



## Design Semantics: Even hybrid Motorcycles need to make noise.

Jaafarnia<sup>(a)</sup>, Bass<sup>(b)</sup>

<sup>(a)</sup> PhD Scholar, Indian Institute of Technology Guwahati

<sup>(b)</sup> Professor, Art Center College of Design, Pasadena

### Article Information

#### Keywords:

Emotion, semantics, high tech product, transportation, psychology

#### Corresponding author:

Mohsen Jaafarnia

Tel.: +91-361-2582802

e-mail: mohsen@iitg.ernet.in

Address: Department of Design,  
Indian Institute of Technology  
Guwahati, 781039, Assam, India

Adele Bass

Tel.: +1-11-626-3040306

e-mail: abass@artcenter.edu

Address: integrated Studies  
Department, Art Center College of  
Design, Pasadena, California, USA

### Abstract

This paper explores the need for artificial sound in high tech products. Changing one of the four sides of the semantic frame changes the meaning and emotional impact of that product. There is a relationship between the four sides of the semantic frame (aesthetic, physiologic, technical, economic) and the five senses (sight, hearing, smell, taste, touch). Replacing sound with sight, smell, taste or touch does compensate for the absence of sound. When high tech products, such as motorcycles, omit sound it confuses the consumer. This research was conducted in two stages: In the first stage the sample consisted of 490 people. In the second stage, 69 people participated. We based our study on questions, interviews and practical tests to determine how artificial sound or the lack of it in high tech products affects the emotional state of the consumer.

## 1 Introduction

Our everyday actions are linked to emotions [1]. We put on warm clothes when we feel a chill even if it's not really cold outside. Sometimes, we imagine the feeling of cold more than the reality of the actual temperature. What are the factors that make us think we are cold when we are not? Undoubtedly some signs of cold are being transmitted. [2] Products like refrigerators and cold drink packages are specifically designed to convey the feeling of cold. Designers use semantics to interpret signs and symbols and assign meaning to actions and objects within particular circumstances and contexts [3]. The study of semantics enables designers to find the right combination of color, shape and image to communicate a consistent semantic frame for a product and produce appropriate responses to it. Those who understand semantics are able to design products that fit consumers' physiological requirements and also take into account the emotional decisions that influence customer satisfaction [4].

Each of the five senses: (sight, hearing, smell, taste, touch) is a human receiver. The information from each of the five senses contains unique meanings that form the four parts of a product's semantic frame (aesthetic, physiologic, technical, economic). Understanding how each of the senses function helps designers create more satisfying products for consumers.

Product features play an important part in transmitting meaning. The audience for a particular product changes dramatically depending on specific features and design details. The consumer may or may not connect with a product for a variety of reasons. It may be the look, feel or sound of a product. Consumer beliefs and attitudes create an emotional base for decision-making [5]. Using the information from only one sense does not give the

consumer the whole picture. When consumers try to hear, smell, taste or touch with their eyes they can only imagine, because each sense is unique. It is not always possible to tell by looking at a piece of cake, how it will taste. We can imagine how good it will taste or smell, but visual inspection alone will not replace the other senses in determining if the cake is tasty.

## 2 The Semantic Frame

Every product has a special identity bound in a semantic frame. This frame contains four functions (aesthetic, physiologic, technical, economic) making a quadrangle (Figure 1). Every side of the square has a relationship to the other sides. A small alteration in one of the sides has a positive or negative effect on the others [6]. Changing one or more of the sides results in a new emotional frame. A product's semantic frame has numerous emotional expressions, but some are very weak. Others are very strong [7].

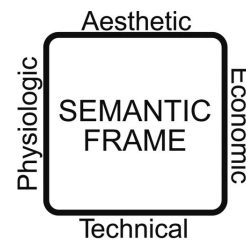


Figure 1. quadrangle of semantics

In Figure 2, both car #1's have the same design and model number (C63 Class) but the designer has changed

the emotional expressions for each car. The original material for the body was painted steel, but the redesign was gold-plated. We can see the effect on the four sides of the semantic frame as follows:



Figure 2. Car #1 : Maroon Painted steel [8] ( top and right), Gold plated steel.[9]

**Aesthetic:** Changing the material from painted steel to gold-plated steel had a positive effect on the aesthetic of the car. The look of the car was enhanced by the gold material. The lustrous quality and greater reflectivity of the precious metal expressed the feeling of speed better than the painted steel. Some modifications were made to the frame to accommodate the precious metal.

