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THE EFFECTS OF IMAGE COMPOSITION ON THE EFFECTIVENESS OF VISUAL ADVERTISEMENTS

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Abstract

Images are an integral part of any visual advertisement, regardless of medium. Whether online banner, digital screen, or wall poster, the decisions of professional designers on how to compose those images are often based on specific rules of composition that describe proper cropping or object placement techniques. However, existing research shows that even individual visual elements can affect the complexity of an image and influence cognitive processing, which, in turn, can affect not only attention or memory, but also the emotional reaction of the viewer. This study aims to explore the influences of some popular composition techniques on the perceived complexity of an image, and their possible impacts on the effectiveness of visual advertisements – specifically, public service announcements (PSAs)

promoting pro-environmental behavior. To this end, two experiments were conducted. The first experiment explored the role of image composition characteristics on the perceived complexity of a picture, and evoked emotions by manipulating the level of cropping and object merging in images. The results of this experiment demonstrated that composition affected image complexity ratings, and at the same time that simplicity correlated with the positive valence of the emotional reaction evoked. The second experiment assessed the impact of image complexity on the effectiveness of PSAs. After observing PSAs containing more complex images, participants demonstrated significantly higher intentions to behave pro-environmentally. This effect was not influenced by the different types of text-based messages used in the PSAs. These findings demonstrate that composition is an important factor that can have a significant impact on the effectiveness of visual advertisements by influencing the attention, emotions, and intentions of viewers of advertisements.

Keywords: *design, complexity, advertisement, emotion, behavior*

Introduction

All advertisements are primarily designed towards achieving the final goal of changing their audience's behavior. Commercial advertisements are usually created to increase sales of products, while public service announcements (sometimes also called public service advertisements or just PSAs) are usually designed to promote a specific pro-social behavior (Bator & Cialdini, 2000). The designers of advertisements strive to achieve this final goal by using a variety of different methods that usually include images, text-based messages, or a combination of both. The simplest attempts to achieve this are made via informational advertisements – advertisements that concentrate on providing information about a product or a desired behavior. However, research indicates that these are the least effective type of advertisements (Bator & Cialdini, 2000; Burger & Shelton, 2011; Griskevicius, Cialdini, & Goldstein, 2008; Janssens & Pelsmacker, 2005). There is even data to suggest that informational advertisements have a similar effect to no advertisements at all (Burger & Shelton, 2011).

Thus, the design of advertisements is more commonly based on evoking emotions. In this article, emotions are understood as reactions to stimuli that are perceived as significant (Bradley, Codispoti, Cuthbert, & Lang, 2001; Lang & Bradley, 2009). Due to this associated significance, emotional reactions are tied to behavioral reactions – namely, either approach or avoidance. Commercial advertisements usually try to increase approach behavior by evoking positive emotions, while PSAs concentrate on decreasing specific behaviors by inducing negative emotions (Dillard & Peck, 2000; Searles, 2010). Moreover, emotional reactions evoked by an advertisement can also affect attention (Teixeira, Wedel, & Pieters, 2012), as well as the evaluation of both the product being advertised and the advertisement itself (Janssens & Pelsmacker, 2005). As such, controlling the emotional reactions of the viewer is an important task for any effective advertisement.

Visual stimuli are evolutionarily effective in conveying significance and inducing emotional reactions (Bradley et al., 2001). While the content of an image is a significant source

of the emotional reaction induced by it (Bernat, Patrick, Benning, & Tellegen, 2006), the visual characteristics of the image are also important. These include: color (Detenber, Simons, & Reiss, 2000); size (Codispoti & De Cesarei, 2007); and shape (Larson, Aronoff, & Steuer, 2012; Watson, Blagrove, Evans, & Moore, 2012), amongst others. The emotional effects of different image characteristics can still be observed when images are used for specific purposes, such as in visual advertising (Pochun, Brennan, & Parker, 2018).

One of the most common characteristics of visual design that must be decided upon when creating visual advertisements is composition. This can be manipulated both during the photography process and in post-production by applying a variety of different techniques (Islam, Lai-Kuan, & Chee-Onn, 2017). To make such a decision easier, there are various artistic rules that constitute an important part of any visual artist's (graphic designer, photographer, etc.) curriculum. Some of the most basic rules of composition involve avoiding merging two adjacent objects, or avoiding cropping through the joints of limbs. Good composition can lead to the more favorable evaluation of a picture (McManus, Stöver, & Kim, 2011). However, the modification of composition through cropping can also have a negative effect due to ambiguity created by the removal of important details (Savakis, Etz, & Loui, 2000). Incorrect cropping can sometimes even exert a stronger negative effect than poor image quality (blurriness, poor resolution, or low brightness). Such effects of composition on emotional valence (i.e., pleasure) can be explained by the phenomenon of cognitive processing fluency (Alter & Oppenheimer, 2009; Winkielman, Halberstadt, Fazendeiro, & Catty, 2006). The cognitive processing of any stimulus requires effort, so people tend to prefer stimuli that require less mental effort (i.e., those that are simpler), while avoiding those that are associated with more effort (i.e., those that are more complex). This is why simple images evoke positive emotions, while complex images are related to more negative emotions (Belke, Leder, Strobach, & Carbon, 2010; Reber, Schwarz, & Winkielman, 2004; Winkielman & Cacioppo, 2001).

