

## Computational Psychology to Embed Emotions into Advertisements to Develop Emotional Bonding

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### Abstract

*The emotional impact of the advertisements and presentation of products on customers/consumers is one of the most important factors in consumer psychology. Cognitive ergonomics tries to strike the balance between work, product and environment with human needs and capabilities. The utmost need to integrate emotions in the advertisements and product presentations cannot be denied. The idea is that advertisement and presentation should be able to engage the customer on emotional and behavioral platform. While achieving this objective there is need to learn about customer/consumer behavior and use behavioral and computational psychology while planning and presenting advertisements. This paper, based on Machine Learning tries to map behavior of the customer/consumer with the product presentation and also provide inputs for affective value for personalized advertisement and product presentations. This work can be used to create impact through advertisement sequencing, use of slogans and above all to cater with psychological needs of customers.*

**Key words:** - Machine Learning, Cognitive Sciences, Computational Psychology, Behavioral Sciences, Affective Computing

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### Introduction

Embedding emotions in the presentations is not a new concept and researchers have been trying it over the years. Though there is subtle difference between customers and consumers we will use term customer from here on. The simple assumption is that customer is also consumer here.

Customers' buying decision depends on his mood, emotions and product properties. But satisfaction of customer is more long term concept and depends on his/her emotional association with the product along with product performance. To establish emotional association and to attract customers researchers worked on embedding emotions in product presentations and advertisements. There are methods to integrate affective aspects into advertisements and product presentations. Various researchers

tried these methodologies. Initial attempts in this direction came in the form of Semantic Differential Method (Osgood, C. E., Suci, G. J. & Tannenbaum, P. H. 1957). Here Semantic Differential Scale is intended to measure statistical impact on the minds of citizens. This tool is typically developed to measure affective impact of political and social streams. In 1978 co-joint analysis is proposed for adjudging the willingness of customers to spend money on a particular product (Green, E. P. & Srinivasan, V. 1978). Even it is calibrated to identify how much a customer is willing to spend on a particular product. This algorithm also checks the changes in customer's willingness with reference to changes or addition in features of the certain product. (Küller, R. 1975) worked on designing a method for evaluating architectural structures. It was basically intended for non-commercial

interests but could have been used effectively for commercial applications. These methods further enhanced with objective of improving product presentations and personalized selling. Another major break through in this research area came in 1990 in the form of Japanese Quality Function Development. It was more focused on associating customers' functional needs and engineering features (Akao, Y. 1990). In 1989-1990 Kansei Engineering is developed. It was all together different perspective towards embedding emotions in the product. In Kansei Engineering, user's emotional needs are sensed and represented for building mathematical prediction model (Nagamachi, M. 1989). This is used to connect customers to selected product properties and that can even used in advertisements and convincing customers. Kansei Engineering is like a breakthrough in this evolution since it was the first attempt to effectively capture and map emotions of users/customers. Quantifying customer's emotional needs was a major contribution of this research. It was one of the very innovative attempts to identify implicit customer needs. Understanding these implicit needs and using them effectively for advertisement was the next part of this research. Implicit needs of client include emotional needs and hidden affinity. Many times client associates himself with a product due to some features those are aligned with his/her culture. It also includes features those satisfy his/her emotional needs and goes beyond typical utility features.

While methods so far were looking for explicit needs, Kansei gone beyond it. Affect is about experienced feelings. Affective computing is about emotional effectiveness and artificial emotional intelligence (Encyclopaedia Britannica Online 2005). In this process it becomes important to capture emotions and knowing how to present them. Concepts of pleasantness and unpleasantness along with