**Technical:** Changing the coating had negative effects on the technical side. In production, gold-plating requires special methods not ordinarily used in conventional body production.

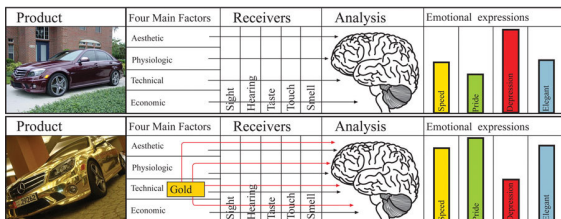


Figure 3. Speed emotion in Car #1: Emotional expressions of body with painted steel (top) Emotional expressions of body with gold plated steel (bottom).

**Physiologic:** The gold's reflectivity had a positive effect on the safety. The gold car worked as a mirror at night. The gold surface reflected other cars' lights and was easily visible in traffic or on the road.

**Economic:** The economic side weakened because of the gold's value. Due to the cost of the gold, the final price was much higher.

Changing the coating on the car affected all the sides of the semantic frame. We changed the visual aesthetic of the car and it had an effect on the physiologic, technical, and economic sides of the frame. The new frame created totally new emotional expressions for the consumer (Figure 3). In this case, we enhanced a visual element. What would happen if we omitted something? What would happen if we produced an electric motorcycle with no sound? Will the omission of an expected sound have a negative effect on the consumer's emotional reaction to that product?

Products do not usually impart meanings from only one side of the semantic frame [10]. Consumers receive input from all five senses. The designer gives meaning to a product through manipulating all or some of the sides of the semantic frame. This meaning is interpreted by the consumer and enters into the decision-making process.

The decision is often an emotional one, based on aesthetic or physiologic desires rather than only technical or economic needs.

Figure 4, demonstrates an analysis of the power of expression:

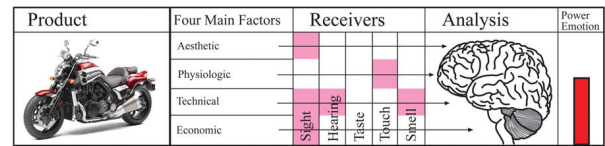


Figure 4. Power emotion in motorcycle No2

- *Sight* appreciates motorcycle's form and color. (aesthetic)
- *Touch* tests the size of the power handgrip and seat size, (physiologic)
- *Sight* inspects the number of accessories, engine size and others technical details. (technical)
- *Hearing* appreciates the powerful sound made by the engine. (technical)
- *Smell* breathes the smoke due to burning gasoline in the engine. (technical)
- *Sight* appraises the quality of the materials (economic).

Decision-making is often influenced by personal beliefs and attitudes, old information and personal memories. Is it possible to really know a product simply by looking at it in a store? Is visual reference powerful enough to replace all the other senses? After taking a product home, do consumers experience the same good feeling they had the day they left the showroom?

### 3 Experiment

How important is sound in high tech products like cars and motorcycles? If a motorcycle is soundless, is it confusing for the consumer? Experiments were conducted to see if the average consumer would have a negative reaction to the omission of sound in high tech products. Subjects were asked to make a relationship between two groups of sounds and three different motorcycles and to state their reasons for making individual choices. We began with an experiment to see if only one sense (sight) gives enough information to a consumer to know a product. The responses were recorded on a printed questionnaire.

### 4 Method

Prepared questionnaires were used both in the interview and to observe and collect experimental data. Data was collected in two stages. In the first stage, out of a total of 490 subjects involved, 257 were men (age 20-50) and 233 were women (age 18-46). All were inhabitants of Guwahati city. The experiment was conducted in coffee shops using four samples (two cakes Figure 9 and two scissors Figure 12). The samples were chosen by consensus and discussions with two professional designers, based on the emotional expression of the objects. Samples included: 1- fake cake made from wood, plastic foam and red silicon gel, 2- real cake with cream and real pineapple jelly, 3- scissors with handles out of the package, and 4- scissors completely inside the package.

The questions were sequentially asked to people at coffee shops. For question 1, the fake and real cakes were shown to them. For the second question, both packages of scissors were shown.