Cognitive processing can also explain the observation that PSAs based on normative appeals tend to be more effective (Bator & Cialdini, 2000; Griskevicius et al., 2008). The reason for this lies in the fact that following existing norms reduces the cognitive effort related to any decision-making process. The higher the cognitive load, the greater the probability of reliance on norms. Therefore, it is possible to increase the effectiveness of norm-based advertisements by simply making them complex enough. However, the degree of complexity that is required for such an effect is not clear.

That is why the **aim** of this study was to explore the effects of composition on emotional reaction and the perception of complexity in images used in a specific practical field – PSA design. The **object of the research** was the effectiveness of visual PSAs and their influence on pro-environmental behavioral intentions. We sought to answer the following questions: What is the effect of image composition on perceived image complexity and the emotional reaction evoked by that image? What is the impact of image composition on the effectiveness of the PSA in which the image is used? Is this effect influenced by the text appeal used in the PSA? To answer these questions, a two-part study was conducted (the study itself was part of a VISORE research project that was funded by a grant [No. S-MIP-17-134] from the Research Council of Lithuania). *The aim of the first*

experiment was to assess the role of image composition in the perceived complexity of an image and the emotional reaction to that image. Two composition aspects were analyzed: the cropping and the merging of the main objects. It was hypothesized that cropping (i.e., "removing" parts of the main object) or merging (i.e., putting the objects closer together) the main objects would make it harder for an observer to process what is depicted in the image. The most extreme cases would be cropping at the joints of moving body parts or making two objects overlap while merging them, because these cases directly violate rules of graphic design. Such violations would make the image more complex and therefore more emotionally arousing and less pleasant.

The aim of the second experiment was to assess the effects of image composition on the effectiveness of the PSAs in which the image was being used. It was hypothesized that PSAs based on a more complex composition of images (depicting cropped or overlapping objects) would be more effective in evoking changes in both the viewers' intention to behave pro-environmentally and actual pro-environmental behavior. However, such an effect would be limited to PSAs based on normative appeal.

1. Methods

1.1. Experiment 1 methodology

Participants. A total of 30 psychology students from Mykolas Romeris University, with a mean age of 23.17 years, took part in Experiment 1. Of these 30, 22 were female and 8 male, and all had normal or corrected to normal vision. Participation was voluntary, and, as a reward for taking part in the study, participants received an optional bonus course credit and a small gift (a souvenir pencil). To ensure ethical standards, the consent of participants was verified both on their arrival to the laboratory and by securing additional verbal confirmation before starting the experiment.

Stimuli. A total of 70 images (photos and drawings) were used in Experiment 1 (see Fig. 1). Of these, 36 images differed in their cropping (9 images were presented with 4 variations: non-cropped, slightly cropped, cropped over joints, and heavily cropped), while 24 varied in the degree to which the two depicted objects were merged (8 images were presented with 3 variations: non-overlapping objects, slightly overlapping objects, and heavily overlapping objects). Therefore, the manipulations that were applied to the images fell into one of 3 categories: no experimental manipulation, a small effect (slight cropping or slight overlapping), or a large effect (heavy cropping or heavy overlapping). An additional fourth level was included for cropping: objects that were cropped over joints (to test a related rule of composition, which specifically states that cropping over joints should be avoided). This addition was necessary because cropping over joints varies between a small or a large effect depending on the position of the joint in the specific image. In addition to these 60 experimental images, 10 additional images were shown in order to conceal the goal of the experiment. Moreover, in addition to the 70 main images, two more images were used in practice trials. All of the original images were selected from graphic design databases that provided free images, with no legal constraints to

their use (*www.mrcutout.com* and *www.pngtree.com*). All of the images were presented in greyscale to avoid any of the effects of color. All of the modifications were performed using the *Adobe Photoshop CC 19.1.3* photo-editing software.