concepts of satisfaction and dissatisfaction are related to affect (Titchener, E. B. 1998). This gave research directions to build affective engine and emotion calibrator using Artificial Intelligence. Researcher further introduced two terminologies associated with the affect. One is occurrent affect and another is disposition to affects. The current state of emotion is called as occurrent affect while a disposition affect talks about which occurrent affect is caused in a certain context (DeLancey, C. 2002). Emotional states keep changing. Customer's emotional state could not be maintained in a particular zone for the long period of time. These emotions are always there in the latent form and reflected as moods (Picard, R. 1997, Kleinginna, P. R. & Kleinginna, A. M. 1981). There are different feelings coming as a response to event. These feelings can be classified into two types: Internal physical feelings and external social feelings. Combinations of emotions trigger mood (Picard, R. 1997). These emotions in some way or other are reflected as expressions. What those expressions could be? It could result in textual or verbal expressions. It could reflect in gestures or actions. It could even reflected as certain decision. (Hrishikesh Kulkarni (2017) used expressions to decode psychological state. These expressions along with transient reactions can be used for team selection or determining possible action sequence (Hrishikesh Kulkarni 2017, Hrishikesh Kulkarni 2018). Determining human emotions could be helpful in building pointers to design personalized product or service advertisements. If a person looks at a product it leads to transition in his emotional state. Lets say a person looks at advertisement or presentation of a product and there is a slight smell of oranges... If a person is from Nagpur a capital of Oranges it develops a nostalgic feeling. If same advertisement/product presentation is seen and sensed by Indian person

in some other country it can lead to nostalgic as well as patriotic feelings. It becomes very important to understand context and emotional traits of a person while he is looking at advertisement or presentations. Emotional traits of an individual can be determined using his expressions. Expression can come in the form of his/her responses. Such expression derived from behaviour can be used for selection (Hrishikesh Kulkaeni & Manisha Marathe 2019).

In this paper, based on impact of past presentations of advertisements on customer and his/her demographic data, his/her emotional traits are identified. These emotional traits are filtered with reference to product selection. In case of presenting customer a product or selecting advertisement for him/her these traits are used. These traits can be used to identify emotional parameters and are embedded in a advertisement to build/develop a personalized product presentations for the customer. In this process emotional appeal of perception with reference to presented product is considered. Typically words shape how emotions are perceived (Lissa Feldman Barrett, Batja Mesquita & Maria Gendron 2011). Then one important aspect is selection of emotions and how to embed emotions in messages, presentations or advertisements. Emotions can be attached to percept. We see a color and emotions can be attached to that percept. In the same way we see certain a set of colors and emotions can be attached to that sequence. If one sees same advertisement with some nostalgic music or music associated with his/her emotional traits it can provide greater emotional impact. Thus emotions can be embedded in advertisements by modifying sequences, changing presentation, adding additional perceptions and adding personalized messages in a particular manner. Jack, R.E., Blais, C., Scheepers, C., Schyns, P.G., & Caldara, R. (2009) worked extensively on decoding

emotions using facial expressions with reference to cultural aspects. Thus emotions are associated with culture, past experiences and present context.

In this research paper, we have considered expressions coming through selection of product and textual responses as input to decide emotional traits. These expressions are collected based on past responses. Along with this information personal data of individual is considered in association with cultural information to derive emotional impact. Three important vectors are used while predicting behaviour of a customer.

1. Personality vector
2. Cultural - Emotion vector
3. Context vector

#### **How color perceived represents emotions:**

Terwogt, M. & Hoeksma, J. (2001) carried out research related to emotional impact of colors associated with advertisements. The impact of same color is different and is very personalized based on personality and cultural background of customers. Singh, S. (2006) worked on color marketing with reference to management decision-making. Color impacts on emotional response of individuals in given situation. There are general emotional traits associated with the colors but the impact of culture and background of individuals is differentiating one (Malanie Alt, 2018). Typically red color has emotions like negativity and fear. But it changes with very personalized context and culture. The impact of same color for Chinese is different while that is completely different for Indians. Various researchers worked on other side of embedding emotions where their focus is on emotional marketing. They concluded that there is direct impact of many factors on purchase decision. These factors typically include brand recall, brand recognition and perceived quality. But there are many other contextual and emotional factors those impact

on decision. These factors include cultural symbols, cultural associations and perceived power of selection (Mai Ngoc Khuong & Vu Ngoc Bich Tram 2015). Personality and emotional simulation models are used to visualize this impact. This is modelled in combination with expression system and dialogue system.

In this research, we have identified four important aspects of product presentation to identify its impact on emotions. These four aspects include color of product, associated/inscribed text, shape of product and expression representing product. Customer's personal profile is captured with simple questionnaire. That typically include place, cultural information if any, age, gender and profession along with responses for certain scenarios. Using this information we created

1. Personality vector
2. Cultural Emotion vector
3. Context vector

While based on product properties Emotional impact vector is formulated.

