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Effects of Picture Modification on Emotional Impact

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Abstract: The aim of the study was to find out if there are features of an image which influence the emotional output to improve the affective pictorial stimuli for advertisements especially in tourism. The present study bases upon emotional pictures of the IAPS which were modified in several ways. In a first step the 18 most desperate images according to Russell's affective space were selected. The second step was the modification from an original picture to a grayscale picture, to a low luminance picture, to a high luminance picture, to a vertical reflected picture, to a high chroma picture and to a blurred picture. In a third step participants were asked to fill out a questionnaire and to rate the evoked emotions using SAM. Results show, that there are important factors of an image which influence the emotional reaction and which could be used to improve the pictorial stimuli for marketing.

Key words: pictures, emotion, IAPS, SAM, tourism marketing.

1. Introduction

Due to the fact that tourism is an intangible product it is very important to have a good marketing. Tourism products like a holiday trip cannot be tested before or cannot be given back. Therefore, tourism marketers have to create a pre-holiday experience and have to build a relationship between the product and the customer gaining customers trust.

Hence, emotion is a meaningful component concerning the advertisement of a tourism product. Bagozzi, Gopinath & Nyer [1] named these products 'feeling ads'. Compared to the 'thinking ads' which communicate hard facts, 'feeling ads' should cause emotions and experiences. Through emotional stimuli a consumer will be activated, therefore, information will be better absorbed and will be kept in mind for a longer period of time [2]. For that reason '… emotional campaigns are almost twice as likely to generate large profit gains than rational ones' [3].

A picture is worth a thousand words, that is the reason why in emotional campaigns, pictures are the most important element of communication. Especially in tourism industry pictures appeal to the eye and are the first things travelers see before they start their journey [4]. Images create first experiences.

Most marketing campaigns use pictures without knowing about their emotional activation impact, although research studies in measuring the evocative ability of pictures exist [5-7] and many pictorial stimuli features influencing visual attention as well as affective reactions have been identified [8]. The purpose of this study is not only to measure the emotion evoked by a given image but furthermore to understand which features of a picture influence the emotional output to improve the affective pictorial stimuli of an advertisement.

2. Theoretical Background

2.1. The International Affective Picture Scale (IAPS)

Despite the fact that there are no obvious physical parameters that can be used to organize emotional stimuli for scientific research and the great diversity of possible affective reactions to physically equivalent events, situations, and stimuli in general, standards and metrics are essential for research on basic and applied problems in psychological science of emotion. The affective pictorial stimuli of the respective scale in the present study have been selected from the International Affective Picture System (IAPS) [5], a scientific picture database addressing the problem of emotional stimulus standardization that is used in experimental investigations of emotion and attention worldwide. The IAPS currently comprises more than 1000 emotionally evocative color photographs standardized as emotional stimuli and covering contents across a wide range of semantic categories. Theoretically the IAPS relies on the dimensional view of affect/emotion according to Russell's circumplex model of affect [9]. Consequently the IAPS pictorial stimuli are standardized on the basis of ratings of pleasure (valence) and arousal, the two fundamental dimensions of emotion according to Russell [9]. As a collection of normatively rated affective stimuli the use of the IAPS database in scientific research allows experimental control in the selection of emotional stimuli and enables scientists to select pictures on the basis of their average reported emotional impact. Furthermore, the standardisation of emotion eliciting pictorial stimuli facilitates the comparison of results across different studies in research of emotion and allows exact replications. Conducting normative rating procedures, each picture of the IAPS database was tested extensively by using the Self-Assessment Manikin (SAM) [10, 20]. The resulting normative scores (mean values and standard deviations) for males, for females and for both sexes combined are available for each picture of the IAPS. According to their normative values the pictorial stimuli can be represented as dots in the two-dimensional affective space (see Figure 1).

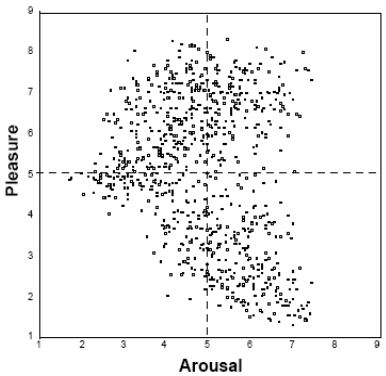

Figure 1. Each picture of the IAPS placed in the two-dimensional affective space according to its mean ratings of pleasure and arousal (Source: [11]).