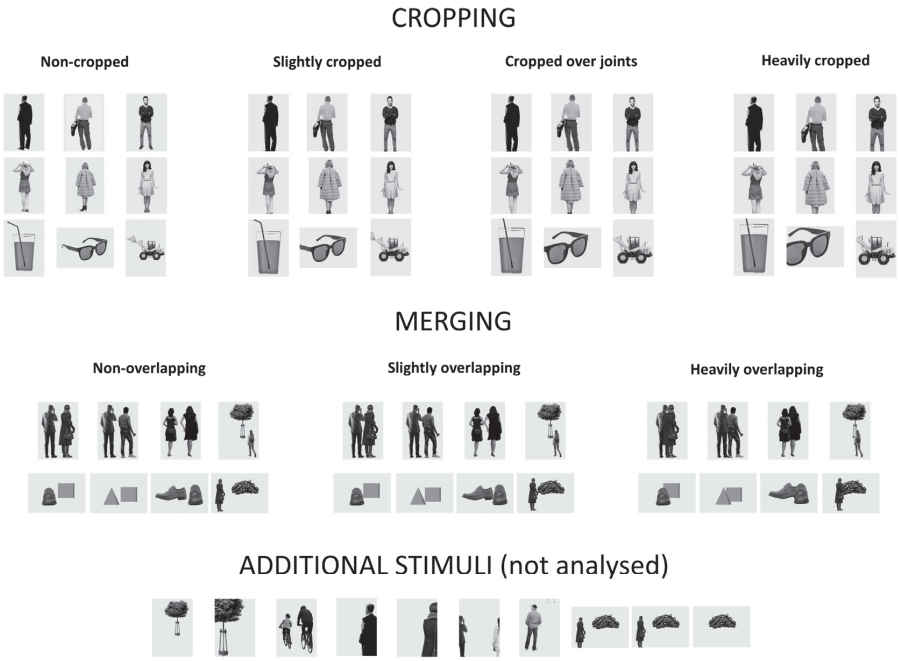

Fig. 1. *The stimuli that were used in Experiment 1*

The main criterion for image selection was that they contained a variety of content that would also be relevant in pro-environmental PSAs, which are part of Experiment 2. The final images depicted people of both genders, trees, and various inanimate objects, but variety was balanced as there was an equal amount of each type of object in each category.

All images were shown on a neutral grey background on a 26-inch screen (1920x1080 resolution, 60 Hz refresh rate), positioned approximately 70 cm from participants' eyes.

Measures. After viewing each image, participants were asked to rate their own emotions using two separate 9-point single item scales: one for emotional arousal (with the labels "*Weak*" and "*Strong*" shown on opposite ends of the scale); and one for emotional valence (with the labels "*Unpleasant*" and "*Pleasant*" on opposite ends of the scale). Additionally, participants were asked to rate the perceived complexity of the image presented by using another 9-point single item scale (with the labels "*Complicated*" and "*Simple*" on opposite ends). All 3 scales were provided on screen after each stimulus. It was emphasized that participants must rate their own emotions (by using the "*EVOKED EMOTION*" descriptors for the arousal and valence rating scales) and the complexity of

the images (by using the "*SHOWN PICTURE*" descriptor for the complexity rating scale). All text was presented in Lithuanian – the native language of the participants.

To observe gaze patterns and to ensure that participants were looking at the screen during the study, eye movement data was also gathered via *Pupil Labs'* eye-tracker headset (Pupil Labs GmbH, Berlin) with double eye cameras (120 Hz sampling rate, 5.7 ms latency, and 0.60° accuracy). Since the available binocular eye data provided an increased level of accuracy, to ensure the comfort of participants and to avoid any negative effect on emotions, a head restraint was not used.

Procedure. Experiment 1 took place in an isolated laboratory room with each participant individually. Each session started with an introduction to the study and a request to the participant to confirm their consent to participate. Next, calibration of the eye-tracking equipment was performed by using 5 on-screen calibration points. Participants were then instructed regarding their task in the experiment. After running two practice trials and ensuring that participants understood the task correctly, the researcher started the main experiment.

At the beginning of each trial, a warning instructing the participant to prepare to observe an upcoming picture was displayed for 2 seconds, after which a fixation cross appeared for another 2 seconds. Then, a randomly selected image appeared in the center of the screen for 6 seconds. After this, participants supplied ratings for the image presented with the help of a computer mouse. Rating time was not limited.

At the end of the experiment, participants answered demographical and vision-related questions (to determine whether they had any issues with their vision), after which they were thanked, debriefed, and rewarded.

The whole procedure lasted approximately 30 minutes. The stimuli presentation, timing, and rating procedure was controlled by the *PsychoPy 1.85.6* software (Peirce, 2009; Peirce et al., 2019).

Data analysis. At first, responses to all of the experimental images were averaged to separate the 4 different cropping (non-cropped, slightly cropped, cropped over joints, and heavily cropped) and 3 different merging (non-overlapping, slightly overlapping, and heavily overlapping) categories. Then, emotional arousal, valence, and perceived image complexity ratings were compared individually for each type of composition feature (cropping and merging) via a repeated measures analysis of variance. All ANOVAs were then followed by Bonferroni multiple post-hoc comparisons. The alpha level for significance was set at $p < .05$. All data was reported so that higher values would show higher emotional arousal, more pleasant emotions, and simpler (less complex) images.

To assess the role of individual images, the responses of all participants were averaged, and mean ratings of emotional arousal, valence, and perceived image complexity were calculated for each experimental stimulus. Then, the Spearman correlation was calculated to analyze the relationships between those 3 measures.

Eye tracking data was used for analyzing whether participants were fixating their eyes on the areas of interest that were either around the borders of the screen (for evaluating the participant's general attention on the experimental task) or around a specific composition feature (for evaluating the participant's attention on the area of cropping or the area of merging, depending on the stimulus).

1.2. Experiment 2 methodology

Participants. A separate group of 30 psychology students from Mykolas Romeris University, with a mean age of 25 years, took part in Experiment 2. Of these 30, 22 were female and 8 male, and all had normal or corrected to normal vision. As in Experiment 1, participation was voluntary, but participants were rewarded with an optional bonus course credit and a small gift (a souvenir pencil) for taking part in the study. Participants' consent was verified upon their arrival to the laboratory and via additional verbal confirmation supplied prior to the start of the experiment.

During data analysis, it was observed that one participant provided too many inaccurate answers while responding to the vigilance questions (56 incorrect answers out of a total of 142 vigilance questions). To ensure the accuracy of the results, the data from this participant was not used for further analysis. Thus, the reported results are based on the responses of 29 participants with a mean age of 25.17 years, of which 22 were female and 7 male.

