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Emotional Evaluation Of A Product/system

Hana Smith
University of Central Florida

EMOTIONAL EVALUATION OF A PRODUCT/SYSTEM

by

HANA SCHUSTER SMITH
B.A. University of Central Florida, 2000
M.S.I.E. University of Central Florida, 2005

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ABSTRACT

Technological advances in products and systems have brought emotional design or emotional engineering to the forefront of research. While several measures to assess emotional expression of products have been developed, the source of the emotion rating of a product or system was often unclear. The purpose of this dissertation is to conduct three studies to examine the causes of emotional ratings and to establish if product-specific emotion rating scales are useful for capturing accurate user evaluations. Three studies were conducted using citrus juicers. Juicers were chosen for several reasons: their wide variety of styles, one self-explanatory purpose (to make juice), and the fact that their benign nature is unlikely to harm participants.

Study 1 isolated juicers that had unique emotion profiles to use in the Study 2. Participants rated 41 juicers with fourteen product-specific emotions. Participants predominantly used "five" of the fourteen emotions in their juicer ratings. Ten juicers with the highest rating consensus, within these five emotions, were chosen for Study 2. Study 2 determined that anthropomorphic tendencies are predictive of emotional ratings. Extreme Anthropomorphism from the Anthropomorphic Tendency Scale (ATS) was used to test individual differences (Sims et al. 2005;Chin et al., 2005). Individuals with low anthropomorphic tendencies were more critical of the products. Sex differences also were analyzed, and significant interactions were found. Women exhibited different preferences for juicers than me. First impression ratings from Study 1 were validated by first impression ratings from Study 2. Finally, Study 3 measured the impact of product interaction on emotional ratings. Participants used seven juicers to make a minimum of four ounces of juice. Pre and post-interaction ratings were compared to determine the effect of interaction on the emotional appraisal of products. The results confirmed that interaction had

an impact on affective ratings. As opposed to experienced users, novice users deviated in their pre-post appraisal, especially on aesthetically boring but highly usable products. Novice users based their entire initial appraisal on aesthetics, while experienced users were influenced by their past experience. Humans rely on past experience to recall likes or dislikes. The findings here suggest that aesthetic appraisal of products (or other environments) will remain influenced by past exposure/experience with those or similar products. Thus, only true novices can remain unbiased by past experience for aesthetic appraisal and capture a true 'first impression'. Also, past experience of users should be assessed when conducting research that relies on emotional appraisal of products. These findings may be especially useful in product development where new designs are based on a golden standard, competition, or go through several iterations of testing. The results may be used to guide human factors professionals to develop measures that more accurately capture affective ratings, and thus create more pleasurable products and systems.

To Eric, my best friend and greatest love,

to my parents, Jan and Vladislava, who made incredible sacrifices to bring me to America,

and to my step-dad, Tony, who loves me as his own.

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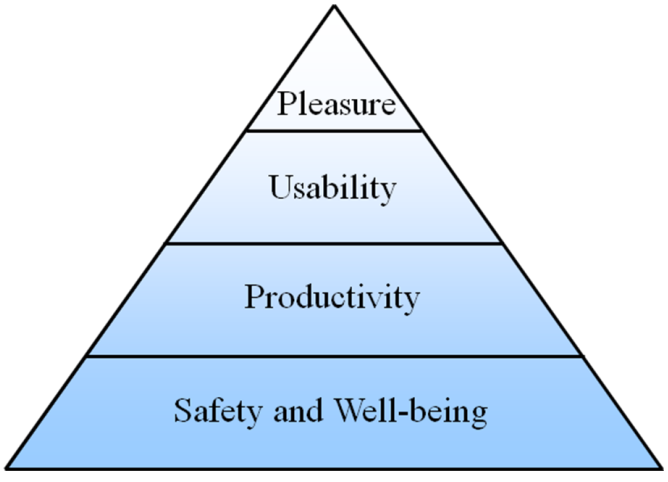
CHAPTER 1: INTRODUCTION

The field of human factors investigates the best ways to design an effective product. There are four aspects to product design, with the foundation anchored in safety and well-being. The pyramid in Figure 1 contains these four aspects in a way that reflects a hierarchy of consumer needs (Bonapace, 2002). This arrangement also reflects the history in which the field of human factors has evolved over the years. In the early stages, human factors focused on safety, well-being, and productivity. The goal was to develop training or a selection process in an attempt to match the *human* to the *task*. After World War II, a shift from task-centered to user-centered design took place. This meant that even complex products, such as computers, were available to the masses. Products and system have become increasingly complex and reflect the continuous technological advances. With this advancement of products, little remains to differentiate between them. So, consumers have raised the benchmark with a new expectation; they want to enjoy using their products. Pleasure, or emotional design, is the next step in meeting consumers' expectations in the field of usability.



Adapted from Bonapace's (2002) hierarchy of user needs when interacting with products.

Figure 1. Hierarchy of Consumer Needs

Although human factors/ergonomics had not really taken shape as a discipline until the 20th century, people have always strived to improve aspects of their environments in terms of safety and productivity. Records of the Greeks using human factors principles date back as early as the 5th century (Marmaras, Poulakakis, and Papakostopoulos 1999). While the ancient Greeks did not use the terms "human factors" or "ergonomics", they did develop ergonomic principles to promote safety and efficiency in their environment. The Greeks' knowledge of anthropometric measurements was used in both designing their environments and creating their art. Today successful product and system design continues to be the goal of human factors specialists, designers, and engineers. As with the early Greeks, early ergonomists and human factors specialists (i.e. Taylor, the Gilbreths, and Chapanis) focused on safety and efficiency.

Though examples of the use of human factors exist as far back as the ancient Greeks, most professionals consider the inception of human factors to have taken place around the industrial revolution—the late 1800s and early 1900s (Cadwell, 1972). The primary goal at that time was to create products that would not hurt or kill people. While early human factors focused on safety, a shift quickly turned to productivity (Green and Jordan, 2002). Examples of this early focus on productivity are the motion and shop management studies of Frederick Winslow Taylor's (1911), and Frank and Lillian Gilbreth's (1916).

Taylor (1911) pioneered early work environment studies known as "time and motion studies." Taylor believed there was one optimal way to perform a task. By performing these observational studies, he could streamline working environments to maximize productivity. For example, he studied workers who shoveled coal. Shovels that were too large were labor intensive workers moved too slowly, but shovels that were too small did not move enough coal. Thus, by

optimizing the size and shape of the shovel, he maximized the shoveling rate to optimize productivity.

Regardless of focus, these early contributions remain the foundation of modern day human factors. In 1916, the Gilbreths' early analysis of surgical environments resulted in a lasting change to surgical procedures. Before this study, doctors would have to interrupt the surgical procedure to look away and find the surgical instrument needed. The Gilbreths' analysis eliminated this safety hazard by creating a process in which surgeons call out the instrument they need and nurses place the item in their hands. This process, which is still used today, allows surgeons to remain focused on the surgical procedure, thereby reducing errors and time spent operating, which in turn improves overall safety for the patient.

The Gilbreths also used time and motion studies to reduce the number of steps in a given task, such as bricklaying. Streamlining bricklaying from 18 to 5 steps nearly tripled the number of bricks a brick layer could put down in an hour, from 120 to 350 (Robins et al., 2003). Furthermore, introducing non-stooping scaffolding reduced worker fatigue. However, improving worker comfort was only a byproduct of improved efficiency, which remained the primary focus. The environment continued to take precedence over the human. It would be a few more decades before the human position moved from being a spoke, to the hub, in the wheel.

In 1943, Alphonse Chapanis was one of the first to modify the environment to fit the user. When skilled pilots crashed perfectly operational planes, he redesigned the cockpit to allow pilots to better discriminate between the landing gear and flaps controls (similar looking side-by-side toggle switches). Chapanis attached a small wedge to the flap control and a small rubber disc to

the landing gear control. The new controls provided both a visual and a tactile cue that prevented confusion and eliminated accidents. The decrease in accidents suggested that the "human" or "pilot error" was in actuality a cockpit design flaw, thus a "cockpit error" (Roscoe, 1997; Vicente, 2004).

The predominant shift to human-centered design did not take place until after World War II. Before then, productivity seldom considered human-centered design; but rather, the focus was on developing training for people to perform a given job or developing selection procedures to find people that fit the job. In the 1940s, the human factors profession really took off with the inception of companies, societies, and government agencies that started to focus on what most people consider to be the ergonomics or human factors of today (Green, Self, and Ellifritt, 1995). Furthermore, the race for space exploration created a demand for an international society, the International Ergonomics Association, to share valuable information worldwide. By the 1980s, human factors expanded its domains of primarily military and space applications, into office ergonomics and the computer revolution. By the 1990s, human factors had permeated most aspects of human interaction.

Today, methods, products, and systems have been refined; thus, a continually evolving shift from safety concerns has expanded beyond usability to emotional design or affective engineering (Bonapace, 2002). Positive emotional appraisal may be the only discerning difference between technologically advanced products. Increasingly prevalent, this new focus is referred to as affective design, "Affective engineering is the study of the relationships between physical and rational product features and their subjective cognitive or emotional influences on the people interacting with them, and the use of the knowledge gained to design more satisfying products"

(opening paragraph of the Affective Engineering web site, 2007). Emotional design or hedonic ergonomics has become a focus area of research under titles such as 'Emotional Engineering', "Affective Design", "Affective Ergonomics", "Pleasure with products", and "Design for human senses" (ENGAGE, 2005). Jordan (2000) explained this shift from technology-centered design to user-centered design as an evolution in hierarchical consumer needs. Jordan's hierarchy of consumer needs consists of safety and well-being, functionality, usability, and pleasure (Green and Jordan, 2002; Jordan, 2000). Today, consumers are no longer surprised by a product's ease of use; they expect and demand it. A shift from basic needs to emotional design is the new discriminating factor that determines a product's success. Thus, emotional design is growing to meet user expectations in the field of usability.

Advances in products and systems have brought emotional design or emotion engineering to the forefront of research. Several measures to assess emotional expression of products are used [c.f., Ekman's Affective States (1999a, 1999b), Pleasure-Arousal-Dominance scale (PAD) (Russell and Mehrabian, 1977), Self-Assessment Manikin (SAM) (Lang, 1985), and Product Emotional Measurement instrument (PrEmo) (Desmet, 2002)]. However, often it is unclear as to the source (product feature) for the emotional evaluation. This research is a series of studies to examine the causes of emotional ratings. In these studies, individual differences and past interactions with products were evaluated for impact on emotional appraisal. Furthermore, PrEmo (2002) emotions were used to determine if product-specific metrics are necessary for assessing products/systems and what further refinement may be necessary. These emotions were chosen, as opposed to other typical measures, such as Ekman's (1999a, 1999b) affective states, because they are product specific. They reflect a person-product interaction, while Ekman's affective

states reflect a person to person interaction. Also, Ekman's affective states (anger, disgust, enjoyment, fear, sadness, and surprise) are disproportionately negative (1 positive, 1 neutral, and 4 negative emotions). Evolutionary psychology explains this negative majority as important for survival since the severity of negative emotions is the difference between recognizing a bad mood versus a mortal threat. However, in general, products are not designed to be threatening or dangerous; thus, Desmet's product-specific emotions were used in a verbal form. The results of this disertation may be used to guide human factors professionals to develop measures that more accurately capture affective ratings and in turn design increasingly positive product experiences.

CHAPTER 2: LITERATURE REVIEW

Emotional Design

Though emotional design has recently gained momentum, it is not a novel concept. As early as the 1970s, techniques trying to capture emotional experience have existed. Several measures have been created in an effort to capture the individual experience of affective interaction. Early examples of measures include the Semantic Differential Methods, Conjoint Analysis, Semantic Description of Environments, Quality Function Deployment, and Kansei Engineering (Schütte, 2005). More models such as the Pleasure-Arousal-Dominance (PAD) (Russell and Mehrabian, 1977; Mehrabian, 1978), Self-Assessment Manikin (SAM) (Lang, 1985), and Product Emotion Measurement Instrument (PrEmo) (Desmet, 2002) illustrate the continued and increasing focus on emotional design. The following section delineates popular approaches for measuring affective responses to products, agents, and systems.

Measurements

Kansei Engineering

One of the early techniques for emotional assessment of design, Kansei Engineering (KE), remains popular and continues to be used today (Nagamachi, 1994; 1995; 1997; 2001). This method translates feelings (Kansei) into product properties in order to facilitate design elements to meet consumer demands. Kansei is a Japanese technique developed by Mitsuo Nagamachi. Translations into English have defined it as a "consumer's psychological feeling or image regarding a new product" (1997) or "translating technology of a consumer's feeling and image for a product into design elements" (1995). The kanji (Japanese characters) for the word Kansei

broken down in Figure 2, illustrates the feeling of the senses, the emotional impact on the person, and the imprint the interaction has left (Lee, Harada, and Stappers, 2002). Lee et al. also define Chisei as the knowledge and understanding gained from experience. Chisei is the logical assessment or the necessary cognitive processing that takes place to verbalized Kansei (see Figure 2: Etymology of Kansei and Chi Sei).

(Lee, Harada, and Stappers, 2002)

Figure 2. Etymology of Kansei and Chi Sei

Kansei Engineering addresses four concerns to capture the consumer's desires. The first concern is to devise a way to capture the consumer's feeling (Kansei) about a given product in terms of ergonomic and psychological estimation. The second concern is to translate the consumer's Kansei into design characteristics. The third concern is focused on how to structure Kansei Engineering as an ergonomic tool. The fourth concern is to meet demands for the current societal trend.

To achieve the above concerns, subject matter experts (SMEs), manuals from existing products, or literature reviews of preceding studies are used to generate lengthy word lists (e.g., several hundred words) pertaining to a specific product (e.g., car) or parts of a product (e.g., steering wheel). This list is reduced by methods such as the affinity diagram, in order to make it manageable and to eliminate redundancy. Participants then rate the list to quantify their Kansei (feelings). Here KE uses Osgood's Semantic Differentials (SD) technique to understand the consumer's Kansei (Osgood, Suci, and Tannenbaum, 1957). SD is a technique designed to measure the connotative meaning of concepts. Participants state their attitude on a continuous scale between two opposing positions (e.g., Excellent, Good, Adequate, Inadequate, Poor). Participants also use methods such as a Likert scale to rate the degree to which these words are portrayed by product prototypes (e.g., 1-skimpy to 5-luxurious or for the word "luxurious" 1-strongly disagree to 5-strongly agree). The luxurious feel desired by consumers may be associated with leather trim or comfortable seats. Specific product characteristics (such as color, texture, or shape) may be manipulated. These ideas are then used to create "ergonomic technology". This step has changed from early prototyping to more technologically advanced methods using Artificial Intelligence or Genetic Algorithms. A regression analysis is used to link the Kansei words to product proprieties and the analysis yields a predictive tool for future product iterations to further meet user goals or expectations. Finally, the design is adjusted to meet current societal trends. This step may take several years to implement. An example of a societal trend is the recent shift from cars that appeared friendly toward aggressive and downright mean looking cars. Car appearance changed from round headlights that look like neotenous eyes and the grills that seem to smile, to cars with headlights that scowl and angry

grills that appear to frown. The welcoming "Hi" has altered to the "Get out of my way" attitude (Welsh, 2006).

While the quantitative predictive property of the Kansei method is an attractive benefit, the prolonged development, product specific analysis, and limited market segment are a few limitations. Also, the words generated are often adjectives that do not describe emotional states (i.e., metallic). They may elicit a product specific response; and, while the response is correlated to specific features, it is not always connected to a particular emotion (i.e., surprise) in the results. It is important to note that the features identified by this process may be instrumental in identifying the source for elicited emotions. Though this widely used method will remain invaluable to designers in an effort to meet consumer needs, it is not restricted to emotional appraisal which is the goal of this dissertation.

Pleasure-Arousal-Dominance Scale

While the KE method is product specific, Mehrabian (1978) was interested in capturing affective reactions that would do more than depict the immediate situation. He believed emotional ratings were the result of stable characteristics that were learned or genetic. This intrinsic stability would lead to greater reliability and thus predictability across a variety of situations and time. Therefore, Mehrabian focused on developing a concise but comprehensive set of temperamental measures to test the generality and stability of disposition. Mehrabian and Russell developed the Pleasure-Arousal-Dominance scale (PAD) (1977). The scale consists of three orthogonal dimensions: pleasure-displeasure, level of arousal, and dominance-submissiveness. The pleasure-displeasure dimension ranges from pain/unhappiness to ecstasy/happiness. Understanding pleasure is a key component in achieving user/consumer preferences and

satisfaction with products and systems. The arousal dimension ranges from low to high on both mental alertness and physical activity. This arousal may be an important factor for assessing environments for users who perform vigilance tasks. In such an instance, color schemes and layouts may be used to heighten mental alertness. For example, for a stress-free shopping experience, store décor may be toned down or building layout may be simplified to alleviate over-stimulated shoppers and promote a more positive experience. The dominance dimension measures dominance versus submission. This dimension also captures external versus internal causality or locus of control. Mehrabian believed that all emotional states could be reduced and explained by these three trait dimensions (pleasure, arousal, and dominance).

The PAD test pairs dichotomous emotion-denoting terms (e.g., happy-unhappy) within each orthogonal dimension. Participants chose the level of agreement between the two terms. For example, they are told to put a check mark between the words that best describes their level of agreement: Happy __ √ __ __ __ __ __Unhappy. Currently the PAD has a total of 34 items: 16 items in the State Pleasure-Displeasure Scale, 9 in the State Arousal-Nonarousal Scale, and 9 in the State Dominance-Submissive Scale. An abbreviated version exists with 4 items in each dimension. Participants taking the PAD should be 15 years of age or older, and should speak English. The test takes approximately 7 minutes, and both computerized and hand written options are available (Mehrabian, 1995). The PAD remains popular for advertising research testing product packaging, web sites, and corporate culture (Havlena and Holbrook, 1986). Though the PAD illustrates a valiant effort to assess the nature of human temperament that may help identify individual differences, it fails to get at the source variable (product feature) that caused the reaction. For example, a person's natural disposition may be positive or negative,

which may influence his or her opinion of product features. Product features may include variability in colors, size, material, or weight, just to name a few. Thus, the PAD fails to distinguish between the general appearance and product interaction for the emotional state.

Self-Assessment Manikin

While the PAD relies on verbal protocol, SAM depicts the same three orthogonal dimensions using a pictorial character (see Figure 3 and Figure 4). After being exposed to a stimulus, participants rate their current state using three scales that consist of five figures arranged from left to right corresponding to the three main dimensions of affect found in the PAD: arousal, valence (pleasure), and dominance (Lang, 1985). On the pleasure dimension, SAM ranges from a smiling character to a frowning character (see the first row in Figure 3 and Figure 4). On the arousal dimension, SAM ranges from sleepy (eyes closed) to excited (eyes wide-open), with additional graphics to depict internal angst and physical activity (see the second row in Figure 3 and Figure 4). On the dominance dimension, SAM ranges in size from large to small to indicate being in control and powerful to being controlled or submissive (see the third row in Figure 3 and Figure 4). Participants can select one of the figures in each scale or place a cross between two characters, which results in a 9-point rating scale analogous to the PAD. A study by Morris (1995) scored 135 emotion adjectives using both the PAD (Mehrabian and Russell, 1977) and SAM (Lang 1985). Morris found significant correlations between the scores. The results showed a .93 correlation for both pleasure and arousal, and a .66 correlation for dominance.

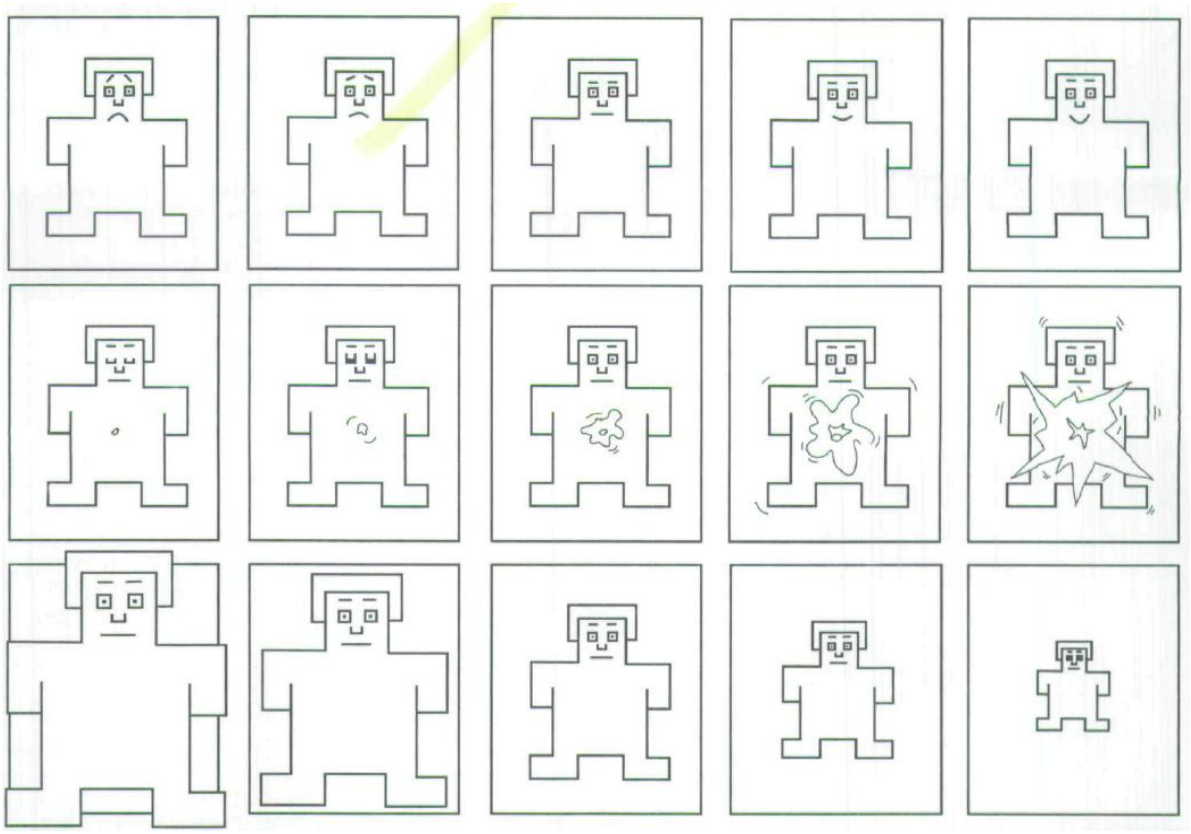


Figure 3 shows AdSAM, the pictorial depiction of the verbal protocol of PAD. The first row allows participants to indicate their level of pleasure; the second row depicts the level of arousal felt; and the third row shows the level of dominance (Morris, 1995a: AdSAM Marketing, LLC).

Figure 3. Self-Assessment Manikin

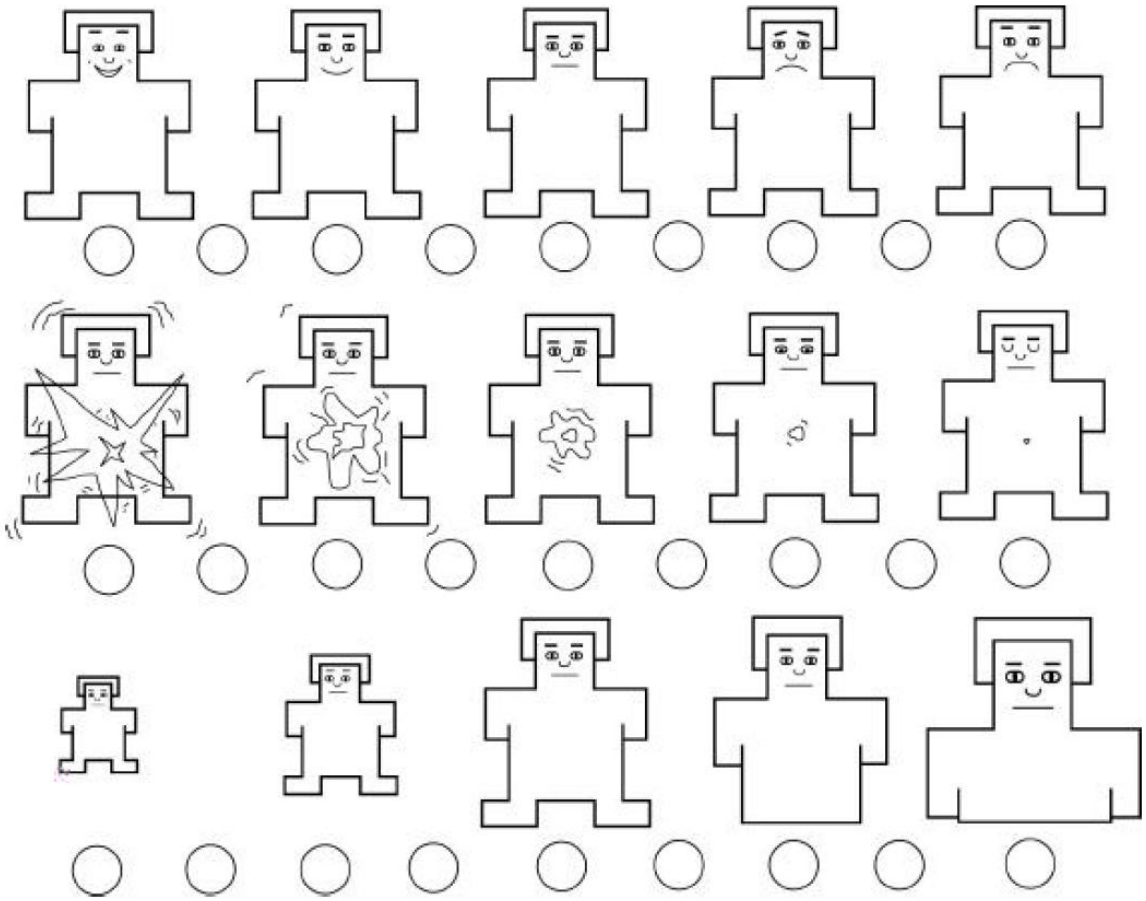


Figure 4 shows another version of the Self-Assessment Manikin called AdSAM. It is not uncommon to see adapted versions with slight variations used in studies today (Morris, 1995b: AdSAM Marketing, LLC).