2.1.1. The Circumplex Model of Affect

Many theorists view the motivational basis of emotional expression in all its variety as having such a simple, two-factor organization. This dimensional view of emotions is mainly founded in Osgood's seminal work with the semantic differential [12], conducting factor analyses on a wide variety of verbal judgments (i.e. semantic differential ratings of emotion terms). The results initially indicated that the variance in emotional assessments is accounted for by two major dimensions, labelled valence (pleasant - unpleasant) and arousal (excited - calm). Similar conclusions have been drawn based on verbal report [9, 13, 14] and in early studies of facial expressions [15].

The circumplex model of affect [9] is based on Osgood's work and one of the most widely studied multidimensional approaches for capturing affective responses. According to this model emotional reactions as well as affective quality in general can be defined by the two orthogonal bipolar dimensions of pleasure/valence (pleasant-unpleasant) and arousal (arousing-sleepy). The validity and reliability of the dimensions have been established over different samples, languages, and cultures [16, 17]. Any affective quality is defined as some combination of the two principal components, and therefore affective ratings can be represented as specific distributions in the affective space defined by the two orthogonal bipolar dimensions. Russell [9] finally identified eight affect concepts to be placed approximately 45° apart in a circular order around the two-dimensional bipolar space (see Figure 2). Resulting from combinations of the two primary dimensions, two additional dimensions of exciting-gloomy and distressing-relaxing help to define the quadrants of the affective space but do not form independent dimensions [9, 18]. Finally the proposed affective space summarizes the wide variety of affective responses and emotional expressions into eight variables (i.e. four bipolar scales) falling in a circumplex. Consequently the affective space can be divided in sections of arousing, exciting, pleasant, relaxing, sleepy, gloomy, unpleasant, and distressing emotional quality. Added a neutral quality to cover the centre of the circumplex affective space, the resulting classification corresponds well with nine possible combinations of pleasure (high, medium, low) × arousal (high, medium, low) (cf. [19]).

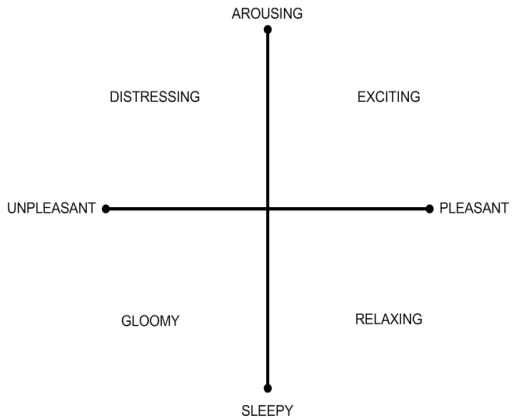

Figure 2. The circular ordering of eight affective descriptors according to the circumplex model of affect [9] (Source: [18]).

2.1.2. The Self Assessment Manikin

The Self-Assessment Manikin (SAM) [10, 20] is a culture-free nonverbal rating instrument designed for quickly assessing affective reactions to virtually all kinds of stimuli on the pleasure and arousal dimension. Initially it was designed as an alternative to verbal self-report measures to eliminate the majority of problems associated with that kind of measures [21]. A graphic character depicting values along each of the two dimensions on a continuously varying 9-point rating scale is used to indicate emotional reactions (see Figure 3). For the dimension of pleasure, the graphic manikin ranges from a happy, smiling figure to an unhappy frowning one. For the arousal dimension, the manikin ranges from sleepy, with eyes closed to excited, with eyes open. Since the development of SAM numerous studies could prove that adults as well as children readily identify with the graphic SAM figure and easily understand the emotional dimensions it represents [21].

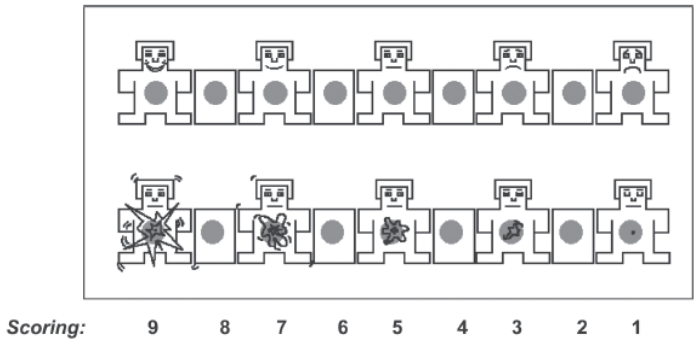

Figure 3. The self-assessment manikin (SAM) [20] used to acquire ratings of pleasure and arousal (Source: [20]).