Questions were as follows:

- 1) Which cake is more delicious and tasty? (For Figure 9)
- 2) Which scissors is more comfortable for working? (For Figure 12)

The second stage of the experiment involved 69 people and explored further details of the observations made during the first stage. Based on observations from the cake and scissors experiment, subjects' reactions to motorcycles and sound were studied. We wanted to know which sound had the most influence over product selection. We postulated three hypotheses. 1\_omission of sound can change the emotional expression of a product 2\_artificial sound can produce positive emotions in users of new products 3\_users relationships to sounds were predictable. (Table 1)

Motorcycle	Sounds	Sound Came from
Control	A	Electromotor
No 1	B	Chainsaw
No 2	C	Scooter
No 3	D	Harley Davidson

Table 1. Hypothesized relationships

We hypothesized that sound is an important factor in product design. Technologically, sound omission in new products is the norm. We can produce soundless motorcycles and cars, but will consumers enjoy these new products as much as the old noisemakers? Will the noise be integral to their personal satisfaction? To test this theory, we conducted another experiment using four sounds with the following properties;



Figure 5. Motorcycle No1 [11]



Figure 6. Motorcycle No2 [12]



Figure 7. Scooter No3 [13]

A: Electromotor: monotonous, very light and low, B: Chainsaw engine: very sharp and high, C: Scooter: low bass sound, D: Harley Davidson: deeper bass voice, very stated loud. We also showed three motorcycles with properties; Motorcycle No.1: specialized frame, very sharp aerodynamic lines (Figure 5). Motorcycle No.2: very powerful form and warm color (Figure 6), Scooter No.3: soft curves and a very light, green color. (Figure 7)

Total subjects involved in the second stage were 69, out of which 14 were women (ages 20-40) and 55 men (ages 18-51). All were inhabitants of the Indian Institute of Technology, Guwahati campus. The experiment was conducted on campus. Figure 8, depicts the data collection methods used in the second stage of the experiment.



Figure 8. Data collection

During the second stage, the following questions were sequentially asked:

- 1) Which sound is right for each motorcycle? (For Figure 14)
- 2) If you bought a motorcycle, and after using it, you realized that this bike did not make a sound like "B" or "C" or "D", but made a sound like "A", how would you feel about that? Please check all relevant emotions the "A" sound brings up for you. (Emotions: I do not have any negative emotion, Cheated, Undesirable, Unsuitable, Deficient, Unable to work, Lost ) (For Figure 15)

### 5 Preliminary Analyses- Results

Selected results have been statistically compiled from the collected data and are presented below. No attempt has been made to validate the results using statistical tests. The sample size was limited to a total of 490 subjects in the first stage and 69 in the second. The percentage distribution of the responses to each of the question is shown in Figure 8.

### 5.1 First Experiment

In this stage we questioned whether, based on sight alone, a consumer could fully know a product. Would the information from the other senses change the consumer satisfaction level? We showed two cakes (a fake cake made out of wood, plastic foam and red silicon jelly and a real cake with cream and real pineapple jelly), (Figure 9) to 490 subjects found using randomized methods. We asked them which cake was more delicious and tasty?

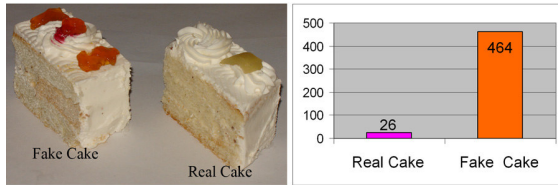


Figure 9. Diagram of the real and fake cake: Cakes (Left) statistic of selection (Right).

464 people (95%) selected the fake cake as being more delicious. When asked why, most of them said the strawberry jelly made the cake look more delicious. Subjects reacted positively to the quantity of jelly and its red color.

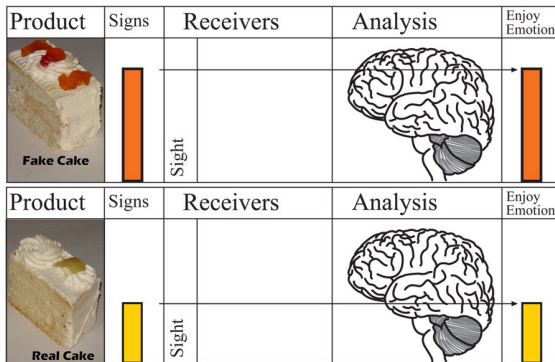


Figure 10. Expression of enjoyment for real and fake cake: Schematic diagram for fake cake (top) schematic diagram for real cake (bottom).