Figure 4. Alternate AdSAM

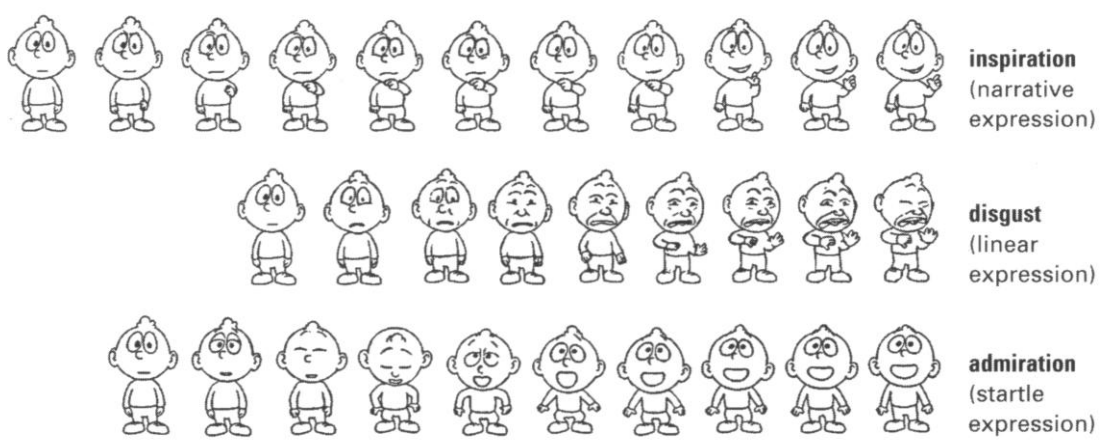
Though very similar, SAM has a few advantages over the PAD. SAM is faster to administer than the PAD; it takes, on average, less than 15 seconds. This prevents participant fatigue, which may be experienced by lengthy or verbal measures. Also, since SAM is pictorial, it is not language dependent and may be used cross-culturally and with children (Lang, 1985). However, SAM was not developed with a product or system design in mind, and thus, it only provides a broad measurement of affect along three dimensions, which limits its application. A specific application, the AdSAM has been developed to rate consumer's purchasing experience and

advertisements (Morris, 1995). AdSAM is a popular measure used to predict consumer behavior, or political campaign efficacy in attracting voters. However, it also fails to indicate the source (product variable) of the emotion felt by the individual, and it does not delineate interaction from the initial product appearance. For example, a product may be rated as pleasurable, but it is unclear if the individual was inspired to do something creative by the product, the product conjured up a memory of something the person owns that similar, the product allowed the person to relax, or the product challenged a person's intellect. All of these may be sources of pleasure, but the specific source remains ambiguous.

PrEmo

As with SAM, PrEmo relies on pictorial representations of emotions for product assessment. However, the pictures also are animated to convey body language, and they have nonverbal vocalization to further illustrate emotion. Over the course of several years and several iterations, Desmet (2002) developed the Product Emotion Measurement instrument (PrEmo) (see Figure 5: PrEmo Interface). Desmet was interested in how products elicit emotion. Several studies were done that narrowed 347 emotions to 14. These emotions were extensively tested for word choice, redundancy, and product specificity. The emotions were further divided into two sections of positive (pleasant) emotions and negative (unpleasant) emotions. PrEmo uses animations to illustrate the fourteen emotions using dynamic presentation analogous to a flip picture book. Each emotion has between nine and fourteen images that begin with a neutral expression and lead to a specific emotion (e.g., disgust, in row 2 of Figure 5: Animation Sequence Sample). The final expressions conveying all fourteen of the emotions can be seen in Figure 6: PrEmo Interface. However, participants only see one of the nine or so images presented randomly, not

necessarily the final expression. Only after clicking on them will the dynamic presentation for a specific emotion be revealed. All animations are viewed for each product at random by the participant's choosing. A 3-point scale is used to rate the relevance of each emotion for a particular product image (See Figure 5, bottom center for 3 ratings). The background of the animated character changes color once a participant rates the product with that emotion to indicate rating progress. Participants choose one of three ratings to describe their level of agreement for each emotion as "I feel this strongly", "I feel this somewhat", or "I do not feel this." Participants must rate all animations for each stimulus.



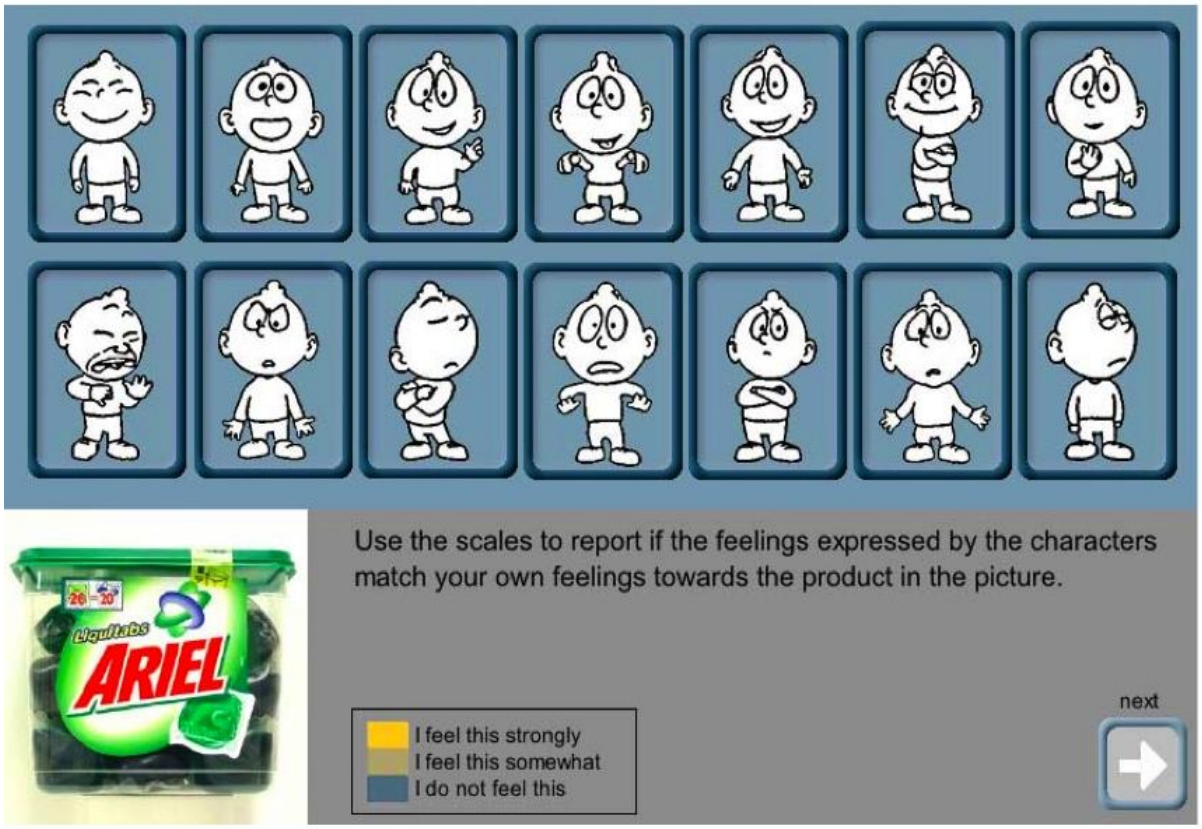
This figure shows the flip picture book like sequence the animated character goes through to create dynamic expression of emotion. The animation is accompanied by non-verbal vocalization (Desmet , 2002).

Figure 5. Animation Sequence Sample

The stimulus image being rated is a thumbnail picture reminder (lower left corner in Figure 6), and all objects are presented in larger format prior to beginning the PrEmo exercise. A sound is associated with the images, but it is non-verbal to avoid culturally specific vernacular. Because the subjects rate each image using all 14 emotions, the PrEmo instrument captures simultaneous emotions, which is when a product expresses more than one emotion at a time. These

combinations generate a product-emotion profile, which is the level of agreement for all 14 emotions for each stimulus. Products may elicit one predominant emotion or several emotions from participants to generate the product-emotion profile. These profiles reflect the complex nature of product opinions. However, these profiles do not describe the reason the product elicited those opinions from the individual. While PrEmo asks individuals to rate objects holistically, KE focuses on a specific attribute. PrEmo lacks the feature-specific manipulations and predictability of Kansei Engineering. Thus, the product-emotion profile generated by PrEmo fails to communicate the source of the emotion expressed by the product. This methodology also limits instinctual reaction (immediate impressions), which would provide insight into first impressions (the initial split-second reaction). Since the emotions are presented randomly, participants may first rate emotions that are incongruent with their first impression. This exposure to alternate emotions may cloud their judgment and their first impression may be lost to the lengthy process. Since participants view every animation and rate all fourteen emotions for each product, the process is more time consuming compared to other measures. Thus, a small number of stimuli may be desired, when using this methodology, to reduce the likelihood of fatigue. The process is extremely complex. Generally, people can attend to 7±2 pieces of information (Miller, 1956). While thorough, PrEmo relies on participants to compare 14 emotions, and attend to visual and echoic information for multiple stimuli; this may be mentally taxing for many individuals. Another weakness of this method is that the instrument is only able to measure the design (the appearance of static stimuli) and the impact it makes on participants. However, participants often were evaluating products that they have used in their own homes and have interacted with, which would be considered dynamic stimuli or product usage, something the measure was not designed to capture. Thus, only with non-interaction or true

novelty can the expression of emotions from a product be captured without the impression of interaction influencing an individual's memory. Despite any shortcomings, it is important to note that Desmet has made a valuable contribution; he developed a list of product-specific or product-focused emotions that try to capture human-product assessment. A word version of these emotions was chosen and used for all of the studies in this dissertation.



This is a sample of the PrEmo interface, a computerized measure used to capture product expression of emotion. Retrieved from designandusability.org, 2007.

Figure 6. PrEmo Interface

Desmet (2002) has identified a few cultural differences during validation of PrEmo. To validate PrEmo as a cross-cultural measure, Desmet tested the measure in Dutch, Japanese, Finnish, and English. The Dutch and English ratings were highly correlated, but the Japanese and Finnish

produced a few differences. One explanation for the differences may be due to translation issues. For example, “Satisfaction” translated to Finnish and than back into English yields “Appreciating or Approving.”

In another experiment, participants rated the appearance of vehicles. A cluster analysis revealed that certain cars shared similar profiles. However, here the subject differences could not be attributed to culture, age, or sex, and remain unexplained. Since the participants have interacted with some of the products tested (this did not explain grouping for emotion ratings), it is possible that past experience influenced their ratings. Personality types may be another explanation for the rating differences. Since the participants were asked to rate the emotion expressed by the products, it is possible that some of the individual differences can be attributed to differences in anthropomorphic tendencies. Highly anthropomorphic individuals may perceive human qualities within objects and thus rate them more or less favorably. A study by Smith et al. (2007) revealed that participant saw certain expressions (e.g., anger) based on the shapes of the headlights and grills of cars. Thus, products and systems may be viewed more favorably or vice versa if they contain human-like qualities or if the person has a strong tendency to anthropomorphize. Anthropomorphism refers to the inclination to attribute human characteristics to non-human entities. Thus, anthropomorphism may be another important area for consideration for emotional ratings of product design.

Anthropomorphism

Anthropomorphism Defined

The origins of the word anthropomorphism come from the Greek anthropos, "human" and morphe, "shape" (Duffy, 2003). Anthropomorphism refers to the act of attributing human

motivation, characteristics, or behavior to inanimate objects (e.g., toys), animals, or other natural phenomena (e.g., hurricanes). The desire to plead with a computer when it fails to turn on, naming a car, cursing a hurricane, or answering for one's cat or dog are all examples of anthropomorphism. People anthropomorphize for a variety of reasons: the presence of a human-like face, physical appearance, social interactions, personality, and familiarity (DiSalvo, Gemperle, Forlizzi, & Kiesler, 2002). It may be human tendency to want to perceive things from a human perspective. People appear to assign anthropomorphic qualities in varying degrees possibly due to individual differences.

To promote relatedness and understanding and to make things more attractive, artists and designers have employed the human form. An example of this is the Tancici Dum (Dancing Building) designed by Frank Gehry and Vlado Milunic, and often referred to as the 'Fred and Ginger' building. It appears to be two figures in mid-waltz, the sway of the lady's skirt depicted by long, bent, flared sheets of glass (see Figure 7: Tancici Dum). DiSalvo and Gemperle (2003) refer to this as "anthropomorphic form." From Inca water-vessels to robots, technology may have evolved, but the human theme (anthropomorphic form) has remained. DiSalvo and Gemperle have further defined the anthropomorphic form to include non-living objects that reflect human-like qualities: physical characteristics, behavior, or interaction. Objects may behave in human-like ways and/or look human-like, and may or may not look animate. Thus, anthropomorphic forms may elicit a variety of human responses, such as the nurturing instinct, by incorporating neotenous features.

The Tancici Dum (Dancing Building) appears to be a couple in mid-waltz illustrates anthropomorphic form.

Figure 7. Tancici Dum

Anthropomorphic forms go beyond the obvious use of body image. DiSalvo, Gemperle, and Forlizzi (2005) extended Buchanan's four orders of design to further define four anthropomorphic forms: structural, gestural, aspects of character, and aware. The first form, the *structural* anthropomorphic form, focuses on anatomy and functions of the human body. Therefore, this form may follow basic biomechanics of motion and anthropometric proportions. An example of structural anthropomorphic form may be a doll. In a general sense, dolls move and resemble the human form. The second form is the *gestural* anthropomorphic form. Gestural anthropomorphic form focuses on non-verbal communication. It encompasses gestures, human behavior and intentions. DiSalvo, Gemperle, and Forlizzi (2005) use the example of Mac OS

10.2 login screen. When an incorrect password is entered, the screen shift sides to side, similar to a human head-shake to indicate "no." The next kind of form is the anthropomorphic form of *character*. This form emulates the traits, roles, or function of people. It focuses on the unique qualities or habits that define individuals, as opposed to the human species as a collective. It reflects societal conventions and context-based human behaviors. An example of the anthropomorphic form of character is the Matryoshka (Russian nesting dolls). The dolls received their name in the 1900 century and during that time the name Matryona or Matriosha was a popular peasant name (History of Russian Nesting Dolls, 2005). The Latin root of the name means, "mother." The dolls, typically female, embody the female form, the ability to nurture and reproduce, and epitomize the cultural attire and job responsibilities (e.g., in hand on third largest doll is a sickle used to harvest grain) (Figure 8: Russian Nesting Dolls). Frequently, examples of the form of character overlap the previous two forms (structural and gestural). The final form is the *aware* anthropomorphic form. This form acknowledges the capacity and social qualities of being human: the ability to think abstractly, demonstrate intention, express curiosity or the desire to learn, and the ability to acknowledge/interact with others. Some robotics and artificial intelligence (AI) display human-like qualities via advanced programming and even display emotional learning. A modern day example is Leonardo, an AI collaboration between Hollywood's Stan Winston and M.I.T.'s Cynthia Breazeal (Seabrook, 2003). While Leonardo is impressive, AI remains prevalent only in movies and laboratories, and is less evident in everyday consumer application. There is a limited level of autonomy that real-world robots possess. Remote control vehicles are a more typical everyday application. The level of anthropomorphism present within a design may have implications for how receptive or reluctant a human may be to interact with the technology.

Figure 8. Russian Nesting Dolls

The widespread use of anthropomorphism as a perceptual strategy to explain the nature of the environment has been around as long as any science (Mithen, 1990). Mithen cites early cases about foragers using anthropomorphism to minimize their memory load and hunters using anthropomorphism to accurately describe animal behavior. Unfortunately, the widespread use has lead to some ambiguity about its definition.

Lockwood (1989) also has elaborated on the various uses of anthropomorphism by defining five categories as they pertain to animals. The first is *allegorical* anthropomorphism, which utilizes animal behavior (not biological facts) to explain a stance, mask identity (e.g., the use of animals for political satire), or bring appeal to the discussion. The use of allegorical anthropomorphism is common in cartoons or films (e.g., Disney's Lion King). The main character, Simba, is healthy and strong, while the sinister character, Scar, is sardonic, scarred, and mangy. The lions represent leaders, while the hyenas represent followers. In nature, the hyenas follow to scavenge the remains left by others. The use of specific animals to imply personality traits is an example of allegorical anthropomorphism. The second category is *personification*. The category is defined

by the use of animals to portray or reflect a human need or want. Lockwood's (1989) example is dressing a dog. The animal does not benefit from the act; the attire is not functional (e.g., keep the dog warm); it is merely amusing to the owner. The third category is *superficial* anthropomorphism. Superficial anthropomorphism is projecting, usually unrelated, human reasons for animal behavior as opposed to recognizing the physiological basis. Frequently, ocean fish are seen jumping out of the water. One may conclude they are jumping for joy, but it is far more likely they are jumping in an effort to elude some larger predatory fish or mammal. The self-awareness necessary to perform joyful acts is replaced with the far less romantic idea of instinctual biological-behavior for survival. The next category is *explanatory* anthropomorphism. This form of anthropomorphism uses human verbiage to explain animal behavior (e.g., a pet who strews out the garbage during your absence is spiteful). It is far more likely the animal smelled some leftover steak bones. In an effort to understand the reasons for unexplained behavior, people attribute human labels to describe motives. The last category is *applied* anthropomorphism. This category refers to humans relying on their personal experience and knowledge of the world to understand and predict the behavior of other living things. An example is found in the commandment, "do onto others, as you would have done onto you." Behaviors have consequences that provide a knowledge base for future actions. Applying these actions justifies or contradicts the current hypothesis. Either way gives people a baseline for explaining the world around them, even if scientifically flawed. The above categorizations are another acknowledgement of the almost involuntary egocentric desire to explain the world in human terms. Hume refers to this as the "universal tendency" (Guthrie, 1997).

Anthropomorphic Language

The use of anthropomorphism is closely tied to spoken language. Subsequent to the emergence of language, knowledge began to be passed down via storytelling. Storytelling was used to communicate knowledge about the local environment (Sugiyama, 2001). Narrative was like an ancient virtual environment. It enabled humans to gain the benefits of information acquisition without the potential perils of first-hand experience. Also, the resources (time and effort) gained could be reallocated to other tasks (e.g., foraging where fruit is abundant). This cross-cultural phenomenon is still universal within cultures, regardless of ability, intelligence, social or economic status, and occurs as early as 3 years of age. However, storytelling generally improves with practice and an increased-knowledge base; thus, proficiency is positively correlated with age. Both factual and fictitious narrative served the ubiquitous function of conveying knowledge about consequences for specific behaviors (e.g., crying wolf or lying), social norms (e.g., marital fidelity), natural phenomenon (e.g., animal migrations), and survival (e.g., avoiding forest fires). According to Sugiyama (2001), who cites nearly a dozen authors, stories by definition have characters and these characters "behave as if they possess human psyches" (pp 225). Stories may involve interaction with nature or animals, and these characters may communicate with each other or humans. Though fictitious, these stories, with the use of anthropomorphism, may still communicate information about animal behavior: where, when, and how they can be located, captured or hunted. Mithen (1990) proposes that the use of anthropomorphism to explain animal behavior freed-up mental resources. Anthropomorphism was used to speed communication and improve understanding. Sugiyama (2001) is quick to point out that not all stories that use anthropomorphism provide accurate information about animal behavior. Sometimes, the human characteristics attributed to the animal characters were too general to describe any valuable

information about animal behavior. Her example is that of "The Rock and the Fox." In this story, the fox challenges the rock to a downhill race. Though the fox was represented as a clever character, the story failed to provide useful information about how the fox behaves in nature. However, another story Sugiyama cites is how the fox and armadillo roped a mare to determine who was the stronger of the two. This story did provide accurate information about the burrowing technique of armadillos. Despite the occasionally flawed nature of anthropomorphism, clearly it has been a valuable tool.

Anthropomorphism is Useful

There is no single reason why people anthropomorphize. It may be human nature for individuals to want to see themselves in their creations. They may find it comforting, adaptive, or that it improves learning. DiSalvo and Gemperle (2005) have identified seven specific theories for the use of anthropomorphism in design: familiarity, comfort, best-bet, social, object-subject interchangeability, phenomenological intersubjectivity, and command and control. The first is the *familiarity thesis*. Guthrie (1993) says that people anthropomorphize, or make familiar, unfamiliar things in an effort explain them. Relating to abstract explanations or difficult ideas exerts far more energy than putting things into terms humans already understand, and humans foremost understand themselves. The second thesis is the *comfort thesis*. While the familiarity thesis is primarily motivated by cognitive desire to explain the world around us based on a human mental model, the comfort thesis is motivated by the emotional drive to reduce discomfort. DiSalvo and Gemperle (2005) say that humans feel more empowered when they interact with things that resemble them. Guthrie responded that anthropomorphism, though frequently comforting, can be equally disheartening. He provides two examples: the wind shuts

a door, but the homeowner imagines an intruder, or a soldier on night patrol mistakes a bush silhouette for the enemy. The third thesis is the *best-bet thesis* (DiSalvo and Gemperle, 2005). This is an unconscious strategy which states that when hedging a bet against uncertainty, anthropomorphizing improves the probability of a favorable outcome. The world is constantly changing and our knowledge base develops with repeated exposure. More is gained when people are correct than is lost when they are not (e.g., Pascal's Wager). As in Pascal's example, after death the belief in God may gain you entry into heaven. However, God's lack of existence at death would fail to result in additional negative consequence. DiSalvo and Gemperle (2005) summarize the fourth thesis, the *social thesis*, from Caporarel and Heyes (1997). This thesis suggests that anthropomorphizing is not impartial, as it has judgmental implications. In this example, anthropomorphism determines a value, determines the boundaries of our interactions, and defines social consequences. For example, anthropomorphizing a pet's behavior changes his hierarchical position compared to other animals (e.g., cockroach). The fifth thesis, *object subject interchangeability*, states that humans anthropomorphize other people or objects that define them, individually or culturally. By giving meaning to what they deem important, they are creating, shaping, and validating the self. The next thesis is *phenomenological intersubjectivity*, which proposes that the anthropomorphism is a manifestation of the way humans organize their environment. The individual's personality is projected onto the object and reflected back to the individuals. This theory states that the interaction with anthropomorphized objects creates a cyclical continuum that makes it difficult to distinguish between what the object projects versus what the person instills onto the object. The last thesis, *command and control*, suggests that humans anthropomorphize the things they seek to control. By anthropomorphizing, objects

become part of an intimate domain dominated by the individual (DiSalvo and Gemperle, 2005). Thus, by anthropomorphizing a car (e.g., naming the car Lilly), the individual asserts ownership.

Design Applications

Technological advances, such as personal organizers, laptop computers, and cell phones, have become a staple in the human environment. Unfortunately, the devices that help organize our busy lives frequently become time-consuming in themselves. With the increasing complexity of current technology, learning product functions has become more labor intensive. Anthropomorphism is one tool designers use to reduce the time investment for learning and to promote knowledge acquisition.

Eberts and Eberts (1989) suggest tasks that require modeling human-computer interaction on human conversations, human awareness of others, and human interaction with their environment. An example may be an automatic teller machine (ATM) having a welcoming message such as, "Welcome, Mrs. Jones," as opposed to, "Account 112475 Active." However, human-computer interactions may be limited in their ability to accurately mimic the nuances of human to human conversation. Human to human interactions are not limited to verbal exchanges and include non-verbal gestures, facial expressions, and body language. Also, technological advances are not capable of faultless verbal recognition due to individual differences in prosody, or recognizing domain specific vernacular. However, many studies have been fine-tuning the knowledge base for which features people focus on and what information these features project. Smith et al. (2007) correlated specific feature variations with the attribution of affective states. Ellis et al. (2005) find that capability attributions varied based on the robot's form as opposed to its behavior. This suggests that first impressions may be influenced by the anthropomorphized

critique of an interface. Burgoon et al. (2000) find that detail or "richness" of an interface has significant influence on decision-making. In that study, computers were more influential than humans. However, human qualities were rated as more socially desirable and humans were perceived as more credible. Attributing human characteristics to a machine may compel humans to interact using social convention (Nass, Fogg, and Moon, 1996). The dichotomy presented in the results of these studies suggests that different computer interfaces may be ideal, based on the task or context. Accurate application of human traits is important because the utility gained from appropriate application is smaller than the damage caused by inappropriate application (Eberts, 1994).