Stimuli. For Experiment 2, 71 PSAs encouraging pro-environmental behavior were specifically created (see Fig. 2). These consisted of an image previously used in Experiment 1 and a text message (presented either over or under the image). Of these, 48 PSAs represented two levels of cropping (in 24 of them, objects were heavily cropped, while in the rest they were non-cropped) and 18 were based on two levels of merging (in 9 of them, two objects were overlapping, while in the rest objects were non-overlapping). In total, then, there were 33 simple PSAs (based on images with non-cropped and non-overlapping objects) and 33 complex PSAs (based on images with cropped or overlapping objects). Images were selected to reflect different types of content that is relevant in PSAs (e.g., featuring living and non-living objects, both genders, subjects looking towards and away from the viewer, and different types of apparel). The specific amount of each type of content was balanced between the different levels of cropping and merging. To conceal the goal of the experiment, 5 additional PSAs were shown. In addition to the 71 main stimuli, one more image was used in practice trials. All images were presented in greyscale to avoid any of the effects of color and to eliminate the risk of color-blindness influencing the results. All modifications were performed using the *Adobe Photoshop CC 19.1.3* photo-editing software.

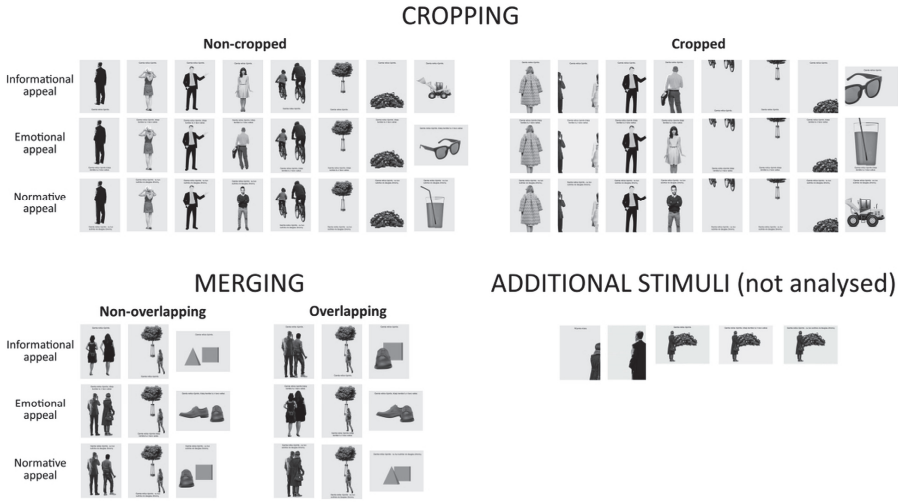

Fig. 2. The stimuli that were used in Experiment 2

The PSAs presented also included text based on three types of appeals: informational, emotional, and normative. Below are the exact extracts that were used during the experiment in both their original language (Lithuanian) and their English translations:

- Informational appeal: "*Gamta reikia rūpintis*" *("You have to take care of nature");*
- Emotional appeal: "*Gamta reikia rūpintis, kitaip kentėsi tu ir tavo vaikai*" *("You have to take care of nature, otherwise you and your children will suffer");*
- Normative appeal: "*Gamta reikia rūpintis – su tuo sutinka vis daugiau žmonių*" *("You have to take care of nature – more and more people agree with that").*

All of the PSAs were shown on a neutral grey background on a 26-inch screen (1920x1080 resolution, 60 Hz refresh rate), positioned approximately 70 cm away from participants' eyes.

Measures. To measure the effects of PSAs on intention to behave pro-environmentally, a series of 5 questions were presented on-screen after showing the PSAs: participants had to answer "*Yes*" or "*No*" to each question by pressing either the left or right mouse button, respectively (there was a constant reminder of the button controls in front of the mouse and on the screen just before the presentation of the question).

The main dependent variable indicating intention to behave pro-environmentally was the response time to the first question (since such a measure is less susceptible to pre-existing attitudes and previous answers, compared to analyzing the degree of confirmation). The first question was always one of the 3 questions related to pro-environmental behavior ("*Would you pick up trash from the ground?*", "*Would you scold a person who is littering?*", and "*Would you litter?*", with the respective answers "*Yes*", "*Yes*", and "*No*" demonstrating pro-environmental intentions). The other 4 questions included

the two remaining questions related to pro-environmental behavior, to constantly keep the participant aware of the variety of questions (so as to avoid the novelty effect), and 2 questions that were designed to test the participant's vigilance ("*Are you now sitting?*" and "*Are you now outdoors?*", with the respective answers "*Yes*" and "*No*" demonstrating sustained attention). Each of the 5 available questions were presented only once during each trial. Other than the aforementioned rules of presentation, the order of the questions presented was random.

To measure actual behavior, a piece of litter (a small piece of packaging from a piece of candy) was left on the ground in front of the participant's chair in such a place that it would seem that the trash could have been left by the previous participant.

After answering all 5 questions, participants were also asked to evaluate the subjective effectiveness of the observed PSA by using a 9-point single-item rating scale presented on-screen (with the question "*How effective was the advertisement shown?*" displayed and the labels "*Ineffective*" and "*Effective*" provided on opposite ends of the scale). All text was presented in Lithuanian – the participants' native language.