2.2. Affective picture perception

Certain visual stimuli features significantly influencing visual attention and eye movements are so elementary to the visual system that they do not require attentional resources to be perceived. These stimuli features are linked to involuntary attention and called pre-attentive or low-level features. Pre-attentive or low-level processing consists of fast, feed forward mechanisms when a visual stimulus first is analyzed in various feature channels. A review of the literature concordantly reveals contrast (e.g. with background, color contrast, luminance contrast), color (e.g. hue, saturation), brightness/luminance, and orientation among the dominant low-level features of static visual cues to influence visual attention on the pre-attentive level [8, 22-26]. The most influential model to describe such bottom-up (i.e. stimulus-driven) control of human attention is the so-called saliency map [27, 28]. High-level (or top-down) processing on the other hand requires feedback processes from memory, may involve template matching and mostly is linked to a particular task an observer has in mind.

3. Methodology

3.1. Pictorial Stimuli

This research project required a compensation of the IAPS material, what has been done through a multistep process. In a first step, close-up views/portrayals of people and animals as well as erotic scenes, war scenes and images of mutilated bodies have been excluded. This was an a priori selection following purposive considerations which was done for most studies using IAPS material.

At this time the picture set consisted of 424 pictures. In the following, these set was subdivided into nine categories of emotional quality. Therefore we applied Russell's two additional dimensions (exciting-gloomy and distressing-relaxing) as well as a neutral emotional quality characterizing the centre of the affective space to more precisely defining the affective space. The next step was to analyze each of the nine categories separately. For each category's inherent images normative pleasure and arousal ratings (means and standard deviation) for males and females have been analyzed. Images judged differently by males and females (i.e. are situated in different categories in terms of their mean scores) have been excluded [29]. Ending up the process of selectively reducing the original IAPS dataset we finally excluded pictures of minor quality as well as too old fashioned content or style from the remaining 263 images which resulted in a set of 245 pictures.

After this multistep process of reducing, two pictures with the greatest distance to the centre (arousal = 5.00, valence = 5.00) have been selected from each category except the neutral category. In the neutral category two pictures nearby the centre have been extracted. Now, the pool consists of 18 images which have been modified differently following further research conclusions mentioned above (see 2.2). Hence, six modifications have been done. On the one hand each picture has been presented in grayscale. Also a vertical reflection has been done with each object. Another variation was to blur the picture. For this we utilized the Gauss-filter with a radius of 10 pixels. Furthermore, to diversify the contrast luminance has been set up to 100 what means that each RGB value of the pixel from the picture increased about 100 or went to the maximum of 255. The same was done to decrease the luminance. Above all, to alter the chroma every color has been raised to 100 percent, so that the image got shiny and purely colored. Overall, the study contained 126 pictures, 18 originals (Figure 5) and respectively six modifications (examples see figure 4).

Figure 4. Image 5210 (original) with its modifications (grayscale, high luminance, low luminance, high chroma, vertical reflection and blurred).

3.2. Questionnaire

Data were collected through an online questionnaire, which was part of a multistep experiment. For each participant, a set of 14 pictures was arranged so that no duplicates were shown. Each set existed of seven pictures with the following order: original, grayscale, high luminance, low luminance, high chroma, vertical reflection and blurred, and another seven pictures in the same order. Due to the fact, that the questionnaire was positioned at the end of the study, all participants saw each picture of their set for 12 seconds before they were asked to fill out the questionnaire and to rate the evoked emotions using the SAM [10]. 22 women and 20 men participated in the study, with the age ranging from 19 to 47 years and almost 60% between 23 and 27 years old.