Until further research is done to identify which anthropomorphic attributes correlate with specific traits, within a given context and with a specified user, the use of anthropomorphism may continue to be an unpredictable tool. The Anthropomorphic Tendencies Scale or ATS has taken the first step to clarify one area of uncertainty—individual differences (Chin, Sims, and Ballion, 2005). Specifically, the ATS quantifies individual differences; how much and in what domains people anthropomorphize.

Anthropomorphic Tendency Scale

Chin, Sims, and Ballion (2006) developed a self-report scale that taps into an individual's tendency to anthropomorphize within certain domains. The Anthropomorphic Tendency Scale (ATS) is a 78 item self-report scale developed to measure anthropomorphic propensity. Three studies preceded the current scale. The first study narrowed the questionnaire to 208 potential items and 12 categorical anthropomorphic areas. The second study further narrowed the ATS to 102 items that loaded on 4 factors (extreme anthropomorphism, anthropomorphism towards pets,

anthropomorphism towards God or a higher power, and negative anthropomorphism), and validated the first study. Extreme anthropomorphism referred to unusual or cute, but atypical forms (i.e., naming a backpack). This form may have a lower agreement response rate than the other three forms of anthropomorphism because it may be perceived as atypical/undesirable, and thus socially unacceptable. Anthropomorphism toward pets and deities are more typical since these forms are socially acceptable. "Negative anthropomorphism" is the negative behaviors directed specifically toward non-human entities, such as frustration expressed towards computers or cars. Negative anthropomorphism is probably far more typical than reported and correlated negatively with social desirability captured by the Marlowe-Crowne Social Desirability Scale (M-C SDS; Reynolds, 1982). The authors hypothesize that the contrary findings may be because participants do not want to be perceived outside the behavioral norm (excessively negative or hostile). However, this form still may be reported more often than Extreme Anthropomorphism, since frustration with computers is a common experience shared by many individuals, especially students, which was this study's test population. The final study examined test-retest reliability by testing 47 participants six weeks apart. It also further reduced the scale to its current 78 items. These studies illustrate that anthropomorphism is a complex area with many sub-categories. Thus, successful design may want to tap into the use of anthropomorphism to promote understanding, relatedness, and/or appeal.

Product or System Interaction

Today, it is a given that products do what they are supposed to, are easy to use, and are centered on the user (Bonapace, 2002). If products fail to meet these basics, they fail to be considered by consumers. Thus, manufactures rely on marketers, designers, and human factors professionals to

figure out consumers' needs, wants, and desires. To get noticed, products have to strive beyond the basics on Jordan's (2000) hierarchy to reach the plateau of pleasurable design.

The Sensory Quality Assessment Method (SEQUAM) uses objective and subjective measures of user's pleasurable sensations in an effort to define pleasurability parameters (Bonapace, 2002). According to Bonapace, there are various sources of pleasure from product design: socio-pleasure, psycho-pleasure, ideo-pleasure, and physio-pleasure. Socio-pleasure refers to pleasure derived from interacting with others, and the features of the product that facilitate a social event. Psycho-pleasure refers to the pleasure that products instill because they function properly or make accomplishing a task satisfying. Ideo-pleasure is derived from either the aesthetic appearance of the product (e.g., art) or the values the product personifies (e.g., recycling bin implies environmental responsibility). Physio-pleasure refers to pleasure experienced by the five senses. An example is the sensations a person may feel sitting in a brand new car, prior to even turning it on or driving it. The new car experience may include the "new car smell," the feel of plush new seats, or a liberal spacious interior, and all these features are registered by the senses and contribute to the overall opinion of the car.

To further understand the source of emotional expression, it may important to look at whether people have previous experience with the objects under investigation. Interaction and emotional connection is an emerging field of interest in marketing. Hegmann (2002) explains how companies study what people think and feel in an attempt to reach customers on a "deeper emotional level". However, usability professionals and human factors specialists want to do more than tug at people's heartstrings. While their goal is to make product and system interactions more pleasurable, it is not the bottom line. Efficiency, usability, and safety remain

foremost. Positive interaction helps facilitate these goals by minimizing fatigue, boredom, or confusion. Pawle and Cooper (2006) also studied emotional interaction with products, but their focus was on brand relationships. Though the marketing field studies emotional design, its contributions are limited to the following topics: effective measures of emotion, impact of individual differences, and the impact of interaction of emotional ratings of products and systems.

Dissertation Purpose

Assessing products, agents, and systems is a multifaceted process. Products exhibit many features that may be driving the emotion elicited from an individual. Some market research has investigated look zones (where an individual focuses attention) for product assessment, specifically fonts, graphics, shapes, etc. (Hotspex, 2006). These and the above studies rely on static pictures of the products (e.g., shampoo bottle). However, the studies seldom consider if the individual has smelled other guava scented shampoos, or handled similarly shaped bottles. His or her experience with that or similar products will likely influence the outcome. Also, people with varying levels of anthropomorphic tendencies may have differing opinions of the bottle shapes. Highly anthropomorphic individuals may see the bottle more favorably if it resembles a human or some other whimsical form (e.g., a fruit). Thus, the findings may be due to product differences or individual differences. Individual differences may encompass culture, gender, anthropomorphic tendencies, interaction, and these may be predictive for product emotional expression. There are two types of expression—expression projected by a product to the person and expression elicited in the person from the product (Desmet, 2002). For this research, the term "expression" is reserved for the emotion elicited by the product visually prior

to interaction or exposure, while "impression" is the emotional impression imprinted on a person during and after interacting with the object. The expression of the product (i.e., the car appears to be smiling) is not considered; only emotions internalized by the participants pre and post interaction are considered.

The following set of studies determined an emotion profile for both mechanical and electrical juicers based on their appearance, tested the impact of interaction, and measured anthropomorphic tendencies. Many items were considered for the above studies. However, juicers were chosen for four reasons. First, the item is benign and participants were unlikely to hurt themselves. Thus, IRB approval was relatively secure. Second, juicers were a simple item with one primary function, to make juice. There was little ambiguity in giving instructions to participants to use the juicers—to make juice. Third, juicers are not everyday objects (e.g., cars) used by the majority of the adult population. However, since the study was conducted in Florida, there were likely to be some people who have used juicers extensively. This dichotomy produced enough users and non-users for the study samples. Fourth, there was great variability in appearance and effectiveness between juicers, which allowed for distinct judgments from participants and comparisons possible. Images of the juicers were used for the first two studies and the actually juicers were used in the third study. The first study determined which juicers have characteristics that generate unique emotion profiles to be used in the following two studies. It was predicted that some juicers would elicit positive emotions while others negative. Juicers that rated consistently on one emotion across the participants would be chosen for Study 2. Study 2 determined whether anthropomorphic tendencies are predictive of emotional ratings. Extreme Anthropomorphism from the Anthropomorphic Tendency Scale (ATS) was used to test

individual differences. It was predicted that participants who score high on the ATS measure would rated the juicers using more of the endpoints in the Likert scale (ones and sevens on a 7-point scale). Sex differences also were analyzed but not anticipated. Also, first impression ratings of the juicers from Study 1 were compared with the first impression ratings from Study 2. Finally, Study 3 measured the impact of product interaction on emotional ratings. Participants used seven juicers to make a minimum of four ounces of juice. Pre and post-interaction ratings were compared to determine the effect of interaction on the emotional appraisal of products. Novice users were predicted to have greater variability in their pre to post scores than experienced users since experienced users may be influenced by past exposure. Prior knowledge of the experienced users would allow them to generate an appraisal prior to using the actual juicers.

CHAPTER 3: EXPERIMENT 1- STIMULI REDUCTION

Purpose

In the first experiment, stimuli reduction, participants examine pictures of juicers and rated them using Desmet's (2002) list of 14 emotions. These emotions were chosen, as opposed to other typical measures, such as Ekman's (199a, 1999b) affective states, because they are product specific, while Ekman's affective states reflect person to person interaction. Another drawback to Ekman's affective states (anger, disgust, enjoyment, fear, sadness, and surprise) is that they are disproportionately negative (1 positive, 1 neutral and 4 negative emotions). Evolutionary psychology explains this negative majority as important for survival since the severity of negative emotions is the difference between recognizing a bad mood versus a mortal threat. While still useful information, this information is incongruent with the desire to produce enjoyable, successful, positive objects, agents, or systems. Desmet, Hekkert, & Jacobs (2000) and Desmet (2002) solved the negative disproportion by using equal numbers of positive and negative product-specific emotions.

The participants chose one of the product-specific emotions they first felt when they saw the juicer. This captured their first impressions and indicated the predominant emotion that stood out at first glance. Next, participants rated the juicers on all fourteen emotions using a 7-point Likert scale to determine the level of presence of each emotion. It was possible that some juicers might elicit more than one emotion from the participants. This methodology isolated the juicers that were unique in their emotion profile to be used in the Study 2. These profiles reflect a consensus rating from the participants across the fourteen emotions for the juicers. Consensus

consisted of high agreement from a majority of the participants on one or more emotions. This step eliminated redundancy, which identified ten juicers chosen for Study 2.

Method

The first study had participants rate photographs of mechanical and electrical juicers using Desmet's list of 14 emotions (see Table 1). Figure 9 shows the 41 commercially available juicers used in the first study. The participants were asked to choose the emotion that they felt strongest when they saw the juicer. This captured their first impressions. Next, participants rated the juicers on all fourteen emotions using a 7-point Likert scale to determine the level of presence of each emotion. This study isolated the juicers that were unique in their emotion profile to be used in Study 2.

Table 1. Product Specific Emotions

Positive Emotions	**Negative Emotions**
Admiration	Boredom
Amusement	Contempt
Desire	Disappointment
Inspiration	Disgust
Fascination	Dissatisfaction
Pleasant Surprise	Indignation
Satisfaction	Unpleasant Surprise

Figure 9. Juicer Stimuli

Summary of Experimental Design

Two measures (First Impression and Likert Scale Rating) and a demographic questionnaire were presented via a web site. First impressions were captured from participants by asking them to choose between the fourteen emotions in a forced choice design (see Figure 10). This captured first impressions, a reaction often missed by lengthy tests, such as the PrEmo. Both the forty-one juicers and the fourteen emotions were presented randomly in both the first impression and Likert scale ratings sections. The definitions of each emotion were presented if the participant scrolled the mouse cursor over the emotion word to ensure understanding (see Figure 11 and see Table 2).

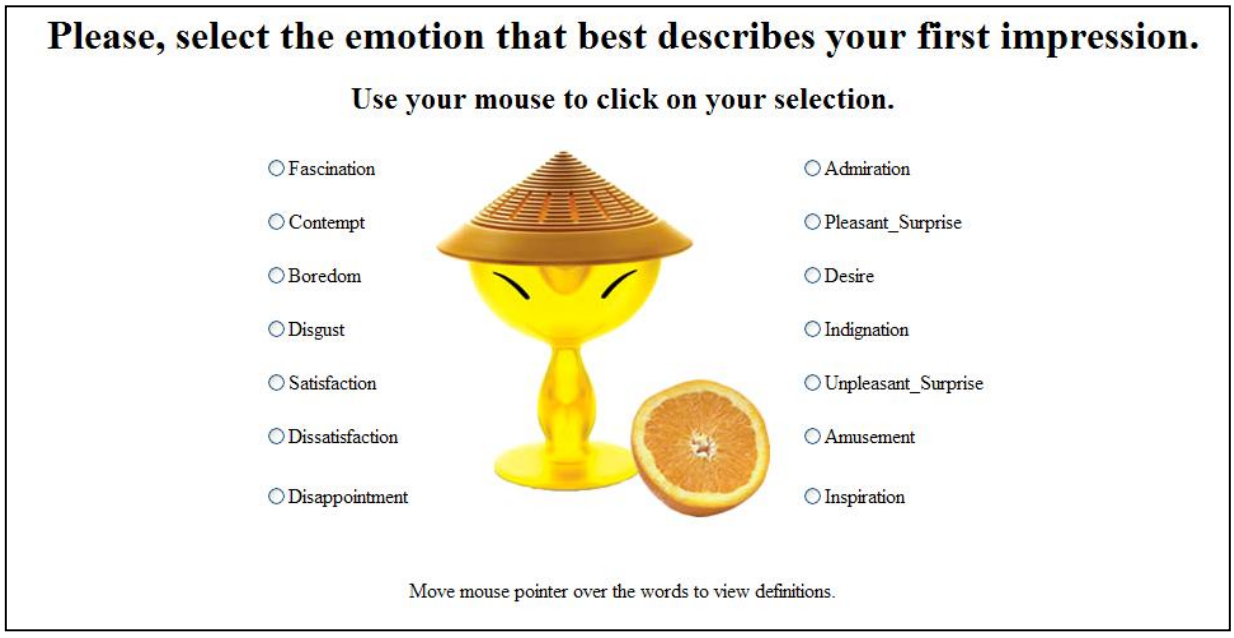


Figure 10. Screen Shot of First Impression

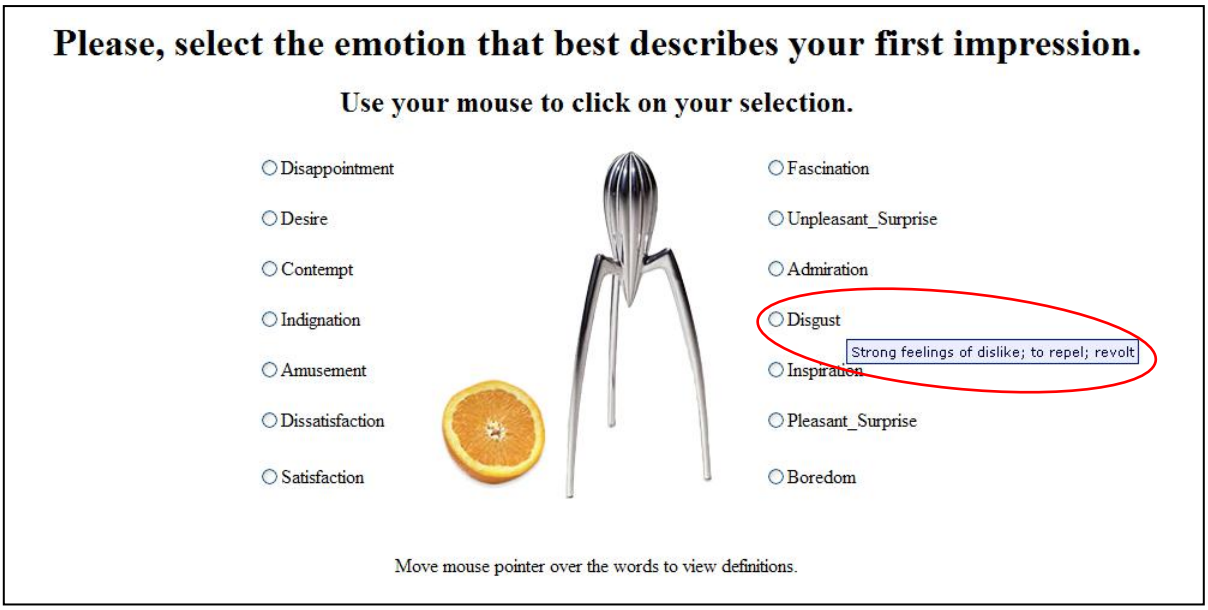


Figure 11. Sample Word Definition

Table 2. Pop-up Word Definitions

Emotion Word	Definitions Provided to Participants
1. Admiration	1. A positive feeling of wonder or approval
2. Amusement	2. The state of being amused or entertained
3. Desire	3. To wish or long for; crave; want
4. Inspiration	4. Something that stimulates or motivates the intellect or emotions, and prompts action and invention
5. Fascination	5. Feeling intensely interested; feeling of great liking for something wonderful and unusual; captivation
6. Pleasant Surprise	6. A sudden unexpected positive feeling of wonder or astonishment
7. Satisfaction	7. A feeling of fulfillment, gratification, contentment, enjoyment, pleasure or comfort
8. Boredom	8. A total lack of interest
9. Contempt	9. A deep, strong sense of dislike, hatred, or lack of respect
10. Disappointment	10. A feeling of dissatisfaction which occurs when an individual expected wants or needs are *not* met
11. Disgust	11. Strong feelings of dislike; to repel; revolt
12. Dissatisfaction	12. A feeling of displeasure or disappointment; discontent
13. Indignation	13. A strong displeasure at something considered offensive or insulting; resentment
14. Unpleasant Surprise	14. Negative astonishment felt from something unexpected, unwanted, and undesired

This table shows the fourteen emotions used to rate the juicers and their pop-up definitions. Definitions would appear when the participant scrolled their mouse over the word.

Research Questions

The main research question was: Which juicers were of unique interest because they exhibited a unique emotion profile? The anticipated result was that whether unusual or ordinary, some juicers would produce a unique emotion profile. For example, some participants would rate the juicers with only positive emotions. Unique ratings included high agreement from participants with respect to a given emotion. For example, a majority of the people chose Amusement for Juicer 27. When multiple juicers had similar level of agreement on the same emotion, the next highest consensus on a second emotion determined whether the juicer was chosen for the Study 2. High consensus on only a few emotions (e.g., just fascination and amusement) indicated that the juicer's appearance elicited a similar reaction from most of the population.

Materials and Procedure

Participants were provided an Informed Consent form, with a brief description of study, and contact information (Appendix A: Experiment Material). A minimum age requirement of 18 years of age was used. Next, the juicer images and emotions were presented randomly on a computer monitor, and participants used a keyboard and mouse to input their reactions. The students rated 41 citrus juicers on fourteen product-specific emotions established by Desmet (2002). The fourteen emotions included seven positive (admiration, amusement, desire, inspiration, fascination, pleasant surprise, and satisfaction) and seven negative emotions (boredom, contempt, disappointment, disgust, dissatisfaction, indignation, and unpleasant surprise). First, the participants were asked to choose one of the fourteen emotions that was indicative of their first impression of the juicer. Next, the participants rated product appearance using a 7-point Likert Scale for the presence of each of product-specific emotion (Desmet, 2002).

In the Likert scale, 1 was used to indicate no agreement, while 7 was used to indicate a high level of agreement. Next, the participants completed a demographic questionnaire to capture age, sex, race, handedness, occupation, and education level. Finally, the participants were given a Debriefing Form. All questions concerning the study were answered via email and phone. All participants were students from various disciplines at the University of Central Florida. Participation was voluntary; however students received extra credit for participation.

Participants and Design

The goal was to collect data from 300 participants. Due to the remote nature of the study (web site collection), some attrition was expected. A total of 356 participants attempted the studies. Of these, 305 successfully completed the First Impression section and were used in the categorical analysis. Participants had to successfully complete over 90 percent of the remaining questionnaires to be retained for the Likert Scale Ratings analysis. Computer failure (e.g., participants used the back button) was the primary reason for incompletion. Accidental omission of a rating explained the many participants with near perfect completion. Two-hundred seventy-six participants completed at least 90 percent with 92.33% being lowest percentage completed used in the Likert Scale Ratings. Participation was voluntary and students received extra credit points for their participation.

Thus, for the First Impression task, participants consisted of 305 University of Central Florida students (86 male, 211 female, and 4 unspecified) ranging in age from 18 to 42 years of age (M = 19.34, SD = 2.78). As mentioned above, some of the participants failed to complete the entire survey due computer errors, failure to follow instructions, or possibly just early withdrawal. Thus, for the second analysis, the Likert Ratings task, only 276 (86 male, 194 female and 4

unspecified) participants ranging in age from 18 to 42 years of age (M = 19.30, SD = 2.99) were used.

Results

Variables

A comparison of the 14 emotions across the 41 juicers was used to analyze emotion profiles. The dependent variables were the 14 emotion ratings of the juicers. Desmet's (2002) 14 product-specific emotions were used (see Table 1: Desmet's Emotions). The subject variable was sex.

The exploratory findings identified juicers that had unique emotion profiles to be used in Study 2. The First Impressions task had participants chose one of the fourteen emotions for each juicer. A frequency table was devised to display the participants' frequency for choosing each emotion for a specific juicer. Juicers that were consistently rated for the same emotion by majority of the participants were identified. The table also revealed that participants rated the juicers with primarily five emotions. The five emotions that stood out were Amusement, Fascination, Satisfaction, Boredom, and Indignation. A strong agreement pattern for first-impressions emotion ratings was used to limit the number of juicers for further analysis. In some instances participants rated two juicers equally with one of the five emotions mentioned above. In those instances, the second emotion frequency score was used to choose the juicer. The only exception was within Amusement where the second highest scoring juicer was the same model juicer in a different color.

First Impression Rating

The strongest consensus was for Juicer 27 (Mandarin Man-yellow color). Thus, this juicer was chosen for Experiment 2. This juicer also was the most positively rated juicer with the highest ratio of positive emotions to negative emotions rating. Only two other juicers were rated with a high Amusement rating (Juicer 28 [Mandarin Man-orange color] and Juicer 13 [L'Equip]), which also yielded a second and third highest rating overall. Juicer 28 was a just different color version of Juicer 27, thus Juicer 13 (L'Equip) was chosen for the next study.

Fascination was the second largest category, second to Boredom. Juicer 12 (Kalorik) received the highest fascination rating. Juicer 18 (Alessi Salif) and Juicer 19 (Breville WS) tied for the next highest fascination rating. Juicer 18 had the second highest positive score, thus it was chosen. It also had an interesting dichotomy between positive and negative emotional attributions.

Only three juicers received high consensus on Satisfaction: Juicer 41, 15, and 10. Thus, Juicer 41 (Black and Decker) was chosen. Its second highest score was boredom. Juicer 15 (Breville 800) and Juicer 10 (Villaware Moderno) received similar ratings for Satisfaction, Fascination, and Admiration, in that respective order. Juicer 10 (Villaware Moderno) was chosen since it had the second highest Satisfaction rating.

Boredom was the largest category defining 22 juicers as their predominant rating. There were three predominant patterns—Boredom followed by Disappointment, Satisfaction, or Dissatisfaction. Juicer 34 (Oster) received the highest Boredom rating and it came from the Boredom/Disappointment category. There was a three-way consensus for the second strongest

Boredom rating between Juicers 37, 40, and 24. Juicers 37 and 40 were followed by Satisfaction, while Juicer 24 was followed by Dissatisfaction. Since Juicer 37 (Aroma) had the strongest consensus, it was chosen.

It would seem that more juicers were chosen from the Boredom category than other categories. This suggests that participants seem to distinguish pleasant emotions, and lump unpleasant products into only one. The only exception was Juicer 21 (Beechwood Reamer), which had the strongest Unpleasant Surprise consensus rating. Juicer 18 (Alessi Salif from the Fascination category) followed; it received the second highest Unpleasant Surprise emotion-rating consensus. This resulted in only nine juicers.

To finalize the ten juicers, Juicer 9 was chosen. Juicer 27 (Mandarin Man from the Amusement category) received the most positive combined ratings across the seven positive emotions, while Juicer 25 (Nigella Lawson) the most negative combined ratings. Juicer 9 (Cuisinart) was the most neutral or ambiguously rated by receiving a nearly 50/50 distribution of positive to negative ratings. Juicer 27 was already in the Amusement category. Juicers 9 and 25 were new to the list. Since participants tended to discriminate between positive emotions rather than negative emotions, only Juicer 9 was chosen to be used to in Study 2. These 10 juicers also were used in the Likert Scale analysis (See Table 3).

Table 3. First Impression Emotion Rating

 Juicer 27 1- Amusement 2- Pleasant Surprise	 Juicer 13 1- Amusement 2- Fascination	 Juicer 18 1- Fascination 2- Unpleasant Surprise
 Juicer 41 1- Satisfaction 2- Boredom	 Juicer 10 1- Satisfaction 2- Fascination	 Juicer 12 1- Fascination 2- Satisfaction
 Juicer 37 1- Boredom 2- Satisfaction	 Juicer 34 1- Boredom 2- Disappointment	 Juicer 21 1- Unpleasant Surprise 2- Boredom
 Juicer 9 1- Boredom 2- Satisfaction *** Neutral between Positive and Negative**		

The top nine juicers received the highest participant consensus for emotion 1 and 2 respectively. There were seven positive and seven negative emotions. Juicer 9 (last row) was nearly equally divided between positive and negative emotions, thus was the most neutral juicer.

Likert Scale Rating

The second analysis compared the ten juicers in Table 3 on their Likert Scale ratings. The juicers were compared for the emotions of Amusement, Fascination, Satisfaction, Boredom, and Unpleasant Surprise. Five 10 (Juicers) X 2 (Sex: Male versus Female) ANOVAs were performed using SPSS 11.5—one ANOVA for each of the top five emotions (DV). The ten juicers are in Figure 12. All ratings were within-subjects, with the exception of sex which was used as a between-subjects variable. It was a large sample but multiple comparisons were performed, thus the significance level was set at p =.05. There was one significant sex differences found within Amusement.