Eye gaze data was again gathered via the *Pupil Labs* eye-tracker headset (120 Hz sampling rate, 0.60° accuracy) to observe gaze patterns and to ensure that participants were not looking away from the screen during the presentation of the stimuli.

Procedure. Experiment 2 took place two weeks after Experiment 1 in the same isolated laboratory room with each participant individually. Each session started with an introduction to the study and a request to the participant to confirm their consent to participate. Next, calibration of the eye-tracking equipment was performed, after which the participant was instructed regarding their task in the experiment. This was followed by a practice trial, and the participant was given the opportunity to ask questions. After ensuring that the participant understood the task correctly, the researcher commenced the experiment.

At the beginning of each trial, a warning to prepare to evaluate an upcoming picture appeared for 2 seconds, which was followed by a fixation cross that appeared for another 2 seconds. Then, a random PSA was presented in the center of the screen for 6 seconds. Next, a 2-second warning appeared instructing the participant to prepare to answer questions, alongside the visual reminder of mouse button controls. A series of questions then appeared one-by-one, which the participant had to answer as quickly as possible. These questions were followed by a blank screen for 500ms, which was soon replaced by the rating scale for the evaluation of PSA effectiveness, on which the participant supplied their ratings using the computer mouse. Rating time was not limited.

At the end of the experiment, the participant was asked to answer demographic and vision-related questions (to determine whether there were any issues with their vision). After this, the participant was thanked for their participation, debriefed, and rewarded.

The whole process lasted approximately 40 minutes. The stimuli presentation and rating procedures were controlled by the *PsychoPy 1.85.6* software (Peirce et al., 2019).

Data analysis. The first step in the analysis of the Experiment 2 data was to evaluate the concentration of participants on the task by analyzing the accuracy of their answers to the vigilance questions.

Then, the responses to all of the experimental PSAs were averaged based on their complexity (advertisements with cropped or overlapping objects were considered complex, while advertisements based on non-cropped and non-overlapping objects were considered non-complex) and the type of appeal that was used in the text (informational, emotional, or normative). This was followed by 2 × 3 (Complexity × Appeal) analyses of variance that were computed for each of the dependent variables: intention to behave pro-environmentally (reflected by the response time to the first question after the PSA); and the self-reported ratings of the effectiveness of the presented PSA. Bonferroni multiple post-hoc comparisons were run after each ANOVA. The alpha level for significance was set at $p < .05$. All data was reported so that higher values would show more positive intention to behave pro-environmentally, longer responses, and more effective PSAs.

As with Experiment 1, eye tracking data was used for analyzing whether participants were looking at the areas of interest that were either around the borders of the screen (for evaluating the participant's general attention on the experimental task) or around specific composition features (for evaluating the participant's attention on the area of cropping or the area of merging).

2. Results

2.1. Experiment 1 results

Differences in image complexity. The self-reported data of Experiment 1 demonstrated that composition affected the perceived complexity of an image. However, this effect was visible only when comparing the level of merging: $F(2, 58) = 4.231$, $MSE = .448$, $p = .019$, $\eta_p^2 = .127$, $1 - \beta = .719$. Pairwise comparisons revealed that images with heavily overlapping objects were perceived as more ($p = .035$) complex ($M = 6.613$, $SD = 1.698$) compared to versions of the same images with non-overlapping objects ($M = 7.108$, $SD = 1.41$). No significant differences in image complexity ratings were observed while comparing different levels of cropping: $F(2.311, 67.006) = .859$, $MSE = .363$, $p = .442$, $\eta_p^2 = .029$, $1 - \beta = .203$ (Mauchly's test indicated that the assumption of sphericity had been violated: $\chi^2 = 20.145$, $p = .001$, $\varepsilon = .770$; therefore, the Hyunh-Feldt correction was applied).

The effects of image composition on the viewer's emotions. The results also showed that composition did not significantly affect perceived emotional reactions. There were no significant differences in emotional arousal, neither as an effect of cropping ($F(3, 87) = .335$, $MSE = .178$, $p = .8$, $\eta_p^2 = .011$, $1 - \beta = .113$) nor merging ($F(2, 58) = .8$, $MSE = .386$, $p = .454$, $\eta_p^2 = .027$, $1 - \beta = .18$). The same was true while comparing emotional valence – no significant effect was found neither in analysis of cropping ($F(2.36, 68.449) = 1.216$, $MSE = .284$, $p = .307$, $\eta_p^2 = .04$, $1 - \beta = .278$, Mauchly's test indicated that the assumption of sphericity had been violated: $\chi^2 = 19.199$, $p = .002$, $\varepsilon = .787$; therefore, the Hyunh-Feldt correction was applied) nor merging ($F(1.71, 49.58) = .249$, $MSE = .265$, $p = .746$, $\eta_p^2 = .009$, $1 - \beta = .085$, Mauchly's test indicated that the assumption of sphericity

had been violated: $\chi^2 = 7.301$, $p = .026$, $\varepsilon = .855$; therefore, the Hyunh-Feldt correction was applied).

