, and personal interviews, are needed for testing and verifying the findings of this study. In addition, only one or two products were used representing the dominant physical affordances—a wristwatch and a ring for visual affordances, bedding materials for tactile affordances, and a laptop for behavioral affordances. External validity of the study could have been higher if more products in each category were tested in the experiment.

This study represents an initial attempt to conceptualize virtual experience in 3-D visualization in e-commerce. As a result, additional paths of research may lead to important findings in this new area. First, the impact of virtual product contextualization should be studied. For instance, traditional e-commerce environments display products absent environmental context. In reality, consumers often prefer to examine products within context, such as the ring displayed on a hand or the laptop computer presented in an office setting. In virtual environments, more choices can be offered for consumers to make selections, which is likely to enhance consumer learning. Second, framing is another area worth exploring. In the present study, 3-D products consisted almost entirely of visual cues, with little textual information. It would be interesting to see how combinations of texts and visual cues, in different amounts or sequences, would affect consumer learning from a virtual experience. Third, individual differences need to be addressed in future research of virtual experience—demographics, psychographics and other personal factors. We know very little about these factors in terms of their potential impact on virtual experience in e-commerce.

Answers to these questions are not only essential to our understanding of this new challenging experience, but also significant for e-commerce practice. With advanced knowledge of virtual experience, marketers and advertisers can design more effective e-commerce environments to enhance consumer learning by highlighting relevant messages and eliminating trivial information.

REFERENCES
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