 Juicer 9 Cuisinart	 Juicer 10 Villaware Moderno	 Juicer 12 Kalorik	 Juicer 13 L'Equip	 Juicer 18 Alessi Salif
 Juicer 21 Beech Wood Reamer	 Juicer 27 Mandarin Man	 Juicer34 Oster	 Juicer 37 Aroma	 Juicer 41 Black and Decker

Figure 12. Juicer Numbers and Name Assignments for the Likert Scale Analyses

Amusement

A within-subjects repeated measures comparison for Amusement revealed a significant main effect for Juicers $F(9,235) = 76.48$, $p < .001$. Juicer 27 (yellow Mandarin Man) (M=5.31,SD=1.99) was significantly more positive from all the remaining juicers at the $p < .001$. The other amusing juicer, Juicer 13 (L'Equip) (M=4.65,SD=1.98) was significantly different than all the other juicers at the $p < .001$, with the exception of Juicer 18 (Alessi Salif) (M=4.01,SD =2.12), at p =.020 (see Figure 13). This dissimilarity is explained in their second most prevalent emotion, the Fascination rating.

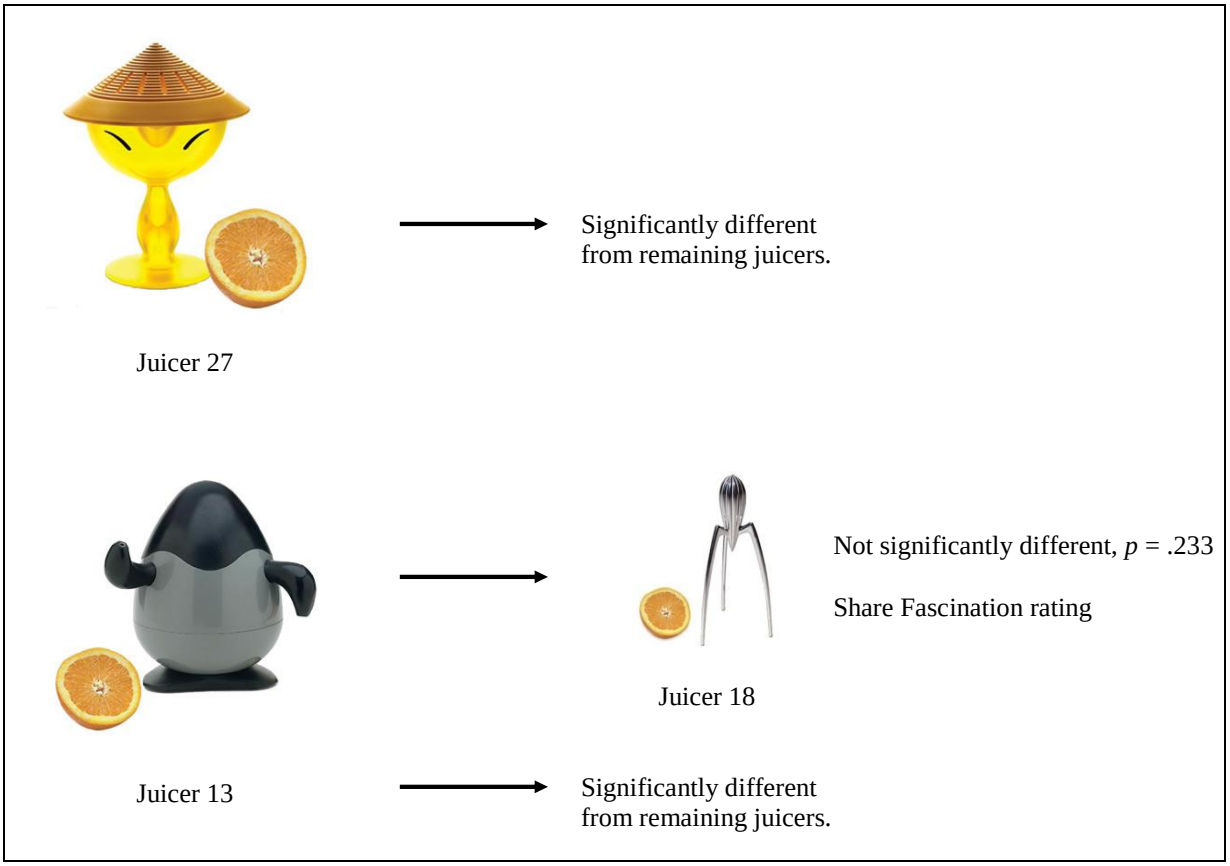


Figure 13. First Impression Amusement Results

Fascination

The analysis revealed a significant main effect for juicers $F(9,240) = 54.69$, $p < .001$. Juicer 12 (Kalorik) (M=3.57, SD=1.86) was not significantly different from Juicer 10 (Villaware Moderno) (M=3.57, SD=1.75), $p = .571$. However, it was significantly different from all the remaining juicers at the $p = .05$. The other Fascination juicer, Juicer 18 (Alessi Salif) was significantly different than all the other juicers at the $p = .05$, with the exception of Juicer 13 (L'Equip) (M=4.38, SD=2.00), $p = .233$ (mention above, Amusement). These two juicers share a Fascination rating (see Figure 14).

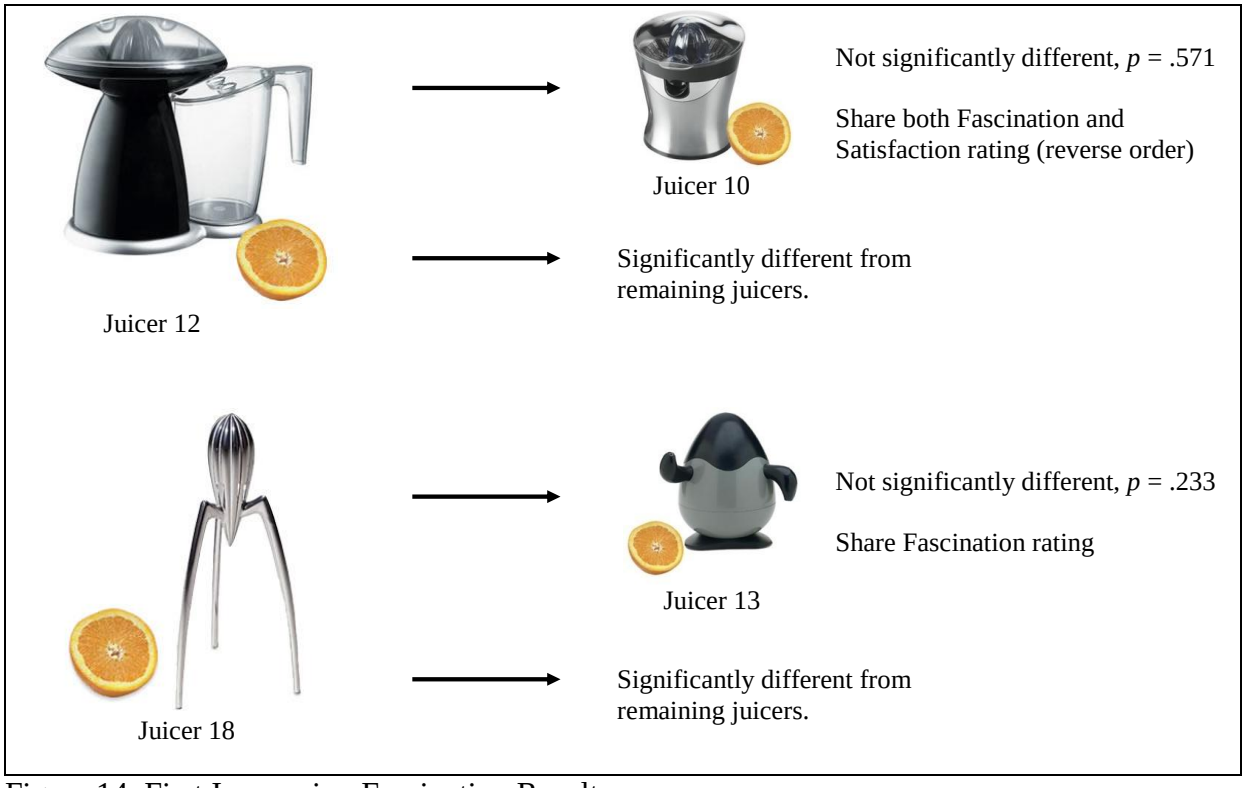


Figure 14. First Impression Fascination Results

Satisfaction

The analysis revealed a significant main effect for juicers $F(9,233) = 31.12$, $p < .001$. The two Satisfaction juicers, Juicer 10 (Villaware Moderno) (M=3.63, SD=1.68) and Juicer 41 (Black and Decker) (M=3.26, SD=1.64), were not significantly different from each other, p =.083. Juicer 10 was not significantly different from the Fascination juicers above, Juicer 12 (Kalorik) (M=3.63, SD=1.76), p = .792. It also was similar to Amusement Juicer 13 (L'Equip) (M=3.92, SD=1.84), p = .094. The other Satisfaction juicer, Juicer 41 was not significantly different from Juicer 9 (Aroma: Most Neutral) (M=3.23, SD=1.74), p = .613. Juicer 41 also was similar to Juicer 18, p = .942. Both were significantly different from all the other juicers at p = .05 (see Figure 15).

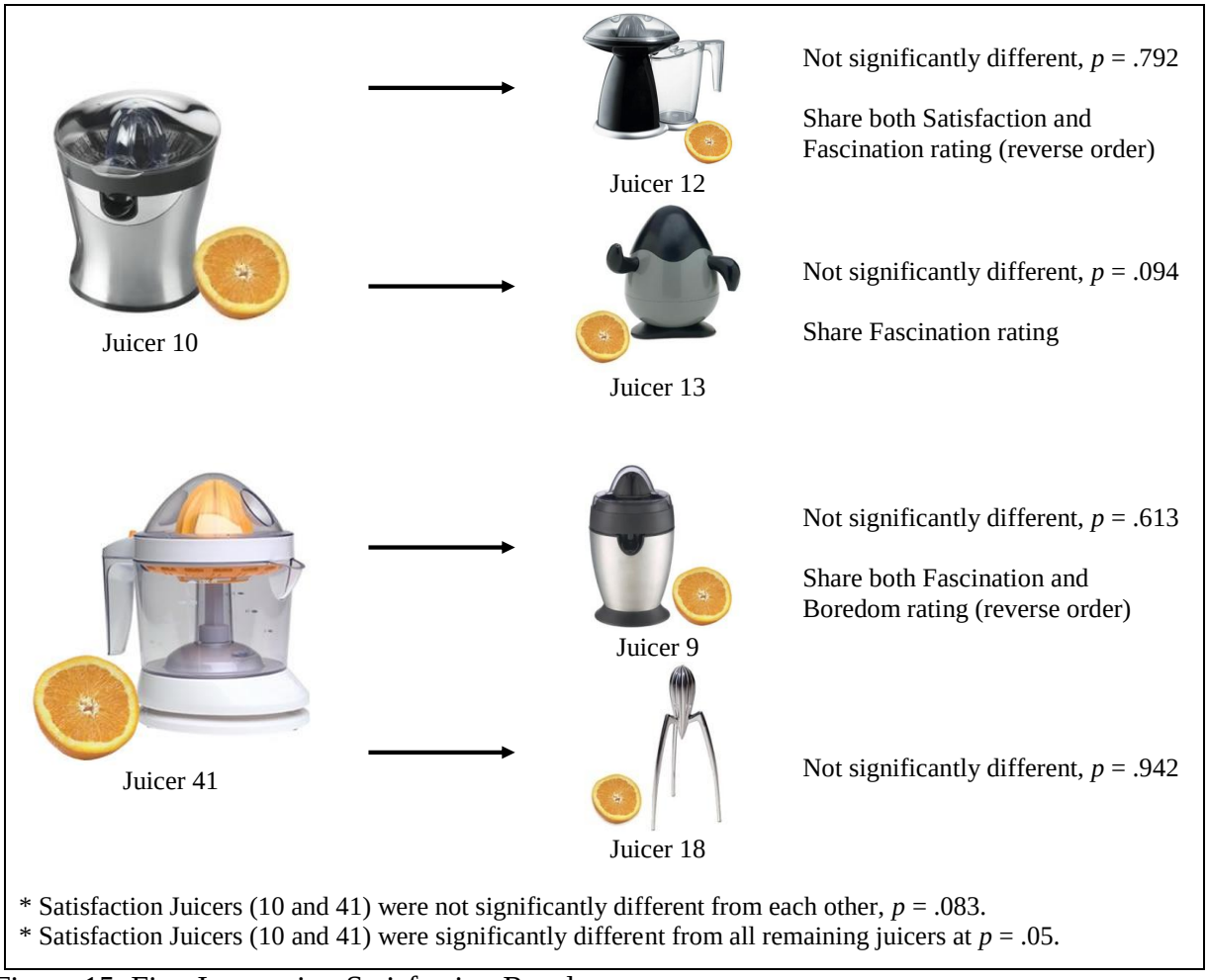


Figure 15. First Impression Satisfaction Results

Boredom

The analysis revealed a significant main effect for juicers $F(9,231) = 46.53$, $p < .001$. The two Boredom juicers, Juicer 34 (Oster) (M=4.59, SD=1.95) and Juicer 37 (Aroma) (M=4.11, SD=1.99) were not significantly different from each other $p = .055$. Also they were both similar to Juicer 21 (Beech Wood Reamer) (M=4.36, SD=2.16), $p = .200$ and $p = .448$. Both the Boredom juicers (34 Oster and 37 Aroma) were significantly different from all the remaining juicers at the $p = .05$ (see Figure 16).

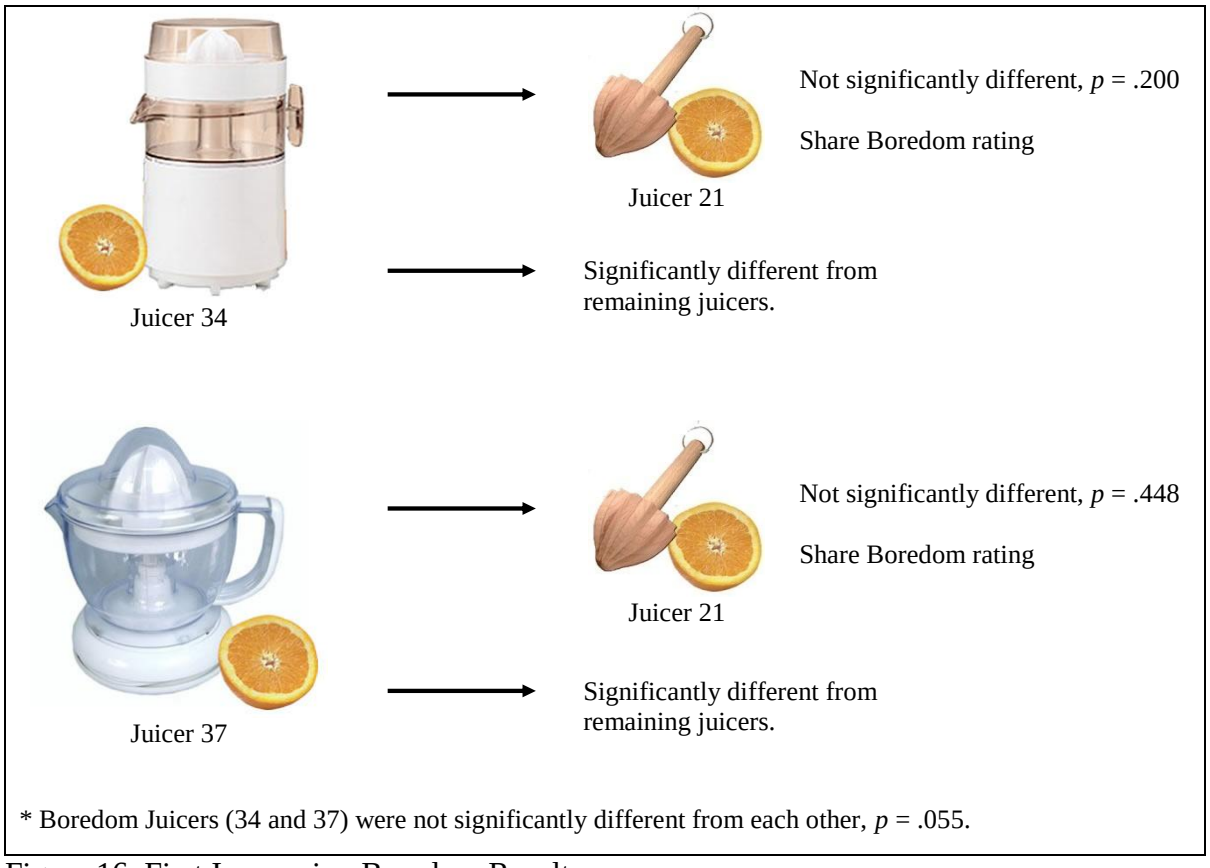


Figure 16. First Impression Boredom Results

Unpleasant Surprise

The analysis revealed a significant main effect for juicers $F(10,259) = 31.49$, $p < .001$. Juicer 21 (Beechwood Reamer) (M=3.74, SD=1.74) was not significantly different from Juicer 34 (Oster) (M=3.44, SD=1.60), p =.069. Otherwise, this juicer was significantly different from or unlike any other juicer with a specific-emotion rating mentioned above at p = .05 (see Figure 17).

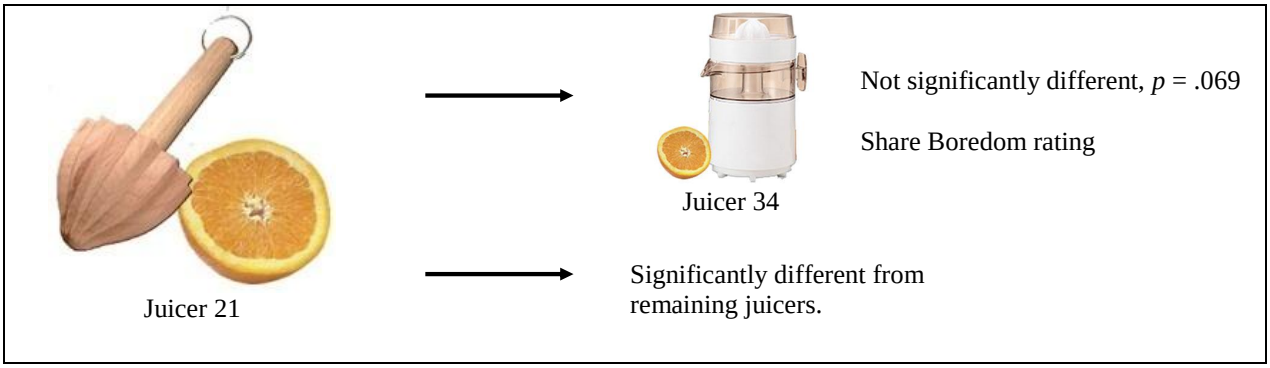


Figure 17. First Impression Unpleasant Surprise Results

Amusement by Sex Comparison

The ANOVA revealed a significant difference between males and females, $F(9,235) = 2.15$, p = .023. There were two juicers that had Amusement as the first emotion, Juicer 13 (L'Equip) and Juicer 27 (Mandarin Man). The planned comparisons revealed that women found the Mandarin Man significantly more amusing than men, $t(269) = 3.23$, p = .001. No significant difference for sex was found for the L'Equip (see Table 4).

Table 4. Amusement and Sex Interaction

	Juicer 13 L'Equip	**Juicer 27 Mandarin Man**
Female	M = 4.98 SD = 1.83	M = 5.46 SD = 1.94
Male	M = 4.14 SD = 2.17	M = 5.04 SD = 2.08
Significance	NS	$t(269) = 3.23$, p = .001

Discussion

Analysis of the frequency table captured the participants' first impressions. There was a remarkable pattern in the frequency table such that participants' opinions clustered predominantly around the positive emotions Amusement, Fascination, and Satisfaction (See Table 5: First Impression Frequency). The largest negative emotional appraisal was boredom. More than half of the juicers (22) were appraised with Boredom. Only one juicer appeared in the Unpleasant Surprise category. This pattern suggests that people discriminate between positive attributes in products, and consider boredom the umbrella term for the negative attributes. It also suggests that consumers are quite particular or judgmental. This supports the notion that consumers want more and will continue to become more discriminating. Thus, products will become increasingly more competitive, and positive appraisal may be reserved for only the upper echelon of products. If people differentiate the positive aspects of product, the evolutionary perspective where people need to discriminate levels of negative attributions for survival is less applicable to products where positive attributes are sought after. Thus, scales such as Ekman's Affective States (1999a), though notably accurate, are not relevant to product and system evaluations. Furthermore, most current scales fail to differentiate between varieties of positive emotions, which may be the new standard for refined design.

The Likert rating analysis suggests that the positive observations may overlap with specific aspects of the juicer (i.e., Juicer13, Fascination and Amusement). It also revealed that products can often possess seemingly contradicting properties (i.e., Juicer 18, Fascination and Unpleasant Surprise). Most importantly, the findings suggest that people have affective responses to juicer that result in specific emotion profiles. The source of these attributions may require further study.

Table 5. First Impression Frequency

Emotion Juicer	Admiration	Amusement	Desire	Inspiration	Fascination	Pleasant Surprise	Satisfaction	Boredom	Contempt	Disappoint	Disgust	Dissatisfaction	Indignation	Unpleasant Surprise
Juicer28	17	152	21	10	20	42	6	2	7	3	7	3	3	12
Juicer27	16	158	11	6	25	46	10	3	9	1	3	6	2	9
Juicer13	11	123	7	10	47	39	8	13	5	3	6	9	5	19
Juicer18	15	60	5	19	97	21	3	5	9	4	31	16	16	34
Juicer19	31	34	22	28	67	33	28	9	12	9	2	11	8	11
Juicer16	34	46	19	18	63	36	23	12	10	6	13	12	5	11
Juicer29	15	53	12	20	61	47	26	12	5	5	10	14	2	23
Juicer4	18	20	16	17	49	22	32	24	15	12	11	23	9	17
Juicer2	21	23	15	19	54	16	33	25	13	12	19	18	18	19
Juicer30	30	27	15	18	61	35	32	25	10	10	9	11	7	15
Juicer11	29	22	23	31	50	28	40	26	16	7	3	10	5	15
Juicer12	22	25	19	21	73	31	32	27	18	9	4	9	5	10
Juicer1	14	23	12	20	57	15	28	30	20	16	22	19	11	18
Juicer3	19	24	20	19	43	11	37	30	24	15	12	21	8	16
Juicer5	20	34	14	26	47	20	28	32	15	16	12	18	9	13
Juicer15	39	15	20	32	44	32	50	24	15	4	7	11	3	9
Juicer10	31	14	28	16	39	27	55	29	14	11	3	16	9	13
Juicer41	15	22	18	9	28	23	72	43	13	17	15	12	8	10
Juicer21	4	37	6	7	18	10	3	45	15	30	39	23	3	55
Juicer20	7	17	18	8	29	15	15	46	17	29	30	31	0	33
Juicer14	18	24	16	23	46	20	24	47	12	16	14	23	7	15
Juicer26	10	25	11	9	32	15	16	50	18	30	17	26	14	32
Juicer17	10	20	7	11	29	17	29	64	16	17	12	35	13	25
Juicer35	19	15	21	17	17	24	47	67	23	12	9	20	3	11
Juicer8	10	20	10	3	24	8	19	73	18	33	20	35	10	22
Juicer32	14	29	6	11	29	24	21	75	15	21	15	30	5	10
Juicer7	6	18	6	6	16	19	27	81	15	29	22	33	9	18
Juicer25	7	19	7	1	11	7	11	85	20	34	39	29	11	24
Juicer33	16	19	7	13	19	18	35	85	23	21	13	18	10	8
Juicer38	9	17	15	6	15	17	48	86	8	30	13	23	6	12
Juicer23	8	12	16	5	15	9	16	91	8	27	23	37	11	27
Juicer36	12	15	6	9	15	17	42	91	23	24	10	20	6	15
Juicer39	14	21	15	12	13	9	56	93	14	19	7	15	3	14
Juicer31	6	17	3	11	5	13	31	94	16	30	17	33	14	15
Juicer22	11	17	11	7	7	14	42	96	18	23	16	19	9	15
Juicer24	8	19	11	4	10	18	17	105	14	23	20	33	8	15
Juicer9	20	14	21	7	27	22	46	76	23	14	4	16	4	12
Juicer37	6	15	8	7	11	15	60	105	19	22	14	12	3	8
Juicer40	6	14	9	9	10	11	43	105	26	27	9	19	5	12
Juicer6	4	25	4	6	11	12	27	101	14	36	12	31	4	18
Juicer34	6	6	10	7	17	3	26	108	19	34	19	27	5	18

This table shows the First Impression frequencies. The columns are the 14-product specific emotions, the rows are the 41 commercially available juicers, and the cells are how many participants choose this emotion as the first impression for the given juicer. The colors indicate the level of participant agreement for choosing the specific emotion as the first impression for that juicer. Red and orange indicate the most and second most agreement between participants while the purple and pink indicate the least chosen emotion for the given juicer. The red circles indicate that the juicers clustered around the five emotions: Amusement, Fascination, Satisfaction, Boredom and Unpleasant Surprise.