The relationship between image complexity and the viewer's emotions. The analyses previously presented compared predetermined types of composition (4 levels of cropping and 3 levels of merging). To create a better picture of the possible effects of individual images, the Spearman correlation was calculated for mean values of emotional arousal, valence, and image complexity ratings. Only one significant correlation was observed – between image complexity and emotional valence: $rs = .612$, $N = 70$, $p = .001$.

Eye tracking data. Eye gaze pattern analysis showed that all participants maintained their attention on the stimuli presented by looking at them, and did not skip a single image (i.e., 100% of the stimuli were observed by participants). Thus, the participants' self-reported ratings can indeed be explained by the influence of the observed images. Moreover, areas of cropping and merging were important compositional features, since all participants fixated on them at least once while observing an image.

2.2. Experiment 2 results

Preliminary analysis. Analysis of the responses to the vigilance questions revealed that only one participant demonstrated a random-like response pattern by answering with only 60% accuracy. Data from this participant was excluded from further analysis, thus all further data is based on the responses of 29 participants.

The effects of image composition on viewers' intentions. It was expected that answers to the questions regarding intention to behave pro-environmentally would show a high degree of pro-environmental response due to their socially desirable nature. The analysis confirmed this idea, as 13 of 29 participants responded with over 90% pro-environmental answers. This is also reflected in the 2 × 3 (Complexity × Appeal) analysis of the variance of the probability to respond pro-environmentally, which found no significant main effect on declared intent to behave pro-environmentally from complexity ($F(1, 28) = .031$, $MSE = .024$, $p = .861$, $\eta_p^2 = .001$, $1 - \beta = .053$) nor type of appeal ($F(2, 56) = .594$, $MSE = .01$, $p = .555$, $\eta_p^2 = .021$, $1 - \beta = .144$). Interaction between complexity and appeal was also not significant ($F(2, 56) = .038$, $MSE = .001$, $p = .963$, $\eta_p^2 = .001$, $1 - \beta = .055$). Thus, PSAs had little effect on declared intent to behave pro-environmentally. Moreover, declared intent did not correspond with actual behavior, since only one participant actually picked up the piece of trash that was lying on the ground in the laboratory room, despite the high percentage of "*Yes*" answers to the question "*Would you pick up trash from the ground?*".

A more meaningful measure of intention was the analysis of response time, since this is more likely to be affected by hesitation or encouragement induced by the PSA. A significant main effect of complexity was observed: $F(1, 28) = 4.627$, $MSE = .036$, $p = .04$, $\eta_p^2 = .142$, $1 - \beta = .547$. Participants answered more quickly regarding their intention to behave pro-environmentally after watching PSAs that were constructed using more complex images ($M = 1.704$, $SD = .407$) compared to response times after viewing PSAs that were constructed using simpler images ($M = 1.766$, $SD = .422$). However, no

significant main effect of appeal was observed: $F(2, 56) = .732$, $MSE = .055$, $p = .486$, $\eta_p^2 = .025$, $1 - \beta = .168$. The interaction between image complexity and type of appeal was also not significant: $F(2, 56) = .297$, $MSE = .045$, $p = .744$, $\eta_p^2 = .011$, $1 - \beta = .095$.

The effects of composition on the viewers' ratings of PSA effectiveness. Self-reported ratings of the observed PSA's effectiveness revealed a significant main effect of complexity: $F(1, 28) = 5.941$, $MSE = .43$, $p = .021$, $\eta_p^2 = .175$, $1 - \beta = .653$. In contrast to previous measures of intention, self-reported ratings showed that the more effective PSAs were those that were based on simple images ($M = 3.329$, $SD = 1.43$) compared to more complex ones ($M = 3.087$, $SD = 1.273$).

Moreover, a significant main effect of appeals was found: $F(1.714, 47.98) = 6.782$, $MSE = .268$, $p = .004$, $\eta_p^2 = .195$, $1 - \beta = .867$ (Mauchly's test indicated that the assumption of sphericity had been violated: $\chi^2 = 7.023$, $p = .03$, $\varepsilon = .857$; therefore, the Hyunh-Feldt correction was applied). Pairwise comparisons indicated that informational appeals were considered to be the least ($p < .01$) effective ($M = 3.019$, $SD = 1.272$), while emotional appeals were the most ($p < .01$) effective ($M = 3.306$, $SD = 1.332$). However, the difference between emotional (M = 3.306, SD = 1.332) and normative ($M = 3.299$, $SD = 1.456$) appeals was not significant. The interaction between image complexity and type of appeal was also not significant: $F(2, 56) = 2.688$, $MSE = .131$, $p = .077$, $\eta_p^2 = .088$, $1 - \beta = .512$.

Eye tracking data. Gaze pattern analysis confirmed the validity of the findings by demonstrating that all participants were looking at the stimuli and did not skip a single image (even those who responded to vigilance questions with incorrect answers). It can, therefore, be claimed that 100% of stimuli were observed by participants. Thus, the registered effects can indeed be explained by the influence of visual PSAs. Moreover, even though the PSAs viewed in Experiment 2 had more detail compared to the stimuli used in Experiment 1, areas of cropping and merging still attracted the attention of the participants, demonstrating that these areas were significant for image processing.