When they were allowed to touch the cakes, they were surprised and shocked to find that the fake cake was very hard and much lighter in weight than the real one.

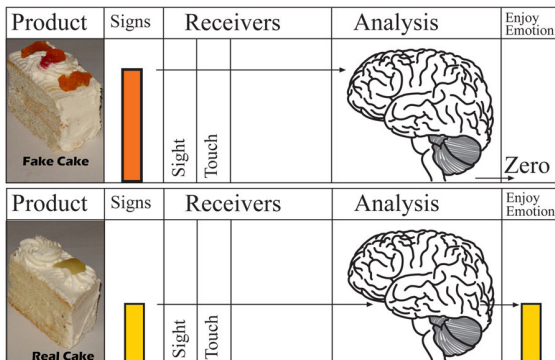


Figure 11. User's opinion after touch: schematic diagram for fake cake (top) schematic diagram for real cake (bottom).

They also realized that the jelly was made of rubber. All subjects changed their vote. (Figure 11)

Personal signs and symbols guide consumer's emotions. Using a knowledge of semantics, designers insert artificial signs and symbols in products to create consistent emotional expression. But designers are rarely concerned with semantic generalizations [14] because few understand the methods of practical design semantics.

The cake experiment demonstrates that consumers need a direct connection to a product to really know it. Consumer satisfaction levels rose proportionally with the number of external senses (receivers) used in the initial selection. The more customers interact, see, touch and smell a product, the better the emotional experience will be before and after purchase. Otherwise they may feel confused and disconnected from it.

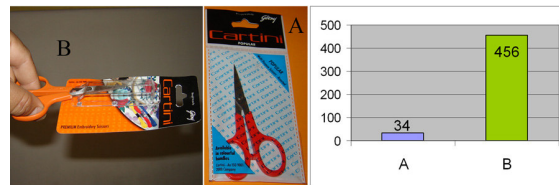


Figure 12. Diagram of the scissors: scissors (Left) statistic of selection (Right).

In this stage we asked how many of the same people would try to explore a new product with their other senses (receivers) besides sight. We showed two packages of scissors to the last 490 subjects and asked which scissors would be more comfortable? Even though both the scissors were visible in the package and had the same design, all of the 490 samples reached out for model B and touched it.

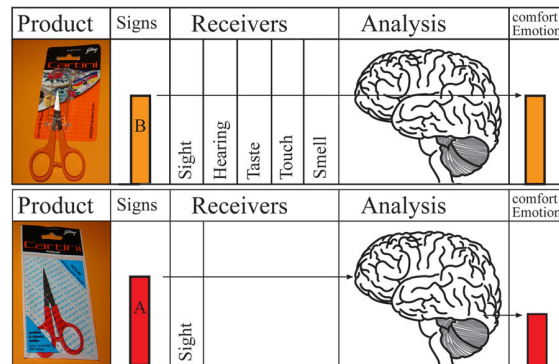


Figure 13. Easily expression for scissors: schematic diagram for model B (top) schematic diagram for model A (bottom).

456 people (93%) of subjects chose model B as more comfortable. When asked why, they explained that they could try it with their hand to make sure the scissors in model B was comfortable. They also said they did not want to make another mistake in selection. Subjects did not want to suffer the same negative emotions they experienced in their earlier choices.

### 5.2 Second Experiment

In the second stage we asked the following questions:

- 1) Which sound is the right one for each motorcycle?
- 2) How would you feel if, after purchasing, you realized your motorcycle did not have any sound?

We wanted to know how many of our subjects recognized and paired the sound they heard with the correct motorcycle.

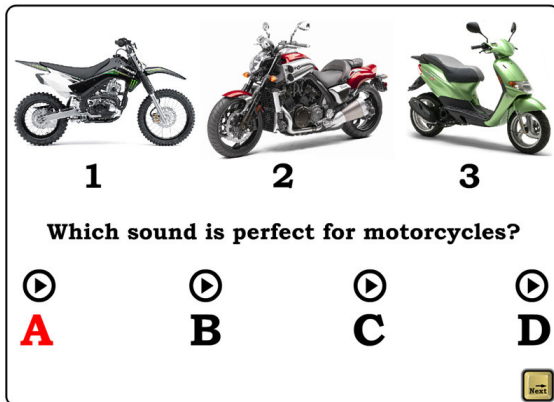


Figure 14. Which sound is perfect for motorcycles?