CHAPTER 4: EXPERIMENT 2- ANTHROPOMORPHISM EXPLORATION

Purpose

In the second study, juicers were rated by individuals with high and low anthropomorphic tendencies. Past studies have results that group participants into categories with similar emotion profiles, but no specific individual differences were identified to explain the source for the rating variability. Guthrie (1997) says that people anthropomorphize, or make familiar, unfamiliar things in an effort explain them. Relating to abstract explanations or difficult ideas exerts far more energy than putting things into terms humans already understand, and humans foremost understand themselves. People often relate to objects to varying degrees based on socially appropriate conduct (e.g., common to express frustration with computers but not coffee mugs) and individual anthropomorphic inclination (Sims, Chin, Yordon, Sushil, Barber, and Owens, 2005). Anthropomorphic tendencies may be one explanation for rating similarities from Study 1.

Study 2 compared participants with high and low score on the ATS and their ratings of juicers to capture the role of individual difference in anthropomorphic tendency on affective responses to products. Desmet's (2002) fourteen product-specific emotions were used to measure affective ratings. Study 2 also looked to see if the first impression opinions remained consistent between the population sample collected in Study 1 and in Study 2.

Method

Summary of Experimental Design

The within-subjects measures (the first impression and Likert scale rating sections) were collected, along with a demographic questionnaire. However, the number of juicers was reduced

to the ten found in Figure 18. In addition, the Anthropomorphic Tendency Scale (ATS) was presented but used as a between-subjects measure (high versus low scores) on the Extreme ATS scale.

 Juicer 9 Cuisinart	 Juicer 10 Villaware Moderno	 Juicer 12 Kalorik	 Juicer 13 L'Equip	 Juicer 18 Alessi Salif
 Juicer 21 Beech Wood Reamer	 Juicer 27 Mandarin Man	 Juicer34 Oster	 Juicer 37 Aroma	 Juicer 41 Black and Decker

Figure 18. Ten Juicers Used in Study 2

Research Questions

The main research question was: Do individual differences in anthropomorphic tendency predict emotional ratings of objects? The anticipated results were:

Individuals with similar scores (high or low) on the ATS will rate juicers with similar emotion profiles (i.e., have the same opinion for a given juicer).

Individuals with high ATS scores will have more extreme score emotional ratings of the juicers than those with low ATS scores. For example, a participant with a high ATS score would rate

the juicer using more extreme ratings (ones and sevens on a 7-point Likert scale), while a participants with a low ATS score will have more median ratings.

Materials and Procedures

Participants were provided an Informed Consent form with brief description of study, and contact information (Appendix A: Experiment Material). A minimum age requirement of 18 years of age was used. Next, the juicer images and emotions were presented randomly on a computer monitor, and participants used a keyboard and mouse to input their reactions. The participants rated product appearance using Desmet's (2002) 14 product-specific emotions, with the same First Impression and Likert scale format as in Study 1. First, the participants were asked to choose one of the fourteen emotions that was indicative of their first impression of the juicer. Next, the participants rated product appearance using a 7-point Likert Scale for the presence of each of product-specific emotion established by Desmet (2002). As before, in the Likert scale, 1 was used to indicate no agreement, while 7 was used to indicate a high level of agreement. Next, the participants completed a demographic questionnaire. Finally, the participants were given a Debriefing Form. All questions concerning the study were answered via email and phone.

Participants and Design

A total of 652 participants attempted the studies. Of these, 520 successfully completed the First Impression section and were used in the categorical analysis, and in the comparison between Study 1 and Study 2. A total of 472 participants had to successfully complete over 90 percent of the remaining questionnaires to be retained for the remaining analysis. These participants were

divided into High and Low Scores on the ATS for Extreme Anthropomorphism using a median split.

For the first analysis, participants consisted of 520 University of Central Florida students (170 male, 338 female, and 12 unspecified) ranging in age from 18 to 56 years of age (M = 20.83, SD = 5.13). Six participants did not report their age. For all remaining analyses, 472 (158 male, 306 female and 8 unspecified) participants ranged in age from 18 to 56 years of age (M = 20.97, SD = 4.48) were used. Two participants did not report their age. Participation was voluntary and students received extra credit points for their participation.

Results

Variables

Individuals who scored high versus low on the Anthropomorphic Tendencies Scale (ATS) subscale were compared on the emotion ratings of the juicers. All four sections of the ATS were administered as the traditional scale, but Extreme anthropomorphism was of interest. For the analysis, independent variables were Extreme anthropomorphic tendency (High versus Low) and the juicers (ten total) chosen from Study 1. The dependent variable was ratings of product-specific emotions on the juicers (Desmet, 2002). However, the frequency data captured by the First Impression validated the results found in Study 1 and thus the same five emotions (Amusement, Boredom, Fascination, Satisfaction, and Unpleasant Surprise) were analyzed. The subject variables again included sex.

First Impression Ratings

First Impression ratings were remarkably similar from Study 1 to Study 2 (see Table 6 and Table 7). Participants' first impression ratings focused on the same five emotions (Amusement, Fascination, Satisfaction Boredom, and Unpleasant Surprise). For this reason, the same five emotions were used in the Likert Scale and Anthropomorphism analysis. Surprisingly, even the participants' distribution across the emotions indicates an uncanny similarity (see Tables 6 and 7). All participants were between-subjects for the two studies; all participants from Study 1 were excluded from participating in Study 2, and a new population of students was collected. In both studies, the five common product emotions chosen were Amusement, Fascination, Satisfaction, Boredom, and Unpleasant Surprise (Figure 19: Percentage Attributed to Each Emotion). With the exception of Pleasant Surprise, which surpassed Unpleasant Surprise (came in sixth), the emotions chosen most frequently mirrored the five in the unique ratings profiles. Pleasant Surprise mostly represented the third and fourth consensus rating, not a unique highest rating for any one juicer (see Figure 19).

Table 6. First Impression Frequency Data Collection Study 1

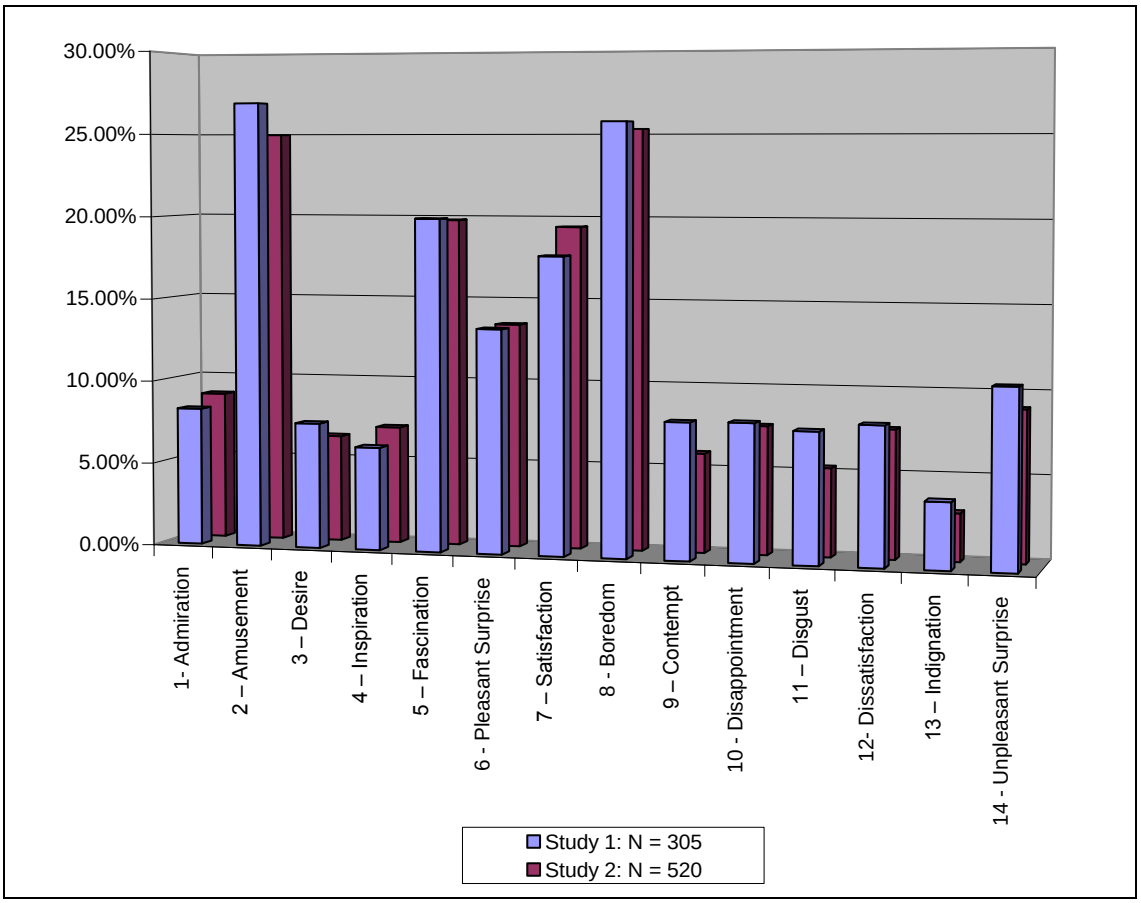
Juicer	Admiration	Amusement	Desire	Inspiration	Fascination	Pleasant Surprise	Satisfaction	Boredom	Contempt	Disappoint	Disgust	Dissatisfact	Indignation	Unpleasant Surprise
J27	16	158	11	6	25	46	10	3	9	1	3	6	2	9
J13	11	123	7	10	47	39	8	13	5	3	6	9	5	19
J12	22	25	19	21	73	31	32	27	18	9	4	9	5	10
J18	15	60	5	19	67	21	3	5	9	4	31	16	16	34
J10	31	14	28	16	39	27	55	29	14	11	3	16	9	13
J41	15	22	18	9	28	23	72	43	13	17	15	12	8	10
J21	4	37	6	7	18	10	3	45	15	30	39	23	13	55
J37	6	15	8	7	11	15	60	105	19	22	14	12	3	8
J34	6	6	10	7	17	3	26	108	19	34	19	27	5	18
J9	20	14	21	7	27	22	45	76	23	14	4	16	4	12

This table shows the First Impression frequencies from Study 1 for the ten juicers that were used in Study 2. The cells indicate the level of participant agreement for choosing the specific emotion as the first impression for that juicer. The columns are the 14-product specific emotions, the rows are the ten juicers used in Study 2, and the cells are how many participants choose this emotion as the first impression for the given juicer. Red and orange indicate the most and second most agreement between participants while the purple indicate the least chosen emotion for the given juicer. N=305.

Table 7. First Impression Frequency Data Collection Study 2

Juicer	Admiration	Amusement	Desire	Inspiration	Fascination	Pleasant Surprise	Satisfaction	Boredom	Contempt	Disappoint	Disgust	Dissatisfact	Indignation	Unpleasant Surprise
J27	15	259	13	19	49	79	12	11	2	7	14	7	10	23
J13	21	216	11	18	89	72	15	13	8	11	8	13	11	14
J12	46	42	34	50	126	49	50	37	24	14	5	16	8	19
J18	19	64	10	28	113	33	6	22	21	23	48	20	17	96
J10	58	28	44	37	79	43	100	65	22	8	2	15	9	10
J41	37	48	26	24	47	46	118	87	21	19	8	19	1	19
J21	15	64	17	15	44	22	25	78	14	56	41	53	19	57
J37	25	25	11	10	21	28	121	173	30	25	12	27	2	10
J34	15	17	15	7	18	15	52	203	21	53	24	48	4	28
J9	31	29	23	16	42	41	117	114	26	28	6	26	10	11

This table shows the First Impression frequencies from the ten juicers used in Study 2. As before the cells indicate the level of participant agreement for choosing the specific emotion as the first impression for that juicer. The columns are the 14-product specific emotions, and the rows are the juicers. Red and orange indicate the most and second most agreement between participants while the purple indicate the least chosen emotion for the given juicer. This table illustrates a remarkable similarity in rating the juicers between the two populations from Study 1 to Study 2. N=520.



All participants were between-subjects for the two studies. All participants from Study 1 were excluded from participating in Study 2, and a new population of students was collected. In both studies, the five common product emotions chosen were Amusement, Fascination, Satisfaction, Boredom, and Unpleasant Surprise. With the exception of Pleasant Surprise, which surpassed Unpleasant Surprise (came in sixth), the emotions chosen most frequently mirrored the five in the unique ratings profiles. Pleasant Surprise mostly represented the third and fourth consensus rating, not a unique highest rating for any one juicer.

Figure 19. Percentage Attributed to Each Emotion

Juicer 27
1-Amusement
2- Pleasant Surprise

Juicer 13
1- Amusement
2- Fascination

Juicer 12
1- Fascination
2- Satisfaction
2- Inspiration

Juicer 18
1- Fascination
2- Unpleasant Surprise

Juicer 10
1- Satisfaction
2- Fascination

Juicer 41
1- Satisfaction
2- Boredom

Juicer 9
1- Satisfaction
2- Boredom
*Same emotions, only the order changed.

Juicer 21
1- Boredom
2-Amusement

Juicer34
1- Boredom
2-Disappointment

Juicer 37
1- Boredom
2- Satisfaction

This figure highlights the changes in First Impression Ratings from Study 1 to Study 2. Juicer 12 had a second emotion tie, thus the addition of Inspiration. The emotions for Juicer 9 simply swapped order but remained the predominant two emotions. Juicer 21 presented a surprise. It was rated 1-Unpleasant Surprise and 2-Boredom in Study 1, and was rated 1-Boredom and 2-Amusement in Study 2. Unpleasant Surprise fell to third in its consensus rating.

Figure 20. Highlighted Differences in Juicer Ratings from Study 1 to Study 2

Likert Scale Ratings

An analysis was conducted to determine if Extreme Anthropomorphic tendencies are predictive of emotion ratings. Five separate 10 (Juicers) x 2 (ATS Score) x 2 (Sex) ANOVAs were performed using SPSS 11.5 (See Table 8, Table 9, and Figure 19). One ANOVA was run for each of the emotions (dependent variable). An a priori decision was made to analyze only the juicers and emotions found relevant and highlighted in Figure 20. Thus, only the five emotions (Amusement, Boredom, Fascination, Satisfaction, and Unpleasant Surprise) that were validated as relevant were analyzed, and all post-hoc investigations were run using only the juicers appraised with their respective emotions. An alphe level of .05 was used for all statistical tests.

Table 8. Study 2 ANOVA Variables

Juicers	**Extreme Anthropomorphic Tendenciy Scale (ATS)**	**Sex**	**Emotion DV**
Juicer 9: Cuisinart	Low Score	Female	Amusement
Juicer 10:Villaware Moderno	High Score	Male	Boredom
Juicer 12: Kalorik			Fascination
Juicer 13: L'Equip			Satisfaction
Juicer 18: Alessi Sailf			Unpleasant Surprise
Juicer 21: Beech Wood Reamer			
Juicer 27: Mandarin Man			
Juicer 34: Oster			
Juicer 37: Aroma			
Juicer 41: Black and Decker			

Table 9. Anthropomorphism Scoring

	Low Extreme Anthropomorphism	**High Extreme Anthropomorphism**
Score Range	42-60	61-191
Number of Participants	238	234

Extreme ATS range: 42- 210

Figure 19. Juicers Used in Study 2

Table 10. Effects for Extreme Anthropomorphism Across Emotions

Emotion	Significant for Juicers	Significant for Juicers x Extreme Anthropomorphism	Significant for Juicers x Sex	Significant for Juicers x Extreme Anthropomorphism x Sex
Amusement	$F(9,431) = 222.28$, $p < .001$, $\eta^2 = .34$	$F(9,431) = 2.34$, $p = .012$, $\eta^2 = .01$	$F(9,431) = 3.59$, $p < .001$, $\eta^2 = .01$	Not Significant at $p = .05$
Boredom	$F(9,436) = 132.93$, $p < .001$, $\eta^2 = .23$	$F(9,436) = 4.68$, $p < .001$, $\eta^2 = .01$	Not Significant at $p = .05$	Not Significant at $p = .05$
Fascination	$F(9,438) = 148.24$, $p < .001$, $\eta^2 = .25$	Not Significant at $p = .05$	$F(9,438) = 4.38$, $p < .001$, $\eta^2 = .01$	Not Significant at $p = .05$
Satisfaction	$F(9,437) = 82.67$, $p < .001$, $\eta^2 = .16$	$F(9,437) = 2.87$, $p = .002$, $\eta^2 = .01$	$F(9,437) = 4.76$, $p < .001$, $\eta^2 = .01$	Not Significant at $p = .05$
Unpleasant Surprise	$F(9,434) = 57.97$, $p < .001$, $\eta^2 = .12$	$F(9,434) = 3.41$, $p < .001$, $\eta^2 = .01$	$F(9,434) = 4.64$, $p < .001$, $\eta^2 = .01$	$F(9,434) = 2.41$, $p = .010$, $\eta^2 = .01$

Juicer Comparisons

Amusement. Both of the Amusing juicers, Juicer 13 (L'Equip) (M = 4.94, SD = 1.89) and Juicer 27 (Mandarin Man) (M = 5.59, SD = 1.84) were significantly different from each other and the remaining juicers, $p < .001$.

Boredom. The three Boredom juicers were the Beech Wood Reamer (21), the Oster (34), and the Aroma (37). Juicer 21 (M = 3.91, SD = 2.11) and Juicer 37 (M = 3.82, SD = 2.04) were not significantly differently from each other, $p = .382$. However, they were significantly different from all the remaining juicers, $p < .001$. Juicer 34 (M = 4.66, SD = 2.05) was significantly different from all the other juicers at $p < .001$.

Fascination. The two Fascination juicers were the Kalorik (Juicer 12) (M = 3.79, SD = 1.81) and the Alessi Salif (Juicer 18) (M = 4.07, SD = 2.06). Both of these juicers were significantly different from the remaining juicers at, $p < .001$, and almost from each other, $p = .015$.

Satisfaction. There were three juicers that were categorized with Satisfaction: Juicer 9 (Cuisinart), Juicer 10 (Villaware Moderno), and Juicer 41 (Black and Decker). Juicer 9 (M = 3.32, SD = 1.589) was not significantly different from Juicer 41 (M = 3.32, SD = 1.69), $p = .884$, but both were significantly different from all remaining juicers. Both of these shared the second emotion rating of Boredom, while Juicer 10's second rating was Fascination. Juicer 10 (M = 3.87, SD = 1.76) was similar to Juicer 12 (Kalorik), Juicer 13 (L'Equip), and Juicer 27 (Mandarin Man), at $p = .614$, $p = .167$, and $p = .017$ respectively. Juicer 12 (M = 3.90, SD = 1.77) and 13 (M = 4.05, SD = 2.06) had Fascination as one of their top two ratings, which

possibly explains the similarity, but Juicer 27 (M = 4.234, SD = 1.971), though positively rated, does not share its top two ratings.

Unpleasant Surprise. Only Juicer 18 (Alessi Salif) earned the Unpleasant Surprise rating, and only as its second highest rating. Juicer 18 (M = 3.021, SD = 2.068), was significantly different from the juicers with the exception of Juicer 34 (Oster) (M = 2.90, SD = 1.85), p = .666. This was a surprise since these juicers did not share the top two emotion ratings. A more likely similarity to Juicer 18 should have been with Juicers 10, 12, and 13 since they share a Fascination rating.

Juicer by Extreme Anthropomorphism Comparisons

Amusement. The ANOVA revealed a significant difference between groups, $F(9,431) = 2.34$, p = .012. There were two juicers that had Amusement as the first emotion, Juicer 13 (L'Equip) and Juicer 27 (Mandarin Man), and one juicer that had Amusement as the second emotion, Juicer 21 (Beech Wood Reamer). The planned comparisons were performed and indicated that the Low Anthropomorphism group rated the Mandarin Man significantly more amusing, $t(466)= 2.55$, p = .011(see Table 11). No significant difference for Extreme Anthropomorphism was found for the remaining juicers.

Table 11. Amusement and Extreme Anthropomorphism Interaction

	 **Juicer 13 L'Equip**	 **Juicer 21 Beech Wood Reamer**	 **Juicer 27 Mandarin Man**
Low Anthropomorphism	*M* = 4.97 *SD* = 1.95	*M* = 2.71 *SD* = 1.96	*M* = 5.77 *SD* = 1.72
High Anthropomorphism	*M* = 4.85 *SD* = 1.87	*M* = 2.87 *SD* = 1.85	*M* = 5.33 *SD* = 2.00
Significance	NS	NS	*t*(466)= 2.55, *p* = .011

Boredom. The ANOVA revealed a significant difference between groups, $F(9,436) = 5.68$, $p < .001$. There were three Boredom juicers: Juicer 21 (Beech Wood Reamer), Juicer 34 (Oster) and Juicer 37 (Aroma). The planned comparisons revealed that the Low Anthropomorphism group rated the Oster significantly more boring than the high anthropomorphism group, $t(465)= 3.76$, $p < .001$ (see Table 12). No significant difference for Extreme Anthropomorphism was found for the remaining juicers.

Table 12. Boredom and Extreme Anthropomorphism Interaction

	 **Juicer 21 Beech Wood Reamer**	 **Juicer 34 Oster**	 **Juicer 37 Aroma**
Low Anthropomorphism	*M* = 4.00 *SD* = 2.19	*M* = 5.02 *SD* = 1.97	*M* = 3.98 *SD* = 2.10
High Anthropomorphism	*M* = 3.83 *SD* = 2.03	*M* = 4.31 *SD* = 2.07	*M* = 3.64 *SD* = 1.97
Significance	NS	*t*(465)= 3.76, *p* < .001	NS

Satisfaction. The ANOVA revealed a significant difference between groups, $F(9,437) = 2.87$, $p = .002$. There were two juicers that had Satisfaction as the first emotion, Juicer 10 (L'Equip) and Juicer 41 (Mandarin Man), and there were three juicers that had Satisfaction as the second emotion, Juicer 9 (Cuisinart), Juicer 12 (Kalorik) and Juicer 37 (Aroma). However, none of the planned comparisons performed proved significant (see Table 13).

Table 13. Satisfaction and Extreme Anthropomorphism Interaction

	 **Juicer 9 Cuisinart**	 **Juicer 10 Villaware Moderno**	 **Juicer 12 Kalorik**	 **Juicer 37 Aroma**	 **Juicer 41 Black and Decker**
Low Anthropomorphism	*M* = 3.33 *SD* = 1.75	*M* = 3.90 *SD* = 1.71	*M* = 3.91 *SD* = 1.84	*M* = 2.97 *SD* = 1.70	*M* = 3.28 *SD* = 1.76
High Anthropomorphism	*M* = 3.31 *SD* = 1.57	*M* = 3.78 *SD* = 1.67	*M* = 3.86 *SD* = 1.70	*M* = 3.03 *SD* = 1.48	*M* = 3.31 *SD* = 1.62
Significance	NS	NS	NS	NS	NS

Unpleasant Surprise. The ANOVA revealed a significant difference between groups, $F(9,434) = 3.41$, $p < .001$. Only Juicer 18 (Alessi Salif) received Unpleasant Surprise as its second emotion rating. No significant difference for Extreme Anthropomorphism was found for this juicer (see Table 14).

Table 14. Unpleasant Surprise and Anthropomorphism Interaction

	Juicer 18 Alessi Salif
Low Anthropomorphism	*M* = 3.09 *SD* = 2.13
High Anthropomorphism	*M* = 2.90 *SD* = 1.99
Significance	NS

Juicer by Sex Comparisons

Amusement. The ANOVA revealed a significant difference between males and females, $F(9,431) = 3.59$, $p < .001$. There were two juicers that had Amusement as the first emotion, Juicer 13 (L'Equip) and Juicer 27 (Mandarin Man), and one juicer that had Amusement as the second emotion, Juicer 21 (Beech Wood Reamer). The planned comparisons revealed that men found the Beech Wood Reamer significantly more amusing than women, $t(462) = 2.06$, $p = .040$, and women found the Mandarin Man amusing significantly more amusing than men, $t(458) = 2.03$, $p = .043$. No significant difference for sex was found for the remaining juicer.

Table 15. Amusement and Sex Interaction



	Juicer 13 L'Equip	**Juicer 21 Beech Wood Reamer**	**Juicer 27 Mandarin Man**
Female	*M* = 5.01 *SD* = 1.89	*M* = 2.67 *SD* = 1.87	*M* = 5.66 *SD* = 5.29
Male	*M* = 4.72 *SD* = 1.93	*M* = 3.05 *SD* = 1.96	*M* = 4.97 *SD* = 1.90
Significance	NS	$t(462) = 2.06$, $p = .040$	$t(458) = 2.03$, $p = .043$

Fascination. The ANOVA revealed a significant difference between groups, $F(9,438) = 4.38$, $p < .001$. There were two juicers that had Fascination as the first emotion, Juicer 10 (L'Equip) and Juicer 12 (Kalorik), and there were three juicers that had Fascination as the second emotion, Juicer 10 (Villaware Moderno) and Juicer 13 (L'Equip) (see Table 16). The planned comparisons revealed that men found the Alessi Salif significantly more fascinating than women, $t(459) = 2.84$, $p = .005$. No significant differences for sex were found for the remaining juicers.