The proposed paper tries to work with these vectors to come up with the impactful advertisement considering emotional suitability of a particular customer. It further calibrates emotional requirements of client with reference to given context and provides indicators so that emotions can be embedded in product presentation and advertisements. Cultural factors are also considered and hence when product is to be presented to a group of individuals with a particular cultural background – the emotions are embedded in it to make it attractive and appealing for that group.

### Embedding Emotions

How to embed emotions in advertisements still remains a million dollar question. In this section, we will discuss about it while describing the method of vector

convergence to identify emotions and embedding them in next section. We presented 10 advertisements to customers and got responses from them regarding their emotional impact. It was amazing to note that four major factors mainly impact emotions – color, shape, text and presentation. Presentation is one of the utmost important factor as it impacts how person perceives the product. In this paper color and shape are two major attributes those are considered for embedding emotions.

The personality vector of customer is used as a reference during first experiment. Using responses by customers, personality vector is determined. Based on these answers customer's personality traits are also determined.

**Hypothesis 1:** Personality vectors defining personality and emotional traits indicative of emotional responses can be determined using expressions of customers

**Hypothesis 2:** Emotions can be embedded in the product by using features like color, shape and presentation

Eq. 1 gives a personality vector while eq. 2 gives emotion vector of a candidate.

$$VP = \begin{bmatrix} VP_1 \\ VP_2 \\ VP_3 \\ \vdots \\ VP_n \end{bmatrix} \quad (1)$$

$$VP = \begin{bmatrix} VP_1 \\ VP_2 \\ VP_3 \\ \vdots \\ VP_n \end{bmatrix} \quad (2)$$

Same advertisement is presented in multiple colors and changing background to capture emotions. When the advertisement of the product presented to 1000 candidates – their responses captured in the form of objective textual responses. In similar fashion total five advertisements are presented to customer. The responses are captured. It is observed that particular percept results in a sort of emotions. Thus it is about identifying perceptions like color, smell, size so that it impacts positively on emotions of the customer. The emotional response of the customers is measured through the actions and expressions. The proposed method takes this complete emotional need identification and embedding emotions in the product presentation as a four step process:

1. Understanding customer's affective needs: (this is a learning phase of the algorithm.)

While doing this, customer is presented a series of advertisements of products of his/her interest. The variations in affective components impacting percept help us to identify his/her affective needs.

2. In case of new candidates based on their personal data the affective needs are calibrated. With reference to affective needs customer is presented products. Part of data which is already labeled is used for testing.

3. Finally, the representative emotional vectors and personality vectors are used to map a

customer to the most suitable product presentation.

4. Based on customers' emotional traits the affective components and features selected for embedding emotions.

Any new candidate is classified in the emotional range from 1 to 5. For the convenience of computation we have taken from 1 to five but it can very easily be extended to bigger number provided we get comparable accuracy.

## Mathematical Model

Calculating affinity among candidates with reference to emotional clusters. The responses by individuals are captured in sequence as a set of products or colors introduced to a customer. Let series  $P = \{P_1, P_2, P_3, \dots, P_n\}$  represents the expected response while series  $Q = \{Q_1, Q_2, Q_3, \dots, Q_n\}$  represent actual response.

The error factor between both responses is determined using eq. 3.



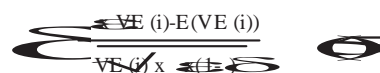
$$E(VE(i)) = VE(i) - E(VE(i))$$

The expected value of VE (Emotion Vector) for new candidate is then given by eq. 4.



$$E(VE(i)) = VE(i) \quad (4)$$

Hence correction is defined as and value can be calculated using eq. 5.



$$VE(i) - E(VE(i))$$

Hence the association/affinity index is given by eq. 6.



$$\text{Affinity index} = \frac{VE(i) - E(VE(i))}{VE(i)}$$

Here calibration index  $c(i) = \frac{VE(i)}{VE(i)}$

In this way a set of vectors are formed representing a particular emotional trait. A set of vectors in a cluster can be defined as

In the case of inclusion of new series the new value of association index, is calculated with reference to old value. Thus new affinity index



with reference to additional cluster can be calculated using eq. 7.

$$(New) = \frac{(New) \times (New)^2 / (n+1)}{(New) \times (New)^2 / (n+1)}$$

Thus affinity index is used to calculate emotional affinity of individuals for a product or set of products. Based on learning, the products' emotional perception features are enhanced to improve personalized affinity for a given customer.