3. Discussion

The main aim of Experiment 1 was to analyze the role of compositional complexity on rating emotion. As expected, experimental manipulations were effective in increasing the perceived complexity of images (although this was noticeable only in the case of merging). Moreover, the findings from previous studies that have observed the relationship between image complexity and emotions evoked (Reber et al., 2004; Winkielman & Cacioppo, 2001) were also confirmed – image simplicity positively correlated with emotional valence. However, there were no significant differences observed in emotional ratings when comparing different compositions.

It should be re-stated that one of the versions of cropping (over a person's joint or an equivalent inanimate object) and one of merging (two adjacent objects with no separating distance in-between) were direct violations of classic composition rules, and so this should have been enough to provoke an emotional reaction due to the atypical nature of the composition. The results in this paper perhaps demonstrate that compositional rules

might be less important for non-experts, as most participants had no visual arts training. Other authors have found that the reactions of experts to images differ compared to those of novice viewers (Bölte, Hösker, Hirschfeld, & Thielsch, 2017; McManus et al., 2011; Reber et al., 2004; Silvia, 2005). This difference between experts and non-experts can remain even while assessing non-art stimuli, such as simple shapes (Vartanian et al., 2017). Thus, these findings suggest that the effects of cognitive processing fluency can be very subjective.

Nevertheless, our selected areas of experimental manipulation (cropping and merging) were significant features in the participants' cognitive processing of the images. Analysis of eye fixation data provided useful information about participants' gaze patterns. While eye movement patterns differed between different participants, all were looking at the areas of cropping and merging, while often ignoring the same areas in non-cropped and non-merged images. This demonstrated that areas of cropping and merging are indeed important for image processing, and thus that they affect processing fluency.

Experiment 1 explored individual images, so the effects of cognitive fluency might differ in more complex stimuli, such as advertisements. Experiment 2 tried to avoid limitations related to basic stimuli and aesthetical experience or subjectivity by studying visual PSAs instead, and measuring intentions to behave. It was hypothesized that PSAs constructed from more complex images would be more effective in evoking changes in the intentions of viewers, and perhaps even in their actual behavior.

The results of Experiment 2 revealed that image complexity had an impact on behavior, or at least on intention to behave. PSAs constructed from more complex images were more effective in encouraging pro-social behavior, such as picking up litter thrown by another individual. However, this effect was limited to intentions and did not extend to actual behavior. Even though all of the participants had the opportunity to demonstrate the exact pro-environmental behavior that they had just indicated their willingness towards (i.e., to pick up litter), only one participant mirrored their intentions in terms of real behavior by actually picking up the litter that was left in the laboratory room. This reflects pre-existing data regarding the discrepancy between intentions and behavior (e.g., Ajzen & Fishbein, 2005).

Moreover, objective measures of response time have shown that complex images are more suitable for PSAs – participants' intentions to behave pro-environmentally were greater after viewing PSAs constructed from more complex images compared to after viewing PSAs based on simpler images. However, the subjective ratings supplied by participants showed the opposite effect – PSAs that were composed of simpler images were judged to be more effective. This clearly demonstrates that the subjective evaluation of advertisements, declared and real intentions, and actual behavior are all separate effects. Therefore, successful modification of one of them does not necessarily translate into a change in the other two. Nevertheless, the current study supports previous studies that also found that positive effects derived from cropping images in advertisements (Peracchio & Meyers-Levy, 1994).

Since most visual advertisements include text messages, Experiment 2 also explored the effectiveness of different text appeals. It was found that participants considered informative

appeals to be the least effective, but there was no advantage to normative appeals over emotional ones. Such results were expected, since subjective evaluation of the effectiveness of PSAs often neglects normative appeals (Griskevicius et al., 2008; Jaeger & Schultz, 2017; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). However, that normative appeals did not differ from other types of appeals in terms of their impact on actual intentions was not expected, as normative appeals are usually the most effective (Burger & Shelton, 2011).

Even more unexpected was the observation that no interactions between stimulus complexity and type of text appeal were found. Normative appeals help to facilitate cognitive processing while making behavior-related decisions (Kallgren, Reno, & Cialdini, 2000). Answering questions about environment-related behavior involves making quick decisions, and examples provided by descriptive normative appeals should alleviate the difficulty of this. At the same time, more complex stimuli should increase the cognitive load on processing. It was expected that an advantageous effect of describing existing behavior would be most visible while observing PSAs containing more complex images. However, the data from the current experiment neither confirmed nor denied this idea. Most likely, the main reason for this was that no advantage of normative appeals was observed while measuring intentions. At the same time, Experiment 1 showed that the emotional effects of images were not pronounced enough. Thus, the current study did not manage to induce the required level of effect on emotional arousal and normative influence to be able to test this interaction fully.

Future studies should, therefore, explore in more detail the interaction between normative appeals and image characteristics related to cognitive complexity and emotional arousal. A greater variety of appeals could provide more accurate comparisons. For example, differently worded normative appeals could have a greater impact. Moreover, the current study used emotional appeals with only negative valence. While the effectiveness of fear-inducing appeals is demonstrated by previous studies (Tannenbaum et al., 2015), they still have their limitations, and positive emotional appeals can sometimes be more effective (Chatelain et al., 2018). For this reason, future studies should include positive emotional appeals as well.