Table 16. Fascination and Sex Interaction

	 **Juicer 10 Villaware Moderno**	 **Juicer 12 Kalorik**	 **Juicer 13 L'Equip**	 **Juicer 18 Alessi Salif**
Female	*M* = 3.36 *SD* = 1.74	*M* = 3.67 *SD* = 1.79	*M* = 4.65 *SD* = 1.92	*M* = 3.88 *SD* = 2.07
Male	*M* = 3.68 *SD* = 1.66	*M* = 3.99 *SD* = 1.84	*M* = 4.40 *SD* = 1.93	*M* = 4.45 *SD* = 1.98
Significance	NS	NS	NS	*t*(459)= 2.84, *p* = .005

Satisfaction. The ANOVA revealed a significant difference between groups, $F(9,437) = 4.76$, $p < .001$. Again, the same two juicers had Satisfaction as the first emotion, Juicer 10 (L'Equip) and Juicer 41 (Mandarin Man), and the three juicers, Juicer 9 (Cuisinart), Juicer 12 (Kalorik) and Juicer 37 (Aroma) had Satisfaction as the second emotion. Men gave three juicers a significantly higher satisfaction rating (see Table 17).

Table 17. Satisfaction and Sex Interaction

					
	Juicer 9 Cuisinart	**Juicer 10 Villaware Moderno**	**Juicer 12 Kalorik**	**Juicer 37 Aroma**	**Juicer 41 Black and Decker**
Female	*M* = 3.21 *SD* = 1.63	*M* = 3.75 *SD* = 1.72	*M* = 3.70 *SD* = 1.79	*M* = 3.06 *SD* = 1.61	*M* = 3.16 *SD* = 1.66
Male	*M* = 3.56 *SD* = 1.66	*M* = 4.02 *SD* = 1.60	*M* = 4.27 *SD* = 1.67	*M* = 2.87 *SD* = 1.56	*M* = 3.57 *SD* = 1.68
Significance	*t*(460)= 2.17, *p* = .030	NS	*t*(460)= 3.31, *p* = .001	NS	*t*(457)= 2.56, *p* = .011

*Unpleasant Surpris*e. The ANOVA revealed a significant difference between groups, $F(9,434) = 4.64$, $p < .001$. The planned comparisons revealed that women were more unpleasantly surprised by the Alessi Salif, $t(457) = 2.30$, $p = .022$ (see table 18).

Table 18. Unpleasant Surprise and Sex Interaction

	
	Juicer 18 Alessi Salif
Female	*M* = 3.17 *SD* = 2.12
Male	*M* = 2.71 *SD* = 1.92
Significance	*t*(457)= 2.30, *p* = .022

Juicer by Extreme Anthropomorphism by Sex 3-way Interaction

Unpleasant Surprise: Only Juicer 18 received an Unpleasant Surprise rating in Study 2, and an a priori decision was made to analyze only the juicers that were rated by with their specific emotions. The three-way interaction was not significant for the Juicer 18 (see table 19).

Table 19. Three-Way Interaction for Juicer 18 (Alessi Salif)

		Extreme Anthropomorphism
Female	**Low**	*M* = 3.19 *SD* = .2.22
	High	*M* = 3.15 *SD* = 2.00
Male	**Low**	*M* = 2.86 *SD* = 1.88
	High	*M* = 2.59 *SD* = 1.95
Significance		NS

Discussion

The First Impression ratings suggest that there are five to six predominant emotions that individuals are inclined to use when rating juicers, as opposed to people. This indicates that specialized scales that differentiate positive emotions may be far more valuable in capturing nuances, previously missed by scales that relied on human emotions used to judge facial expression, where negative attributes discrimination is typical. Though this study suggests a high reliability for between the Study 1 and Study 2 populations, future studies will want to verify whether these emotions hold up for other products. This may produce a generalized product-specific scale.

In some instances, the juicer comparisons showed a lack of significance that implied that they were in fact similar. For example both Juicer 9 (Cuisinart), and Juicer 41 (Black and Decker) share the same first (Satisfaction) and second (Boredom) emotion rating received a similar rating; they were not significantly different from each other in the eyes of the participants. However, the third Satisfaction juicer, Juicer 10 (Villaware Moderno) had a second rating of Fascination. It turned out to be similar to others juicers with Fascination or other positive emotion ratings, but not the other two Satisfaction juicers mentioned above. This finding suggests two things: first that juicers can share a dichotomous positive and negative rating, and that juicers seen as overall positive may be grouped together as opposed to, juicers that share the same first emotion only. Though positive experiences are desired, it will be increasingly important to differentiate the source of the ratings.

One possible explanation may be individual differences, such as anthropomorphic tendencies or sex. Both of those were found to be predictive. Contradictory to the proposed hypothesis, the higher or more extreme ratings came from the Low Anthropomorphism group. They were more critical of the Oster, rating it as more boring, and more amused by the Mandarin Man. Possibly the ability to anthropomorphize and empathize with objects reduces the tendency to be judgmental. Another explanation may be that the Low Anthropomorphism group captured a population inclined to answer in use the endpoints in scales, both for the ATS and for the juicer ratings. Sex differences were not predicted; however, some were found. Women found the Mandarin Man significantly more amusing and the Alessi Salif less fascinating. Anecdotal responses by participants in these studies showed that men and women seemed to be examining different aspects of the juicers. For instance, women were more likely to classify the Mandarin

Man as “cute,” while men are less likely to do so. Men were more likely to consider the fluid dynamics or thought that the Alessi Salif resembled a space ship or appeared futuristic, while women were more likely to see it as a creepy or spider-like. It is not clear if gender roles or cultural stereotypes play into the gender specific appraisals. Women are more inclined to draw smiley faces and for that reason may find the Mandarin Man’s face cuter. Social roles also suggest that women may be more disturbed by the presence of insects—this may explain their stronger disdain for the Alessi Salif. This could explain why women gave the Alessi Salif a higher Unpleasant Surprise rating than men. In either instance, sex differences did alter some opinions of juicers across the emotions. It is important to note that with the substantial population the effect size was very small.

CHAPTER 5: EXPERIMENT 3 - ROLE OF INTERACTION

Purpose

Previous research has focused on emotions elicited by a product—the result of product expressions. However, it may be difficult for people to distinguish the design of a product from recollections of interacting with that or with a similar product. Results of past interactions may have a strong influence on individual opinions of products. A pre/post study was performed to determine the true impact of interaction on emotion ratings of the products. The interaction helped differentiate product expression from impression. The term "expression" was reserved for the emotion expressed by the product visually and pre-interaction, while "impression" was the emotional impression imprinted on a person during and after interacting with the object. The expression ratings provided by novices should be free from preconceived notions. In Study 2, the degree to which an individual anthropomorphizes, or relates to, an object was shown to have a small effect on the initial product evaluations or "first impressions." Thus, the ATS was used again. Experienced users and novices were used to rate a variety of the same product type (i.e., juicers) pre and post interaction. Novices were defined as having no prior experience with the stimuli product, while experiences users were defined as frequent users with multiple interactions.

The purpose of this study was to measure the impact of product interaction on emotional ratings. The knowledge gained should illuminate researchers, designers, and marketers to the effects of interactions so they can adjust testing practices.

Method

Summary of Experimental Design

As with the previous experiments, participants rated juicers using Desmet's (2002) list of 14 product-specific emotions (see Table 1: Product Specific Emotions). The dependent variables were again the first impression and Likert scale rating sections. However, these were collected both pre and post actual use of the juicers. The juicer stimuli were further reduced to seven (see Figure 20). The images and emotions were again presented on a computer. As before, the images of the juicers and the order of the emotions were randomized. Participants also used the juicers in a random order. Participants used all seven juicers to make a minimum of 4 ounces of orange juice. A pilot test was done to determine the number of ounces. Four ounces appeared to give participants enough time to form an opinion without prolonging the procedure unnecessarily. The entire process took between one hour, fifteen minutes to just under two and half hours. Participants did have the option of drinking the juice, or pouring it down the sink. After each juicer was used, the participant filed out the adapted Juicer Usability Scale and the Feedback Scale. The Anthropomorphic Tendencies Scale (ATS) (Sims et al., 2005) was presented in the post juicer-use computer session and again used as a between-subjects measure (high versus low scores) on the Extreme Anthropomorphism subscale. A demographic questionnaire was presented at the end of data collection. Along with usual questions about sex, age, and race, information about orange juice preferences and past experience using juicer also was collected. Additional measures of usability were collected to explain changes of opinion on account of interaction.

Figure 20. Juicers Used in Study 3

Research Questions

The main research question was: How is emotional appraisal of products influenced by interaction? The anticipated results were that emotional ratings would be influenced by past experience. The difference between novice users' pre and post interactions should yield a greater difference than those with juicing experience. Experienced participants may recall and thus be influenced by past exposure while rating the product pre-interaction.

Materials and Procedure

Participants were provided an Informed Consent form with brief description of study and contact information. A minimum age requirement of 18 years of age was used. Next, participants rated product appearance using Desmet's 14 (2002) product-specific emotions and a Likert scale of 1 to 7 (as in above studies). This was performed on the computer and was considered the pre-interaction condition. Next, the participants were asked to make a four ounce glass of juice using

each juicer. All oranges were pre-sliced by the experimenter. Juicers were used in a random order. Manuals were provided upon request, and the experimenter did not interact with the participants, with the exception of cutting additional oranges, or if participants posed a threat to themselves (e.g., put plugged in juicer under running water). The participants answered the Usability Questionnaire and Feedback Scale after each juicer. Following the use of all seven juicers, the participants rated product appearance again using Desmet's 14 (2002) product-specific emotions (post interaction). Next, the participants completed the ATS and a demographic questionnaire. Last, a Debriefing Form was provided, and any questions the participants had concerning the study were answered (see Appendix A for all study related materials).

Participants and Design

A total of 49 participants attempted the study. Of these 44 were retained for analysis. Three were lost to internet/computer errors, and two failed to follow instructions. Participants were collected at the University of Central Florida from varying disciplines. Participants ranged from 18 to 48 years of age (M = 23.80, SD = 6.37). Additional demographic information is available in Table 20: Demographics. Participation was voluntary and students received extra credit.

Table 20. Demographics

Sex (Quantity)	**Race**	**Age**	**Handed**	**Experience**	**Education**
-Female (25)	-African American (6)	18 yrs. (5)	-Right (39)	-Novice (22)	-High School (22)
-Male (19)	-Asian and Pacific (7)	19 yrs. (8)	-Left (4)	-Experienced (22)	-College (AA, BA, BS) (12)
	-Caucasian (Non-Hispanic) (28)	20 yrs. (9)	-Ambidextrous (1)		-Graduate Degree (MA, MS, PhD) (10)
	-Hispanic (1)	21 yrs. (1)			
	-Indian (1)	22 yrs. (1)			
	-Multi-Cultural (1)	23 yrs. (2)			
		24 yrs. (1)			
		25 yrs. (2)			
		26 yrs. (2)			
		27 yrs. (3)			
		28 yrs. (2)			
		29 yrs. (3)			
		31 yrs. (1)			
		32 yrs. (1)			
		35 yrs. (1)			
		40 yrs. (1)			
Total (44)		48 yrs. (1)			

Variables

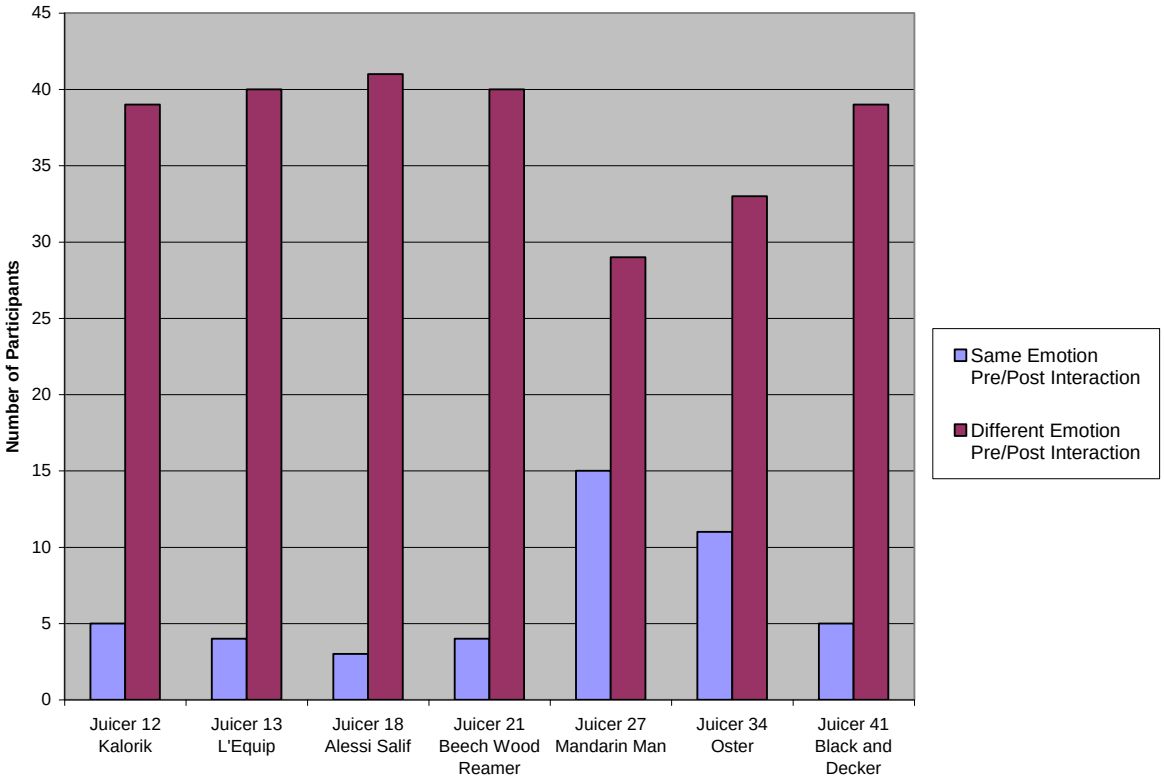
The independent variables were juicers, level of expertise (Novice versus Experience), and impact of interaction (Pre versus Post). The dependent variables were pre/post change-score for ratings of 14 emotions. Additional dependent measures included System Usability Scale (Brook, 1996), the Feedback Scale, and juicing ability. The subject variables were sex, age, race, and juice preferences, purchasing preferences, and juicing ability.

Results

First Impression

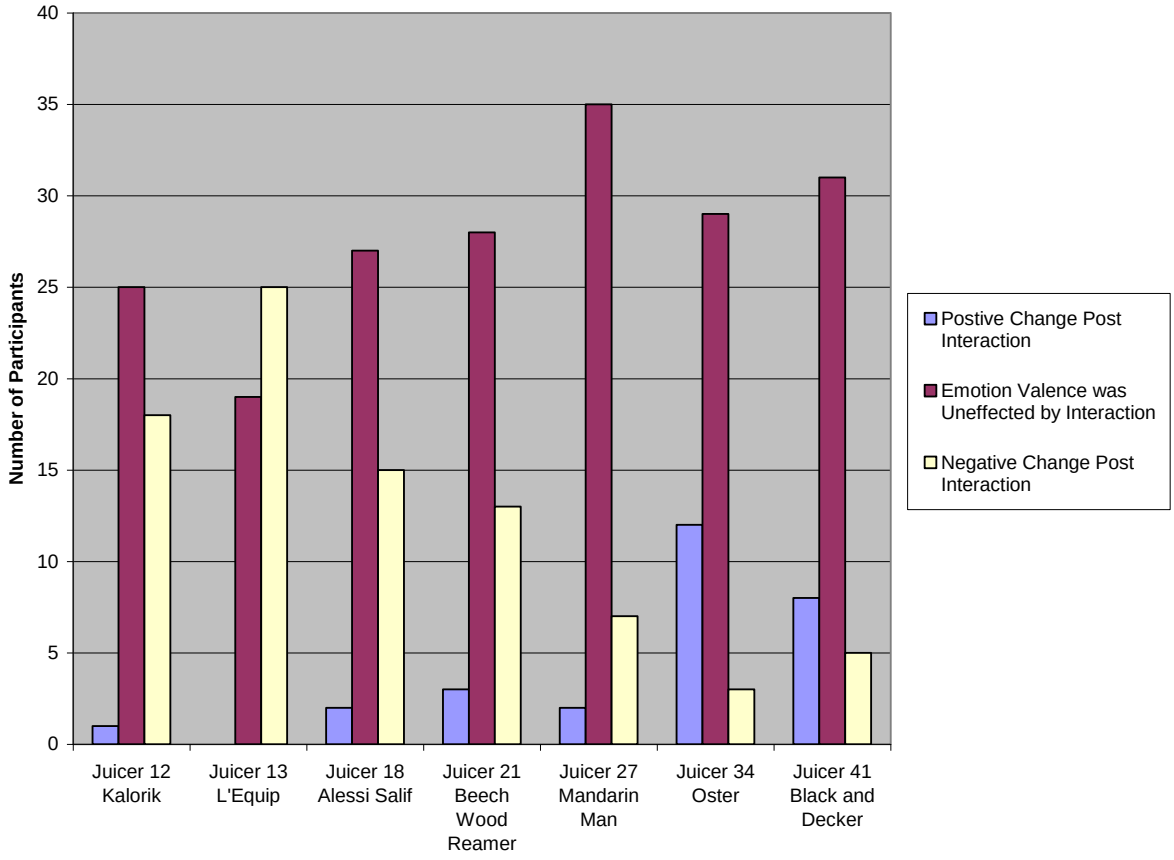
A preliminary look at the First Impressions revealed that interaction had the least impact on Juicer 27 (Mandarin Man) followed by Juicer 34 (Oster) (see Figure 23: Participant Emotion Ratings Consistency). This table only reflects whether the participants changed their appraisal from any one emotion to another, but does not describe any trends (positive or negative). A further investigation looked at whether interaction gained using the juicer influenced appraisal

from a positive to a negative, from negative to a positive, or remained consistent (see Figure 22). Juicer 34 (Oster) and Juicer 41 (Black and Decker) had the greatest positive changes, and Juicer 12 (Kalorik) and Juicer 13 (L'Equip) had nearly or no positive changes. The Oster also had the least negative change, while the L'Equip had the greatest negative change. Opinion soured so greatly for the L'Equip that every participant changed valence on the emotion rating. Also, it received the greatest number of negative ratings post interaction (see Figure 22). It was anticipated that experienced users would be less inclined than novices to change their juicer ratings. However, Figure 23 does not provide details about if the opinions changed valence. For example, an experienced user may have chosen Dissatisfaction pre-interaction and Disappointment post-interaction, and did not believe them to be vastly varied. Emotion trends revealed that valence did change after interaction more for certain juicers (e.g., L'Equip), and remained consistent for others (e.g., Mandarin Man) (see Figure 22: Emotion Trends Post Interaction).



The results of this graph indicate that participant's interaction had least impact of the Mandarin Man followed by the Oster juicer.

Figure 21. Participant Emotion Ratings Consistency



The table shows whether interaction caused participants to change their rating of the juicer to a from a negative to a positive emotion, remained consistent within the same valence post interaction, or change from a negative to a positive emotion.

Figure 22. Emotion Trends Post Interaction

After interaction with the juicers, and upon concluding the survey portions of the study, participants were asked which juicer was their favorite and least liked (see Figure 23). The consensus for desirable juicers was the Black and Decker, Mandarin Man, and Oster, in that order. Comments made by participants suggest that the Mandarin Man was picked for appearance because he was often referred to as "Cute." The Black and Decker, and Oster were picked for ease of use. For this same reason, the overwhelming majority of the people did not like the Beech Wood Reamer; which was said to be difficult to use.

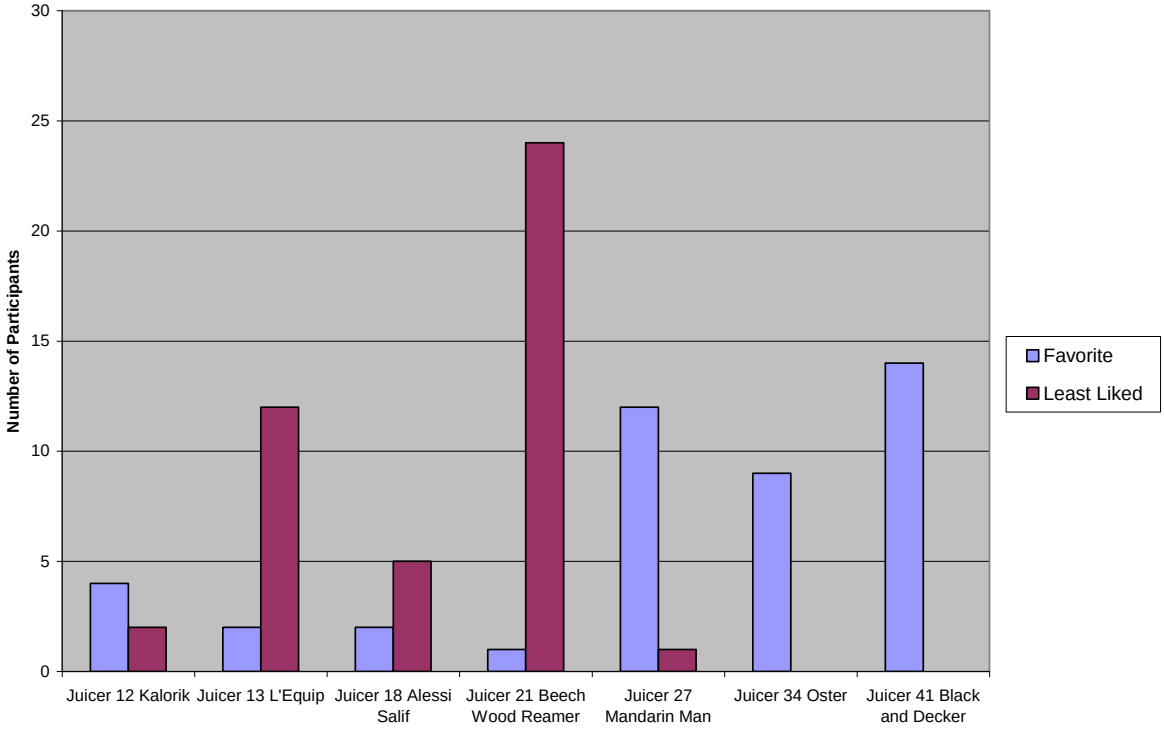


Figure 23. Post Interaction Impressions of the Juicers

Likert Ratings

Experience gained by interacting with the product was expected to influence expression ratings. The difference of novice users' pre and post interactions was predicted to yield a greater difference than expert users who can recall and may be influenced by past exposure while rating the product pre-interaction. Additional measures on usability were collected to explain possible changes of opinion on account of interaction.

The proposed hypothesis stated that novice participants would have greater variability then experienced participants between their pre-interaction and post-interaction ratings of the juicers. Past interaction with juicers was expected to influence the perspective of the experienced

participants, thus their scores should vary less. A one-sample t-test was conducted on the delta score for the Likert Ratings of the juicers form trial 1(pre-interaction with the juicers) and trial 2 (post-interaction). The dependent variable was the change score of from the 7-point Likert Rating of the emotions. Only the five emotions validated in the previous two studies were used for the analysis: Amusement, Boredom, Fascination, Satisfaction, and Unpleasant Surprise. As before, the emotions were only analyzed for the juicers in which they were one of the top two consensus ratings highlighted in Study 2. A summary of the juicers and the emotions they are analyzed for is in Figure 24. SPSS 11.5 was used to perform all analysis.

 Juicer 12 Kalorik 1- Fascination 2- Satisfaction 2- Inspiration	 Juicer 13 L'Equip 1- Amusement 2- Fascination	 Juicer 18 Alessi Salif 1- Fascination 2- Unpleasant Surprise
 Juicer 21 Beech Wood Reamer 1- Boredom 2-Amusement	 Juicer 27 Mandarin Man 1-Amusement 2- Pleasant Surprise	 Juicer34 Oster 1- Boredom 2-Disappointment	 Juicer 41 Black and Decker 1- Satisfaction 2- Boredom

Figure 24. Juicers and Emotions Analyzed in Study 3

The following one-sample t-test comparisons were performed to determine if there was a significant difference between the pre-post ratings for the above juicers. Four juicers were found to have changed between pre and post ratings (see Table 21). The significance level was adjusted to $p = .003$, to account for the fifteen t-test comparisons.