## Results

Emotions are embedded in the advertisement in the form of percept. It could be color or changes in color, it could be sound, it could be text used for advertisements or it could even be shape of the product. As discussed in previous section we have clustered the candidates based on their responses in the emotional zones. Personality vectors and emotion vectors are used for classification. We have collected response expressions for 1000 candidates. We clustered them using affinity index.

Inclination toward buying the same product which is needed by the candidate is calibrated on scale 0 to 4. The product selected in such a way that – it is a product good to have. 0 indicates complete disagreement towards buying while response 4 means customer has made his decision to buy it.

Data set of 10 candidates for different colors is given in Table 1. The same way data is collected for other emotional features. The clustering is done based on similarity of responses. We have not considered slogans or text inscribed on product, but it could be another way of embedding emotions. These clusters are used for learning. For test set data, personality

vector is used for mapping emotional traits of individuals. Then based on cluster and other personality analysis of individual a product with mapping emotional features is presented to customer. Responses for the other combinations are also collected from customers.

Table 2 gives comparison between actual ranks and expected ranks. In 60% of cases the embedded emotions in the form of color and shape impacts the customer and the product is ranked as best one. In 20% of the cases there is some other single product customer ranks above this product and in rest of the cases there are two or more products out of set of five products customer ranks above this product.

**Table 1: Emotions embedded through colors**

Candi date	Context One				
	Blue	Red	White	Green	Black
Cluster I					
1	2	0	3	1	1
2	2	1	4	1	2
3	3	0	3	1	1
4	3	2	4	2	3
5	2	1	5	4	4
Cluster II					
6	1	2	2	4	4
7	4	0	3	3	3
8	1	1	2	3	4
9	1	3	3	1	3
10	4	2	3	2	2

Table III depict percentage accuracy with reference to embedded emotions for five classes of different emotional types.

**Table II: comparison with skill based classification**

Serial No	Scenario One	
	Expected Rank	Actual Ranks
1	1	1
2	1	2
3	1	1
4	1	3
5	1	1
6	1	1
7	1	2
8	1	1
9	1	1
10	1	2

<sup>a.</sup> All the results are compared with already labeled data in test set

**Table III: Percentage Accuracy**

Emotional Type (Class)	Context Affinity Index
0	65
1	67
2	66
3	71
4	71

Fig. 1 depict class-wise percentage accuracy. It clearly suggests that there is higher accuracy observed in classes 3 and 4 as compare to class 0, 1 and 2.

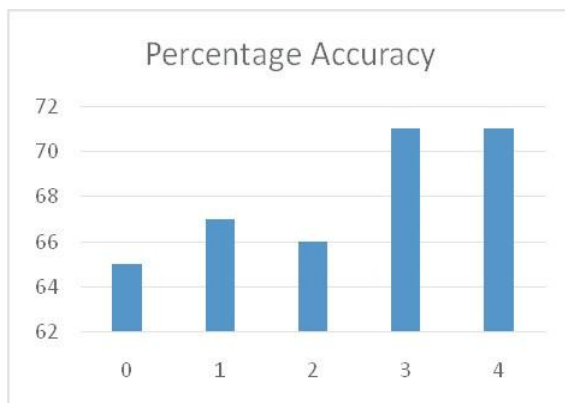


Fig. 1 Class-wise accuracy

Fig 2 depicts comparison between actual and expected rank of emotion embedded products. It can be observed from the diagram that for six out of 10 samples the rank is matching exactly. The representative rank comparison makes sure that embedding emotions using affinity index can make products more appealing to customers.



Fig. 2 Comparison of Results

## Conclusion

Computationally it has always been challenging to measure emotions and check whether the selected product is producing right impact. Computational psychology experiments were based on color selection. In this paper, we have proposed a method for embedding emotions into the advertisements and experiments to measure the success of the same. The association and affinity index is used for mapping individuals to emotion vectors. The results are measured based on ranking done by customers and ranking done by affinity based association. In most of the case the algorithm confirmed accuracy greater than 60%. This method can further be enhanced to accommodate different facets of customer emotions. It can even be enhanced to include text inscribed on the product.

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