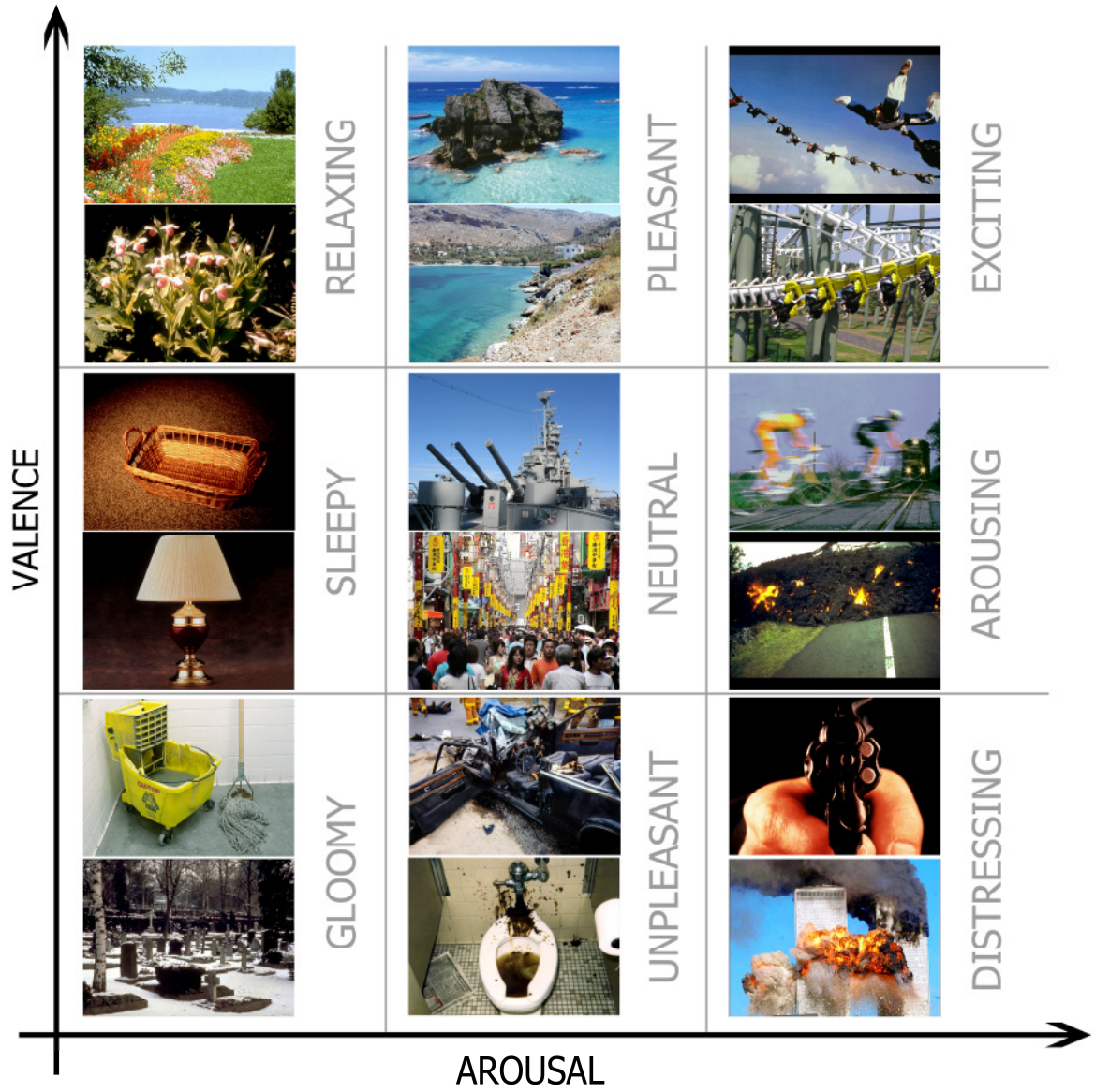

Figure 5. All original images with their emotional category.

4. Results

To answer the question whether there are features of a picture which influence the emotional output, we had a look at several plots at first. As in the IAPS studies all pictures have been illustrated in Russell's [9] affective space, also all pictures of the present study are displayed in this space. Each plot shows pairs of original pictures and one of their modifications. In Figures 6 to 8, plots with clearest results are illustrated. All plots pointed out a shift in their position from the original image to the special modification, but the blurred pictures, the vertical reflected pictures and the grayscale pictures show a well-defined pattern in each picture modification (see Figures 6 to 8). The original-grayscale plot is characterized through decreasing values what can be seen best in pictures with higher valence values (Figure 6).