Table 21. Delta Score Pre/Post Interaction Comparison

Juicer	**Emotion**	**T-test Results**	**Mean / Standard Deviation**
Juicer 12 (Kalorik)	1- Fascination	$t(43)= 3.370$, $p = .002$	M = -.95, SD = 1.88
Juicer 12 (Kalorik)	2- Satisfaction	NS	NS
Juicer 12 (Kalorik)	2- Inspiration	NS	NS
Juicer 13 (L'Equip)	1- Amusement	$t(43)= 4.74$, $p < .001$	M = -1.57, SD = 2.19
Juicer 13 (L'Equip)	2- Fascination	$t(43)= 5.71$, $p < .001$	M = -1.45, SD = 1.69
Juicer 18 Alessi Salif	1- Fascination	NS	NS
Juicer 18 Alessi Salif	2- Unpleasant Surprise	NS	NS
Juicer 21 Beech Wood Reamer	1- Boredom	NS	NS
Juicer 21 Beech Wood Reamer	2-Amusement	NS	NS
Juicer 27 Mandarin Man	1-Amusement	NS	NS
Juicer 27 Mandarin Man	2- Pleasant Surprise	NS	NS
Juicer34 Oster	1- Boredom	$t(43)= 3.29$, $p = .002$	M = -.93, SD = 1.90
Juicer34 Oster	2-Disappointment	NS	NS
Juicer 41 Black and Decker	1- Satisfaction	$t(43)= 4.79$, $p < .001$	M = .91, SD = 1.58
Juicer 41 Black and Decker	2- Boredom	NS	NS

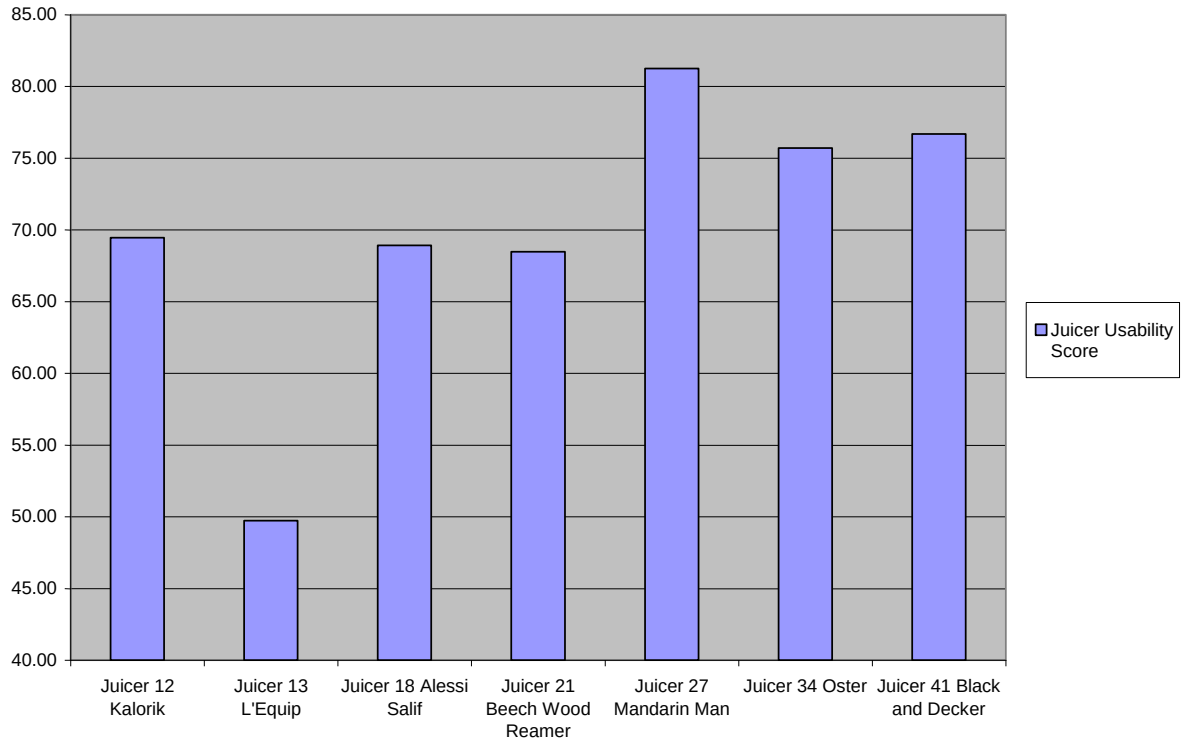
A series of fifteen independent-sample t-test comparisons was performed to compare Experienced and Novice groups, to determine if where the significant differences exist on the Likert ratings between pre-post interactions. The significance level was adjusted to $p = .003$, to account for the fifteen t-test comparisons within each group. For both the Experienced and Novice group, opinion remained consistent pre and post-interaction for the given emotions with the exception of Juicer 13 (L'Equip) (see Table 22 and Table 23).

Table 22. Experienced User Pre/Post Comparisons

Juicer	Emotion	T-test Results	Mean / Standard Deviation
Juicer 12 (Kalorik)	1- Fascination	NS	NS
Juicer 12 (Kalorik)	2- Satisfaction	NS	NS
Juicer 12 (Kalorik)	2- Inspiration	NS	NS
Juicer 13 (L'Equip)	1- Amusement	$t(21)= 4.25$, $p < .001$	$M = -1.57$, $SD = 2.19$
Juicer 13 (L'Equip)	2- Fascination	$t(21)= 5.10$, $p < .001$	$M = -1.45$, $SD = 1.69$
Juicer 18 Alessi Salif	1- Fascination	NS	NS
Juicer 18 Alessi Salif	2- Unpleasant Surprise	NS	NS
Juicer 21 Beech Wood Reamer	1- Boredom	NS	NS
Juicer 21 Beech Wood Reamer	2-Amusement	NS	NS
Juicer 27 Mandarin Man	1-Amusement	NS	NS
Juicer 27 Mandarin Man	2- Pleasant Surprise	NS	NS
Juicer34 Oster	1- Boredom	NS	NS
Juicer34 Oster	2-Disappointment	NS	NS
Juicer 41 Black and Decker	1- Satisfaction	NS	NS
Juicer 41 Black and Decker	2- Boredom	NS	NS

Table 23. Novice User Pre/Post Comparisons

Juicer	Emotion	T-test Results	Mean / Standard Deviation
Juicer 12 (Kalorik)	1- Fascination	NS	NS
Juicer 12 (Kalorik)	2- Satisfaction	NS	NS
Juicer 12 (Kalorik)	2- Inspiration	NS	NS
Juicer 13 (L'Equip)	1- Amusement	NS	NS
Juicer 13 (L'Equip)	2- Fascination	$t(21)= 3.51$, $p = .002$	$M = -1.45$, $SD = 1.69$
Juicer 18 Alessi Salif	1- Fascination	NS	NS
Juicer 18 Alessi Salif	2- Unpleasant Surprise	NS	NS
Juicer 21 Beech Wood Reamer	1- Boredom	NS	NS
Juicer 21 Beech Wood Reamer	2-Amusement	NS	NS
Juicer 27 Mandarin Man	1-Amusement	NS	NS
Juicer 27 Mandarin Man	2- Pleasant Surprise	NS	NS
Juicer34 Oster	1- Boredom	NS	NS
Juicer34 Oster	2-Disappointment	NS	NS
Juicer 41 Black and Decker	1- Satisfaction	NS	NS
Juicer 41 Black and Decker	2- Boredom	NS	NS



The usability scores are percentages captured by the, adapted for Juicers, System Usability Scale. The scores reflect a cumulative percent score, 100 % total, for the overall usability of the juicer.

Figure 25. Usability Scores

Discussion

The ratings by experienced users were expected to differ less from the pre/post condition than the novices who were rating the product with no prior exposure. The results support the hypothesis that past interaction, with the existing or similar products, provided experienced users insight for assessing the products. The experienced users' opinions did not change significantly for juicers pre and post-interaction, with the exception of Juicer 13 (L'Equip). This may be explained by the poor usability score of Juicer 13 (see Figure 25). Juicer 13 was particularly atypical of most electric juicers, almost resembling a penguin. However, the results indicated

that the novice users' opinions failed to change. These results initially contradicted the interaction hypothesis.

Upon further reflection, the first impression results indicated that participants' opinions often changed post-interaction from one emotion to another all together (see Figure 21). Often, post interaction, they also changed valence—initially positive rated juicers were rated negative after using them , and vice versa (see Figure 22). Thus, an exploratory analysis was considered to determine which juicers and emotions explained this shifts.

Exploratory Analysis of Pre/Post Trends

As above, a series of independent-sample t-test comparisons was performed, for both Experienced and Novice groups, to determine if there were significant trends on the Likert ratings between pre-post interactions. The significance level was reduced to $p = .001$, to account for the many exploratory t-test comparisons within each group. The results in Tables 24, 25, and 26 indicate an unfavorable trend for Juicer 13 (L'Equip) from both groups. However, the Novice group showed an improved opinion for Juicer 34 (Oster) and Juicer 41 (Black and Decker).

Table 24. Exploratory Pre/Post Comparisons for Experienced User

Juicer	**Emotion**	**T-test Results**	**Mean / Standard Deviation**
Juicer 13 (L'Equip)	Amusement	$t(21)= 4.25$, $p < .001$	M = -1.73, SD = 1.91
Juicer 13 (L'Equip)	Disappointment	$t(21)= 6.46$, $p < .001$	M = 2.91, SD = 2.11
Juicer 13 (L'Equip)	Dissatisfaction	$t(21)= 5.85$, $p < .001$	M = 2.86, SD = 2.30
Juicer 13 (L'Equip)	Unpleasant Surprise	$t(21)= 5.23$, $p < .001$	M = 2.50, SD = 2.24

Table 25. Exploratory Pre/Post Comparisons for Novice User

Juicer	**Emotion**	**T-test Results**	**Mean / Standard Deviation**
Juicer 13 (L'Equip)	Disappointment	$t(21)= 4.69$, $p < .001$	M = -1.45, SD = 1.69
Juicer 4 Oster	Pleasant Surprise	$t(21)= 4.06$, $p = .001$	M = -1.45, SD = 1.69
Juicer 34 Oster	Satisfaction	$t(21)= 3.69$, $p = .001$	M = -1.45, SD = 1.69
Juicer 41 Black and Decker	Admiration	$t(21)= 4.00$, $p = .001$	M = -1.45, SD = 1.69
Juicer 41 Black and Decker	Pleasant Surprise	$t(21)= 4.78$, $p < .001$	M = -1.45, SD = 1.69

Table 26. Trends

Juicer	**Emotion**	**Expert / Novice**	**Trend**
Juicer 13 (L'Equip)	Amusement	Expert	Down Less Amused
Juicer 13 (L'Equip)	Disappointment	Expert	Up More Disappointed
Juicer 13 (L'Equip)	Dissatisfaction	Expert	Up More Dissatisfied
Juicer 13 (L'Equip)	Disappointment	Novice	Up More Disappointed
Juicer 34 Oster	Pleasant Surprise	Novice	Up More Pleasantly Surprised
Juicer 34 Oster	Satisfaction	Novice	Up More Satisfied
Juicer 41 Black and Decker	Admiration	Novice	Up More Admirable
Juicer 41 Black and Decker	Pleasant Surprise	Novice	Up More Pleasantly Surprised

Discussion

The exploratory analysis revealed that all participants had an unfavorable experience with Juicer 13 (L'Equip). This juicer had unique appeal when just considered visually, but presented many complications when being used by participants. Most participants failed to remove the arm-looking spouts, and thus had extreme difficultly cleaning it. The interior bowl was level and retained several ounces of juice before it came out the spout. This delay in the appearance of

juice caused most participants to ream a used up orange-half for a prolonged time. Several participants also commented on how loud this juicer was.

However, the novice group showed an improved opinion for Juicer 34 (Oster) and Juicer 41 (Black and Decker). These were two ordinary, perhaps mundane-looking, electric juicers. Actual juicing performed with these altered the novices' opinions, suggesting that overall usability can leave a positive impression for aesthetic appraisal.

Predictive Properties of Juicer Appraisal

A 7-point Likert feedback scale was used to capture what motivates participants' appraisal. A stepwise multiple regression analysis was used to determine the specific attributes on the feedback scale that influenced overall juicer rating. The overall juicer rating was predicted by: easy to use, confusing, expensive, complicated, easy to clean, intuitive, worth the effort, annoying, satisfying to use, efficient, fun, costly, effortless, frustration, would purchase, would use again, and would recommend to others. SPSS 11.5 was used to perform the analysis and the significance level was set at $p = .05$.

Juicer 13 (L'Equip)

The L'Equip overall rating was predicted by recommend to others, efficient, effortless, and cost. The recommend to others was positively related to the overall rating and accounted for 81.7 percent of the variance, $t(41) = 7.95$, $p < .001$. The additional contribution of efficient and effortless accounted for a significant portions of the residual respectively, $\Delta R^2 = .070$, $t(40) = 4.13$, $p < .001$, and $\Delta R^2 = .012$, $t(39) = 2.52$, $p = .016$. The additional contribution of perceived cost accounted for the only other significant portion of the residual, $\Delta R^2 = .011$, $t(38) = 2.17$, $p =$

.037. The remaining variables were excluded because they failed to predict a significant portion of overall rating (see Table 27).

Table 27. Juicer 13 (L'Equip) Stepwise Entry

Step	Variable Entered	R^2	*F*	df	*p*	ΔR^2
1	Recommend to Others	.817	182.91	1, 41	$p < .001$	.817
2	Recommend to Others Efficient	.887	156.63	1, 40	$p < .001$	.070
3	Recommend to Others Efficient Effortless	.899	115.12	1, 39	$p < .001$	.012
4	Recommend to Others Efficient Effortless Cost	.910	95.69	1, 38	$p < .001$	.011

Juicer 34 (Oster)

The Oster overall rating was predicted by recommend to others, and effortless. The recommend to others was positively related to the overall rating and accounted for 75.9 percent of the variance, $t(41) = 8.66$, $p < .001$. The additional contribution of effortless accounted for the only other significant portion of the residual, $\Delta R^2 = .028$, $t(40) = 2.30$, $p = .027$ (see Table 28). The remaining variables were excluded because they failed to predict a significant portion of overall rating.

Table 28. Juicer 34 (Oster) Stepwise Entry

Step	Variable Entered	R^2	*F*	df	*p*	ΔR^2
1	Recommend to Others	.759	129.39	1, 41	$p < .001$	.759
2	Recommend to Others Effortless	.787	74.09	1, 40	$p < .001$	.028

Juicer 41 (Black and Decker)

The Black and Decker overall rating was predicted by recommend to others, would use again, and annoying. The recommend to others was positively related to the overall rating and accounted for 81.5 percent of the variance, $t(41) = 3.29$, $p = .002$. The additional contribution of would use again accounted for a significant portion of the residual, $\Delta R^2 = .022$, $t(40) = 2.34$, $p = .024$. The additional contribution of annoying (lack there off) accounted for the only other significant portion of the residual, $\Delta R^2 = .016$, $t(39) = 2.04$, $p = .048$ (see Table 29). The remaining variables were excluded because they failed to predict a significant portion of overall rating.

Table 29. Juicer 41 (Black and Decker) Stepwise Entry

Step	Variable Entered	R^2	*F*	df	*p*	ΔR^2
1	Recommend to Others	.815	181.15	1, 41	$p < .001$	.815
2	Recommend to Others Would Use Again	.838	103.30	1, 40	$p < .001$	.022
3	Recommend to Others Would Use Again Annoying	.853	75.72	1, 39	$p < .001$	.016

Discussion

The above regression analysis suggests that the ability to recommend products to others serves as a main predictor of overall favorable assessment of the juicers. Individuals may believe that specific product ownership is a reflection or extension of their personality. Thus, the inclination to share or display products with others is a cumulative reflection of the aesthetic appraisal and usability.

Limitations

Having a large sample of varied juicers provides opportunity for results otherwise not possible. However, the large sample may have enabled a learning effect for novices. Juicers are simple devices that function mostly one way; the orange half is reamed on a cone-shaped dome. Though, this did perplex a few participants, skill transference was evident. For example, fewer participants failed to put a cup under the Oster spout, if the Oster followed the Kalorik which also had a spout that directed juice to an external reservoir. The practice effect of using so many juicers may be mitigated by a between-subjects design. Between-subjects would capture true novelty of first use since there would be no transfer from one juicer to the next about potential usability. Since subject differences may be more pronounced in a between-subjects design, a small sample may be the ideal compromise.

This study only divided participants into users and novices. Reamer experience (experience with non-electric, manual hand reamers or reamer with dish to catch juice) did not impact electric users but vice versa did seem to change interaction expectations based on past experience. Observation of the study revealed that experience may be better defined on a continuum and users should possibly be divided into two groups of users, manual (e.g., hand held reamer, reamer with a dish to catch juice) and electric. Electric users showed a higher capacity for knowledge transfer to manual juicers, while manual-experience users were often puzzled by their first electric juicer experience (e.g., often picked up the juicer to look for an on/off switch when electric juicers are typically activated by touching the orange to the cone). The manual-experience users still displayed some mastery that separated them from the novice counterparts. For example, novices bore down with the Beech Wood reamer into an orange half directly on the

counter with no cup underneath and the juice just poured onto the counter, or the same technique was used inside a cup quickly submerging the orange half in the juice. Thus, three groups may be more ideal: novice, manual experience, and electric experience.

Future Study

Prior to interaction, the preferred juicers were colorful, while the less favorably-rated juicers were white or wooden. This suggested that individuals may examine certain material properties when rating products visually. These opinions may change with interaction, especially with novice populations. Understanding these motivators will provide insight into aesthetic appraisal. While aesthetic appeal may get the product out of the store and into the home, it is usability that is likely to keep it in there or to promote its use. Also, usability is more likely to build brand loyalty.

In future studies, time on task may be a valuable variable since overall time spent in the study varied from about 1 hour and 15 minutes to 2 hours and 30 minutes. Also, time using the juicers varied with both level of experience and juicer type. This variable may capture usability attributes. Future studies will need to determine the cause for emotion rating choices; does utility, novelty, usability, aesthetics, functionality, anthropomorphic tendency, or recollection of past experiences color one's perspective, and if so, to what degree.

CHAPTER 6: CONCLUSION

Application

The dissertation findings may be used to guide human factors professionals to develop measures that more accurately capture affective ratings. The results indicate that product-specific or product-focused emotions are necessary for product appraisal. Previous studies (e.g., Smith et al., 2007) have relied on established emotional appraisal, such as Ekman's Affective States (1999a, 1999b). Though notably accurate to describe human-to-human interaction, the affective states (anger, disgust, fear, sadness, surprise, and happiness) are predominantly negative (4 negative, 1 neutral, and 1 positive). From an evolutionary standpoint, negative appraisal is far more valuable for human preservation. However, negative appraisal of products simply means they are unlikely to survive in the competitive retail industry. The results in this dissertation suggest that positive emotions are used to differentiate product appraisal. Participants used more positive emotions to discriminate between products, and they used *boredom* as the primary descriptor for negative appraisal. Just over half of the juicers were rated as boring. This suggests "boredom" is an umbrella term for negative appraisal. Since boring may be interpreted as the opposite of "fun," it also explains the shift toward pleasurable design. Consumers want to anticipate having fun using their new products. This indicates that users are getting far more particular and have raised their expectations. Since this study was conducted with juicers, further research may refine whether the emotions are domain specific or generalizable across domains.

The results also suggest that individual differences (sex and anthropomorphic tendencies) explain some rating differences. Additional research may be needed to determine what specific

attributions are correlated with sex differences. Anthropomorphism is another individual difference that showed predictive qualities for testing for emotional design ratings. Individuals with low anthropomorphic tendencies were more critical of the products. It should be noted that the effects were small, and stronger effects may exist within other individual differences (e.g., cohort).

The results confirmed that interaction had an impact on affective ratings. As opposed to experienced users, novice users deviated in their pre-post appraisal, especially on aesthetically boring but highly usable products. Novice users based their entire initial appraisal on aesthetics, while experienced users were influenced by their past experience. Humans rely on past experience to recall likes or dislikes. The findings here suggest that aesthetic appraisal of products (or other environments) will remain influenced by past exposure/experience with those or similar products. Thus, only true novices can remain unbiased by past experience for aesthetic appraisal and capture a true "first impression". Also, past experience of users should be assessed when conducting research that relies on emotional appraisal of products. These findings may be especially useful in product development, where new designs are based on a golden standard, competition, or go through several iterations of testing.

Jordan (2002) explained a shift from technology-centered design to user-centered design, as an evolution in hierarchical consumer needs. Jordan's hierarchy of consumer needs is functionality, usability, and pleasure. Today, consumers are no longer surprised by product ease of use, they expect and demand it. The element of surprise is reserved for poorly-functioning products or products that promote an exceptionally pleasurable experience. Thus, a shift from basic needs to emotional design is increasingly prevalent. This consumer demand has opened up doors for

human factors professionals to be involved in the early stages of product development, where they have the greatest impact on product design. The findings in this dissertation will help guide human factors testing through this early development process.

APPENDIX A: EXPERIMENTAL MATERIAL

First Directions Prior to Informed Consent:

Juicer Evaluation

On the next page you will be presented with an informed consent form, which you will need to read over and sign. After this you will be able to continue with the study. Extra credit will automatically be assigned after completing the study.

Continue >>

Second Directions following Informed Consent:

You are participant id: 1. Please write this down and use this number if you have any questions or problems with the study.

Continue >>

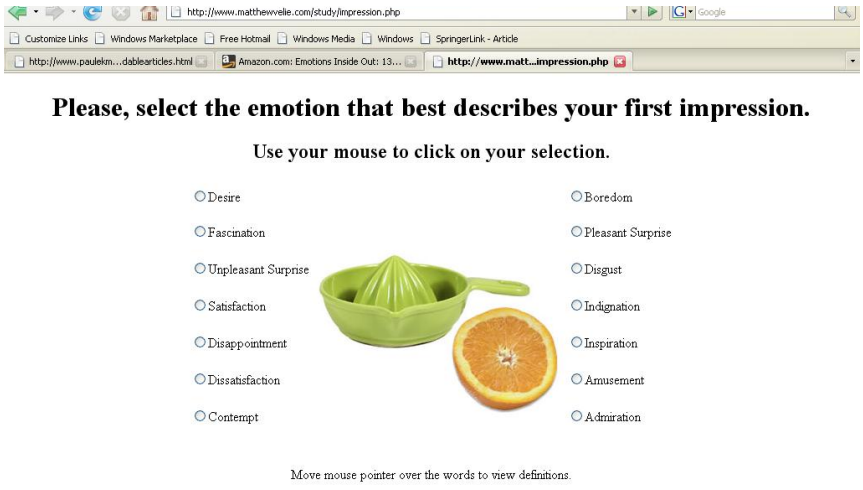
Directions 1:

Directions

In the following section, you will see a picture of a juicer and a list of 14 emotions. You will be asked to tell us the emotion that you feel when you see the product. We are interest in your first impression. If you are unsure of the definition of a word, highlight the word and the definition will appear. Once you have selected an emotion, the screen will automatically move to the next picture. So, please choose carefully. The same orange is included in each image to provide a reference for the juicer's size.

Continue >>

Sample Screen:



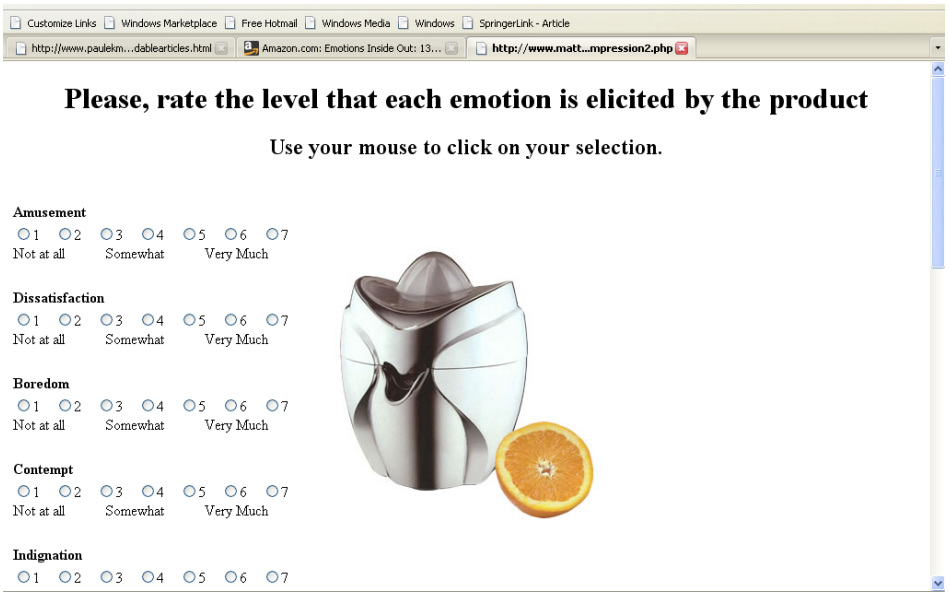
Directions 2:

Directions

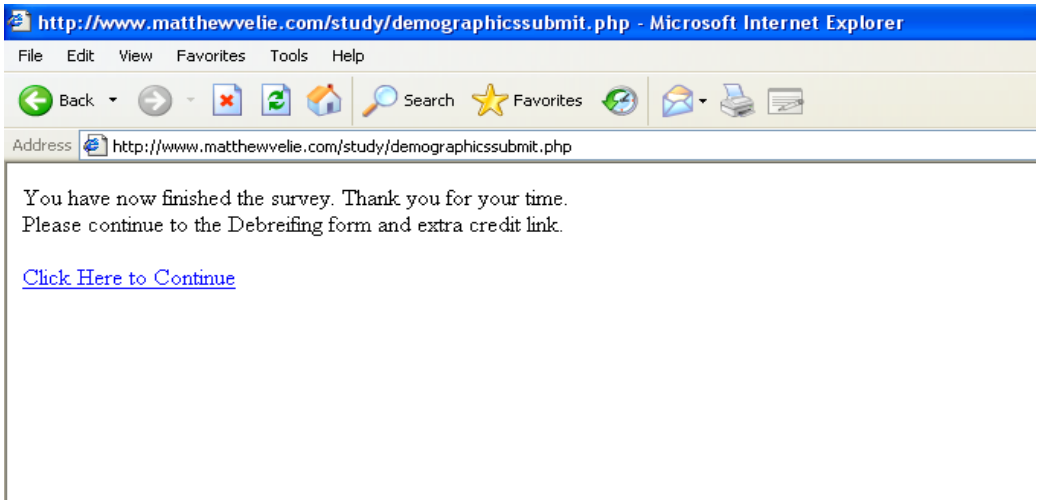
In the following section, you will see a picture of a juicer and a list of 14 emotions. You will be asked to tell us how strongly you feel the emotions when you see the product.