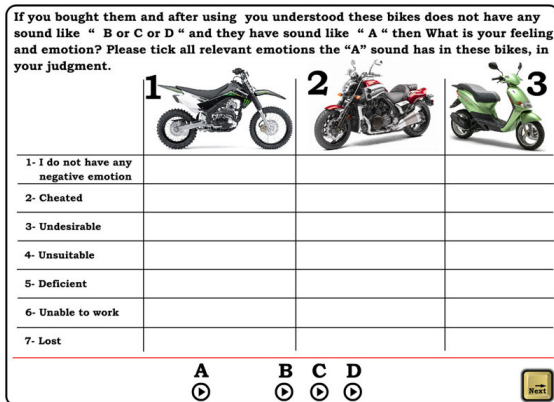


Figure 15. What is your feeling and emotion?

Because of the high percentage of correct pairings, we confirmed that consumers like to hear the sound that is consistent with a particular motorcycle. Sixty-two people (91%) matched sound "B" to Motorcycle (No.1). Sixty-three people (91%) matched sound "C" to the Scooter (No.3) and Sixty-one people (89%) matched sound "D" to Motorcycle (No 2). A small number of subjects did not miss hearing a sound. We deduced this because they paired sound "A" (the control) to motorcycle (No.1). False selection of the control occurred when one person selected sound "A" for Motorcycle (No 1). Two people selected sound "A" for Motorcycle (No 2) and four people selected sound "A" for Scooter (No 3). Accordingly, we questioned their feelings about the missing sound. The results are listed in Figure 16.

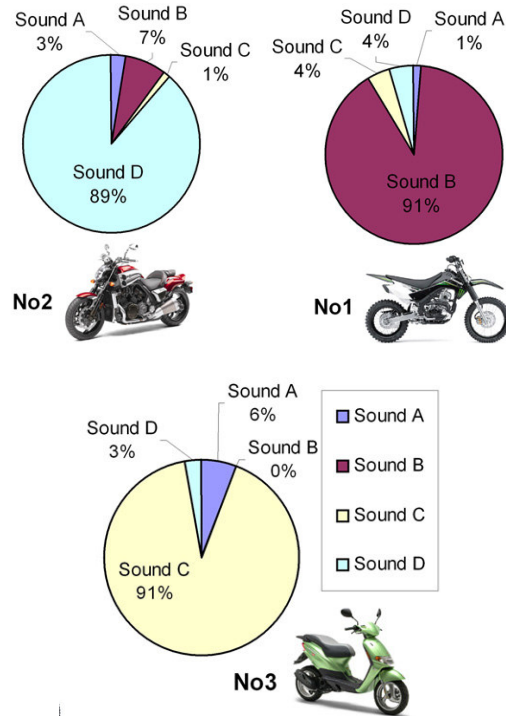


Figure 16. Percentage of selection sounds for motorcycles: motorcycle No2 , motorcycle No1 , scooter No3 .