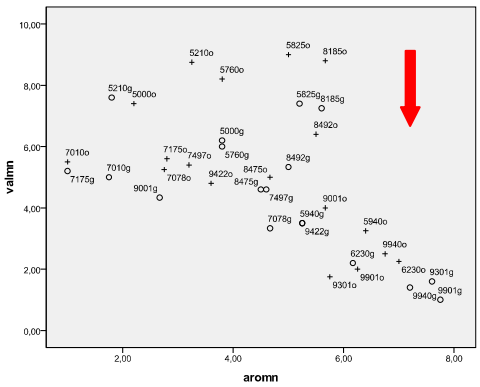

Figure 6. Original-grayscale plot.

Also the original-vertical reflected plot is distinguished by decreasing values. There, images can be merged into two groups, those with lower arousal values in the original minimize their arousal value as well as their valence value through the modification and those with higher arousal values reduce their valence values but their arousal values increase (Figure 7).

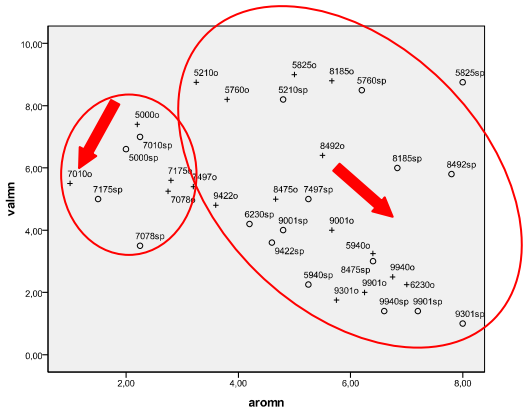

Figure 7. Original-vertical reflected plot.

Moreover, in the original-blurred plot a distinct tendency to the centre can be seen. Almost every picture diminishes its arousal value. For the valence level, once again pictures can be merged into two groups. High valence pictures decrease their valence value and low valence pictures increase their valence value (Figure 8).

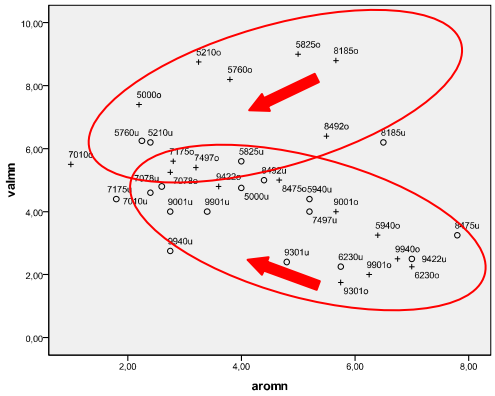

Figure 8. Original-blurred plot.

All these results just base upon viewing the plots. And as we can see, there are differences through modifications which influence the emotional output. Consequently, a closer look at the data is crucial.

Thus, the next step was calculating distances between original values and all transformations whereas no explicit pattern can be found. On the other hand, mean values from each distance indicate only positive valence values and all except the blurred arousal mean value are negative. Furthermore, distances of the arousal values are smaller than the valence distances. A positive distance means a lower value in contrast to the negative distances. As already visible in the plot results above, grayscale pictures, blurred pictures as well as vertical reflected pictures are silhouetted with their large distance against all other modifications (Table 1).

Table 1. Mean values of distances between original values and all modifications.

		Valence Distance	Arousal Distance
Modifications	Gray	0,89	-0,33
	High luminance	0,06	-0,11
	Low luminance	0,54	-0,15
	High chroma	0,35	-0,49
	Vertical reflection	0,59	-0,74
	Blurred	1,05	0,31

Results of plots and distances show that apparently not all modifications are relevant for emotional reactions. Hence, the non parametric Wilcoxon Test indicates that no arousal values are significant. Solely, valence values for grayscale pictures (0.000), low luminance pictures (0.011), vertical reflected pictures (0.029) and blurred pictures (0.011) are significant.

5. Limitations of the study and implications for further research

According to Osberger & Maeder [8] unfortunately to date there is little quantitative data available regarding the exact weighting of different low-level features as well as their interrelationship, which may differ to a certain extent from image to image. Thus, the authors propose to consider a large number of factors when modeling visual attention. Furthermore, they point out that in most cases there is also little known about the context of viewing and the content of the respective scene and therefore such information usually has to be neglected. Several authors underline the importance of such high-level influences like the context of presentation in modulating the effectiveness of low-level features on attention [22, 23]. Based on respective research results they suggest a combined effect of all respective features on attention.