Moreover, the current study assessed general characteristics of emotional reaction (arousal and valence) without attempting to differentiate between specific discrete emotions, such as happiness, fear, or surprise. This might be important, considering that affective reaction can be based both on an image's aesthetic properties (i.e., beauty) and real-life importance (Tan, 2000). The majority of the participants had no previous art expertise, and it has already been noted that experts may react differently than novices to images (e.g., Bölte et al., 2017). As such, it is possible that the artistic novices participating ignored aesthetic aspects of the images, and instead concentrated only on the real-life relevance. If this is true, it is possible that the participants rated emotional arousal (i.e., the strength of emotional reaction, which is closely related to the perceived importance of the stimulus, Bradley et al., 2001) lower. Perhaps this reflects a conscious attitude that a basic picture of a shoe simply cannot evoke any emotion, an idea that could have distorted subjective ratings of emotional reactions. This would also explain the discrepancy

between the results from indirect measures (such as response speed) and more subjective measures (such as rating scales) that were used in the current study to assess the intentions of participants to behave pro-environmentally.

Nevertheless, despite these limitations the current study provided valuable data that can be used by both researchers and practitioners. For instance, when planning future studies, it is important to consider that even small and localized image manipulations can change the general perceived complexity of the stimulus, which might have an unexpected effect in experimental studies involving visual stimuli. Similarly, it is vital to keep in mind that simple reliance on artistic rules is not enough – in order to design an effective advertisement, the exact psychological effects of specific design elements should also be considered. The results of this study have provided some specific factors that professionals should be aware of.

Conclusions

The current study evaluated the impact of image composition by assessing the effectiveness of different cropping and merging techniques in advertisements using several different measures: subjective evaluations; intentions (both declared and as indicated by reaction time); gaze analysis; and actual behavior. Experiment 1 confirmed that such details as the cropping of single objects or the merging of two adjacent objects together can significantly affect perceived complexity, while Experiment 2 demonstrated that these complexity-increasing manipulations of composition might be enough to increase the likelihood of evoking behavioral change in the advertisement's audience. The main strength of the study was in the fact that these two experiments allowed for the assessment of the role of composition both in isolated images and in the context of PSAs. An additional important feature of the study was the fact that the methodology of both experiments included several independent steps to increase the validity of the results. The primary safeguard was eye-tracking, which allowed the authors to ensure that participants were looking at the experimental stimuli throughout the study, despite the relatively long duration of the experiments. Moreover, the second experiment also included vigilance questions that allowed us to notice and exclude cases exhibiting random responses.

However, some planned measures did not show sufficiently accurate results for more in-depth analysis, and so future studies should explore the role of subjective audience evaluations, classic rules of composition, and different contexts in more detail. Despite these limitations, the existing findings can be directly applied when designing effective visual PSAs, commercial advertisements, and many other areas related to visual design, such as editing media material, designing app interfaces, or creating virtual environments.

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THE EFFECTS OF IMAGE COMPOSITION ON THE EFFECTIVENESS OF VISUAL ADVERISEMENTS

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Summary

It is well known that an image can have a significant effect on a viewer's attention, emotions, and even their actions. Such effects are critical in many areas where images are used, including: marketing, media consumption, software design, and many others. One of the main characteristics of an image that can affect the viewer is composition (McManus, Stöver, & Kim, 2011). Decisions regarding composition are an important part of a graphic designer's workflow, and are often based on the classic rules of design acquired during training. The resulting composition of the image has an effect on the cognitive effort that is required by the viewer to process it. Complex images require more mental effort and, thus, are likely to evoke more negative emotional reactions compared to simpler images (Belke, Leder, Strobach, & Carbon, 2010; Reber, Schwarz, & Winkielman, 2004; Winkielman & Cacioppo, 2001). The increased cognitive load induced by complex images can also be a factor in determining the effectiveness of the message that is being communicated by public service announcements (PSAs), as observers are likely to try to reduce cognitive load by following the norms that are suggested by PSAs (Kallgren, Reno, & Cialdini, 2000).

This study assessed the impact of manipulating two characteristics of image composition (cropping and merging objects) on the perceived complexity of individual images and the emotional reactions evoked by them. Additionally, the effectiveness of using these images in PSAs promoting pro-environmental behavior was tested. It was hypothesized that the perceived complexity of an image would influence the effectiveness of the visual advertisement in which the image was used: PSAs based on more complex images would increase the intention to behave pro-environmentally, especially if that PSA was based on normative appeals.

This involved a two-part study. The first part assessed the role of image composition on the perceived complexity of the image, the emotional reaction evoked, and the relationship between image complexity and emotion evoked. The results of the first experiment revealed a significant effect exerted by the merging of objects in an image on later ratings of that image's complexity. A significant positive correlation between image simplicity and emotional valence rating was also observed.

The second part tested images from the first experiment in the context of PSAs, which also included different text messages promoting pro-environmental behavior. The results of the second experiment demonstrated a significant effect (increased intention to behave

pro-environmentally) of perceived complexity on the effectiveness of the PSA. However, contrary to expectations, there was no advantage to normative appeals.

The results of this study demonstrated that image composition is a significant variable for advertisement design, but this significance depends on the goals of the advertisement (emotional, behavioral, or attentional). Moreover, it was demonstrated that effects declared by the audience might not correspond to actual effects on intentions or behavior.

Keywords: *design, complexity, advertisement, emotion, behavior.*

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