Continue >>

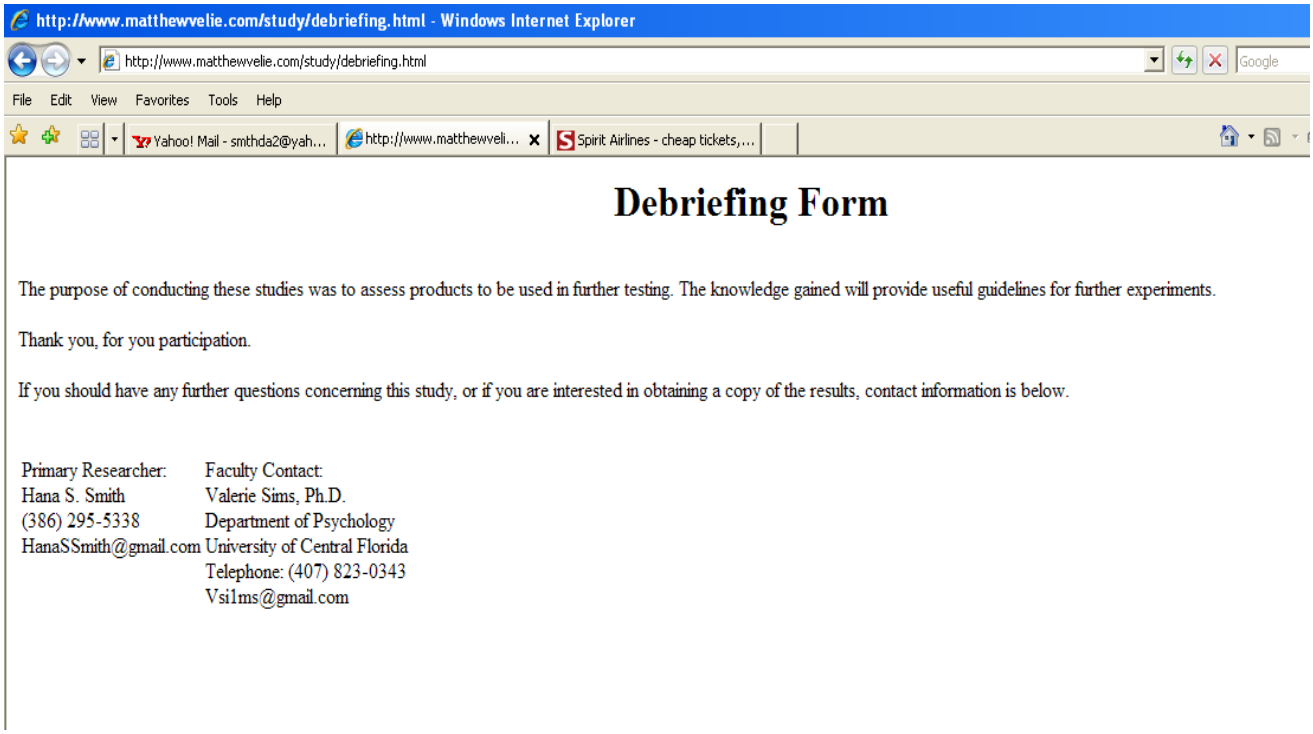
Sample Screen 2:



Thank you:



Debriefing:



Additional Scale for some participants: (ATS) Anthropomorphic Tendency Scale

Informed Consent Form

The University of Central Florida supports the protection of human participants taking part in research. We are presenting the following so that you can decide whether you wish to participate in this study.

The "Juicers of Interest Study" will ask you to evaluate pictures of juicers using 14 emotions (e.g. inspiration). Pictures will be presented on your monitor. A mouse and keyboard will be used to provide feedback. Upon completing the evaluation, you will be asked to fill out a demographic questionnaire. Last, you will be presented a debriefing form. This process should take less than an hour. The information gained from your feedback will be used to identify a sample of juicers to be used in another study. You can call the experimenter with any questions concerning the experiment.

There are no anticipated risks to you as a participant in this study. The benefit to you is added knowledge about participation in research. Your participation is strictly voluntary and you may withdraw at any time without negative consequence and you do not have to answer any questions that make you feel uncomfortable in any way. All research will be password protected or store in a locked cabinet or secure computer. Access to data is restricted to the researchers and involved faculty. No individual's data will identifiable with the actual person since the Sona system generates an anonymous id. Sona is the primary form of recruitment.

If you wish to see the results of this study, you may request a write-up of them from the investigators listed below. Additionally, you may contact the investigator with questions about this research.

Primary Researcher:
Hana S. Smith (386) 295-5338
HanaSSmith@gmail.com
University of Central Florida
Telephone: (407) 823-0343
Vsi1ms@gmail.com

Faculty Contact:
Valerie Sims, Ph.D.
Department of Psychology

The University of Central Florida requires that the following statement appear on all consent forms.

This research study has been reviewed and approved by the UCF Institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246. The telephone number is (407) 823-2901.

If you believe you have been injured during participation in this research project, you may file a claim with UCF Environmental Health & Safety, Risk and Insurance Office, P.O. Box 163500, Orlando, FL 32816-3500 (407) 823-6300. The University of Central Florida is an agency of the

State of Florida for purposes of sovereign immunity and the university's and the state's liability for personal injury or property damage is extremely limited under Florida law. Accordingly, the university's and the state's ability to compensate you for any personal injury or property damage suffered during this research project is very limited."

Information regarding your rights as a research volunteer may be obtained from:

Barbara Ward
University of Central Florida (UCF) Institutional Review Board (IRB)
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: (407) 822-2276

I am 18 years of age or older. I understand the experiment procedures described above and I agree to participate in this study. If this information is correct please fill in your Sona ID and click continue.

Continue	Cancel

APPENDIX B: SYSTEM USABILITY SCALE

Juicer Usability Scale

	Strongly disagree				Strongly agree
1. I think that I would like to use this juicer frequently	1	2	3	4	5
2. I found the juicer unnecessarily complex	1	2	3	4	5
3. I thought the juicer was easy to use	1	2	3	4	5
4. I think that I would need the assistance from a technical person to be able to use this juicer	1	2	3	4	5
5. I found the various functions in this juicer were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this juicer	1	2	3	4	5
7. I would imagine that most people would learn to use this juicer very quickly	1	2	3	4	5
8. I found the juicer very cumbersome to use	1	2	3	4	5
9. I felt very confident using the juicer	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this juicer	1	2	3	4	5

Juicer Usability Scale Scoring

Questions

1. I think that I would like to use this juicer frequently OK
2. I found the juicer unnecessarily complex
3. I thought the juicer was easy to use OK
4. I think that I would need the support of a technical person to be able to use this juicer
5. I found the various functions in this juicer were well integrated OK
6. I thought there was too much inconsistency in this juicer
7. I would imagine that most people would learn to use this juicer very quickly OK
8. I found the juicer very cumbersome to use
9. I felt very confident using the juicer OK
10. needed to learn a lot of things before I could get going with this juicer

Questions 2, 4, 6, 8, and 10 are reverse-coded prior to analysis.

SUS Scoring

SUS yields a single number representing a composite measure of the overall usability of the system being studied. Note that scores for individual items are not meaningful on their own.

To calculate the SUS score, first sum the score contributions from each item. Each item's score contribution will range from 0 to 4. For items 1,3,5,7,and 9 the score contribution is the scale position minus 1. For items 2,4,6,8 and 10, the contribution is 5 minus the scale position. Multiply the sum of the scores by 2.5 to obtain the overall value of SU.

SUS scores have a range of 0 to 100.

Adapted to Juicers from: Brooke, J. (1996) *SUS: a "quick and dirty" usability scale*. In P. W. Jordan, B. Thomas, B. A. Weerdmeester & A. L. McClelland (eds.) Usability Evaluation in Industry. London: Taylor and Francis.

APPENDIX C: FEEDBACK SCALE

Feedback Scale

Please rate each function (i.e. Easy to use) from 1 to 7.
1 Strongly Disagree **2** Disagree **3** Slightly Disagree **4** Neutral **5** Slightly Agree **6** Agree **7** Strongly Agree

1 2 3 4 5 6 7
1 Strongly Disagree 7 Strongly Agree

	Rating
Sample Feature	4
Easy to use	
Confusing	
Expensive	
Complicated	
Easy to clean	
Intuitive	
Worth the effort	
Annoying	
Satisfying to use	
Efficient	
Fun	
Costly	
Effortless	
Frustrating	
Would purchase	
Would use again	
Would recommend to others	

Overall Juicer Rating (Please Circle):

1 2 3 4 5 6 7
Extremely Negative Extremely Positive

APPENDIX D: PERMISSION LETTERS

Hana Smith
Department of Psychology
Univ. of Central Florida
4000 Central Florida Blvd.
Orlando, FL 32816-1390
407-823-4344
Fax: 407-823-5862

19 March 2008

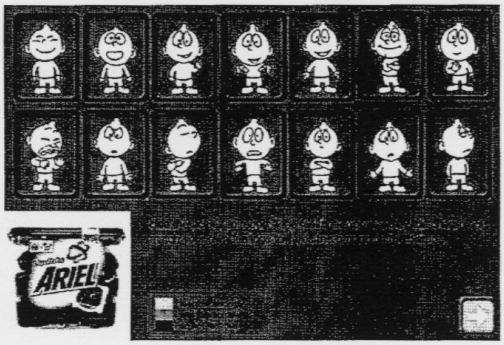
Dear Pieter:

A few months ago I purchased your book. Though I did not use your measure, I did cite and describe the measure in my dissertation as a recent measure available for emotional evaluation of products. Though my verbal summary is thorough, certain images really help explain the measure far better than my words alone. Since the images fail to reproduce within the email, I have attached a word file that shows exactly how they would appear and the citation. Of course a reference will appear in the references (Desmet, P. (2002). Designing Emotions. Belgium: Rector Magnificus.).

This letter is a request to use PrEmo images within my dissertation along with a citation. I am completing a doctoral dissertation degree at the University of Central Florida entitled "Emotional Evoluation of a Product/System." I would like your permission to reprint in my dissertation the following images:

This figure shows the flip picture book like sequence the animated character goes through to create dynamic expression of emotion. The animation is accompanied by non-verbal vocalization (Desmet , 2002).

Figure 1. Animation Sequence Sample



This is a sample of the PrEmo interface, a computerized measure used to capture product expression of emotion. Retrieved from designandusability.org, 2007

Figure 2. PrEmo Interface

The excerpts to be reproduced are the Animation Sequence Sample and the PrEmo Interface pictured above. The requested permission extends to any future revisions and editions of my dissertation, including non-exclusive world rights in all languages, and to the publication of my dissertation on demand by UMI. These rights will in no way restrict republication of the material in any other form by you or by others authorized by you. Your email permission and reply to this letter will also confirm that you own or your company owns the copyright to the above-described material.

If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope. Thank you for your attention in this matter.

Sincerely,
Hana Smith

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:
By: _____
Pieter Desmet
Landbergstraat 15
2628CE Delft
The Netherlands

Date: 20/03/2008

Hana S. Smith
Department of Psychology
Univ. of Central Florida
4000 Central Florida Blvd.
Orlando, FL 32816-1390
386-295-5338
Fax: 407-823-5862

19 March 2008

Dear Dr. Seunghee Lee:

I am writing to attain permission to put an image from your Lee et al. (2002) article.

I am completing a doctoral dissertation at the University of Central Florida entitled "Emotional Evaluation of a Product/System." I would like your permission to reprint the following image in my dissertation:

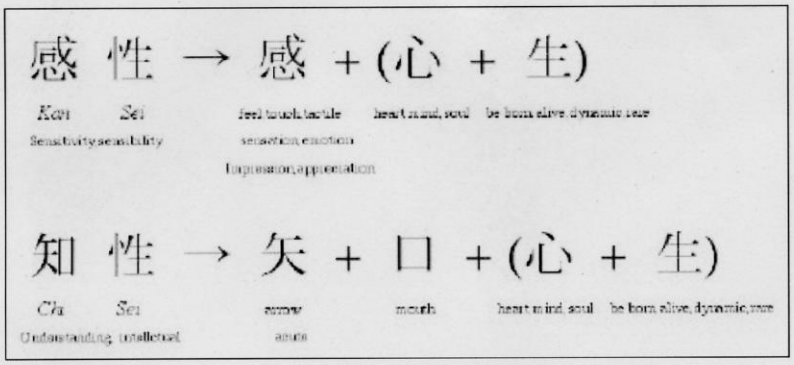


Figure 1. Etymology of Kansei (Lee, Harada, and Stappers, 2002).

Lee, S., Harada, A. & Stappers, P. J. (2002). Design based on Kansei. In W. S. Green & P. W. Jordan, (Eds.), *Pleasure with products: Beyond usability* (pp. 219-229). London: Taylor & Francis.

I review several product evaluation measures/techniques and feel that pictures provide a beneficial visual aid. The image to be reproduced is the Etymology of Kansei, figure above. The requested permission extends to any future revisions and editions of my dissertation, including non-exclusive world rights in all languages, and to the publication of my dissertation on demand by UMI. These rights will in no way restrict republication of the material in any other form by you or by others authorized by you. Your signing of this letter will also confirm that you own or your company owns the copyright to the above-described material.

If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope. Thank you for your attention in this matter.

Sincerely,
Hana Smith

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

By: 李 昇姬
Seunghee Lee
Associate Professor
Major of Kansei, Behavioral and Brain Sceinces ,
GS of Comprehensive Human Sciences
University of Tsukuba,
Japan

Date: 23rd, March. 2008

Hana S. Smith
c/o Lisa Mindak AEHF Program Assistant
Department of Psychology
Univ. of Central Florida
4000 Central Florida Blvd.
Orlando, FL 32816-1390
386-295-5338
Fax: 407-823-5862

10 April 2008

Dear Dr. Morris:

I am writing to attain permission to put images from AdSAM related publications.

I am completing a doctoral dissertation at the University of Central Florida entitled "Emotional Evaluation of a Product/System." I would like your permission to reprint the following image in my dissertation:

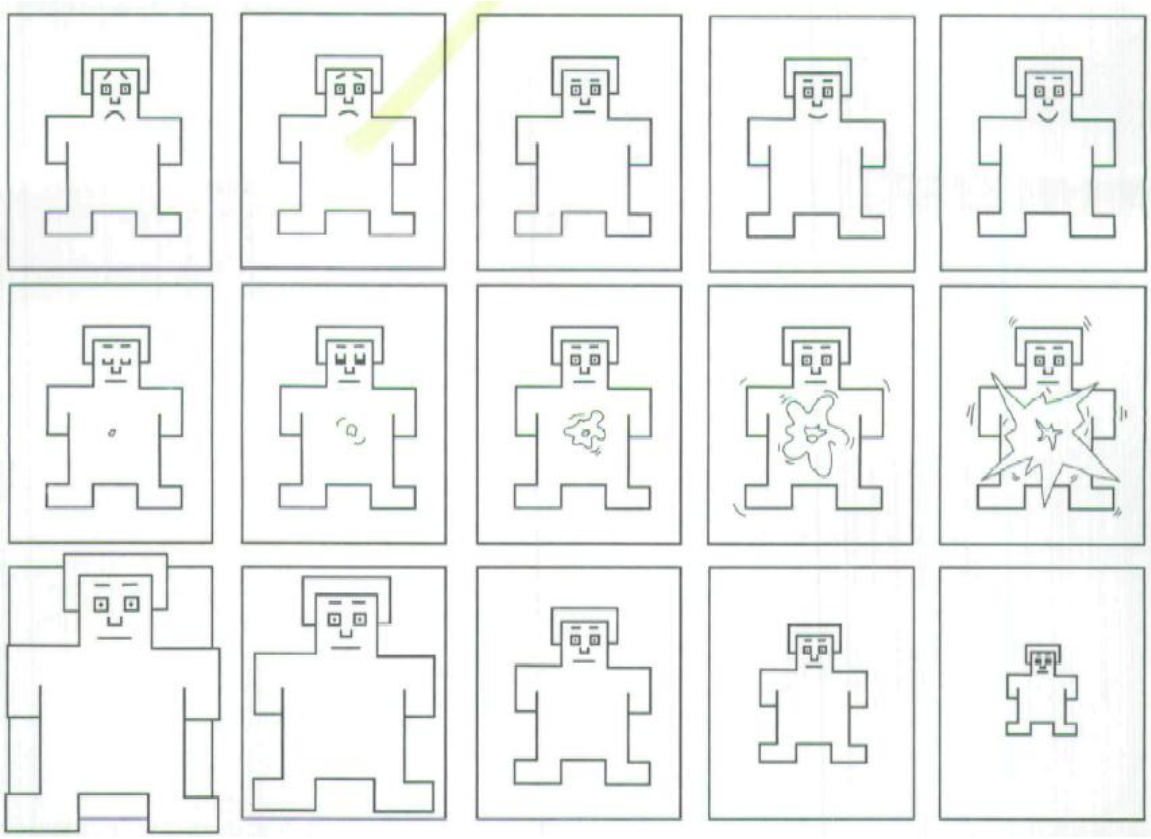
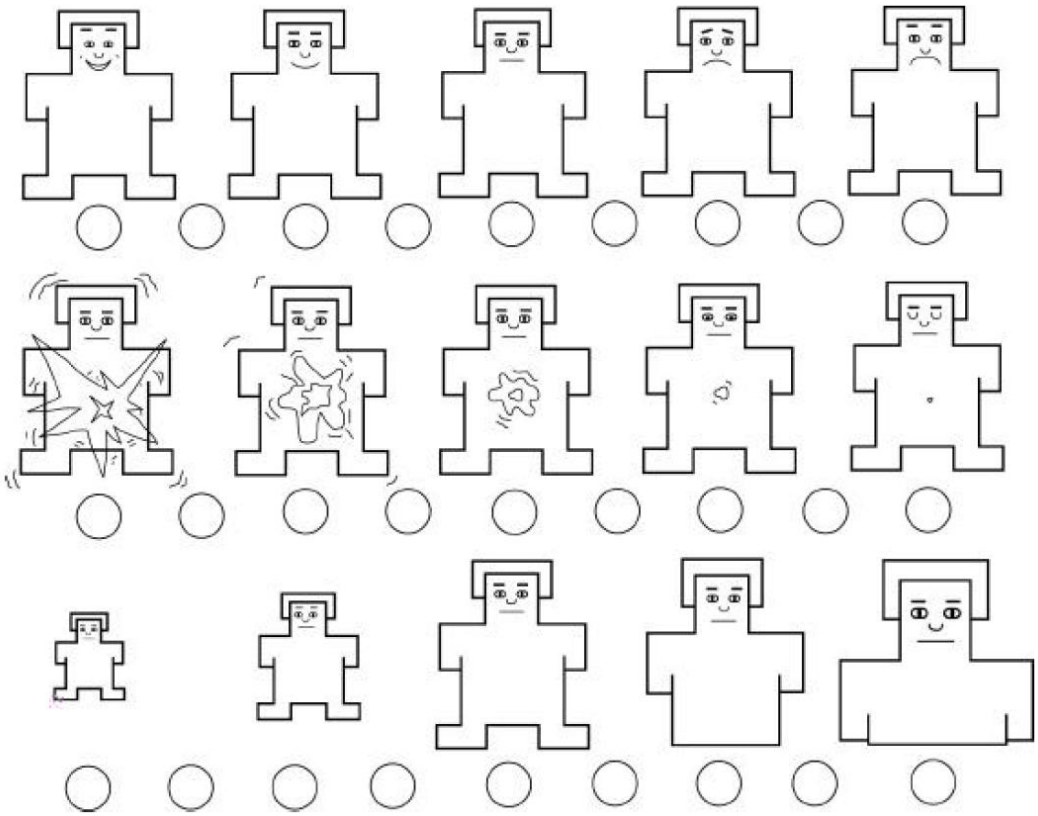


Figure 1: AdSAM: Self Assessment Manikin



The following citations is used in the references:

Morris J. D. (1995). Observations: SAM: A self-assessment manikin. *Journal of Advertising Research, 35*(6), 63-68.

Morris J. D. (1995). Observations: SAM: A self-assessment manikin. An efficient cross-cultural measurement of emotional response. Retrieved from Web http://www.adsam.com/observations.pdf on September 21, 2007. Original appeared in *Journal of Advertising Research.*

I review several product evaluation measures/techniques and feel that pictures provide a beneficial visual aid. The image to be reproduced is the Self-Assessment Manikin and Alternate Self-Assessment Manikin, figures above. The requested permission extends to any future revisions and editions of my dissertation, including non-exclusive world rights in all languages, and to the publication of my dissertation on demand by UMI. These rights will in no way restrict republication of the material in any other form by you or by others authorized by you. Your signing of this letter will also confirm that you own or your company owns the copyright to the above-described material.

If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope. Thank you for your attention in this matter.

Sincerely,
Hana Smith

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

By: _____
Jon D. Morris, Ph.D.
Department of Advertising
University of Florida
Weimer Hall, PO Box 118400
Gainesville, FL 32611

Date: _____

APPENDIX E: IRB APPROVAL LETTERS

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Exempt Review Status

From: **UCF Institutional Review Board**
FWA00000351, Exp. 5/07/10, IRB00001138

To: **Hana S Smith**

Date: **October 02, 2007**

IRB Number: **SBE-07-05209**

Study Title: **Emotional Ratings of Juicers**

Dear Researcher:

Your research protocol was reviewed by the IRB Chair on 10/1/2007. Per federal regulations, 45 CFR 46.101, your study has been determined to be **minimal risk for human subjects and exempt** from further IRB review or renewal unless you later wish to add the use of identifiers or change the protocol procedures in a way that might increase risk to participants. Before making any changes to your study, call the IRB office to discuss the changes. **A change which incorporates the use of identifiers may mean the study is no longer exempt, thus requiring the submission of a new application to change the classification to expedited if the risk is still minimal.** Please submit the Termination/Final Report form when the study has been completed. All forms may be completed and submitted online at https://iris.research.ucf.edu.

The category for which exempt status has been determined for this protocol is as follows:

2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures, or the observation of public behavior, so long as confidentiality is maintained.

(i) Information obtained is recorded in such a manner that the subject cannot be identified, directly or through identifiers linked to the subject, **and/or**

(ii) Subject's responses, if known outside the research would not reasonably place the subject at risk of criminal or civil liability or be damaging to the subject's financial standing or employability or reputation.

A **waiver of documentation of consent** has been approved for all subjects. Participants do not have to sign a consent form, but the IRB requires that you give participants a copy of the IRB-approved consent form, letter, information sheet, or statement of voluntary consent at the top of the survey.

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Janice Turchin on 10/02/2007 11:14:00 AM EDT

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Expedited Review and Approval of Requested Addendum/Modification Changes

From: **UCF Institutional Review Board**
FWA00000351, Exp. 5/07/10, IRB00001138

To: **Hana S Smith**

Date: **February 19, 2008**

IRB Number: **SBE-07-05209**

Study Title: **Emotional Ratings of Juicers**

Dear Researcher:

Your requested addendum/modification changes to your study noted above which were submitted to the IRB on 02/16/2008 were approved by **expedited** review on 2/18/2008.

Per federal regulations, 45 CFR 46.110, the expeditable modifications were determined to be minor changes in previously approved research during the period for which approval was authorized.

Use of the approved, stamped document(s) is required. The new form(s) supersede all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Subjects or their representatives must receive a copy of the consent form(s).

This addendum approval does NOT extend the IRB approval period or replace the Continuing Review form for renewal of the study.

On behalf of Tracy Dietz, Ph.D., IRB Chair, this letter is signed by:

Signature applied by Janice Turchin on 02/19/2008 10:32:24 AM EST

Janice M Turchin

IRB Coordinator

Internal IRB Submission Reference Number: 002187

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Expedited Review and Approval of Requested Addendum/Modification Changes

From: **UCF Institutional Review Board**
FWA00000351, Exp. 5/07/10, IRB00001138

To: **Hana S. Smith**

Date: **February 20, 2008**

IRB Number: **SBE-07-05209**

Study Title: **Emotional Ratings of Juicers**

Dear Researcher:

Your requested addendum/modification changes to your study noted above which were submitted to the IRB on 02/19/2008 were approved by **expedited** review on 2/19/2008.

Per federal regulations, 45 CFR 46.110, the expeditable modifications were determined to be minor changes in previously approved research during the period for which approval was authorized.

Use of the approved, stamped document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Subjects or their representatives must receive a copy of the consent form(s).

This addendum approval does NOT extend the IRB approval period or replace the Continuing Review form for renewal of the study.

On behalf of Tracy Dietz, Ph.D., IRB Chair, this letter is signed by:

Signature applied by Janice Turchin on 02/20/2008 10:38:42 AM EST

IRB Coordinator

Internal IRB Submission Reference Number: 002228

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