Concerning the modifications of the respective picture features a further limitation of the present study is that we did not focus on specific regions, objects or elements within the images but aimed at changing the overall global stimulus appearance. In contrast to research on affective picture perception, most research on visual attention/visual search to date has been conducted to be able to identify specific areas or elements within an image (or any other static visual cue) which are considered by an observer to be of highest perceptual importance. Consequently the respective research results concerning the identification of low-level features as well as their specific effects refer to such so-called regions of importance and not to the perception of the overall picture. In other words, in contrast to these studies we mainly concentrated on modified low-level features' effects on the emotional impact and not on the attentional focus.

Another limitation in our study applies to the modifications we employed, especially luminance and chroma. In our study the complete picture was diversified, which means, in the case of luminance, if we increase all pixel values, a lot of gray colored pixels will be white and a lot of details will disappear. For further studies, each pixel itself will be modified for its own.

Due to the size of our sample (42 participants) further limitations of the study arise concerning the generalization of our results. In this context it is also worth mentioning that each single original as well as modified version of an image has been evaluated six times at most.

Finally it has to be said that the present paper describes the first steps of data analysis. As future research is concerned a number of detailed follow-up examinations will be conducted to bear significant findings.

6. Discussion and Conclusion

The aim of the study was to find out if a specific feature of a picture has an influence of the emotional reaction. Precisely, the study investigated 18 pictures from the IAPS according to Russell's affective space and six modifications of each of the 18 pictures. Basis of the study was a SAM questionnaire which was to fill out at the end of a multistep experiment where also psycho-physiological measurements and eye-tracking were conducted.

The results of the present study revealed that there are modifications which had an impact on the emotional focus. Generally, arousal values were not crucial at all because of the Wilcoxon Test. In all modified versions, arousal values did significantly differ from their original version values, unlike their valence values. That means the intensity of the emotion was not the determining factor. Maybe the reason for this is that the previous experience of life to several situations which were shown in the pictures is totally different and therefore the intensity fluctuated. Everybody had the same emotional direction (valence value) but their amplification was divergent.

Moreover, three of the six modifications presented a clear pattern in their diversification. Vertical reflected pictures had two characteristics, a lower intensity value (low arousal value) in the emotional direction was becoming a still lower and also a more negative emotional direction (valence and arousal values decreasing). Whereas, pictures with a high intensity (high arousal value) became a still higher and the valence value also reduced. This reaction could depend on our pictorial stimuli, because, in contrast to pictures with high intensity (scenes with more objects or landscapes), those with lower intensity were objects (for example a light bulb, flowers or a basket) situated near the middle of the picture and nothing around them (picture-ground composition). Why these two different picture compositions arouse various influences through the vertical refection cannot be said yet, further research is necessary. Pattern of the blurred pictures had a tendency to the centre. They were displaced in the direction of the neutral category according to Russell's space. To blur the picture could cause an uncertainty by the test person because she/he cannot see clearly and does not know exactly what the content is about. Another obvious changing was caused by the grayscale transformation which was continuously evaluated negative. As we know from perceptual psychology, color could cause emotions. Important signs have been marked red because red is a signal color. Also for picture perception color is a factor having an influence on the emotional outcome.

At this point, if we talk about color, we could ask why saturation had no impact. Although there is no significance and no obvious pattern in our results, we think that there is an effect. The reason could be that we only modified the whole picture and not adapted to each pixel.

Concerning the research question if there are modifications which have an influence of the emotional reaction the results revealed a significant shift from original to grayscale, from original to vertical reflected and from original to blurred pictures. As we can see in our results, low-level features are important to improve the emotional stimuli but are just second order. The content of the picture is to rank first.

Nevertheless, to advance the affective pictorial stimuli for an advertisement, marketers have to pay attention to pictures they use in their campaigns because not only the content is important. In other words, some of the tested modifications have the potential to enhance the picture for a better emotional advertisement – 'a feeling ad' [1].

A good and correct elected image will stimulate people to have a look at the offer, to trust the campaign and to buy the tourism product because pictures attract attention, are inspiring and they create first experiences. With the best adapted picture the pre-experience will last until the booked holidays. That all will be kept in mind and tourists will come back for their next holidays.

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