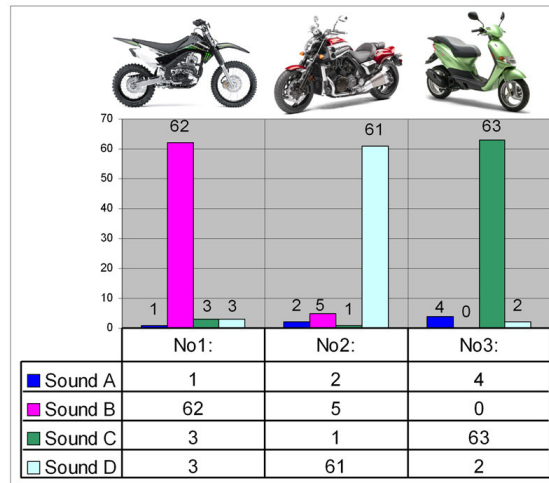


Figure 17. Number of people that selected sounds for motorcycles

When asked how they would feel if, upon getting home they realized their vehicle had no sound, there were a higher number of subjects had negative emotional reactions to the motorcycle sounds. (No 1) and (No 2). (Cheated, Undesirable, Unsuitable, Deficient, Unable to work and Lost). The Scooter (No 3) which had a gentler, rounded form produced opposite results. Eighty four percent of subjects had a negative emotional reaction to sound "A" for Motorcycle (No.1) Figure 18, (Cheated 22%+ Undesirable 16%+ Unsuitable 27%+ Deficient 5%+ Unable to work 7%+ Lost 7%= 84%) and Motorcycle (No 2) Figure 19, (Cheated 20%+ Undesirable 19%+ Unsuitable 22%+ Deficient 11%+ Unable to work 6%+ Lost 6%= 84%). They stated that the sound was

unacceptable. Sixteen percent had no problem with the missing sound. (Figure 18, 19) They experienced no negative emotions. Scooter (No.3) produced the opposite results. When compared, subjects were satisfied that sound “A” fit the Scooter (No 3). In this case, 73 percent of subjects did not have a negative emotional reaction (Figure 20)

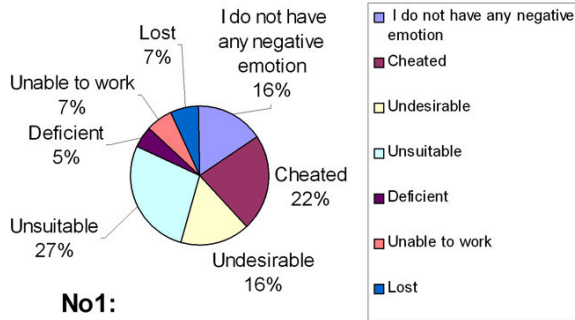


Figure 18. Emotions for motorcycle No1 with sound “A”

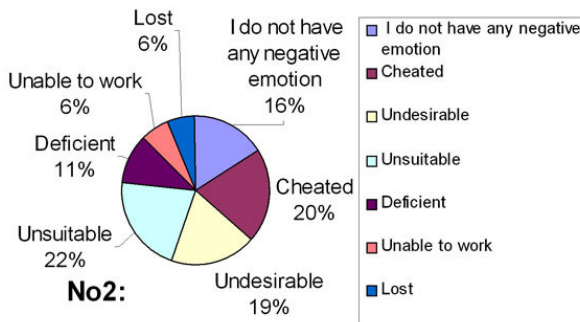


Figure 19. Emotions for motorcycle No 2 with sound “A”

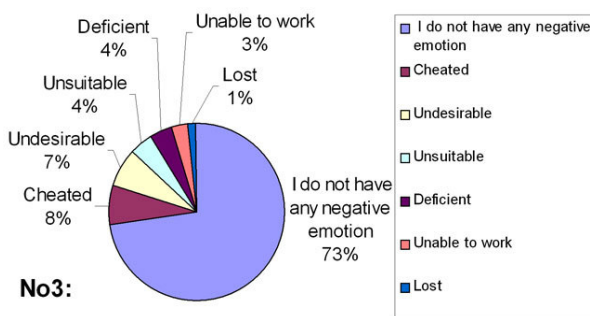


Figure 20. Emotions for scooter No3 with sound “A”

## 6 Discussion

Interpreting the meaning of a product with limited senses often leads to mistakes in decision making due to a lack of information. In phase 1, we learned that one sense (receiver) is not enough to know the meaning of a product. The selection of the wrong cake demonstrated that vision alone is not a good replacement for the other senses. When subjects were able to touch the cake, they realized they had been fooled. Their primary experience caused them to choose more carefully the second time, reaching out to touch the scissors.

In the second stage, subjects listened to different motorcycle sounds and paired them to motorcycle forms.

(Figure 17) A majority of subjects correctly identified and paired the sounds to the appropriate forms, indicating that consumers experience associations to sounds. The results were compiled for comparison. (Figure 18, 19 & 20)

## 7 Conclusions

Most consumers have the ability to correctly identify and match sounds with their respective motorbikes. (scooters vs. motorcycles). When sound is omitted in high tech products, it changes the meanings of the semantic frame and has a negative effect on the emotional expression of the product. The absence of expected sound can alter other semantic meanings that have powerful expressions on the other side of the frame. (Figure 4) Consumers have definite judgments about sound. The correct sound can be very satisfying, but the wrong sound can be disturbing. In the first experiment, when subjects reacted negatively to finding out the cake was a fake, they used the halo effect to make a new judgment [15]. The halo effect results when the consumer becomes blind to all the good features of a product and focuses only on the problem areas. Assumptions are narrowed down to one or two prominent characteristics that overshadow all other traits. When consumers found that they were not able to eat the fake cake or hear the right sound for the motorcycle, they focused only on that issue. They were unable to enjoy the other aspects of the product and the experience was essentially ruined. It took only one negative side to collapse the delicate balance of the semantic frame. (Figure 18, 19 & 20)

Sound omission does change the emotional expression of a product. The feeling of power is one of the important emotions that a rider seeks and that is not limited to mechanical vehicles. Before the invention of the automobile, people looked for expressions of power in their animals. When buying a horse or an elephant, one looked for an animal with a powerful figure. The animal was often elaborately decorated for a better “power expression”.

The same is true for motorcycles. Riders have chopped, lowered, striped and painted their bikes to epitomize speed for as long as people have been straddling two wheels. A powerful motorcycle needs a powerful sound. Artificial sound alleviates some of the negative emotions experienced by the lack of genuine sound and creates greater levels of consumer satisfaction. Electric motorcycles can be marketed successfully if designers insert artificial sound in the engines. The future of high tech electric motorcycles depends on an electronic soundboard to compensate for the omission of sound.

## Appendix

List of Automobiles, scissors and motorcycle pictures and the brand names used as samples for experiments.

labels in this paper	Brand	Source
#1	Mercedes-Benz model C63	<a href="http://www.mercedes-benz.com">http://www.mercedes-benz.com</a>
A	Cartini scissors	
B	Cartini scissors	
No 1	Kawasaki	<a href="http://www.khi.co.jp/mcycle/eng/">http://www.khi.co.jp/mcycle/eng/</a>
No 2	Honda Vmax	<a href="http://world.honda.com/">http://world.honda.com/</a>
No 3	Derbi Atlantis	<a href="http://www.derbi.com/">http://www.derbi.com/</a>

## References

---

- [1] H. Read, *The Meaning of Art* (London: Faber & Faber Limited, 1972) , 25.
- [2] W. Visser, *The cognitive artifacts of designing* (Mahwah: Lawrence Erlbaum Associates, 2006), 73-75.
- [3] D. Mick, "Consumer Research and Semiotics. Exploring the Morphology of Signs, Symbols and Significance." *Journal of Consumer Research* 13 (September ) (1986).
- [4] K. Boulding, *The Image* ( Ann Arbor: University of Michigan Press, 1956).
- [5] C. J. Mowen & S. M. Minor, *Consumer Behavior: A Frame Work* (5th ed.). ( New Jersey: Prentice Hall, 2008), 40.
- [6] M. Jaafarnia, *Form and Space in Industrial Design* (Tehran: Sima ye Danesh Publications, 2007), 66.
- [7] D. A. Norman, *Emotional Design: Why We Love (or Hate) Everyday Things* (New York: Basic Books, 2004), 181.
- [8] "Painted steel's picture with liver color," Accessed December 10, 2009, <http://www.dragtimes.com/Mercedes-Benz-C63-AMG-Timeslip-17161.html/>
- [9] "Gold plated steel's picture with golden color," Accessed December 10, 2009, <http://thepirata.com/gold-plated-mercedes-benz-c63/>
- [10] M. Chaturvedi, *New Product Development* (New Delhi: Wheeler publisher, 1997),25.
- [11] "Motorcycle No1." Accessed December 25, 2009, <http://www.khi.co.jp/mcycle/eng/>
- [12] "Motorcycle No2." Accessed December 26, 2009, <http://world.honda.com/>
- [13] "Scooter No3." Accessed December 25, 2009, <http://www.derbi.com/>
- [14] K. Krippendorff, *The semantic turn: a new foundation for design* (Boca Raton: Taylor & Francis Publishing, 2006), 86-87.
- [15] J. Helgeson and A. Kluge, J. Mager, C. Taylor , "Trends in consumer behavior literature: A Content Analysis." *Journal of Consumer Research* 10 (March) (1984).